

EXPLORE!

Volume 1, No. 1 April 1993

"Welcome to Explore!"

Explore! is a newspaper/magazine/workbook/newsletter published for elementary teachers in the state of Utah and surrounding regions by the University of Utah's Center for Integrated Science Education.

Students learn best when they learn for themselves, and they learn for themselves when they are motivated and interested. Even those students with serious difficulties in academic work can become motivated, involved, and very knowledgeable in activities which "turn them on." These activities may be sports, outdoor recreation, cars, space, aircraft, stamp collecting, video games, computers, or other topics.

Explore! will provide ideas, resources, and a network of people to help you provide science, technology, and math experiences and opportunities for even your most difficult students. By tying science to current and local events and to subjects and activities which interest students, we hope to help you implement more effective science activities for more students.

Explore! is part of CISE's ELEM-NET project--a network of teachers, scientists, engineers, retired people, businessmen, and other professionals available, literally on call, to help with your questions and problems related to science, math, and technology activities.

Two folks who know a lot about chemistry, Professors Ron Ragsdale and Noel DeNevers, are profiled on the last page together with phone numbers and available hours. They are on call as your personal consultants and resource people to help you and your students with chemistry related questions. Don't hesitate to call, that is what Explore! is all about.

There are also undergraduate and graduate students at the University who are willing to help. You can reach some of them through our office. See back page for details.

We hope you find Explore! interesting and useful. We encourage your comments and input. Let us know what is helpful, what is interesting, and what is irrelevant or not interesting. Our goal is to work with you to provide the most effective, interesting, and exciting science and math experiences for Utah's elementary students.

Inside This Edition

- Science Education, Science Standards, and the Utah Core Curriculum
- National Teachers Awards to Utah Teachers
- Resources for Utah Teachers

MOLECULES!

This is a fun experiment to demonstrate basic molecules and simple reactions.

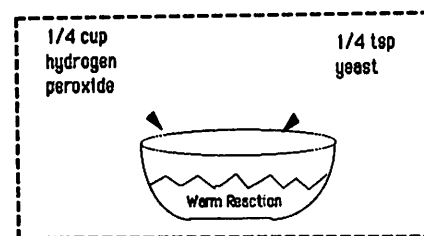
Materials:

- Yeast Packet
- 3% Hydrogen Peroxide (@.69 for 16 oz. at most drug stores)
- Bowl, measuring cup and measuring spoons



Do this experiment in a sink. Pour 1/4 cup 3% hydrogen peroxide into a bowl. Sprinkle 1/4 teaspoon of yeast in the bowl and observe what happens. Stir this solution and observe again. Is the bowl warm?

What is Happening?



A chemical reaction occurs when yeast is mixed with hydrogen peroxide. Hydrogen peroxide molecules have two hydrogen atoms and two oxygen atoms (2 H's and 2 O's) The yeast removes one of the oxygen atoms which leaves us with two hydrogen atoms and one oxygen atom or H₂O (water).

continued on page three

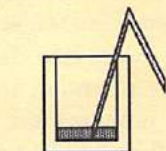
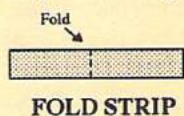
EXPLORE!

Volume 2, Number 1, August 1994

"Making Water Run Uphill"

Water spreads on some things (like very clean glass) and beads up and doesn't spread on others (like a freshly polished car or a clean Teflon pan). Water also tends to penetrate into things that are highly porous (like soils, fabrics, and sponges). This combination of spreading (chemists call it "wetting" and penetration (absorption) goes by the name of capillarity.

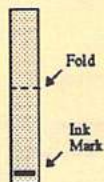
Many kinds of paper allow water to wet or/and penetrate. Take a strip of newsprint about 6 inches (roughly 15 cm.) or so long and maybe half an inch wide (about 1 cm or so); crease it in the middle of the strip, and drape it over an empty glass so that one end of the strip just touches the inside bottom of the glass. Now pour a little bit of water into the glass -- just enough so that the water makes contact with the strip of newsprint. The water will very slowly march up the strip of newsprint, actually opposing gravity. For some papers the water actually climbs out of the glass and down the other half of the paper!



DRAPE OVER
THE GLASS

Again, this is called capillarity, a very important part of industrial chemistry. Capillarity is based on the tendency for water to spread on the newsprint and to penetrate into the newsprint.

Now we're going to have you separate colors in a process called "chromatography." Black ink is generally a mixture of several colors. Take a water soluble (non permanent) black ink and a fresh strip of newsprint. Now mark a thin black line on your newsprint above where the water will make contact. You're going to put this newsprint back in the same glass and do the same experiment as above, but this time there will be a strip of black ink which the water will encounter as it climbs up the strip of paper.



The black ink is soluble in the water. As the water molecules try to spread up the paper they dissolve and pull the black ink with it -- the dye molecules in the ink are moved up the paper with the water. Black ink is usually a mixture of different kinds of dye molecules of different colors; it turns out they don't all move at the same rate because another process starts to happen. Dyes or colored molecules, in addition to dissolving or interacting with the water, also try to interact or bind with the paper itself.

Continued on page 3

FREE

Chemistry Information!

The American Chemical Society has a wonderful series of information booklets on acid rain, ground water, chemical risks, hazardous waste management, and biotechnology. These pamphlets are designed to provide you, as a teacher, and other adults with the scientific information needed to become involved in the social and political questions on these topics. You may obtain them free by calling (202) 872-8725, or by writing American Chemical Society, Dept. of Government Relations

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THANKS!!

We would like to thank all of our sponsors who have made EXPLORE! possible: the American Chemical Society, Dreyfus Foundation, Michael Foundation, and US West. We have received many positive responses in support of our efforts and would like EXPLORE! to continue. Local sponsorship of thematic issues are needed for next year. For example, one of the issues will be about pets. We are looking for local pet stores, veterinarians, and pet supply/feed stores to contribute. Another issue will be on objects that move, such as bicycles and automobiles. Bicycle shops and car dealers would be ideal sponsors. If you know of someone or a business who would like to be the proud sponsor, please have them contact Mary McDonald (581-4171) or Joe Andrade (581-4379) at the Center for Integrated Science Education at the University of Utah.

Science and Art? Art and Science?

What do they have in common?



A great deal it turns out ... Many famous scientists were also artists and musicians. Developments and perspectives in art over the eons have greatly influenced the thinking of scientists and the development of science. The folks responsible for the development of the Utah Science/Arts Center know this and they are working hard to bring you a major, interactive, hands-on, discovery-based, science center which is also an arts center -- but neither arts nor science in the usual exhibition, didactic sense. This is art and science in which you fully engage your hands, as well as your brains, and discover for yourself!

We recently came across a little book, Nature Through Science and Art by Susie Grin Griswell, Tab Books, 1994. We were so impressed with it, we bought two copies and we want to give one to you. See the details below on how you can win a copy!

A really wonderful book for adults interested in learning more about the connections between art, science, and the humanities is Art and Physics: Parallel Visions in Space, Time & Light, by Leonard Shlain, William Morrow Publishers, New York, 1991. This inexpensive paperback traces the development of art and physics from the earliest days to the present. You will never again think of art and physics or art and science as two separate, independent subjects after reading this book.

The Utah Science/Arts Center folks have chosen Leonardo as the theme for their science/arts center on wheels. Leonardo da Vinci, the ultimate Renaissance man, hundreds of years ahead of his time, is serving as the icon and theme for the Utah Science/Arts Center centennial project. This was described in detail in the last Spring issue of *EXPLORE!*, Volume 1, Number 5, March 1994. If you didn't get it, call us and we'll send you a copy.

You'll be hearing more about this project and about Leonardo da Vinci in future issues of *EXPLORE!*

How to Win

Nature Through Science And Art

by Susie Grin well



Send us a brief description -- with sketches or photos of course -- of an innovative and successful classroom project where nature, science, and art are all involved and each helps your students learn about the other, using an integrated approach to learning and observation. Direct it to us here at the Center for Integrated Science Education (address on the back page) by October 1, 1994. The write-up which promises to inspire and interest others the most will win a copy of the Griswell book. The winning entry will be published in our next issue of *EXPLORE!*

"My Summer Job With Leonardo"

How about asking your students to fictionalize a summer job with Leonardo da Vinci, or maybe with Galileo, or perhaps with Archimedes? Just a little background reading in an encyclopedia would provide enough material for a range of writing and drama/theater experiences.

The trick is not to learn any specific set of facts, but to encourage the kids to learn how to learn. Exactly what they learn doesn't really matter, as long as they are learning and excited and motivated about it.

The March, '94 issue of *Science and Children*, one of the National Science Teachers Association publications, has a good article called "My Summer With Leonardo." Judy Hoffman, a teacher in Texas, shared her class writing assignment experiences about famous scientists. Kids can pretend that they are lab assistants for some important and famous scientist. They could either read a biography or two, or in the case of local scientists or engineers, actually interview them and spend some time in the lab. It need not be a famous scientist; it could be a local scientist or engineer. Such activities need not be limited to science, of course, they can also relate to art, music, and other areas.

Give it a try! If the March '94 issue of *Science and Children* is not available in your school library and you'd like a copy of Judy's article, give us a call at 581-4171, and we'll get one to you.

Happy reading and writing!

*Before you can move
anyone else, you must
move yourself.*

Socrates



Sponsored by
the Center for Integrated
Science Education (CISE)
University of Utah *

ANNOUNCING

Third Annual 1994-'95 High School/Middle/Elementary School Science Writing Awards

Prizes will be awarded in three general categories:

- 1) High School,
- 2) Middle and Junior High School, and
- 3) Elementary School.

Science Topics can include:

- Health and Medicine,
- Environment & the Biosphere,
- Life Science & Technologies, and
- Physical Sciences & Technologies.

The Prizes:

- Prizes will be awarded in each category. The awards will consist of a certificate and cash prize (\$75 1st place and \$25 2nd place in each category). In case of multiple writers, the cash prize will be equally divided among the authors.
- The awards will be presented at the 1994 Journalism awards convocation at Brigham Young University in April, 1995.

Eligibility:

- All high school, jr. high school, and elementary class newspapers and magazines in the state of Utah are eligible to compete, both public and private.
- Entries may consist of news stories, features, editorials, reviews, interviews, fiction, etc, including complete issues of class or school newspapers.
- Entries may be submitted by individuals, by parents or guardians, by teachers (for example, Journalism, English, Science, or by anyone in the general public who sees the story, newspaper, or magazine..
- Although there are no specific requirements as to minimum or maximum length, it is expected that they will be of sufficient length and quality to be of general benefit in improving or enhancing the reader's science and technology awareness, literacy, and/or understanding.

To Enter:

- Entries must be submitted by April 1, 1995.
- Entries should be in the form of a letter addressed to Mary McDonald, Manager, CISE, 2480 MEB, University of Utah, 84112 and indicate that they are to be considered for the Science Writing Awards for 1994-'95.
- Entries should include a photocopy or clipping of the story, including the mast head of the paper or magazine showing the date of publication.
- Entries should indicate the prize category, complete name & address of student writer, their social security number, their age, year in school, the name of the newspaper or magazine, and the complete address of the editor. Contest winners will be requested to submit a photo for publication by CISE.

The Center for Integrated Science Education reserves the right not to award one or more prizes if, in the opinion of the judges, there is insufficient competition or quality in the entries.

* Funds provided by a grant from the Dreyfus Foundation, the American Chemical Society, the Michael Foundation, US West, and by the Center for Integrated Science Education.

FREE Chemical Information!

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and Science Policy, 1155 16th Street NW, Washington, DC 20036.

A useful little booklet is *Safety in the Elementary (K-6) Science Classroom*. It is advisable to have safety discussions and demonstrations regularly in the classroom. This can even be part of a unit on health and safety in general. Basically, good safety practices are common sense, but it certainly doesn't hurt to be reminded. If you can't get the booklet directly from the American Chemical Society, give CISE a call and we'll send you a copy.

The American Chemical Society (ACS) has a number of publications targeted more towards parents. One is called *Helping Your Child Learn Science*. You might introduce your PTA to get a number of copies which could be made available to parents for them to do science activities for their kids. Unfortunately, this one is a little too long (50 pgs) for us to copy for you, but you may be able to get additional copies by sending a note to the American Chemical Society. It's certainly worth a try.

Science in the Dark!

Joe Andrade's discovery-based inservice, *Integrated Science Concepts and Themes*, will be offered at five locations during the 1994-'95 year. This 10 hour, 1 credit inservice is called "Science in the Dark!"

Utilizing various examples and novel experiments with unique marine organisms which bioluminesce, you will be involved in a range of observations and experiments which tie together various aspects of chemistry, physics, and biology.

An abbreviated workshop will be given at the NSTA Meeting in Las Vegas in November under the title, "Science in the Dark: Photons, Plankton, and the Ozone Hole."

The schedule for 1994-'95 is not yet set. Contact your district science inservice coordinator or the CISE office for further information.

National Program to Assist Science Education Reforms in Your District

Your school district can enact science education reform with the aid of The National Science Resources Center (NSRC). NSRC sponsors a program, *Elementary Science Leadership Institute*, to establish an effective, hands-on science program in every school district across the country. The Institute provides teams of administrators, curriculum specialists, teachers, and scientists with the information and skills they need to develop and maintain effective hands-on elementary science programs. For more information and to obtain an application, write to: National Science Resources Center, Arts and Industries Building, Room 1201, Smithsonian Institution, Washington, DC, 20560.

"Making water run uphill" *continued from page 1*

Chemists call this process adsorption. The dye molecules which tend to bind to the paper surface can't move as fast. They are constantly getting slowed down by the binding process and lag behind. Those dye molecules which don't bind to the paper surface simply move with the advancing water and migrate up the paper more quickly, so after 5-10 minutes, depending on the dye, the kind of paper, and the exact dimensions of your experiment, you start seeing a range of colors. We use a non permanent water soluble marker, such as used for overhead transparencies, but almost any water soluble black dye will work. What doesn't work is a dye made up of solid mineral pigments. Just try different black, water-soluble inks or dyes and several different kinds of newsprint. There is usually a deep blue or purple component, a bright green component, a touch of a yellow component. These go together to make a black dye.

USA Today newsprint works very well, Salt Lake Tribune is pretty good. One issue of the Salt Lake Tribune, the Deseret News, or USA Today will give you hundreds of specimens; we use the blank paper on the margins.

There are a lot of variations on this set of experiments. Take the newsprint, for example, and make a ruler out of it. Use permanent black ink now to write down a set of lines, maybe at one millimeter intervals, and that way you can measure the rate at which the water climbs up the strip in the chromatography experiment. In the case of the chromatography experiment (the non-permanent ink separation), after the experiment you can let the strip dry and then mark the highest position of the different colors.

Separating chemicals on paper and other porous materials in this way is widely used in biology, medical, and even crime laboratories to help separate and identify different chemicals in mixtures. You can test all kinds of things. Test the different kinds of markers and pens, food dyes from home, different kinds of colored food.

If you have a small pipet or eye dropper the kids can run around the room and simply put a tiny drop of water on almost everything and see if the water beads up or spreads. You're introducing them to many kinds of chemistry in this set of activities: solubility, absorption, adsorption, capillarity, separation, chromatography. Connect this to art activities by having them draw the experiment, and especially the separation of colors on the strips. If you take a large piece of blank newsprint and put a big drop of water in the middle, the water will spread outwards in a radial, circular pattern. If you draw various patterns with black inks or other colored non-permanent inks on the paper before putting the water on, as the spreading water takes the ink with it. This permits a variety of very artistic designs. Maybe a few of them could even write a song about it!

We'd love to learn about your experiences and adventures with chromatography. Send us a note and a letter, hopefully some sketches, and maybe even some examples of your paper strips. For every letter that we receive, we'll send you a neat little plastic pipet which your kids can use to place drops of water on surfaces. Surface science is an important branch of both chemistry and physics. It's important in almost all aspects of everyday life. Questions? Call: Joe Andrade (801) 581-4379.

Talk Environment!!!



JoAnn Lighty
Call 581-5763
during the day.

with JoAnn Lighty

Have you or your students ever wondered what happens to wastes when they are burned?? JoAnn is willing and able to answer your questions on solid waste incineration and air pollution from combustion systems in the environment. Utah has several commercial incinerators for medical, hazardous, and municipal wastes.

JoAnn is an Associate Professor of Chemical and Fuels Engineering as well as Departmental freshman advisor at the University of Utah. She is eager to talk to students about chemical engineering curriculum and careers. She has spent time as a speaker with programs designed to aid young women to enter science fields. Give JoAnn a call!!!

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Talk Biology-Chemistry-Physics!!!!



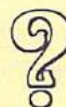
Karin Caldwell
Call 581-5455
during the day.

with Karin Caldwell

Karin can tell you all about molecules (small and large ones), emulsions, polymers and particles. She has participated in the Expanding Your Horizons Conference to encourage young women in science. She has been known to go out to schools and do demonstrations and speak to students about science.

Karin is Associate Professor of Bioengineering and Director of the Center for Biopolymers at Interfaces (CBI). She finds time and enjoyment hiking and skiing in Utah's mountains. In addition, she is the president of the Swedish Heritage Society of Utah and holds board positions in the Wasatch Mountain Club and the Utah Symphony Guild.

Give Karin a call, but be careful, her enthusiasm for science is contagious!!!



Corner

Do you or your students need help with scientific questions? The following University faculty have plenty of information and ideas to share with you and your classroom. Please give them a call!! (and post this for everyone to use!)

CHEMISTRY

Noel DeNevers - Call 581-6024
from 8 to 5 or at home 328-9376 from 6 to 10 pm.

Ron Ragsdale - Call 581-7621 from
9 to 6 or at home 268-2149
from 7 to 10 pm.

PHYSICS

Sid Rudolph - Call 581-4803 from
8 to 5.

Gale Dick - Call 581-6408 from 8
to 5 or at home 359-5764.

Bob Kadesch - Call 583-0123 in
the evenings.

SCIENCE EDUCATION

Julie Gess-Newsome - Call 581-7158 during the day and
467-5183 in the evening.

MATH

Herb Clemens - Call 581-5275
during the day.

Peter Alfeld - Call 581-6842 or
leave a message at 581-6851.

BIOLOGY

Pat Renfranz - Call 585-3819
from 9 to 7 or 466-6585 from
7 to 9 pm.

John Roth - Call 581-3412 during
the day.

FOOD and NUTRITION

Sherm Dickman - Call 582-6910

EXPLORE!

CENTER FOR INTEGRATED
SCIENCE EDUCATION
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Salt Lake City, Utah 84112
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Jason Bagley.....Science Fair Specialist
Mindy Steadman....Program Assistant

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*Clip, Save, and Post
for Your Resources!*

EXPLORE!

Volume 2, Number 2, November/December 1994



SCIENCE SLEUTH

*We challenge you
and your students
to find science all
around you!*

First, start with your classroom. List as many science topics/concepts/themes/activities that you and your students can! This may include light from the windows as energy, overhead fluorescent lights as another form of energy, or the energy of heating the room. If you become stuck on what constitutes science themes and concepts, you may

Continued on page 2

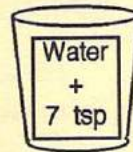
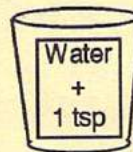
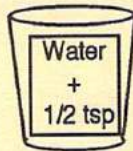
Why salt roads and sidewalks in the winter?



This is a fun activity to demonstrate the effect of salt on the freezing point of water!

MATERIALS: Salt
5-ounce (150 milliliters) paper cups
Measuring teaspoons (1 teaspoon = 5 milliliters)
Freezer (usually in the teacher's lounge)
Masking tape
Marking pen

Take four cups and label; "Water + 0 tsp", "Water + 1/2 tsp salt", "Water + 1 tsp salt", and "Water + 7 tsp salt":



Continued on page 3

WonderScience

The American Chemical Society publishes WonderScience, an absolutely wonderful, highly illustrated, cartoon format booklet of science activities targeted to the elementary level. Each issue is focused on a particular theme and is just loaded with wonderful, easily implementable, hands-on activities. Unfortunately, we cannot duplicate copies of this for you, but you should see to it that your school subscribes. It is quite inexpensive. You can subscribe by contacting the American Chemical Society, WonderScience magazine, P.O. Box 57136, Washington D.C. 20077-6702. Because multiple copies are cheaper, a district may want to subscribe for all of its elementary schools.

If a child is to keep alive his inborn sense of wonder... he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in.

Rachel Carson

Why salt roads and sidewalks in the winter? *continued from page 1*

Add the designated amounts of salt to the cups and then add the water. Stir well.

For the upper grades, students can determine the percentage of salt simply by dividing the amount of salt by the amount of water and then multiplying by 100.

$$\% \text{ Salt} = \frac{\text{Amount of Salt in milliliters (ml)}}{\text{Amount of Water in milliliters (ml)}} \times 100$$

To get the number of teaspoons in milliliters, take the number of teaspoons added to a cup and multiply by 5 ml. For example: 1 teaspoon X 5 ml = 5 ml. The percentage of salt in this cup would be $\frac{5 \text{ ml}}{150 \text{ ml}} \times 100 = 3.3 \%$.

What is the percentage of salt in the other cups?

Place the cups in the freezer. Observe and record the observations at two-hour intervals. What happens to the water? What happens to the salt solutions?

Adding salt lowers the freezing point of water. When salt is applied to sidewalks and roads, the water will freeze at a lower temperature.

The solution with 2.5 ml of salt is nearly the same salt percentage found in biological fluids such as blood. At this percent, the freezing point of water is lowered by .5°C* (which lowers the freezing point of water by approximately 1°F from 32° to 31°F). When 5 ml of salt is added to the water, the percentage is almost 3%, or the salinity of ocean water. This lowers the freezing point of water by nearly 2°C (the freezing point of water lowers approximately 2-3° F to 29-30°F). What happened when 35 ml of salt was added to the water? This is nearly 23% salt concentration and is the point where the salt can no longer stay mixed with the water. Just before this saturation occurs, the freezing point of water is lowered by 20°C (bringing the freezing point of water to -4° F).

The Great Salt Lake varies in the amount of salinity from 0 to more than 23%. You may want to try this with various water samples taken from different locations around the lake. If you have further questions, you may want to call our chemistry faculty listed on the back page of EXPLORE!

*0°C is equivalent to 32°F. To convert Celsius to Fahrenheit, multiply the Celsius by 1.8 and add 32.

The Center for Integrated Science Education

**Teacher Workshops:
Integrated Science Concepts and Themes**

**Hands-on, discovery-based
inservice using bioluminescence!**

*Bioluminescence is a nearly ideal subject with which to experience general science themes and concepts.
Don't miss out on this one!!!*

For more information contact Joe Andrade at 581-4379. There is still room on this year's schedule! The inservice accomodates 15-25 teachers in their school or district office.

SPECIAL SPRING INSERVICE

University of Utah

March 3: 4-7 pm

March 4: 8am - 3pm

Call Joe Andrade at 581-4379 for details and to sign up!
University Continuing Education Credit is available

*The Bennion Community Center and Center for
Integrated Science Education present:*

**Science Education
Support Project**

Have you ever picked up an ice cube with an ordinary piece of string? Lit a flourescent tube with a balloon? Understood what causes a tornado? The Bennion Community Service Center at the University of Utah is embarking upon a new project for the 94-95 school year. The Science Education Support Project is intended to enable both University and elementary students to comprehend the "wonder" of science. University students will present assemblies designed to help the students use science to understand the world around them. Students are also planning to create class presentations to help students learn to make things grow, light up, and change color. And understand Why! The Science Education Support Project will help bring more enthusiasm to the elementary school calassroom. For more information, call the Center for Integrated Science Education at 581-4171.

Science Sleuth *continued*

want to look into *Science For All Americans*. This is the Project 2061 report and was used nationally and locally to write the new science curriculum. Another book that may help you is *Benchmarks for Science Literacy*. Both of these books are available from Oxford University Press, Dept. EC, Madison Avenue, New York, NY 10016. You may inquire with your district science coordinator or local bookstore for a copy. Science concepts and themes are covered in our special inservice course (*see story on page 3 of this issue*).

Once you have exhausted the science possibilities in your classroom, you could then check out the entire school! Don't forget to step outside into the school yard (there's lots of biology, ecology, and physics out there)! Just to take this a bit further, why not look for science in the home??!! The kitchen is full of science!

Now that you have found some of the science around you, what are you going to do with it? Have you thought about tying all this science into the new elementary core curriculum? How does it fit in with your grade level topics and objectives? Can you make hands-on activities from the science around you?

Give it a try and let us know your results. We will award the submittal that best ties in science around them to their grade level curriculum! Send your findings to Mary McDonald at the Center for Integrated Science Education, University of Utah, 2480 MEB, Salt Lake City, Utah 84112. Please include your name, grade, school, and district on your lists.

Good luck finding the science all around you!

Science at the UEA Convention

The Center for Integrated Science Education was represented at the recent UEA convention. Joe Andrade, Co-Director, spoke in the Friday Science Education session on the Leonardo Project of the Utah Science/Arts Center, a science center on wheels which will be on the road in early 1996, the state centennial year. This project was profiled in the March, '94 issue of EXPLORE!. If you would like further information on the Leonardo Project and the unique Utah Science/Arts Center initiative, please contact Joe at 581-4379.

The Science in the Dark bioluminescence activities and materials Joe uses in his inservices were also include as part of the Utah Nature Study Society exhibits and activities.

We were particularly impressed by the range of materials and services in the exhibit hall of the UEA meeting. Although science materials are still a very small part, it is clear that it is a part which is growing rapidly. We urge you to attend and participate in next year's UEA and to pay particular attention to the science activities, materials, and services -- many of them free for the asking!

*Look for the next issue of EXPLORE!
in January/February --
it will be coming to your mailbox via your principal!*

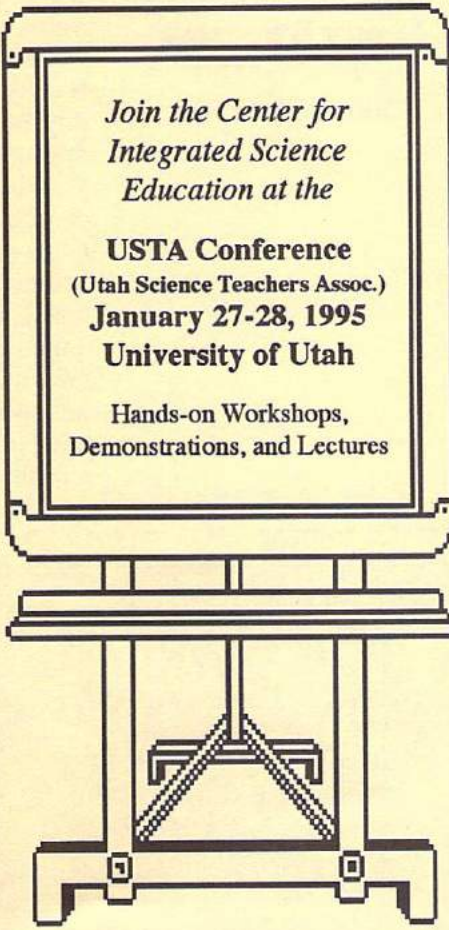
Scientific American

Keep your eyes on Scientific American Magazine, particularly the Amateur Scientist section. Although these materials are more at the high school level, occasionally there are topics which you will find interesting for your own reading and possibly for use in the classroom. For example, the April, 1994 issue had a story called "Chemistry and Physics in the Kitchen." The Amateur Scientist section of the same issue was on hands-on activities titled "The Kitchen as a Lab." If you're into cooking, you will really like this. It is also a good way to teach units and measures ranging from ounces, cups and quarts to milliliters, cubic centimeters, and liters.

*Join the Center for
Integrated Science
Education at the*

USTA Conference
(Utah Science Teachers Assoc.)
January 27-28, 1995
University of Utah

Hands-on Workshops,
Demonstrations, and Lectures



Talk Science Education

with Julie Gess-Newsome and
Sherry Demastes ...



Julie Gess-Newsome
Call 581-7158
during the day.

Julie is an Assistant Professor of Science Education in the College of Education. As a science educator, her research focuses on the science understandings of preservice and inservice teachers at the elementary and secondary levels. Julie's interests in these topics have been stimulated by her eight years of experience as a high school biology and general science teacher. She is currently teaching the preservice elementary and secondary science methods courses at the University of Utah, as well as science education courses at the Master's and PhD level. Julie has been active in the process of revising the state science curriculum and is quite knowledgeable about science education issues, both locally and nationally. Give her a call!!!!

Sherry Demastes
Call 581-7158
during the day.

Sherry just moved here from Louisiana and will coordinate science education teacher training and programs with Julie Gess-Newsome in the College of Education. Sherry has taught high school biology, physical science, environmental science, and chemistry courses. Her experience includes developing course curricula and coordination of instructional goals for science courses for grades K-12. She has sponsored science fairs, science literary rallies, and science quiz bowls. Her experience includes practical applications of the theoretical base of science teaching. For questions regarding the teaching of science in the classroom, please give Sherry a call!!!

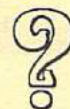
EXPLORE!

CENTER FOR INTEGRATED
SCIENCE EDUCATION
University of Utah, 2480 MEB
Salt Lake City, Utah 84112
581-4171 Fax 585-5361

Newsletter Staff

Joe Andrade..... Project Director/Editor
Mary McDonald... Program Coordinator
Jason Bagley..... Science Fair Specialist
Mindy Steadman... Program Assistant

*Explore! is made possible by grants from the
Dreyfus Foundation, the American Chemical
Society, the Michael Foundation, US West, and by the Center for Integrated Science Education.*



Corner

Do you or your students need help with scientific questions? The following University faculty have plenty of information and ideas to share with you and your classroom. Please give them a call!! (and post this for everyone to use!)

CHEMISTRY

Noel DeNevers - Call 581-6024
from 8 to 5 or at home 328-9376 from 6 to 10 pm.

Ron Ragsdale - Call 581-7621 from
9 to 6 or at home 268-2149
from 7 to 10 pm.

PHYSICS

Sid Rudolph - Call 581-4803 from
8 to 5.

Gale Dick - Call 581-6408 from 8
to 5 or at home 359-5764.

Bob Kadesch - Call 583-0123 in
the evenings.

MATH

Herb Clemens - Call 581-5275
during the day.

Peter Alfeld - Call 581-6842 or
leave a message at 581-6851.

BIOLOGY

Pat Renfranz - Call 585-3819
from 9 to 7 or 466-6585 from
7 to 9 pm.

John Roth - Call 581-3412 during
the day.

FOOD and NUTRITION

Sherm Dickman - Call 582-6910

Biology-Chemistry-Physics

Karin Caldwell - Call 581-5455
during the day.

ENVIRONMENT

JoAnn Lighty - 581-5763 during
the day.



Clip, Save, and Post
for Your Resources!

Science and Sports

CNN Headline news, Monday March 22, reported an innovative and highly effective educational program "Directed Sports," in which sports activities are used to facilitate the learning of mathematics. Kids do exercises, team events, relays, and other activities which involve mathematics activities, such as counting, multiplication and addition. For example you count baskets by twos in basketball; touchdowns are by 6's in football.

Rather than keep sports and academics totally separate, the two are simply merged in innovative ways to attract and motivate those students who might have difficulty with purely academic subjects. Imagine the recess period with various mathematic and even science activities. Use your imagination and the kids will use theirs.

Let us know if this approach works for you so we can share your ideas and successes with other teachers.

Science Education, Science Standards, and the Utah Core Curriculum

"Kids learn best when they Explore things for themselves." "Discovery-based, hands-on activities are the best way to teach science and the scientific process." These are typical of the conclusions that have been drawn from a series of studies done over the last ten years on science education and science literacy in the United States. The Project 2061 report of the American Association for the Advancement of Science (AAAS), Science for all Americans, and the more recent Elementary School Science in the Nineties, conclude that hands-on, discovery-based science is the best way to go.

Many teachers have difficulty with this approach because of the way the Utah state and district core curricula are implemented, and the type of tests by which student performance is assessed. The situation is likely to change very quickly. First, the Utah state core curriculum is currently undergoing review, and will be dramatically revised over the next several years in accordance with national standards for science education. There is now a national committee developing science education standards and assessment methods. That committee is composed of many people who advocate hands-on, discovery-based, multi and interdisciplinary approaches to science education. It is safe to predict that national science standards will reflect those sentiments and beliefs. It is therefore advisable for Utah teachers to begin to incorporate discovery-based, hands-on science as much as they possibly can in their classroom environments.

Admittedly, this is difficult in many cases because of very low budgets, overcrowded classrooms, and inadequate facilities and other resources. That is part of the purpose of EXPLORE!, this new, activity based newsletter produced by the Center for Integrated Science Education (CISE) at the University of Utah, is designed to help you implement discovery-based, hands-on science in your classes.

A preliminary national standards document is expected in late 1993, and by the end of 1994 criteria and a framework for judging science curricula, teaching, and assessment, will be available. If you would like to get on the mailing list for drafts or for further information, contact the coordinating council for Education, National Research Council, 2101 Constitution Ave., Washington, DC 20418, Kathleen Holmay, 202-334-1489.



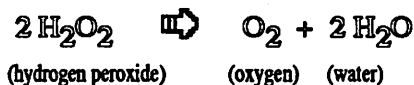
CONGRATULATIONS to Linda Preston! Linda is the proud recipient of the \$10,000 Shell Science Teaching Award sponsored by Shell Oil Co. and NSTA. Criteria for the award was based on impact on science education, creative and innovative teaching, working with at-risk students, and setting a positive role model. Linda received her undergraduate degree from the University of Minnesota and a Masters from the University of Utah. She has been teaching science for 17 years, nine of which have been in Park City. Many of you may recognize Linda from the many inservices she did in 1991 for elementary teachers.



CONGRATULATIONS to RevaBeth Russell! RevaBeth is the recipient of DOE-TRAC summer research award and the "Outstanding Biology Teacher for 1992" from the National Biology Teacher Association. She received her B.S. from BYU and is currently working on her Masters from the University of Utah. RevaBeth has taught algebra, earth science, practical chemistry, biology, ecology, human biology, and AP biology at Lehi High School for the last eleven years and at Mother's High School for the last three years. Her main focus is to make science applicable and related to the student's life. She is constantly trying to learn more and better ways to present ideas.

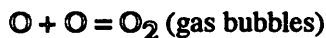
MOLECULES!

continued from page one



In this reaction, yeast is called the catalyst. Without it, the hydrogen peroxide would just sit in the bowl. When catalysts are found in living cells, they are called enzymes. In this case, the enzyme is catalase.

The bubbles you see are made up of the same stuff we breath: Oxygen. Two of the oxygen atoms that are removed join together to form oxygen gas.



Was the bowl hot? When reactions get hot, they are called exothermic reactions.

When you are done, pour the contents of the bowl down the sink.

From Adventures with Atoms and Molecules,
Mebane, R. and Rybolt, T., Enslow Publishers,
N.J., 1987

Classroom Award!

Besides yeast, what else can be added to hydrogen peroxide to cause the same result?

Ask your class for suggestions and send us your most interesting responses, even if they don't work. A \$25 prize will be awarded to the class with the most unique response. If selected, your class's creative response will be published in the next edition.

Explore! is Printed on Recycled Paper

RESOURCES

for Utah Teachers

There are a variety of regional, state and national resources available. The Utah Science Teachers Association (USTA), a chapter of the National Science Teachers Association (NSTA), is a very active group and has a special membership option for elementary teachers. You can be a member of the USTA for only \$6.00 a year, which entitles you to the USTA quarterly newsletter and attendance at USTA semi-annual meetings. NSTA publishes 4 magazines relating to science education at every level (1742 Connecticut Ave. Washington, DC 20009). Your school library should receive those issues appropriate to your grade levels.

Other local publications and newsletters which contain information on science teaching activities, resources, and short courses include:

■ You Can with Beakman and Jax

Salt Lake Tribune in the Sunday comic section.

■ The Cultivator

Red Butte Gardens and Arboretum, University of Utah, 390 Wakara Way, Salt Lake City, UT 84108

■ Utah National History

Utah Museum of Natural History
University of Utah S.L.C., UT 84112

■ Museum Times

Children's Museum of Utah
840 N. 300 W., Salt Lake City,
UT 84103

■ Monthly Events Calendar

Hansen Planetarium
15 S. State, Salt Lake City, UT 84111

■ Safari

Hogle Zoological Garden
2600 E. Sunnyside Ave. (840 S.)
P.O. Box 58475
Salt Lake City, UT 84158-0475

ANNOUNCING...

The 2nd Utah Bioluminescence Contest

The Center for Integrated Science Education (CISE) at the University of Utah is studying bioluminescence in the State of Utah. You can help -- especially if you live in rural areas, have access to public lands away from artificial lights, and if you're not afraid of the dark! First Prize is \$100, Second Prize is \$50. Everyone is eligible, including visitors to Utah.

Your entry should include the following information:

- Your complete name, address, and phone number, and a signed statement saying that we may use your information in a scientific publication.
- A map of Utah showing where your observations were made.
- A local map showing more exactly where your observations were made.
- Photographs of the locations and the organisms (optional).
- A complete description of the organism and of the bioluminescence observed, including sketches and measurements.
- The dates, time of day, temperature, and weather at the time of your observations.

Your entry must be neat and legible -- preferably typed. DO NOT include any specimens.

Bioluminescence is light generated by animals and plants. Certain parts of Utah have bioluminescent fireflies. There may be worms, mushrooms, and other species. The best time to observe them is at night, preferably a dark night with no moon. The best time to observe fireflies is at dusk around 8-9 p.m. There could also be bioluminescent centipedes, millipedes, snails, or earth worms.

Mail your entry to us by July 19, 1993 to The Utah Bioluminescence Project, Center for Integrated Science Education, 2460 MEB, University of Utah, Salt Lake City, UT 84112



Noel DeNevers

TALK CHEMISTRY!

with Noel DeNevers
and
Ron Ragsdale



Ron Ragsdale

Call 581-6024 from 8 to 5 or at home 328-9376 from 6 to 10 pm

Call 581-7621 from 9 to 6 or at home 268-2149 from 7 to 10 pm

You name it....molecules, atoms, acids, plastics, reactions, etc. Both Ron and Noel are waiting to hear from you and your classroom! Ron is a professor in the Chemistry Department at the University of Utah. He conducts the famous "Faraday Lectures"-a lively demonstration of chemistry for classroom audiences. Noel has been with the University of Utah since 1963. His interests are in chemical engineering. He has written a textbook "Technology and Society" and conducted a course on the same. Ron and Noel are full of information to share with you and your classroom-give them a call!!!!

Clip and Save for Your Resources!

EXPLORE!

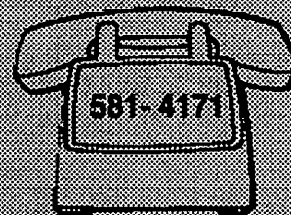
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Jason Bagley... Activity Editor
Dan Jensen... Assistant Activity Editor
Cindi Dunford... Program Assistant

Please give us a call if you have information to contribute or suggestions for this newsletter!



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Spring and Summer Events!

PROJECT LEARNING TREE

University of Utah
May 21 & 22

INTRIGUES OF THE PAST:

Investigating Archeology

University of Utah
May 14 & 15

PROJECT WILD

University of Utah
May 7 & 8

TEACHING THE FUTURE:

Linking the Classroom to Space

University of Utah
Dates To Be Announced

Call Julie Gess-Newsome
581-7158

ELEMENTARY SCIENCE

TEACHING METHODS

University of Utah
July 12-22 1993
Mon-Friday 8 to 5
Call: Linda Preston
1-654-2435 (home)
or Sid Rudolph
581-4803

WEATHER SATELLITE EDUCATIONAL WORKSHOPS

FOR TEACHERS

Weber State University
June 14-25
August 2-13
Call Wayne Wahluquist
626-6943/6207

SCIENCE INSERVICES

Brigham Young University
Call Marv Tolman 378-4801
or Richard Tolman 378-4398

7TH ANNUAL BEAR LAKE

ELEMENTARY SCIENCE RETREATS

USU Training Center on Bear Lake
June 14-17, June 21-24, June 28-July 1

ELEMENTARY SCIENCE/MATH EXCURSION

University of Victoria, Victoria, BC
August 2-14

2ND ANNUAL SUPER SCIENCE INSERVICE

Kennedy Space Center, Florida
July 11-16

7TH ANNUAL BEAR LAKE

SUMMER SCIENCE RETREATS (ADVANCED)

USU Training Center on Bear Lake
July 19-22, July 26-29

SCIENCE & TECHNOLOGY

IN ELEMENTARY CLASSROOMS

USU Campus/University Inn Housing
July 12-16

Call Donald Daus 750-1130

EXPLORE!

Volume 1, No. 2, September 1993

"WELCOME TO EXPLORE!"

Welcome to the second issue of *EXPLORE!* If you missed our introductory issue in April, *EXPLORE!* is a newspaper/magazine/workbook/newsletter published for elementary teachers in the state of Utah and surrounding regions by the University of Utah's Center for Integrated Science Education. *EXPLORE!* will provide ideas, resources, and a network of people to help you provide science, technology, and math experiences and opportunities for even your most difficult students. By tying science to current and local events and to subjects and activities which interest students, *EXPLORE!* will help you implement more effective science activities.

We hope you find *EXPLORE!* interesting and useful. We encourage your comments and input. Let us know what is helpful, what is interesting, and what is relevant. Our goal is to work with you to provide the most effective, interesting, and exciting science and math experiences for Utah's elementary students. If you would like to obtain a copy of our first issue (*Resources for Utah Teachers, Utah Core Curriculum and National Standards, and Chemistry Resource Network*), please contact our office at 581-4171..

What are Plastics and Polymers?

.....pop bottles, milk containers, shoes, cassette tapes, TV boxes.....in today's advanced world, plastics, sometimes known as polymers, are being used almost everywhere! Originally, they were made from natural fuels like oil and coal which contain molecules consisting of two basic elements: carbon and hydrogen. Many different plastics are made by changing the organization of the carbon and hydrogen atoms. Nitrogen and oxygen atoms are also used in some plastics. These changes let us make plastics with different properties for different reasons. In plastics, these properties are determined by the length and structure of the polymer chains that comprise it. One interesting property is density, which is simply the relationship between the mass of a material and its volume.

Here's a classroom activity you can try with your students!

Take some identical pop beads which can be connected together end to end. Imagine one bead is a single, small molecule. Now connect 10 or 100 beads together in a string of beads-you now have a tiny polymer-like "molecule."



A real polymer has thousands of beads in each molecule. Poly means many-"mer" refers to the individual bead--aha!-- Polymer! Your string of beads is like a piece of cooked, wet spaghetti. Imagine a bowl of moist, cooked spaghetti-and you have a piece of "plastic." Plastic materials have billions of polymers, all entangled or connected in some way. Try to stir the spaghetti-try to pull one strand of spaghetti out of the bowl-difficult, right? That's why plastics can behave like solids even though their individual molecules (polymers) are long, thin, and squiggly. Imagine a bowl of long, thin spaghetti and another bowl of a long but thick spaghetti-two different polymers....two different plastic materials!! Hey-you're almost ready to be a plastics scientist or engineer-encourage your students that way, because there are great futures in polymers and plastics.

Here is another simple activity you can do with your students!

Metals are dense, air is very light (low density), plastics are in between. Plastics with air in them are foams.

Find a scale or balance (a small postal scale will work well-the secretary in the main office should have one for you to borrow!). Now you can weigh things.



Continued on the Next Page

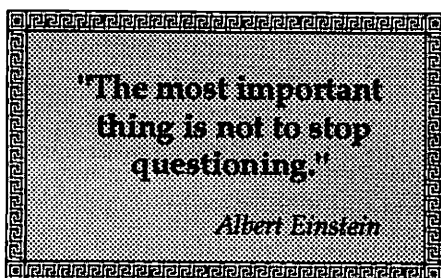
PBS Special

The Secret of Life

Premiering fall 1993, a new eight-part public television series will show how the revolution in molecular biology is affecting our world, including ethical, social, and legal questions. *The Secret of Life* offers an exceptional educational opportunity. Many of the concepts can be incorporated into science, math, and language arts lessons for grades 3-5.

A full-color classroom poster with reproducible hands-on activities on the back is being offered free. The poster is included in the September issue of *Science and Children*, the National Science Teachers Association magazine for elementary school teachers, or you may write to: Educational Print and Outreach, WGBH, 125 Western Avenue, Boston, MA, 02134. All elementary teachers are invited to enter the teacher contest. By watching the eight-part series and answering a few questions, you may be a winner in the "1994 Science Grasp!"

This Upjohn-sponsored program includes a 10-day workshop detailing hands-on approaches to elementary science, computer and electronic mail network with other elementary teachers, sponsorship to the NSTA National Convention, and the creation and publication of a book of original hands-on activities. Details about the contest are available on the poster.



What are Plastics and Polymers?.....Continued from Page 1

How can we measure volume-- old Archimedes figured it out when he stepped into a very full bath tub--yes, the volume of water you displace is equal to your volume. You know your weight (we can keep this part a secret!). Weight (actually, mass) divided by volume is.....DENSITY!

$$\text{Density} = \frac{\text{Weight (Mass)}}{\text{Volume}}$$

Find a good measuring cup (preferably one marked in milliliters). Fill it half full of water--now put a solid object in it--some gravel or small rocks will do. The object must be completely underwater. See the water rise? The difference in the water levels before and after is the volume of the rocks. Now weigh the rocks. Weight divided by volume equals density. Can the kids measure their own density (at home--in the bath tub--with their parent's help!?).

Now, let's go to the garbage can and get some plastics! If it floats, that means its density is less than water--take a metal paper clip, straighten it out to make a straight wire. Stick it in the plastic piece, and force the plastic underwater (be sure you don't trap any big air bubbles)--now you know the volume of the plastic--weigh it and you will have the density! Repeat this for each type of plastic and record your findings in a table like the one below.

| Plastic Type | Weight (Mass) | Initial Water Level | Final Water Level | Plastic Volume (Final Water Level- Initial Water Level) | Density (Weight/Volume) |
|--------------|---------------|---------------------|-------------------|---|-------------------------|
| | | | | | |
| | | | | | |

Which plastic had the highest or lowest density? Why do plastics have different densities? Which plastics float? What happens to plastics when we litter in the lake? Would the same plastics still float in sea water? --add salt to water and try it! You can easily measure the density of your seawater by weighing some and measuring the volume. What other properties do plastics have? (Does it bend? Can you see through it? Does it break? Is it smooth?)

Utah's "Interlinks"

The Utah Alliance for Science, Math, and Technology Education publishes a newsletter called *Interlinks*. Utah Alliance was organized in December 1991 and includes a broad cross-section of people from education, business, government, and the community. Their mission is to facilitate cooperation, action, and communication among groups and individuals of the community, to improve and integrate science, math, and technology education so that students become competent, responsible citizens. If you would like more information about the Alliance, or about *Interlinks*, contact the Alliance's office at (801) 626-7258.



Just in time for the recent dinosaur mania! Zinj Magazine is a new magazine designed to teach kids of all ages to respect, protect, and preserve our prehistoric and historic resources in a lively, fun and challenging manner. Zinj is published four times a year by the U.S. Forest Service, National Park Service, BLM, Utah Division of State History, and the Interagency Task Force. For more information, contact Lydia Nibley, Zinj Magazine, 300 Rio Grande, Salt Lake City, Utah 84101, (801) 533-3530.

Congratulations!

to
Abbie Klein
from
Cedar City!!!

Abbie was a winner in our First Annual Journalism Contest! She received a check for \$25 as the youngest entrant in the contest (Abbie is a sixth grade student in Cedar City). Awards were announced at the Utah Journalism Educators Association Workshop and Awards Ceremony held on the BYU campus on April 16. Abbie's brief and highly entertaining story, "Slug Invasion Slimes Spring," was originally published in the TLC Times. Krista Dykstra, an elementary teacher, is editor of TLC Times. We certainly hope this award will encourage more students to write about science and technology issues. Look for our announcement of the Second Annual Journalism Contest in the next issue of EXPLORE!

SCIENCE FAIRS

A science fair project should not be merely a book report, an experiment copied from a book, or a hobby collection. Doing a science fair project involves formulating a question, designing experiments, and drawing conclusions from the experiments. Students learn to better organize their time, think through a process, and meet a deadline.

The Center for Integrated Science Education is coordinating science student volunteers from the University to become active participants in helping you with science learning in the classroom. Elementary students can be more involved in the process of science if they could consult with someone on science fair projects. We can arrange for University science students to come to your school as science project advisors. The University student will work with a child (or children) to assist in the development and learning of the scientific process. Call 581-4171 or write Center for Integrated Science Education, University of Utah, 2480 MEB, Salt Lake City, Utah 84112.

If you are interested in starting a science-fair at your school, we have numerous tips on how to organize and conduct one. Look for more info on science projects and fairs in future issues of *EXPLORE!*

National and Local Science Curriculum Update

The Center for Integrated Science Education has obtained the July '93 Progress Report of the National Science Education Standards. The report addresses the issues of content, teaching, assessment, and program and policy standards. A Critique and Consensus Feedback Form is included in the Appendices. If you would like a copy of this report please call (202) 632-0952 or 581-4171.

After an extensive series of hearings around Utah about how elementary teachers feel about the State Science Core Curriculum, the Core has undergone a revision process. Twenty elementary, secondary and university teachers spent a week reconceptualizing and rewriting the core this summer. Twelve schools are being asked to pilot the core during the next school year, with a final version being ready for distribution in the Fall of 1994. For additional information, please contact Brett Moulding, Science Education Specialist, Utah State Office of Education, 250 East 500 South, Salt Lake City, UT 84111, (801) 538-7791.

TEST TUBING

with plastics

Young children enjoy mixing things together. An inexpensive and safe alternative to glass or plastic test tubes is to use clear plastic straws. A paper or food wholesale house should sell the straws by the gross. Fast food places will probably give them to you-just ask! To make the test tubes, cut the straws into quarters. For the bottoms of the test tubes, use waterproof clay (available from a florist's shop). Play dough may also work. Ask the children to divide the clay into pieces, roll these pieces into balls, flatten the bottoms, and place them on their desks. Then insert a straw into each piece of clay. Now the mixing can begin!

Use eyedroppers to fill the test tubes. This is a great way to work on motor skills in younger children. The size of the test tubes will limit the amount of mess. Children tend to notice that the liquid inside doesn't pour out when the test tube is turned upside down. Sometimes a child will hold the eye dropper straight down to squirt into the tube and an air bubble will block the passage. Encourage the children to ask questions and make observations.

*"Students and Chemistry-
The Perfect Mix,"
by Glenda Carter
Science and Children,
Feb. 1992*

RESOURCES

for Classroom Activities in Plastics and Polymers

The Center for Integrated Science Education has available "Polymers All Around You!", a polymer activity book for elementary teachers and students. The books are available free of charge on a first come, first serve basis. In addition, The Center has on file other books, videos, sources, and activities. Please contact Joe Andrade, Mary McDonald, or Mindy Steadman at the address and phone number listed on the back page of EXPLORE!



TALK PHYSICS!

with Sid Rudolph and Gale Dick



Sid Rudolph

Call 581-4803 from 8 am to 5 pm

Gale Dick

Call 581-6408 from 8 am to 5 pm or at home 359-5764

Have your students ever asked questions about the physics of something and you just didn't know the answer? Both Sid and Gale are available to assist you with your students' questions. Sid, a professor in the Physics Department, writes and coordinates all the physics labs and is well known for his teacher training courses during the summer. He is available during the day. Gale's expertise is physics and he has taught a variety of general education courses incorporating science topics. Bob Kadesch, Sid's colleague, is also eager to help you with questions in the evening. His home number is 583-0123. All three have received recognition and awards for excellent teaching. Give them a call and test them on their knowledge of physics!!!!!!!

 *Clip and Save for Your Resources!*

Upcoming Events!

USTA ANNUAL FALL CONFERENCE

The Utah Science Teachers Association will have their annual meeting during the upcoming UEA conference September 30-October 2. Paul Doherty, Project Director, Exploratorium in San Francisco, will be the keynote speaker on October 1. If you would like more information about the upcoming conference, please contact Richard Tolman at 378-4398.

SCIENCE AWARDS

Six elementary teachers from Utah are state-level awardees for the 1993 Presidential Awards in Excellence in Science and Mathematics Teaching, a program sponsored by the National Science Foundation. From this group, the 1993 Presidential Awardees will be named this month. State-level elementary awardees are: J. Camille Cammack, Sunset View, Provo; Sally M. Curtis, Taylorsville, Salt Lake City; Shauna R. Lund, Valley View, Bountiful; Karen R. Bishop, Ferron, Ferron; Lois S. Douglas, Lynn, Ogden; Jimalea Webb, Reading, Centerville. Congratulations!!!

..... **Attention!!!!**

In the next issue of **EXPLORE!** we will feature food activities. \$25 will be awarded to the elementary class with the most innovative, food science activity!!!! Call 581-4171 for details!

QUESTIONS ANYONE?



Do you or your students have questions which you just can't answer? The following University faculty are full of information and ideas to share with you and your classroom. They eagerly await your calls!!!!!!!

CHEMISTRY CONTACTS

Noel DeNevers

Call 581-6024 from 8 to 5 or at home 328-9376 from 6 to 10 pm.

Ron Ragsdale

Call 581-7621 from 9 to 6 or at home 268-2149 from 7 to 10 pm.

BIOLOGY CONCERNS

Pat Renfranz

Call 585-3819 from 9 am to 7 pm.

John Roth

Call 581-3412 during the day.

SCIENCE EDUCATION

Julie Gess-Newsome

Call 581-7158 during the day and 467-5183 in the evening.

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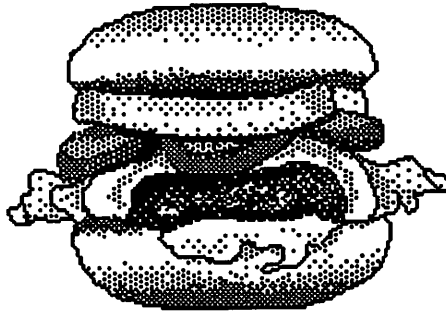
Volume 1, Number 3, November 1993

Colors of M&M's

This activity requires just a few bags of M&M's. Have your students divided into groups of three or four. Give each group a small bag of M&M's (do not eat them!). Have the students first guess at the most common M&M color. Then have them open the bag, separate the M&M's by color, and count the number of each color. One of the students in the group can be assigned to collect the data.

When all of the groups have collected the data, you can graph on the board the M&M colors for each group. You may want to determine the average number of one color which may be found in a bag. What can you say about the most common color of M&M's? What can you say about the other colors of M&M's?

Now for the fun part! When the data evaluation is completed, have the students eat the M&M's!!!



Learning Science with Food

Exploring Chocolate Chip Cookies

Yes, that's right, chocolate chip cookies are ideal for teaching children about strip mining and ecology! All you need are toothpicks and chocolate chip cookies! Have your students excavate chips, or "jewels", from the cookies with the toothpicks. As the students hack away, some of the cookies will break or crumble. Why does this happen to some of the cookies? Are some of the cookies soft and others hard? (You may want to vary this among the students.) What holds the chips in place? How difficult is it to remove a chip? How could the method be improved? Compare with rock and soil formations.

When all of the chips have been removed, ask the students to reassemble their cookies. This part is admittedly a little difficult, but it provides experience with ordering a disordered system.

*"Four-Star Science Teachers," Instructor,
March 1990, pg. 42.*

What makes food appealing?

For this activity you will need unprepared, uncooked food from different groups. From the meats group you may want to bring in chicken, steak, or ham; for vegetables: carrots, celery, lettuce, tomatoes, etc.; for fruits: apples oranges, peaches, bananas; and for grains: beans, wheat, rice.

Place the foods out on a table, keeping them in their respective groups. Divide the students among the different food groups. Have each group smell, feel, observe, and taste the food. Have the students record their findings. What color is it? Does it have texture? What about size? What shape is it? How does it feel? Is it slimy? Does it feel cold? warm? Discuss the differences among the food groups. Which ones are more appealing? How do these foods grow? Why are they more appealing?

Foods which taste and smell better have chemicals which produce an appealing flavor or scent. Often these chemicals are found in the flower, fruit, leaf, stem, or root of the plant. Can your students think of examples, other than foods they eat, in which chemicals that smell like fruits or vegetables are used to make products appealing? Chemicals in plants are important in food for people and animals. Everything people and animals eat can be traced to plants. Our breakfast cereals can be traced to wheat, rice, or oats, all plants. The meat used above may have come from a cow that ate plants to live. What other foods do we eat that can be traced to plants?

Sherman Dickman, Professor of Biochemistry, Emeritus, University of Utah provided the basis for this activity.

"Wonder Science"

The American Chemical Society, together with the American Institute of Physics, publishes an absolutely wonderful set of physical science activities each month entitled, *WonderScience*. Each issue focuses on a particular topic and involves hands-on activities with easily obtainable, everyday materials. There is far more material in each issue of *WonderScience* than we can even begin to distill in EXPLORE!

We recommend that each elementary school subscribes to *WonderScience*, circulates it, and makes it available to the elementary teachers. The cost is very small. One subscription is \$6 per year, plus \$3.50 for postage and handling. You can subscribe by contacting American Chemical Society, *WonderScience* Magazine, P.O. Box 57136, Washington, D.C. 20077-6702. Because multiple copies are cheaper, a district may want to subscribe for all of its elementary schools.

Local Garage Sale Funds Science!

Last June, Vicky Major and Susie Heaton, parents from Oakhills Elementary School in Bountiful, held a fund-raising garage sale on the school grounds. With the \$1,000 raised from the garage sale, they started the Science Start Foundation. With matching District funds (the District matches funds collected by parents), Science Start has \$2,000! Vicky and Susie will use the money to improve science learning at Oakhills. They plan to set aside an area of the library with updated, hands-on science material for students and teachers. Science mentors will be asked to come into the classroom on a regular basis to help with experiments. In addition, they will use the money to organize a science fair at Oakhills Elementary.

To find out more about organizing efforts at your school, call Vicky at 298-5838 or Susie at 295-1767.

Parents can make a difference!!!!!!

"Give people fish and they eat for a day; teach them to fish and they eat for a lifetime."*

** assuming they don't overfish and deplete the population!*



Major Science Museum Planned for Utah

The Utah Science Center will be a major interactive, discovery-based science and technology center located in the Salt Lake City area. The project has been under study and development for nearly four years by a large task force and group of committees. The Center would be a statewide resource for elementary teachers and would provide labs and related opportunities for elementary teachers and their classes to enhance their science process and content skills.

The Science Center Task Force is looking for volunteers and for input from throughout the education community. If you are interested in providing or otherwise helping with the development of this unique educational resource, contact Utah Science Center, c/o Hansen Planetarium, 15 S. State, Salt Lake City, UT 84111.

The Center for Integrated Science Education is working closely with the Science Center Task Force in developing exhibits, programs, and activities for the science center. Joe Andrade, Director of CISE, also serves as Program Co-Chair for the Utah Science Center initiative. You may contact Joe at 581-4379 for further information.



Food & Plastics

Almost all of our food products today come packaged in some type of plastic. In our last issue of EXPLORE! we found that plastics had different densities and density was the ratio of the Mass (weight) divided by Volume. Have your class discover the densities of different plastics which are used for food storage and handling.

Collect samples from food and determine the density for each. Classify the plastic by using the chart below (most food containers have a recycling symbol). Which container had the highest or lowest density? Why do plastics have different densities? What happens to the plastics when we are through with them? How many plastic containers does your class throw away in a week?

Determine where recycling bins are located in your area. Encourage students to implement recycling in their own homes. Discuss some of the recycled products listed below. How many can be found in the home?

| Type of Plastic | Recycling Symbol | Typical Packaging Uses | Other Uses | Recycled Products |
|----------------------------|------------------|---|---|--|
| Polyethylene Terephthalate | 1 PET | Soda, peanut butter, vegetable oil bottles | Recodrning tapes, x-ray film | Carpets, Soda bottles, Skis, Tennis ball fuzz |
| High-Density Polyethylene | 2 HDPE | Milk & juice bottles, Grocery bags, Detergent bottles | Gasoline tanks, Shipping containers | Trash cans, Stadium seats, Bases of soft drink bottles |
| Polyvinyl Chloride | 3 V | Shampoo & water bottles, Food wrap | Windows, doors, Sprinkler pipe | Floor mats, Pipes, Hose, Mud flaps |
| LowDensity Polyethylene | 4 LDPE | Trash bags, Squeeze bottles | Toys, Household appliances | Garbage can liners, Grocery bags |
| Polypropylene | 5 PP | Drinking straws, Syrup, Ketchup, Yogurt, Margarine Containers | Carpet, Toys, Outdoor furniture | Paint buckets, Manhole steps |
| Polystyrene | 6 PS | Foam & clear containers for take-out food, egg cartons, plastic utensils, videocassette boxes | Syringes, Insulation, Videocassettes | Trays, Flower pots, Pipe, Trash cans |
| Others | 7 | Anything else | Applications in building, science, transportation | Plastic Lumber |

Source: The Shaping of Things to Come. The Society of Plastics Industry, Inc., P.O. Box 12057, Hauppauge, NY 11788-9705.

National Science Education Standards

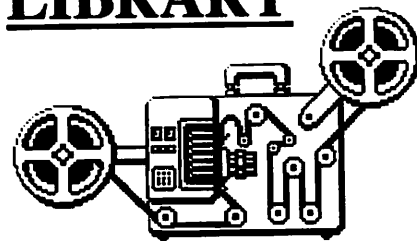
As mentioned in our last issue, a progress report was issued in July '93 by the National Committee on Science Education Standards and Assessment (NCSESA). The beauty of the reforms will be that the standards for curriculum development will be defined, as well as the standards for assessment, teacher preparation and performance. What is meant, and what is not meant by "standards?" According to Susan P. Speece, Chair, NABT Task Force on National Standards, "National standards for curricula should be goals for which young people in different age brackets strive-demanding, but attainable learning goals providing a vision of what we want all of our young people to know and be able to do. They must be reducible to a set of minimum competency thresholds. The standards should help states, localities, teachers and others who select or develop curricula or frameworks-allowing for local variation and adaptations, but providing sufficient consistency from school-to-school, town-to-town, and state-to-state so that a change of schools, or a household move does not create educational chaos for the students." (from *News & Views*, October 1993, pg. 12).

Perhaps one of the greatest strengths of the National Standards is the section on the Nature of Science. This chart is the framework from that section and gives you a feeling for what is expected.

Your input is important. If you are interested in receiving copies of the current documents, please write to Elizabeth Stage, National Committee on Science Education Standards and Assessment, 2001 Wisconsin Avenue, NW, Washington, DC 20418.

| NATURE OF SCIENCE | |
|----------------------------|---|
| Modes of Inquiry | Formulate Questions Plan Experiments Make Systematic Observation Interpret and Analyze Data Draw Conclusions Communicate Understanding of Inquiry |
| Habits of the Mind | Intellectual Honesty Skepticism Tolerance of Ambiguity Openness to New Ideas Communication and Sharing |
| Attitudes and Dispositions | Curiosity Reflection Pleasure in Understanding Empowered to Participate |

VIDEO LIBRARY



CISE is beginning to acquire a number of excellent modern videos related to hands-on science education. In some cases we have the permission to duplicate these videos. In other cases we can only loan them to you.

One of particular relevance to Polymers is "Not Your Average Field Trip!," presented by the Society of Plastics Engineers. This is a very modern, rapidly moving, highly interesting video on the use of plastics in modern products. There is an excellent segment on plastics in the Saturn automobile. It is designed for junior high audiences but will work for upper elementary as well. If you are interested, give us a call and we will send you a copy. No more than one per district.

Next Issue of EXPLORE!



Win \$25 simply by sending us the best classroom science activity about sports!!! The activity could be about ski wax, acceleration, Michael Jordan's rebounding height, etc. We must have the activity by December 20, 1993. Send your ideas to Mary McDonald, CISE, University of Utah, 2480 MEB, Salt Lake City, Utah 84112. Fax 585-5361.

ANNOUNCEMENT

The 2nd Annual Science Journalism Contest

First Prize
\$75

*New Elementary
Category!*

Second Prize
\$25

Individual class or school newspapers are eligible. The newspapers submitted should have at least several stories dealing with science topics. These could include reports of individual student or class investigations, field trips, science fairs, visitors, etc. Stories should show how science is connected to student interests and to other parts of the curriculum, including art, writing, sports, reading, and other areas of special interest. Awards will be made to the editor of the paper to use for classroom supplies and materials. A copy of the newspaper must be submitted. Awards announced in mid-April 1994.

Send To: JD Andrade, CISE, University of Utah, 2480 MEB, Salt Lake City, Utah 84112

Deadline: April 1, 1994 for papers printed during the 1993-1994 school year

Sponsored by the Herbert and Elsa Michael Foundation



Talk Biology!

with Pat Renfranz
and John Roth....



Pat Renfranz

Call 585-3819 from 9 am
to 7 pm or 466-6585 from
7 pm to 9 pm


John Roth

Call 581-3412 from
9 am to 6 pm

.....from DNA to large organisms.....Pat and John are biologists ready to hear from you and your students. Pat's expertise is in neural and developmental biology; she teaches laboratory classes in biology. John is Professor of Biology and does research on the genetics of bacteria. Both Pat and John place middle and high school students in summer research labs as part of the Howard Hughes Biological Research Program. This year they are developing a teacher inservice and training component to the program. If you have any suggestions for what you as a teacher would like to see happen, give them a call!!!!

 *Clip and Save for Your Resources!*

QUESTIONS ANYONE?

 Do you or your students have questions which you just can't answer? The following University faculty are full of information and ideas to share with you and your classroom. They eagerly await your calls!!!!!!

CHEMISTRY CONTACTS

Noel DeNevers

Call 581-6024 from 8 to 5 or at home
328-9376 from 6 to 10 pm.

Ron Ragsdale

Call 581-7621 from 9 to 6 or at home
268-2149 from 7 to 10 pm.

MATH CONNECTIONS

Herb Clemens

Call 581-5275 during the day

PHYSICS

Sid Rudolph

Call 581-4803 from 8 to 5.

Gale Dick

Call 581-6408 from 8 to 5
or at home 359-5764.

Bob Kadesch

Call 583-0123 in the evenings.

SCIENCE EDUCATION

Julie Gess-Newsome

Call 581-7158 during the day and
467-5183 in the evening.

Upcoming Events!

PRESIDENTIAL AWARDS

FOR EXCELLENCE IN SCIENCE AND MATHEMATICS TEACHING

Recognition is given to K-12 teachers for their teaching of science or mathematics in self-contained classrooms, as resource teachers, or as subject-matter specialist. There are two award groups for elementary teachers: (1) elementary mathematics and (2) elementary science. Only teachers who have not previously received the Presidential Award are eligible. The submission process requires that teachers either nominate themselves or be nominated by a colleague, administrator, student, or parent. The nominated teacher will prepare a packet of specific material for his or her state or district selection committee to review.

Deadline for nominations: December 1, 1993

Brochures with nomination forms are available from your state or district science or mathematics supervisor, or one of the offices below:

PAESMT

National Council of Teachers of
Mathematics
1906 Association Drive
Reston, VA 22091-1593
(703) 620-9840

PAESMT

National Science Teachers Assoc.
1840 Wilson Blvd.
Arlington, VA 22201-3000
(703)243-7100

EXPLORE!

**CENTER FOR INTEGRATED
SCIENCE EDUCATION**

University of Utah, 2480 MEB
Salt Lake City, Utah 84112
581-4171 Fax 585-5361

Newsletter Staff

Joe Andrade ... Project Director/Editor
Mary McDonald ... Program Coordinator
Jason Bagley ... Activity Editor
Mindy Steadman ... Program Assistant

Explore! is made possible by grants from the Dreyfus Foundation, the American Chemical Society, the Michael Foundation, US West, and by the Center for Integrated Science Education.

EXPLORE!

Volume 1, Number 4, January 1994

Classroom Activity Winner!

Congratulations to Jerri Everett from Stewart Elementary School in Centerville for winning our classroom activity award. Jerri uses a football to teach her second graders about motion. (We added a little extra to the lesson.)

MATERIALS:

- Soft Football
- Stop Watch (Optional)
- Meter Stick (Optional)

What happens to a football when thrown? Does it appear to tumble? Does it appear to fly "straight" without tumbling? Does a tumbling football fly faster and further than a straight-flying football? Why do tumbling footballs fly differently than straight-flying ones?

Divide students into groups of 3 or 4. Two of the students will throw the football back and forth (the football should be thrown straight across as opposed to throwing it high into the air). Assign another student to use the stop watch (or a watch with second hand) to clock the time the football leaves the hands of one student to the time it is caught by the other one. Have another student measure the distance from the first student to where the ball was caught. Observe if the ball was "straight-flying" or "tumbling." Record the time the ball was in the air, the distance the ball was thrown, and the type of flight.

Now let's determine the velocity of the football! Velocity is the distance the ball was thrown divided by the time to go that distance.

continued on page three

Sports and Science!!!!



Let's Get Active!!!!

Tracy Richards, a student teacher at Nibley Park Elementary School in Salt Lake City, gets her students ready for learning by exercising them!!! Tracy is full of ideas which fit right into the classroom and teach children about their muscles, bodies, and fitness. She is willing to share those ideas with you and can be reached at 531-9348. Here is a simple way to do some exercise while learning about the body. How does exercise make a difference? What affect does activity have on your heart rate and, therefore, overall health?

To measure heart rate, simply have your students take their pulse at their wrist or at the neck, just below the ear. Count the beats for six seconds and then multiply by ten. This will be the heart rate in beats per minute. Now let's compare heart rates for different activities!!!

Have your students measure their heart rate after the first fifteen minutes of class (after they have been sitting quietly). Record the heart rate. This will be the normal heart rate. Have them measure their heart rate again just after they have actively played at recess. Record this heart rate. You can have them measure and record their heart rate after a sports activity in PE or Healthy Life Style class. To get a heart rate for a short duration activity, have the students sprint (maybe fifty yards or so), run in place, or do jumping jacks for about three minutes and record the heart rate.

Is there any difference in the heart rates??

Sports can be divided into those that are aerobic and anerobic. Aerobic sports have a continuous heart rate roughly above 60 to 75% the normal heart rate. Aerobic sports include cross country skiing, basketball, aerobics, bicycling and soccer. They require body activity

continued on page three



PRINTED ON RECYCLED PAPER

Introducing Science to Parents

"A Science Open House" appeared in the December '93 issue of *Science and Children*, one of the magazines published by the National Science Teachers Association. This article is about an open house to highlight your science program.

"Show parents how exciting and informative your science curriculum is. Let them explore the equipment, observe the organisms, and experience curriculum materials as their children do." The kids can demonstrate their favorite science activities to their own parents, and perhaps to the parents of others. It will give them pride in what they are doing, experience in presentation skills, reinforcement, and encouragement to do a lot more science.

If that magazine isn't available in your school library, call us at 581-4171 to request a copy. Please be sure to leave your name and mailing address on our friendly phone mail.

Stimulating Science Projects and Fairs

by Jason Bagely, CISE Science Fair Specialist

How do most children perceive science? Although it is important to understand scientific basics, true science involves asking questions and searching for answers. Science fairs can suit this purpose, especially in elementary school when children are so full of curiosity and questions.

Almost any question can be used as a science fair topic. Sometimes, parents and teachers feel like topics must be limited to chemistry and physics, or to "the same thing we did last year" (How many volcano projects have been submitted? Too many!) Instead of encouraging students to dig up an old book on experiments, encourage students to do a "personal experiment" to learn something completely new. Help students find a question which is safe, original, and of interest to them. Help students determine how to find the answer and develop a plan. After the hands-on work is complete, students should draw conclusions. What does this mean? How could I improve the experiments? Is my conclusion valid? This is the same procedure that professional scientists follow in their research.

A helpful preliminary is to do a class project, where you demonstrate the question-answer method of science. Let the class be involved in the topic selection ("How long does it take soft drinks to lose their carbonation?") and make a guess to the answer ("Expensive drinks stay bubbly longer"). After selecting a specific topic (questions are best), lead the class through discussion on how to proceed. ("How can we find out which soft drink stays bubbly the longest?") Plan and perform the hands-on experiment together. Consider other options ("What if the soft drinks are hot or cold?"). Good science questions can be "answered" by simple experiments and observations. At the end of the experiments, help students draw conclusions by restating your original guess and by recording results in an organized way. ("Now, which drink did stay bubbly the longest? How can we tell someone else what we found? Would a graph work?")

There are many books on science fair projects, but few books exist to help teachers planning these fairs. A new guide to help elementary school teachers with science fairs has been prepared by CISE and is available (free) to teachers. Interested? Contact us at 581-4171 and we will send you a copy (leave your name and mailing address, please).

PTO

to Hold After-School Science Series!

In March, the P.T.O. (Parent and Teacher Organization) at Parley's Park Elementary in Park City will hold an after-school science enrichment series for children in the second, third, and fourth grades. Paula Loboschefsky (correct spelling!) along with P.T.O. President, Francie Schenck, have organized people from local groups who have a strong tie to science education. Educators from groups like the Center for Integrated Science Education, Utah Museum of Natural History, and Hansen Planetarium, just to name a few, will present different topics. The classes will be held every Wednesday after school from 3:15 to 4:15 and are limited to fifteen students. Parley's Park Elementary will have their annual Science Fair at the end of March. Projects developed in the series will be presented at the Science Fair.

If you are interested in knowing more about involving the PTA or PTO at your school in science projects, give Paula a call at 649-1528.

*Look for
the next issue
of **EXPLORE!**
in a new portfolio
of science information
to be distributed by the
State Office of Education!
The portfolio is expected
to be in your mail box
by mid-March.*

*Knowledge must come
through action!*

Sophocles

Congratulations!

to the following elementary teachers from throughout the state who have received awards from USTA (Utah Science Teachers Association) for outstanding science teaching methods!!!

Larry Rock

Park Elementary School, Richmond

Larry relies on hands-on activities and visual aids (very little on textbooks!) to teach science to fourth graders. He is responsible for Weather Station at the Park School where his class reports the weather conditions on the Channel 2 nightly news! Each year, he takes his class on a four day trip to Yellowstone to study geology and animals, and perform water and plant experiments. Larry invites professors, forest rangers, parents, and others into the classroom.

Michelle Deleeuw

Circleville Elementary School, Circleville

Michelle teaches science to her first graders across the curriculum. The students have designed their own dinosaur T-shirts and perform a play about dinosaurs for parents and other students. She also started the Dinosaur Club called the Dinomites. In past years, she has taken her students to see the petroglyphs at Fremont Park. As a math project, her students measure size changes in "rubber" dinosaur shapes that "grow".

Cheryl Dearing

Grantsville Elem. School, Grantsville

Cheryl teaches her fifth grade students science through hands-on experiences! She uses many of the activities from Super Science Blue Magazine (Scholastic Books) and lets her students choose the topics, such as plants, animals, Hubble telescopes, etc. Cheryl has taught other teachers how to do hands-on science and is looked upon as the school's science specialist. When her fifth grade class was part of the Middle School, Cheryl would take them on overnight field trips to the Oquirrh Mountains.

Gloria Jones

Myton Elementary School, Myton

Gloria makes science something to be experienced, not just read out of a book. Her third grade students have gone on bug hunt field trips, overnight bird trips, and overnight star gazing trips. She conducts special units on insects, safety, nutrition and human body, plants, amphibians and birds. Gloria invites local community members, such as the Myton Fire Dept., into the classroom. Gloria contacts the local newspapers for coverage and involvement.

Sherry Eaton

Park Elementary School, Spanish Fork

Sherry brings the wonder of science to her first grade students. Her classroom science corner is full of living things. Sherry builds positive self-esteem in her students through a "Yes, I can do it!" attitude. She has taught science workshops for other elementary teachers in the district and is always willing to share her ideas, plants and animals. She serves on the Nebo District's science committee. Park School was selected to pilot the state's new science core curriculum.

Julie Baker

East Sandy Elementary School, Sandy

Julie does more than teach third graders in the Jordan School District. She writes and conducts science and math inservices for other teachers. In addition, Julie writes science curriculum and is a master science instructor for ITV. She has helped prepare Windows in Science (laser disk technology) with the company Optical Data. Julie will be writing activity books for the revised state core curriculum changes.



Next issue of
EXPLORE!

**Music
and
Entertainment!!!!**

Win a \$25 classroom award simply by sending us the best hands-on classroom activity about music and entertainment!! The activity should be inexpensive, easy to implement, and full of exploratory questions!! Send your ideas to Mary McDonald, CISE, University of Utah, 2480 MEB, Salt Lake City, Utah 84112. Fax 585-5361.

Classroom Award Activity (continued from front page)

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}}$$

Let's say your students measured 3 meters as the distance. The clocked time to be travel the three meters was 1 second. The velocity of the ball is 3 meters/1 second which is 3 meters per second!! Can you show that this is roughly 10 feet/1 second or 7 miles/ 1 hour?

So, which football travels faster--the tumbling or the straight-flying one? Which one traveled further? Compare the turning (or spinning) of a tumbling and straight-flying football. Which one is spinning more? A spinning football flies straight and therefore flies faster and farther. Spinning stabilizes the motion of the football!!!

How about trying some walking or running velocity experiments?!!

Let's Get Active!!!! (continued from front page)

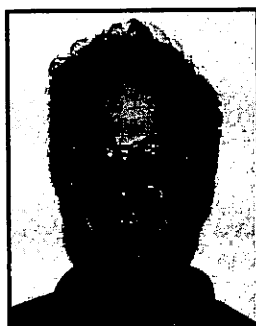
over a long duration of time. Anaerobic sports, such as downhill skiing, gymnastics, and football, are usually of shorter duration. Anaerobic activity is non-continuous with a heart rate approximately 80% above the normal heart rate.

Unfortunately, sitting in the classroom (or sitting anywhere else) does not burn fat or build muscle!!! To keep student's bodies in good health, they need to be involved in more exercise. A good elementary level book related to these topics is Linda Allison's Blood and Guts by Little Brown and Co., 1976. It is in the education or science section of many bookstores and gift shops. Tracy can tell you more about exercise and aerobic classes for children to get them fit!!!!!!



Talk Math

with
Herb Clemens
and Peter Alfeld....



Herb Clemens
Call 581-5275
during the day

Peter Alfeld
Call 581-6842 during the day
or leave message at 581-6851

Both Herb and Peter know that math is fun!!!! Herb is the director of ITAG, Institute for the Theory and Application of Geometry, which is designed to improve math skills at all levels. "Elementary Mathematics through Geometry", a program for teacher enhancement, training and materials development, has been implemented at Washington Elementary School in the Salt Lake School District. Peter's expertise is in numerical analysis. He volunteers one day a week to teach math in an alternative elementary classroom. Put your math questions together, pick up the phone and call Herb and Peter.....they are ready and willing to help you and your students!!!!

 *Clip and Save for Your Resources!*

The Center for Integrated Science Education Upcoming Teacher Workshops on Integrated Science Concepts and Themes using Bioluminescence

Spanish Fork

January 28 & 29: Friday 4 to 7:30 pm, Saturday 8 am to 4 pm
Coordinators: Nedra Kalk and Leslie Jorgansen 798-4000 ext 21

Bountiful

February 8 & 9: Tuesday 12 to 5 pm, Wednesday 1 to 5 pm
Coordinator: Vicky Major 298-5838

Salt Lake City

March 4 & 5: Friday 4 to 7:30 pm, Saturday 8 am to 4 pm
Coordinator: Lawrence Burton 272-5971

EXPLORE!

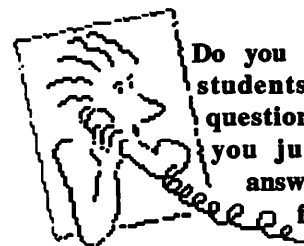
CENTER FOR INTEGRATED
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University of Utah, 2480 MEB
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Call 583-0123 in the evenings.

SCIENCE EDUCATION

Julie Gess-Newsome
Call 581-7158 during the day and
467-5183 in the evening.

NUTRITION

Sherm Dickman
Call 582-6910 during the day.

BIOLOGY CONCERNS

Pat Renfranz
Call 585-3819 from 9 to 7 or
466-6585 from 7 to 9 pm.

John Roth
Call 581-3412 during the day.

 *Clip, Save, and Post
for Your Resources!*

EXPLORE!

Volume 1, Number 5, March 1994

Thanks!

The Explore! Staff and the Center for Integrated Science Education thank all of you who have provided input to help improve and enhance Explore! This little newsletter was launched a year ago in Spring 1993. We have all been pleased with the response to Explore! and the strong interest Utah's elementary teachers have shown in enhancing science experiences in their classrooms.

We also thank those individuals in the University of Utah who have agreed to serve as personal resources and contacts for your questions in chemistry, physics, biology, mathematics, science education, and nutrition. They are all listed on the back cover. Additional topics will be highlighted in future issues and your list of expert contacts and consultants at the University of Utah will grow with each subsequent issue. Use them. They are friendly, they are accessible, and they really are interested -- even eager -- to help you and your students with your questions and projects. We thank them all.

We also thank our supporters, particularly the Dreyfus Foundation, the American Chemical Society Polymer Education Program, Utah's Michael Foundation, U.S. West, and the University of Utah for providing facilities, help, and financial resources with which to publish and distribute Explore! and with which to maintain and enhance the other projects of the Center for Integrated Science Education.

The newsletter has been designed and produced by Mary McDonald, an undergraduate student at the University of Utah, with the assistance of Jason Bagley and Mindy Steadman. I thank them all.

J.D. Andrade, Ph.D., Co-director, CISE

Joe Dickinson
Biology

University Sci Ed. Outreach
targeted science teachers



Classroom Activity Winner!

Congratulations to Carla J. Cleavinger, Elementary Music Specialist, Uintah School District, for winning our classroom activity award!!!!

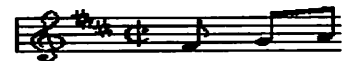
Carla directly relates music to a particular classroom curriculum whether it be science, math, social studies, or language arts. Recently, a third grade teacher asked Carla to supplement a unit on simple machines with a lesson in music. A dismantled piano was brought in and the children given a short demonstration. The children were asked to point out examples of simple machines in the piano. Keys and pedals on a piano are examples of hammers and levers. When a key is pressed down, it causes a "hammer-like" piece to strike a string and set the string vibrating. Tuning pegs are actually screws which adjust the tension on the string.

The piano is rolled about on a wheel and axle. Often, pianos are moved into a building by a ramp--or an incline plane. Your students will enjoy making sounds into the piano cavity and listening to those sounds pass over the strings!!!



MUSIC & ENTERTAINMENT & SCIENCE!!!

Sounds of Music

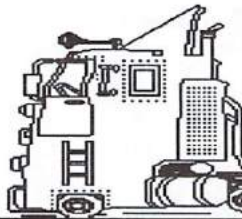


Why do we hear music? You hear a sound when something vibrates, but only if it vibrates very quickly. On average, people only hear things which vibrate 27 times or more each second. If you could wave your hand backwards and forwards 27 times in one second, you may hear a very low note. The fastest vibration most people can hear is 20,000 vibrations each second--much higher than the highest piccolo note! Here are some sound activities students will love!!!

Stretch a rubber band around your thumb and forefinger. Pluck it to make a noise. Now hold one end of the rubber band in your teeth and the other end in your fingers. Be careful--don't let go! Pluck the rubber band again. Does it

Continued on page 3

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Leonardo on Wheels!!!!

Leonardo on Wheels? Yes! The Utah Science Center Authority, in collaboration with the Utah Arts Council, has proposed a major state centennial project, *Preview: Leonardo on Wheels*, a mini science/arts center on wheels designed to roam the state, providing hands-on, interactive, science and arts activities throughout Utah. Joe Andrade, CISE's Director, serves as Chairman of the Program Committee for the Utah Science/Arts Center, a state project to design and implement a major, hands-on, interactive, science and technology discovery center/museum for the state of Utah.

As you travel out of state, be sure to visit the Exploratorium in San Francisco, the Oregon Museum of Science and Industry in Portland, the Pacific Science Center in Seattle, the Los Angeles Museum of Science and Industry in L.A., or the Van Fleet Science Center in San Diego -- and those are just the ones on the West Coast. There is also a small Discovery Center in Boise, Idaho. As one travels through the midwest and on east, there are perhaps 25 major, hands-on, interactive, science and technology centers. Visit any one of them and you will get an introduction and idea of *Preview* -- of what you can expect -- for the Utah Science/Arts Center when it opens in 1997 or 1998. Since we don't want to wait that long, *Preview: Leonardo on Wheels* will give you and your students a taste of the science/arts activities and experiences which you can expect from the Science/Arts Center.

Leonardo will have 6 major components:

- **Leonardo on Wheels:** Interactive hands-on activities involving art, science, and technology, designed to nurture discovery and creativity;
- **Leonardo's Protégés:** Means to involve the local community in ongoing science/art education via a local docent program;
- **Leonardo's Hams:** Performances and related activities involving local talent as well as scientists and artists on tour;
- **Leonardo's Fantasies:** Visualization and Graphics Experiences and Interactions;
- **Utah's Leonardos:** Utah Science/Art/Technology -- celebrating the past 100 years; and
- **Leonardo's Library and Shop:** Reference Center/Shop.

Governor Michael Leavitt perhaps said it best, "As we enter a new high tech world, education and training becomes even more important, and we must...take a quantum leap forward." (Inaugural Address, January, 1993.)

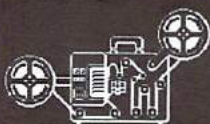
The mission of the Utah Science/Arts Center is to celebrate the joys of discovery and creativity by nurturing the scientist and artist in each of us. The general theme of *ORIGINS* kindles curiosity, stimulates imagination and affirms the joy and exhilaration of science and art while fostering a greater respect for the past, an understanding and appreciation of the present and a thoughtful and informed outlook to the future.

Leonardo on Wheels will not only bring science to you, to your district, to your city, but will enable you and your students to directly participate in enhancing science education in Utah and throughout the region. It will profile your students' and your classes' best science projects. It will encourage teachers and students from throughout the state to help design and implement novel and innovative hands-on science experiences. It will work closely with the Childrens' Museum of Utah, the Utah Museum of Natural History, and other institutions throughout the state to provide unique and vital science and technology experiences for our students and children.

If you would like to get on the mailing list for the Utah Science/Arts Center project, please call Joanna Fisher at the Hansen Planetarium (801) 531-4932 and leave a message to that effect with your name and mailing address. If you would like to get actively involved in the Program Committee, contact Joe Andrade at 581-4171.

Joe offers a course through the University of Utah called Science Projects for the Utah Science Center. You can obtain graduate science education credit while performing a vital community service. This course can be taken at any quarter of the year and scheduled on an independent study basis to meet your schedule and needs. Contact him at 581-4171.

Science in Films



A popular film was *Lorenzo's Oil*. This film, in addition to being entertaining and highly rated, is a good introduction to a number of topics relative to science education.

The parents of Lorenzo, a boy who is afflicted with a rare fatal disease, challenge the scientific and medical research world to come up with an effective therapy or treatment. Basic scientific and medical research are treated dramatically but fairly in this film. The parent's desperation for a quick cure, the scientist's need for controlled and conclusive studies, the physician's interest in providing treatment and in minimizing false hopes and expectations, and even some introduction to quackery and unrealistic miracle cures are all dealt with in the film. It would be a good class project to view and to discuss this film. The teacher may want to view it first and to prepare a brief discussion and introduction to the film prior to having the students see it.

CISE has a variety of clippings and materials on this film which we will be happy to send to you upon request.

Congratulations!

to Karen Bishop and Shauna Lund,
elementary teachers from Utah,
for winning the 1993 Presidential Awards
for Excellence in Science and Mathematics Teaching!!!

Karen Bishop
Elementary Science Winner from
Ferron Elementary, Ferron, Utah

Karen teaches Kindergarten students using an integrated curriculum. The major themes of her lessons are centered around science with literature, writing, math, art, and music incorporated. Karen emphasizes processing skills as opposed to fact learning. Her students are encouraged and taught to use available resources to find information. The sample lesson plan Karen submitted focused on the change of seasons. She has an "apple tree" bulletin board where students can observe the seasonal changes of an apple tree.

Shauna Lund
Elementary Math Winner from
Valley View Elem., Bountiful, Utah

Shauna teaches from the premise that all her first grade students can be successful at math. She uses manipulative materials to develop a concrete understanding of math and then switches to pictorial representation. Finally, the math concepts are presented in the abstract. An example of Shauna's lesson plan is "North Pole Math" where students record daily weather temperatures, make predictions, and graph data. Shauna has taught inservices for the State Office of Education, the Math and Science Education Foundation, and the Davis School District.

Science Fair Update

by Jason Bagley
Science Fair Specialist,
Center for Integrated
Science Education

It seems like the beginning of the year prompts many schools to hold a science fair. But this year, schools are finding new ways to make science fairs different. For example, at Cottonwood Elementary, the science fair organizer coordinated parent volunteers to spend time in each classroom. This allowed students the chance to receive one-on-one attention and help with their projects.

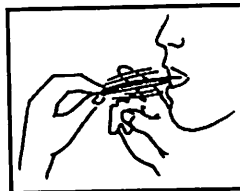
At Oakridge Elementary, those responsible for the science fair used a modified award strategy. Everyone received an award for participating. However, about 60 of the 200 projects were given special honors for following the scientific method. In addition, several local companies donated extra gifts for participants chosen at random. Through this award strategy, each student felt like a winner.

Several schools held fairs for the first time. These are often difficult for parents or teachers who undertake responsibility to plan and coordinate the first science fair. Congratulations to those who did so! In the future, if teachers/science fair organizers would like help with their fairs, call us for some suggestions.

Enclosed is *Science Fairs: An Elementary School Guide*. Please take the time to read over the guide and pass it on to the science fair coordinator at your school. If your school does not have a science fair, recruit parents, PTA, administrators, and other teachers into organizing one!

Sounds of Music continued from page one.....

sound different? Use rubber bands of different sizes to hear different sounds. Tap your teeth with your fingernail and listen to the sound. Ask a friend to tap their teeth and hear the difference.



When the rubber band is between your teeth, the vibrations of the rubber band pass through your teeth to your jawbone and the bones of your skull. The sound travels to your inner ear and seems very loud. Your own voice sounds different to you than to other people because most of the sound travels through your bones rather than through the air. Violinists also hear the sound of their instrument through their bones.



Try this simple activity.....Unfold a paperclip into a square shape. Tie a 30 cm long piece of cotton thread onto the middle of the paperclip. Wrap the other end of the thread around your forefinger. Put your forefinger in your ear and bend over so that the paperclip swings freely. Tap the paperclip against the edge of a table or chair. What do you hear? What do you hear if you take your finger out of your ear?

The vibrations made by tapping the paperclip are very small. They do not travel easily through the air to your ears. Sound travels better through solid things like cotton thread than through air. With your finger in your ear, you hear a much louder sound!!!

If you would like more music ideas, write to The National Science and Technology Centre, PO Box E28, Queen Victoria Terrace, Canberra ACT 2600, Australia. Request the EXSCITER PAK—Exciting Science & Technology Resource Pak.



Sherm Dickman
Call 582-6910

Talk Nutrition!!!!

with Sherm Dickman

Food is something all of us encounter every day!!! Sherm's specialty is food and nutrition and he uses it to do science demonstrations and hands-on experiments!! He is a Professor Emeritus of Biochemistry and holds a title in the Nutrition Department.

Sherm likes to eat!! His philosophy is that eating should not be a mechanical activity, but that food should be eaten slowly as an aesthetic activity. By rolling food over your tongue after chewing it, you achieve the maximum taste sensation. Nutrition is not just vitamins, it is the art of eating food!

Sherm has countless classroom food activities to share with you and may possibly come to your classroom to demonstrate some of those activities. He has been known to show up with hands-on objects--apples, oranges, celery, raw meat, etc. Students enjoy being blindfolded and then directed to feel, smell, and taste the various food items. For more learning with food and nutrition, give Sherm a call!!!!



Clip and Save for Your Resources!

*The Center for
Integrated Science Education*

**Upcoming
Teacher Workshops**
Hands-on, discovery-based
inservice using bioluminescence!

*Bioluminescence is a nearly ideal sub-
ject with which to experience general
science themes and concepts.
Don't miss out on this one!!!!*

Salt Lake City
April 15 & 16:
Friday 4 to 7:30 pm
Saturday 8 am to 4 pm
Coordinator:
Darla Motzkus 578-8256

ANNOUNCEMENT

**Art/Science Contest
Featuring the Geology of
Yellowstone**

Here is a chance for your fifth and sixth grade students to have their art work displayed at Yellowstone National Park in May! *From Geology to Landscape* is intended to encourage lifelong appreciation of nature and involvement in preserving the values that our national parks represent. If you would like more information on the guidelines of the exhibit, please call us at 581-4171. Please don't delay, each entry must be received by April 1st!!!

EXPLORE!

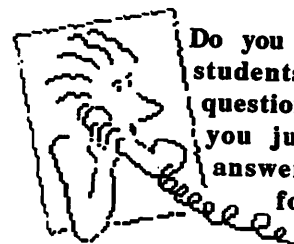
**CENTER FOR INTEGRATED
SCIENCE EDUCATION**
University of Utah, 2480 MEB
Salt Lake City, Utah 84112
581-4171 Fax 585-5361

Newsletter Staff

Joe Andrade..... Project Director/Editor
Mary McDonald... Program Coordinator
Jason Bagley..... Science Fair Specialist
Mindy Steadman... Program Assistant

Explore! is made possible by grants from the Dreyfus Foundation, the American Chemical Society, the Michael Foundation, US West, and by the Center for Integrated Science Education.

QUESTIONS ANYONE?



Do you or your students have questions which you just can't answer? The following

University faculty are full of information and ideas to share with you and your classroom. They eagerly await your calls!!!!!!

CHEMISTRY CONTACTS

Noel DeNevers

Call 581-6024 from 8 to 5 or at home
328-9376 from 6 to 10 pm.

Ron Ragsdale

Call 581-7621 from 9 to 6 or at home
268-2149 from 7 to 10 pm.

PHYSICS

Sid Rudolph

Call 581-4803 from 8 to 5.

Gale Dick

Call 581-6408 from 8 to 5
or at home 359-5764.

Bob Kadesch

Call 583-0123 in the evenings.

SCIENCE EDUCATION

Julie Gess-Newsome

Call 581-7158 during the day and
467-5183 in the evening.

MATH FAVORITES

Herb Clemens

Call 581-5275 during the day.

Peter Alfeld

Call 581-6842 or leave a message at
581-6851.

BIOLOGY CONCERNS

Pat Renfranz

Call 585-3819 from 9 to 7 or
466-6585 from 7 to 9 pm.

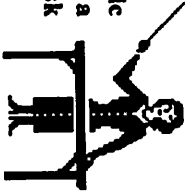
John Roth

Call 581-3412 during the day.



*Clip, Save, and Post
for Your Resources!*

The Scientific Method



- Choose a topic.
- State the question.
- Read about your topic (an encyclopedia is a good source) and ask others about it.
- Form a "hypothesis". This is your guess to answer your question based on what you have learned from your reading.
- Observing and experimenting. How will you test your guess to answer your question?
 - Plan what materials you will need.
 - Estimate how much time it will take you to finish. Will you have enough time?
 - Keep a notebook and record everything about your project. The first entry should be your original questions or idea - include notes you have taken when reading about your subject. Make it easy to read. Use sketches, drawings, graphs, etc.
 - Test different conditions one at a time (i.e. different temperatures, what time of day, the amount of water, number of weights, etc.)
 - Repeat the experiment several times and average your results.
 - Record your results; pictures, drawings, graphs, or tables will help your display.
- What does it all mean?

Show the meaning of your observed information on graphs and tables. State your interpretation.
- Conclusions
 - How would you now answer your original question?
 - What errors may have affected your results?
 - How does the project apply to "real life"?

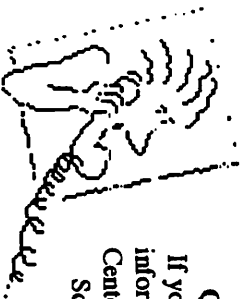
Guidelines for Successful Projects

(Sample)

1. Successful projects follow the scientific method and ask original questions.
 2. Successful projects will be neatly displayed. The display should include the title (often, a question), the student's hypothesis, a description of the experiment (pictures or drawings are encouraged), the student's results, and an answer to the question (conclusions).
 3. Students present their projects to the judges. A short oral description (5 min) should demonstrate understanding and perspective.
 4. Successful projects receive parental input, but allow the student to do the work.
 5. Successful projects are creative and enjoyable for the students and their audiences.
- * All projects that have followed these guidelines should receive an award. Every student can win!

Bibliography

- Gowen, L.F. and E.A. Marek, "Science Fairs: Step by Step." *The Science Teacher*, (January 1993). 37-40.
- Levin, K.N. and R.E. Levin, "How to Judge a Science Fair." *The Science Teacher*, (February 1991). 43-45.
- Van Deman, B.A. and E. McDonald, *Nurs and Bolts: A Matter of Fact Guide to Science Fair Projects*, The Science Man Press, Harwood Heights, IL (1986).

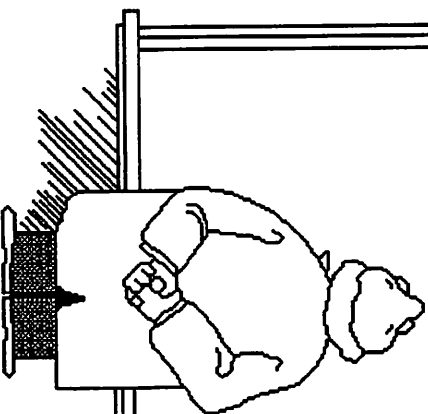


Questions?

If you desire more information, call the Center for Integrated Science Education at 581-4171.

Science Fairs

An Elementary School Guide



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How to Begin

- Pick a date, time, and specific place.
- Develop guidelines and criteria by which all projects will be categorized and judged, i.e. an original experiment following the scientific method, an organized display of the project, an oral presentation reflecting the student's knowledge.
- Recruit teachers, PTA, administrators, and parents to provide input and assistance. (Consider publicity, an assembly with students, finding judges.)
- Consider high school/college students and local professionals as mentors.
- Send a note home containing pertinent information.

You have decided to put on a science fair in your school. *Congratulations!* Science involves asking questions, making guesses about the answer (hypothesis), performing experiments to test the hypothesis, and drawing conclusions. This guide is mainly for teachers and other school fair organizers. Here you will find ideas on how to get started, how to involve parents, methods to assist students in their projects, judging tips, and a list of alternatives to science fairs. Remember, science fairs succeed because teachers take the time beforehand to help students formulate ideas and help students complete their projects.

Suggested Types of Projects

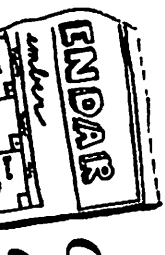
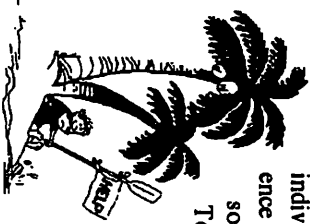
- **Collections (K-3 only)** - These should be accompanied by written material.
- **Demonstrations (K-3 only)** - These involve demonstrating a scientific concept or process.
- **Inventions** - Students can identify a need and invent something to meet the need. The upper grades should include experimentation and library research.
- **Personal Experiments** - These are the essence of science. Students follow the scientific method to make an educated guess to a question, perform experiments to test their guess (their hypothesis), and draw conclusions based on what they observe.

Alternatives to Science Fairs

- **Class fairs** - Have a miniature science fair with your class.
- **Class project(s)** - Involve the entire class in one or more projects using the scientific method.
- **Demonstrations/Collections** - a demonstration or collection fair can help students learn to classify or to demonstrate a scientific concept.

Helping Students

Help students choose a topic of interest by referring to local science museums, newspapers, old science text books, the library, project titles from previous projects, or individuals who have some interest in science (parents, relatives, university professors, high school science teachers). Topics don't have to be "chemistry, physics or biology." They can be anything which allows students to ask questions and discover answers. Remember, students need direction throughout the project, not just at the beginning.



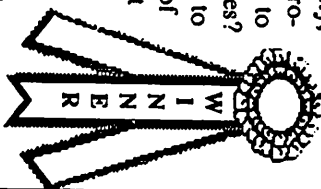
**Choose
a Date!**

Developing Appropriate Questions

- "Computers" - Too general.
- "How can computers help teach children to read?" - Better, but still too general.
- "At which of the following will children spend more of their leisure time learning to read: computers, books, television, or other people?" - This may take some thought, but is certainly original.
- "Caffeine" - Too general.
- "How do drinks with caffeine affect people?" - Better, but should be even more specific.
- "How will drinking regular vs. decaffeinated coffee each morning affect my parents' dexterity?" - Most specific.
- "How does drinking alcohol affect math skills?" - Although original, this is not an acceptable topic as it poses a safety hazard.
- "Which beverages affect students' ability to do math?" - Safe (no alcohol) but still vague.
- "Does exercise enhance math skills in 4th grade students?" - Specific and experimental.
- "How does temperature affect the pressure of carbonated drinks?" - Experimental.

Judging

Judges must be educated as to how the fair is to be judged. What criteria are expected for outstanding projects? Are students doing this for a grade? How will awards be given? Usually, one judge can evaluate 20-30 projects. Do you want each project to be judged twice by different judges? Do the students know this? Plan to select an appropriate number of judges. After two hours, it becomes harder for the judges to effectively evaluate the projects.



Judges should base their evaluations on criteria laid out previously. Ideally, students are present during the judging to explain their project to the judge. Each student should receive some constructive input. "Non-competitive fairs" are becoming more popular. Every student receives an award if they follow certain guidelines and present an adequate oral description of their project.

Outcome/Assessment

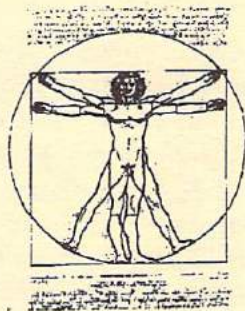
Were students given enough time to prepare their projects? How closely did students follow the scientific method? Did parents help with the projects? (Too much?) What went well with judging? Improvements? What will we did differently next year? (*Pass this information to the person in charge of the fair next year!*)

Safety is Important!

In approving projects, steer students from projects that may be harmful. Pay special attention to heat, chemicals, electricity, live animals, and toxic substances.

EXPLORE!

Volume 3, Number 1 August 1995



Leonardo is coming to town!

*Join the Renaissance Revival-
Explorations in the
Arts and Sciences*

You've heard a lot about the *Leonardo on Wheels* project in past issues of *Explore!* Although Leonardo da Vinci has been gone for nearly 500 years, his unique way of connecting art, science, and technology has become the focus of Utah's *Leonardo on Wheels* project. The new traveling art, science & technology center will begin touring communities around the state in March 1996. If you have ever been to a science center in other cities (i.e. Exploratorium in San Francisco, Pacific Science Center in Seattle, OMSI in Portland, Reuben H. Fleet Space Theatre and Science Center in San Diego) then you have an idea of what *Leonardo on Wheels* is all about. *Leonardo on Wheels* will go beyond the traditional science museum by drawing connections to the arts!

The *Leonardo on Wheels* project team has been working hard to build interactive exhibits and activities which will make *Leonardo on Wheels* an exciting learning experience for you, your students, and the community. The concepts surrounding these exhibits and activities will be connected to the state core curriculum standards and objectives to facilitate your classroom lessons! As the exhibits and activities develop, teacher materials will be prepared and made available in advance of Leonardo's visit to your area.

You can become part of this exciting project as a trained apprentice who prepares your class and assists other teachers in preparing their classes for pre-visit, visit, and post-visit activities. As a trained apprentice, you may opt to assist

continued on page 2

TEACHERS, PLEASE NOTE:

You can apprentice with LEONARDO ON WHEELS.

See inside page for details!

EXPLORING POLYMERS WITH PAPER CLIPS AND SLIME!

Children are fascinated with the world around them. One of the materials that is common to their everyday use is polymers. Notebooks, pencil lead, shoes, clothing and many other objects familiar to your students may be made from polymers. This activity will help you explain and demonstrate the nature of polymers to your students. Have fun!

MATERIALS

Paper clips (about 100 for every group of 2-4 students will be sufficient, you may want to use different types of paperclips to demonstrate different polymers)

Elmer's Glue-All
(Polyvinyl Acetate)

Water

Food Coloring

Borax (Sodium Tetraborate)

continued on page 3

Education is not
the filling of a pail,
but the lighting of a fire.

William Butler Yeats



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TEACHERS

Take part in the RENAISSANCE REVIVAL

Apprentice with LEONARDO ON WHEELS

The Renaissance was a time of challenge and excitement. New discoveries and enhanced creativity led to dramatic advances in art, science, and technology. Now, as we approach the 21st century, we are faced with a similar opportunity. Don't be left behind!

Join Leonardo's apprenticeship program, and rediscover your own creativity. Explore the dynamic interactions between art and science, and learn how Leonardo's exhibits and programs connect to the state core curriculum.

Training starts September 26, and continues through the fall. Classes will meet at the University of Utah from 4 to 6 p.m., Tuesdays and Thursdays. There will be a no-credit fee of \$50 through the Division of Continuing Education or 4 hours of graduate credit available at the University of Utah tuition schedule fee. This course will meet the state requirements for 4 inservice hours. Class size is limited to 30 participants, so act soon!

**FOR MORE
INFORMATION,
CONTACT:**

**Sandy Zicus
272-1314
or Mary McDonald
581-4171**

LEONARDO ON WHEELS *continued from page 1*

with the general operation of Leonardo while it is in your community. District inservice and University of Utah credits are available for this apprenticeship program. If you are interested, please call Sandy Zicus at 272-1314 or Mary McDonald at 581-4171.

Evaluation sessions will be set up beginning in August 1995 and continuing through December 1995. These evaluation sessions are important in assessing the effectiveness of the exhibits and programs in communicating artistic and scientific concepts. During these sessions, we will be drawing the connections with the state core curricula. If you are located in the Salt Lake Valley and would like to bring your class and/or other colleagues to an evaluation session, please contact Mary McDonald at the Center for Integrated Science Education (581-4171).

If you have ideas and suggestions for the Leonardo on Wheels project please call Mary McDonald now! Perhaps as a teacher in an area serviced by a major science center you had positive and/or negative experiences that you would like to share with Leonardo on Wheels. Maybe you have some creative ways to involve other teachers or students in the project. Or you may be aware of a theatrical play for elementary students that connects art and science that you would like to see implemented in the Leonardo on Wheels project. Perhaps you have had success with a classroom activity combining art and science that you would like to share with others across the state. **Your experiences and inputs are valuable to the Leonardo on Wheels project. Please call!**

Literature Available To Involve Parents in Science

Several books and guides are available to assist parents in doing science activities with their children at home. Two excellent ones we have found are *Helping Your Child Learn Science* and *Sharing Science with Children: A guide for parents*.

Helping Your Child Learn Science was prepared by the Office of Educational Research and Improvement at the U.S. Department of Education. For information on the price of single copies or bulk quantities, call the U.S. Government Printing Office Order Desk at (202) 783-3238. The stock number for the book is 065-000-00520-4.

Sharing Science with Children: A guide for parents is an excellent brochure developed by the North Carolina Museum of Life and Science. For copies of this guide write: Georgiana M. Searles, North Carolina Museum of Life and Science, P.O. Box 15190, Durham, NC 27704.

Plastics in Our World

Plastics in Our World is a packet of curriculum materials for use with grades K-6 prepared by the American Plastics Council in a joint initiative with The Society of the Plastics Industry, Inc.

The curriculum materials are designed for easy integration into science, language arts, mathematics, art and music, and in skill areas involving classifying, collecting, analyzing, communicating, observing, inferring, measuring and using models. The K-3 materials include lessons on understanding solid waste, source reduction, products from recycled plastic, and actions to take. Materials for Grades 4-6 are about waste generation and landfills, source reduction, degradability and composting and waste-to-energy.

Plastics in Our World is available at no cost to teachers by calling 1-800-2-HELP-90. Operators are available at this number to answer your questions about plastics in the environment.




Outdoor Education with
Pamela Mills Poulsen of
Red Butte Garden and Arboretum

Pam is Manager of Environmental Education for Red Butte Garden and Arboretum located in the Research Park area of the University of Utah campus. The facility is one of the West's preeminent horticultural landmarks that offers several onsite programs to teachers and students. *These programs are designed to assist teachers in meeting the standards and objectives of the State Science Core Curriculum.*

Field classes for K-12 are hands-on experiences guided by teachers and docents. Information and previsit lesson packets are sent to classrooms in advance. Third and fourth grade students, middle school biology students and high school bio-earth students can participate in the Canyon Conservationist program. This program offers hands-on activities that explore native flora and fauna, local ecology, watershed and habitat restoration, human values and responsibility, and environmental stewardship.

Red Butte Gardens and Arboretum also offers training for teachers of 4th grade students, middle school biology students and high school bio-earth students to facilitate using the Red Butte Environmental Learning Area and other foothill environments as outdoor classrooms. Outreach kits are available to teachers throughout Utah. These kits contain lesson plans and materials for classroom and appropriate outdoor sites. Another region-wide program (Utah, Nevada, Idaho, and Wyoming) assists educators in teaching about wildflowers. The program includes lesson plans and materials for an art competition for K-6 and a photography competition for 7-12.

Pam is more than willing to assist you with outdoor educational materials that can be used in the classroom or at their University of Utah facility. Please call Pam at 581-3744 for more information!

 **Clip and Save for Your Resources!!**

EXPLORE!

**CENTER FOR INTEGRATED
SCIENCE EDUCATION**
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Newsletter Staff

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and by the Center for Integrated Science Education.*

Do you or your students need help with scientific questions? The following University faculty have plenty of information and ideas to share with you and your classroom. Please give them a call!! (and post this for everyone to use!, day numbers are listed unless otherwise specified)

■ CHEMISTRY

Noel DeNevers - Call 581-6024
from 8 to 5 or at home 328-9376 from 6 to 10 pm.

Ron Ragsdale - Call 581-7621 from
9 to 6 or at home 268-2149
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■ OPTICS & IMAGING

Doug Christianson - 581-7859
George Gray - 585-6157

■ SCIENCE EDUCATION

Julie Gess-Newsome or Sherry
Demastes - 581-7158

 **Clip, Save, and Post
for Your Resources!**

Paper Clips and Slime *continued from page 1*

MATERIALS CONTINUED

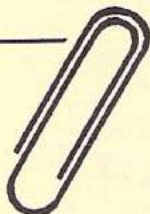
Cups (paper or foam) *

Stir Sticks*

Measuring cup

Measuring spoons

*you will need 2 cups and 2 stir sticks for each group



Paper clips are useful for demonstrating polymers. A single clip can represent a molecule. By linking a single clip with other clips you can increase the size of the molecule, hence, you will have 'many' molecules linked ('poly' means 'many'). To demonstrate the differences between different materials, link 3 clips to represent Butane gas, 9 clips for oil, 49 clips for paraffin wax, and 2000 clips for polyethylene (milk jug material). Notice the tremendous size difference between gas and the polymer (polyethylene)! Polymers are large molecules!

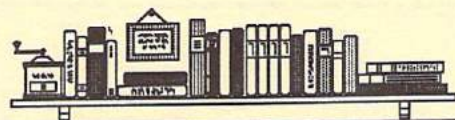
Divide your students into groups of 2 - 4 and have them build polymer chains. You may want to have some of the groups build polymer chains from different types of paper clips (colored ones or try using different sized paperclips). Now, have the students drop the polymer chains onto their desk top. What happens? Do they fold up and kink? Do all the polymer chains fold in the same way? Do the chains weigh the same (a simple postal scale usually found in the school's office can be used to weigh your polymer chains). This activity demonstrates that different polymer chains have different physical properties.

MAKING SLIME

Sometimes, polymers link with other polymers in a crosslinking arrangement. To demonstrate this, take two paper clip polymer chains and link them together about every other clip with a single clip (forms a ladder shape). Drop the newly formed polymer chain on the desk top. How does the crosslinked polymer chain differ from the single polymer chain? Stronger? More or less flexible? Larger molecule? Now, have your student groups make a sample of crosslinked polymer chains - otherwise known by the popular name "slime"!

To make slime, each group will need 2 cups and 2 stir sticks. For the polymer part, in one of the cups, add 1 part water and 2 parts of Elmer's glue. Mix. For color, add a drop or two of food coloring. For the crosslinking agent, mix a dilute solution of 2 tablespoons of Borax for each cup of water. Warm water works best. Give each group Borax solution in their empty cup (they will need the same amount of Borax solution as the Elmer's glue solution, please, do not have them drink or eat the solutions!) When every one is ready, add the crosslinking solution to the Elmer's glue solution in the first cup. Just a little at a time and mix!

What is happening? Does the new mixture look like either of the original ones? How is it different? The mixture should be able to mix and roll in the hands. The Borax solution crosslinked between the Elmer's glue polymer chains to form a new material with different physical properties!



Science Book Library

A wonderful new book that you may want to add to your classroom or school library is **SCIENCEArts: Discovering Science Through Art Experiences** by Mary Ann Kohl and Jean Potter. This book is published by Bright Ring Publishing, 1993, ISBN 0-935607-04-8. SCIENCEArts is available for quantity discounts through bulk purchases for educational use. You can contact: Bright Ring Publishing, PO Box 5768, Bellingham, WA 98227, (206) 734-1601, FAX (206) 676-1271 for more information. Icons are used to identify age level, art technique, planning/preparation, author's favorite, heat source needed, seasons, outdoor activity, help, safety cautions, and concepts for each activity in the book. The chapters include Water & Air, Light & Sight, Motion & Energy, Reaction & Matter, and Nature & Earth. We think you and your colleagues will find this book useful for classroom teaching. *Enjoy!*

Thanks to ARUP

The Center for Integrated Science Education wishes to thank ARUP (Associated Regional and University Pathologists, Inc.) of Utah for their generous contribution to support the printing of EXPLORE! ARUP is dedicated to continually improving patient care through excellence in laboratory testing, service, education, and research with clients throughout the United States.

ARUP's clients include community hospitals, university teaching hospitals, hospital groups, commercial laboratories, group purchasing organizations, military and government facilities, and major clinics.

**Again, thanks to ARUP for
their support of science
education in Utah!**

EXPLORE!

Volume 3, Number 2 December 1995

Activating Parents

Parents are eager to help in the classroom, but often prefer some guidance and insight on effective activities. Science activities are a wonderful way to involve parents in their children's education, both in and out of the classroom.

For example, the activity to the right, "Is Milk a Polymer?", can be copied and sent home with the student as an activity to do with his or her parent. The materials are purposely kept simple, using only common household items. Or, you may want to ask an eager parent to read over the activity and then invite him or her into the classroom to do the activity with groups of students.

Parent sometimes need just an opportunity to get involved in their child's education. Once you have provided them that opportunity, especially in conducting activities in the classroom, they begin to become excited enough to want to come back! Science is wonderful, but "hands-on" activities require time to plan and acquire the needed materials for an entire class! Parents can help ease your time constraints and may bring in some fresh ideas!

In the January 1994 EXPLORE!, we suggested an article from the Science &

continued on page 2

Is Milk A Polymer?

First, let's ask ourselves, what is a polymer? Polymer is a word made of two parts: the first part is "poly" which means "many", and the second part is "mer" which means "part." A polymer is a huge molecule made from many repeated units. So, is milk a polymer? Let's try an experiment first before we answer that question.

MAKING WHITE GLUE FROM MILK

Are you always using and looking for glue in your classroom projects? Well, here is a simple way for you and your students to make their own glue from milk! We will initiate a chemical change to turn the milk into glue. How will you know when the milk has turned into glue? What will the change look like? Are the amounts important in this process? What could happen if you do not carefully measure the amounts of materials for this activity? (Try it!)

MATERIALS NEEDED

- 2 small paper drinking cups
- 1 tablespoon of white vinegar
- 1/4 cup 2% milk (powdered milk will work)
- 1 pinch of baking soda
- spoon for stirring
- 2 paper towels or coffee filters
- 1 pair safety scissors
- black and white construction paper
- tablespoon measure

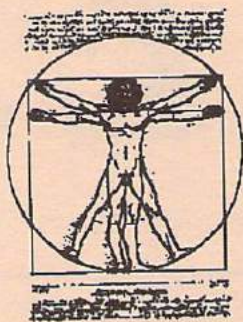


continued on page 3

*** Kids & Chemistry ***

The above activity is a sampling of materials available in **Kids & Chemistry**, an outreach program of the American Chemical Society. **Kids & Chemistry** is a program designed to bring scientists together with children to do hands-on science activities. Activities are available in two formats: pre-packed "Activity Paks" which come complete with supplies and instruction materials for up to 40 children to conduct 4-7 different activities. Activities are also offered in print-only form. Each activity is reviewed for use of everyday items found at home (or in a lab); must relate to a child's everyday life; and the materials must be safe. To date, there are six different activity packs and 30 printed activities. To receive more information about the activities, please call the American Chemical Association **Kids & Chemistry** order line at 1-800-227-5558, press 0 and request extension 6106.

LEONARDO



UPDATE

If you missed the Leonardo on Wheels event at the Utah State Fair in September or at the UEA Convention in October, don't worry. Leonardo on Wheels is preparing to pack up with loads of activities and take them to your community. To bring you up to date on Leonardo's itinerary, the truck will be pulling into the following communities on the dates specified:

PRICE

March 8 - 15

CEDAR CITY

April 12 - 20

ST. GEORGE

April 22 - 29

School visits at each site are scheduled separately. If you are in the Price area, call Karen Houser at 637-1732. Teachers in the Cedar City area can call Mary McDonald at 581-4171, and if you are in the St. George area, please call Jim Brickey at Woodward Elementary School, 628-0001. Just a little note about the St. George school visits - Grades 5 and 6 will be scheduled first, followed by Grade 4. If you or others are interested in volunteer opportunities with Leonardo on Wheels, please call Dorrie Dean at 468-3601. Leonardo on Wheels will be open to the public while at these sites. Be sure to bring your family out for an exciting time!

Activating Parents continued from front page

Children magazine titled "A Science Open House." In this article, teachers are encouraged to invite parents and students to a special event in their classroom or school. Together, parents and students do hands-on science activities and share their discoveries with others. If you would like a copy of this article, please write or call Mary McDonald at the Center for Integrated Science Education, University of Utah, 2480 MEB, Salt Lake City, Utah 84112, (801) 581-4171.

Helping Your Child Learn Science is an excellent book published by the U.S. Department of Education that can be used by parents. This book begins with the basics and includes several activities to be done at home and in the community. In the back of the book is a section, Parents and Schools, that offers ways for parents to help improve elementary school science.

Another excellent source is **Sharing Science with Children: A Guide for Parents** developed by the North Carolina Museum of Life and Science. One of the nice features of this guide is the chart that offers clues to the way children change in various age groups.

In case you are wondering, both parent guides are available, free of charge, from the American Chemical Society, Office of Public Outreach, Volunteers in Public Outreach, 1995 Catalog. You may obtain this catalog from Mary McDonald at the address and phone number listed above or by calling the American Chemical Society direct at 1-800-227-5558, option 54.

COLLEGE STUDENTS SET CHILDREN ON FIRE!

by Rachel Woods, Science Education Support Project

Cruelty to children? A bizarre lab experiment run amuck? Actually, it's none of the above. The Science Education Support Project is a group of University of Utah students that volunteer their time to set children's minds "on fire" about science. The project is a joint effort between the Lowell Bennion Center, a community service center on the U of U campus, and the Center for Integrated Science Education. College student volunteers visit schools to give demonstrations and assemblies designed to excite children about science.

The demonstrations and experiments are used to explain scientific concepts. We work hard to dispel the myth that science is hard, boring and done only by a guy in a white lab coat. Instead, we try to keep demos exciting and easy to understand. We also practice kitchen science, meaning that most of the things we use in our experiments can be found in the kitchen or around the home. That way, teachers can repeat the experiments with future classes, and children can try them on their own at home.

Because these are University of Utah students, we are currently focusing on the Salt Lake area. If you are in Salt Lake District and are interested in having us visit your school, please contact Rachel Woods or Abby Bird through the Bennion Center (Phone: 581-4811; Address: 101 Olpin Union, University of Utah, SLC 84112)

Step 1: Pour 1/4 cup of 2% milk into one of the paper cups. Record what the milk looks like in your lab record.



Step 2: Add 1 tablespoon vinegar. Stir for 1 minute and record what the new mixture looks like. Is there evidence of a chemical change? A chemical change occurs when a substance is transformed into something new. Examples of chemical changes include gas being given off, or changes in color, solubility, and temperature.



Step 3: Drape a paper towel or a coffee filter over the second cup. Push the middle of the towel down to form a space so that the mixture can be poured in.



Step 4: Pour in the curds and whey (the whey is the clear liquid part that separates out) and let it filter until the whey has gone through the paper towel into the cup.

Step 5: Very gently squeeze the rest of the whey from the curds into the cup. Dump the whey down the sink.

Step 6: Scrape (with a clean spoon) the curds into the empty cup. Add a pinch of baking soda and stir well. Now you have made your own white glue. (Allow 6 hours for your glue to dry completely.)



The glue you have made is from a protein found in milk called casein. Casein is a natural polymer - a protein - and makes a good glue. This protein is usually dissolved as part of the milk. When vinegar was added to the milk, a chemical change transformed this protein into a solid. (This is a little like what happens when you cook an egg and is called "denaturing" a protein.)

When the milk coagulates or clumps up like this it has turned into curds and whey. Milk soured in this way is more digestible. This same process helps turn casein into cheese, plastics, jewelry, and even house paint. The protein molecules are very long and stringy and have lots of "sticky" points on their surfaces, which allow them to act as a glue.

The reaction to produce the white glue works very well. This activity allows students to measure, mix, filter, and recover a precipitate (a solid that falls out of solution and an indication that a chemical reaction has taken place). The addition of the vinegar will generate wrinkled noses; be prepared for lots of "ooh, this smells!" comments. The distaste fades as the reaction occurs. The addition of the baking soda neutralizes the vinegar. The bubbles released are CO_2 from the reaction with the vinegar (bubbles are another indication that a chemical reaction has taken place).

You may want to organize your students in groups when doing this experiment and have each group vary the ingredients slightly. For example, one group could add 1 1/2 tablespoons of white vinegar while another group could try using 1/3 cup of milk. Each group could then test their glue to see which combination works the best. When testing, use the original recipe as a "control" to compare the glue strengths.



Science Book Library

WOW! What a collection of books! At the recent NSTA Convention in Salt Lake City, we discovered the wonderful collection of Dorling Kindersley (DK) Family Library books, videos, and CD-ROMS. For younger children, DK publishes Let's Explore Science Series - a book full of simple yet educationally sound science experiments. For the older children, DK has several selections in the science area - Dictionary of the Earth, Earth Atlas, DK Science Encyclopedia, 101 Great Science Experiments, Smithsonian Visual Timeline of Inventions, and Eyewitness Science Series. The Eyewitness Science Series includes such topics as Electricity, Energy, Force and Motion, Light, and Matter.

If you haven't seen the DK Family Library, we suggest you visit your local bookstore. Many of the selections are available there. Also, we encourage your school's librarian to check out the DK collection for the school's library. To receive information on the entire series, please call Sonia Maxfield in Salt Lake City at 944-1351 or Karla Marsden in Sandy at 571-1211.

Never give children the chance of imagining that anything exists in isolation. Make it plain from the very first that all living is relationship. Show them relationships in the woods, in the fields, in the ponds and streams, in the village and the country around it.

Aldous Huxley



Beth Kaplan Steele:
**Teacher and Student
 Services Available at the
 Utah Museum of Natural History**

The Utah Museum of Natural History (UMNH), located on Presidents' Circle at the University of Utah, is a dynamic educational organization which provides visitors the opportunities to learn about the geology, biology, and anthropology of Utah and surrounding regions.


TOURS: K-12 school groups can tour the Museum with or without guidance from a docent. Previsit materials which correlate with the State Science Core Curriculum are sent to teachers in advance.

FOURTH GRADE: Junior Science Academy is a hands-on museum experience for 4th grade classes. Students participate in 2-hour sessions each week for three consecutive weeks and attend classes in biology, geology, and anthropology.

KITS: UMNH recently redesigned its outreach kits to better serve K-8 teachers and students. Outreach visits to classrooms led by Museum docents may be scheduled, or the kits may be checked out by teachers. Thanks to a grant from USOE, in 1995-96 UMNH will make outreach visits to 4th grade classrooms throughout Utah. For kit topics, please contact Beth.

INSERVICE: Teacher inservice workshops are held throughout the year at the Museum. Upcoming topics include The Great Salt Lake Story, The Natural History of Genes, Mammalian Evolution, Structural Geology and more. Workshops may be taken for inservice or University of Utah Credit. The Great Salt Lake Story is an interdisciplinary, comprehensive activity guide designed for student investigation of the Great Salt Lake. Targeted primarily at grades 3-8, it is available for purchase at the Museum.

Beth is the Curator of Education at the Utah Museum of Natural History. You can learn more about these and other programs by calling Beth at 585-6310!

 **Clip and Save for Your Resources!!**



Do you or your students need help with scientific questions? The following University faculty have plenty of information and ideas to share with you and your classroom. Please give them a call!! (and post this for everyone to use!, day numbers are listed unless otherwise specified)

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Noel DeNevers - Call 581-6024
 from 8 to 5 or at home 328-9376 from 6 to 10 pm.

Ron Ragsdale - Call 581-7621 from 9 to 6 or at home 268-2149 from 7 to 10 pm.

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Pam Poulsen - 581-3744

■ **SCIENCE EDUCATION**

Julie Gess-Newsome or Sherry Demastes - 581-7158

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EXPLORE!

**CENTER FOR INTEGRATED
 SCIENCE EDUCATION**
 University of Utah, 2480 MEB
 Salt Lake City, Utah 84112
 581-4171 Fax 585-5361

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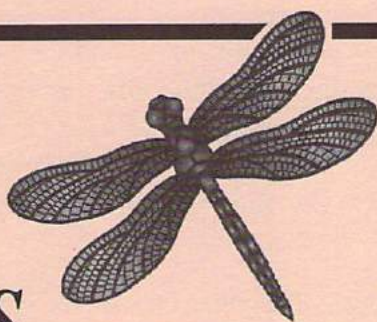
EXPLORE!

Volume 3, Number 3 March 1996

Scientific American Frontiers and GTE have teamed up to bring outstanding science programs to local PBS stations. On January 17, 1996 Frontiers aired FLYING HIGH, which investigated the science of flight from birds to man-made flying machines. Accompanying the show was a teacher guide featuring several activities relating to flight and air that could easily be done in the classroom.

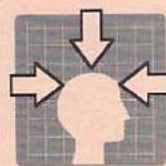
ACTIVITY 1 from this guide is featured on page 3 of this issue of EXPLORE!. If you are interested in obtaining a copy of the complete guide, contact the Scientific American Frontiers' School Program directly at 1-800-315-5010. If you are interest-

SAILING & SKIMMING WITH WINGS



ed in finding out when this show will be aired again, contact KUED at 581-7777. A video of the show is available for \$18 by calling the SCHOOL PROGRAM and is worth adding to your District's media library.

Please turn to page 3 for the activity Modeling Insect Wings.



SCIENCE WITHOUT WALLS

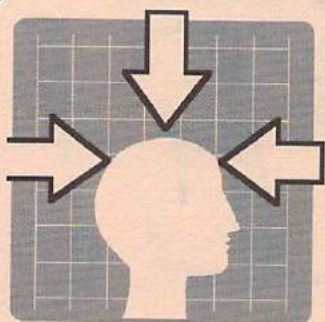
A Science Telecourse

Science Without Walls: Science in Your World, is a new major science telecourse being developed by CISE's Joe Andrade, produced by the University of Utah's Media Solutions Group, and offered through the Division of Continuing Education. The course is now in production, and is expected to air for the first time during Fall Quarter, 1996. Offered as a Liberal Education course, the course will also be available to teachers for inservice and lane change credits.

Science Without Walls is a concept- and inquiry-based course primarily for non-science majors. Focusing on major science concepts applicable to all science disciplines, the course is intentionally multi- and inter-disciplinary. Science is

Thanks to the Phillips 66 Company in Woods Cross, Utah for making this issue of EXPLORE! possible. Phillips 66 encourages and supports science education for teachers and students throughout Utah!





SCIENCE WITHOUT WALLS

continued from page 1

treated as an integrated set of concepts and phenomena which connect all common science disciplines and majors, hence the name, Science Without Walls. The programs are based on Joe's popular 10 hour inservice course, Integrated Science Concepts and Themes, which has been taken by some 400 teachers throughout the state over the last four years.

Although there will be special sections offered for inservice and preservice teachers, tied to the State Science Core and to the new National Science Education Standards, the main purpose of the course is to empower you to develop a life-long interest in science, and a motivation to continue to study and experience science on a daily basis. The concluding programs involve discussions and experiments as to how science relates to your everyday life, empowering you to be an even more responsible, involved citizen and resident.

Joe is now designing the syllabus for the course, and also a unique labless laboratory in which all of the major concepts, themes, and principles developed in the course will be experienced in a hands on manner by the students in their own home environment, using a unique Labless Lab® kit. For more information contact Mary or Mindy at the CISE office (801) 581-4171.



True or False?

T

F

Agriculture is part of the science, social studies, healthy lifestyles, and math cores.

Agriculture is mentioned specifically in the science, social studies, and the healthy lifestyles core. But if you answered true, you will be pleased to learn that the *Ag in the Classroom* program can supply you with the materials you need to teach the 3 R's; using agriculture as the vehicle. Additionally, if you teach children about plants, animals, insects, soils, conservation, microorganisms, economics, history, or nutrition (to name a few) *Ag in the Classroom* can provide you with valuable resources and materials, including lesson plans, teacher kits, bulletin boards, software, videos, posters, and more.

The Utah Foundation for Ag in the Classroom and Utah State University have partnered to bring Utah teachers the *Ag in the Classroom* program. "Our mission is simple, we want to provide teachers what they need to teach children about their food and fiber. We hope that students will also gain an appreciation for the miracle called agriculture." Debra Spielmaker is the Project Coordinator responsible for teacher in-service, pre-service, teacher resources, and a teacher newsletter.

The Utah Ag in the Classroom Program networks with other states and with the National Ag in the Classroom Program. "Agriculture is not a special interest," says Debra Spielmaker, "it is our connection to life." Agriculture is more than farming. Less than 2% of our population produces our food. We all depend on this 2%. About 20% of our population is involved in our food and fiber system. Agricultural scientist, engineers, processors, and distributors all are part of the agricultural industry. We all need food, fiber (clothing), and shelter (forestry). Agriculture encompasses the entire curriculum. Contact Debra Spielmaker at 801-797-1657 if you would like your name added to the mailing list or if you would like more information. The address is; Utah State University, Logan, Utah 84322-2315.



Debra Spielmaker

SAILING & SKIMMING WITH WINGS

continued from page 1

You will need the materials listed to the right to do this activity.

MODELING INSECT WINGS

Investigating skimming and surface tension

As seen on *Frontiers*, the wings of flying insects may have developed from smaller wing-like extensions that aided the organism in sailing or skimming across the water's surface. In this activity, you will construct insect models that illustrate the action of these adaptations and the properties of surface tension.

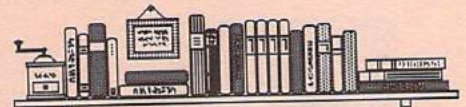
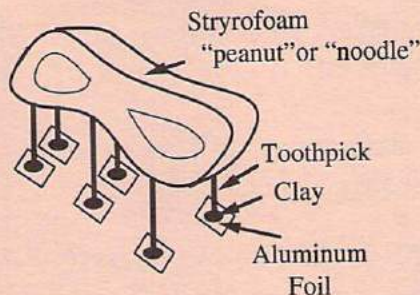
Procedure

- 1 Working in groups of two or more, build a model of a stonefly using a plastic foam "noodle" or "peanut" to represent the insect's body.
- 2 Break three toothpicks in half; each half represents an insect's leg.
- 3 Cut six squares of aluminum foil, 1/2" on each side.
- 4 Place a small lump of clay in the middle of each of the six foil pieces.
- 5 Insert one end of each toothpick into the clay. Insert the other end into the plastic foam noodle.
- 6 Construct a second model following steps 1 to 5. Add a paper sail to this model (try different positions and shapes for the sail to see which is most effective).
- 7 Fill a large cookie tray with water about 1/4" deep.
- 8 Blow through a straw and race the models across the cookie tray.
- 9 After the race is finished, compare the actions of the two different designs. How does the sail-like wing give the insect an advantage? Experiment with different sizes and shapes of wings, and then design and test a more efficient sail. When you are satisfied with your design, enter it in a classroom race challenge.

Do you think your stonefly model would have been supported by the water's surface tension without the aluminum foil pieces? Is the most efficient sail design the largest? How might the stonefly adjust its path? Surface tension - the skin-like cover of a liquid produced by the cohesion of its polar molecules - allows tiny insects to walk on top of water without sinking.

MATERIALS

- plastic foam packaging "noodles"
- toothpicks
- clay
- aluminum foil
- paper
- small tubs or large cookie trays
- washers



Science Book Library

Incredible!

We have discovered a wonderful science book titled **Incredible Edible Science!** which connects basic science concepts to everyday subjects of food and cooking. It addresses questions such as -

- Why does water boil?
- How do you make ice cream?
- What is the difference between baking powder and baking soda?
- Why are pickles sour?
- Why does fruit turn brown?
- Why does popcorn pop?
- What is the difference between light and dark meat?

and many others.

The book is arranged in sections to include solutions, acids and bases, sugars and starches, proteins, and cells. Each section features recipes relating to the science.

Incredible Edible Science was written by Tina L. Seelig and is a *Scientific American Book for Young Readers*, published by W. H. Freeman and Company in New York. Request a copy for your district library or for your own classroom resources!

*Imagination
is greater than
knowledge.*


Albert Einstein



*Talk
Rocks & Earth Science
with Margie Chan...*

Margie can tell you how rocks are formed by wind and water. Sedimentary rocks are all around us and are seen in all our state's National Parks! Margie Chan is Professor of Geology at the University of Utah, where she teaches and researches sedimentary geology. She is interested in the Earth's history, it's resources, and environmental issues. She has studied some of the oldest rocks and some of the youngest rocks in Utah. She advises undergraduate and graduate students in earth science and is active in the Association for Women Geoscientists. Out in the field, Margie and her husband take their two young sons exploring for clues to the Earth's mysteries!

Margie can answer your, or your students', questions about rocks! Please give her a call at 581-6551.

 *Clip and Save for Your Resources!!*

**? SCIENCE
LINE**

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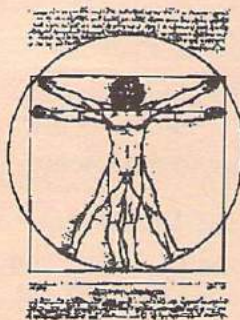
Julie Gess-Newsome or Sherry Demastes- 581-7158

■ **NATURAL HISTORY**

Beth Steele - 585-6310

 *Clip, Save, and Post
for Your Resources!*

LEONARDO UPDATE



Leonardo on Wheels, a new traveling art, science, and technology center, received overwhelming and very enthusiastic responses at the State Capital kick-off celebration! After a stop in Price from March 8 to March 15, *Leonardo on Wheels* will travel to Provo. In April, *Leonardo on Wheels* sets up in St George. If you would like more information regarding

Leonardo on Wheels' travel plans, or to schedule your class when it is in your area, please call (801) 533-3237.

EXPLORE!

CENTER FOR INTEGRATED
SCIENCE EDUCATION
University of Utah, 2480 MEB
Salt Lake City, Utah 84112
581-4171 Fax 585-5361

Newsletter Staff

Joe Andrade.....Project Director/Editor
Mary McDonald....Program Coordinator
Mindy Steadman.....Program Assistant

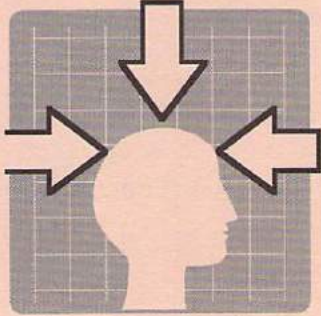
*Explore! is made possible by grants
from the Dreyfus Foundation, the*

*American Chemical Society, the Michael Foundation, US West Chevron,
Therotech, ARUP, Inc, Myriad Genetics, Becton Dickinson, BARD Access,
Phillips 66, Alliant Techsystems, and by the University of Utah*

EXPLORE!

Volume 4, Number 1 August 1996

SCIENCE WITHOUT WALLS:



Science In Your World

Learn basic science concepts this fall through a new and exciting inquiry-based telecourse, *Science Without Walls: Science in Your World*. The new course is primarily for non-science majors and focuses on major science concepts applicable to all science disciplines.

There are six parts to the course: the first deals with the processes and the experimental nature of sci-

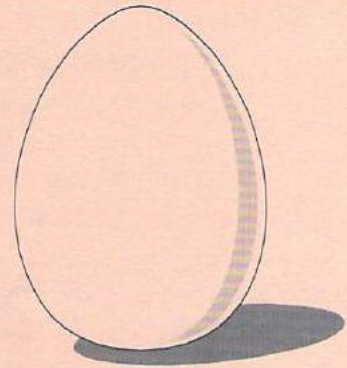
ence and its connections with the arts. The second deals with physics, the third with chemistry, the next part with biology. The fifth applies the first four to nature, the environment, and environmental issues. The concluding programs involve discussions and experiments as to how science relates to your everyday life, empowering you to be an even more responsible, involved citizen and resident. A complete listing of the programs can be found on page 4.

Science Without Walls: Science in Your World will air on Channel 9, KULC, Tuesdays from 7 to 9 pm beginning October 1, 1996. Course materials include several paperback textbooks, a comprehensive syllabus, and a unique Labless Lab kit of experiments. The course is offered for 5 credit hours as Liberal Education 144. For registration information contact the Telecourse Office in the Division of Continuing Education at 801-581-5752.

The Working Cell

*by Betsy Price, Project Director,
Natural History of Genes*

From our research on how to teach genetics to middle and high school students, we have discovered how very little students understand the smallest unit of life -- the cell. Students can develop, while in elementary school, their understanding that living things are made of living cells and that cells of different shapes, color and size are busily working everyday to keep us alive.



Students often think of the cells only as structure. All cells generally have three basic structural features; an

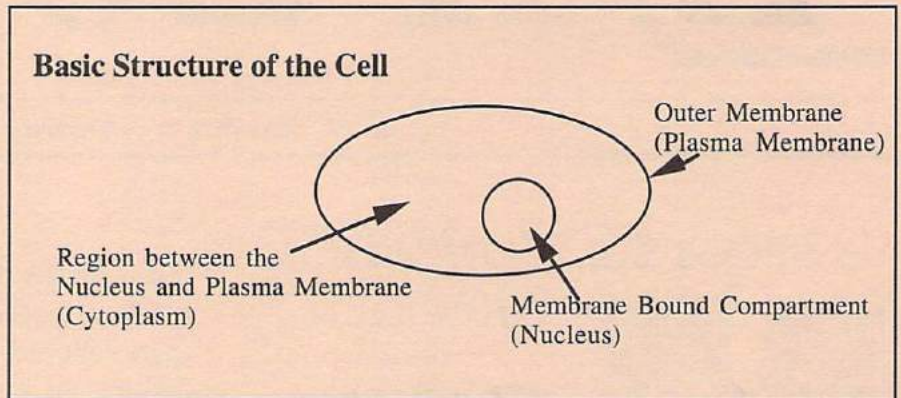
continued on page 2



The Working Cell *continued...*

outer membrane (plasma membrane), a membrane bound compartment (nucleus), and everything inbetween the outer membrane and nucleus (cytoplasm). It is within the cell, the smallest unit of life, where the properties of life are retained, i.e. the ability of a cell to duplicate itself.

For the most part, cells are too small to be seen with the naked eye. A few cells such as the bird eggs, cells in the red part of a watermelon, and the fish eggs called caviar are visible without the aid of a microscope. Why are most cells so small? The smaller the cell, the more efficiently materials can move into the cell and be used to build new cells.

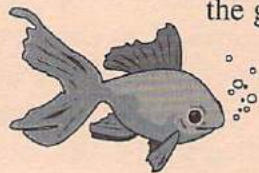


You will want to stress with your students then that all living things are made of one or more cells; each cell is the basic living unit; and a new cell arises only from cells that already exist. Below are some simple activities that students can do to investigate size, shape, and color of cells.

Activities

The Working Cell Learning Center

Activity 1:



Obtain a chicken egg, red part of a watermelon, and fish eggs from the grocery store. You may want to set up a table as a learning center. Let your students explore the differences in shape, size, and color of the cells. Can they identify the three basic parts of the cells? Have your students draw a picture of the cells and write down the function of the cells.



Activity 2:

MATERIALS:

Microscope with microscope slides
(available from your local junior or senior high school,
or ask a parent to lend one)

Samples: red onion, onion root, carrot, cork,
leaf, cheek, pond water

Clear nail polish
Iodine
Q-tip or toothpick

Make a cell learning station by first preparing slides of cells from the bulb of a red onion, onion root, cork, leaf, carrot, muscle, cheek, and one celled organisms found in pond water. To prepare a slide of cheek cells, use a popsicle stick to remove some dead cells from the inside of your cheek. Place them on the slide, stain with a drop of iodine, put on a cover slip, and seal the sides with clean fingernail polish. After the polish has dried, wash the slide and place it at the learning center for students to view. This is a great cell to use because the nucleus is visible and your students can see the cell membrane.

continued on next page

The Working Cell *continued...*

To prepare slides of the onion, carrot, and cork, slice a very thin piece and place on the slide (a razor blade works well for obtaining a thin slice). If you need assistance in preparing the slides, you may want to call your local junior or senior high science teacher.

Allow your students to investigate the variety of cells. Ask your students to think of what the function of each cell might be by its shape, size, and color. The students should observe that whatever part of a living organism is viewed it is made of cells and the cells of each part have a particular job to do everyday.

Importance of Teaching Science...

What we have discovered seems to be a common phenomena in teaching science across the board. Students learn to repeat definitions and memorize concepts from the textbook; however, they really don't understand or believe all that we tell them. A researcher on another project found that students believe that science in school is one thing and the real world is a totally different thing.

Let me give you an example of this. Next time you are with a group of kids (or adults) ask them where plants get their food. A surprising number of people will say from the ground. The reason is that for about one week in science class they learn about photosynthesis and the rest of their life they live in a world where they buy plant "food" and put it in the ground to "feed" their plants. Plants do obtain essential nutrients from the soil which may be added by people as plant "food", but it is in the photosynthetic process where plants use energy from the sun to build their own sugars, starch, and other needed molecules.

Betsy Price is the Project Manager for the Natural History of Genes at the Utah Museum of Natural History (UMNH). To learn more about upcoming pre-genetic workshops for elementary teachers and other opportunities call the Utah Museum of Natural History at 581-6928.

THANKS!

EXPLORE! is made possible by grants from the Dreyfus Foundation, the American Chemical Society, the Michael Foundation, US West Chevron, Theratech, ARUP, Myriad Genetics, Becton Dickinson, BARD Access, Phillips 66, Alliant Techsystems, APTUS, and by the Colleges of Engineering, Science, Mines and Earth Sciences, and Graduate School of Education at the University of Utah.



Science Book Library

A wonderful addition to your science library is the Science Snackbook Series produced by the Exploratorium, a world renowned science center located in San Francisco. Designed for teachers and home-schoolers, the Science Snackbook Series gives complete instructions for how to build classroom versions of popular Exploratorium interactive exhibits. Teacher-tested experiments, activities, and demonstrations in the books are easy to build using common materials.

In collaboration with John Wiley & Sons, the Snackbook material has been organized by topic into four new volumes:

The Magic Wand and Other Bright Experiments on Light & Color

The Cheshire Cat and Other Eye-Popping Experiments on How We See the World

The Cool Hot Rod and Other Electrifying Experiments on Energy and Matter

The Spinning Blackboard and Other Dynamic Experiments on Force and Motion

Each book sells for \$10.95 and is available by calling 1-800-359-9899 or by ordering through your local bookstore.

Education is not preparation for life; education is life itself.

John Dewey

Science Without Walls Program Schedule

(continued from page 1)

Each program listed below is one-half hour long. On Tuesday nights, starting October 1, 1996, four programs will be aired on Channel 9, KULC between 7 and 9 pm. Clip and post this schedule for your colleagues or family. You may also want to send a copy home with your students to encourage parental viewing.

- The World of Science-The World of Art
- Observing and Perceiving: The Senses
- Patterns and Numbers
- Extending Your Senses
- Integrated Concepts & Themes: Systems and Models
- Integrated Concepts & Themes: Scale
- Integrated Concepts & Themes: Constancy, Change & Matter
- Integrated Concepts & Themes: Energy, Disorder & Life
- Physicists In the Wild: Earth, Sun, Moon, Stars & Seasons
- Inertia, Gravity, & Senator Garn
- Energy, Efficiency, Entropy: You Can't Even Break Even!
- Interstate Physics
- Action At A Distance: Private Lightning and Electricity
- From Magnets to Electricity
- From Electrons to Light: Electromagnetic Waves
- From Newton to Quanta -- and Certainty to Uncertainty
- Chemists in the Wild: Air, Water, Earth & Fire
- Your Personal Periodic Table
- From Atoms to Molecules
- From Metals to Water
- From Water to Solutions
- Molecular Alchemy: From Molecules to Molecules
- Very Personal Chemistry: Kitchens & Bathrooms
- Guns and Bombs: Chemical Reactions in Action
- Biologists in the Wild
- What is Life? -- Diversity and Extinction
- What is Life: -- The Very Early Days
- What is Life? -- From Bacteria to You
- Energy In: Fuel & Light
- Energy Out: Biomass and Work
- Information In: The Senses
- Information Out: Language, Communication, and Culture
- Your Brain and Consciousness: Use It or Lose It!
- Is There Intelligent Life on Earth?
- Planetary Medicine: The Gaia Model
- Your Stuff: Cars and Transportation
- Luck and Risk: Personal and Private Statistics
- Medicine & Health -- Yours
- Creativity -- Yours
- Citizen Empowerment: Where Do We Go From Here?

DIAL-A-SCIENTIST



University faculty members are prepared to address your science questions. Please give them a call!! (Day numbers are listed)

CHEMISTRY

Noel DeNevers.....581-6024
Ron Ragsdale.....581-7621

PHYSICS

Sid Rudolph.....581-4803
Gale Dick.....581-6408
Bob Kadesch.....583-0123

MATH

Herb Clemens.....581-5275
Peter Alfeld.....581-6842

BIOLOGY

Pat Renfranz.....585-3819
John Roth.....581-3412

FOOD & NUTRITION

Sherm Dickman.....532-5644

BIOLOGY-CHEMISTRY

Karin Caldwell.....581-5455

ENVIRONMENT

JoAnn Lighty.....581-5763

OPTICS & IMAGING

Doug Christianson.....581-7859
George Gray.....585-6157

OUTDOOR EDUCATION

Pam Poulsen.....581-3744

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EXPLORE!

Volume 4, Number 2 December 1996



Holiday

CHEMIS-TREE

by Dr. Frankie Wood-Black,
Associate Environmental Scientist, Phillips 66

Below, and on the next page, are several activities you and your students can do to learn science while making holiday ornaments. These activities are designed mostly for grades K-3, but can be adapted for grades 4-6.

Crystal Creations

Adapted from "Apples, Bubbles,
and Crystals: Your Science
ABC's" by Andrea Bennett and
James Kessler



MATERIALS (per student or group):

- black construction paper
(cut into the shape of snowflakes, etc.)
- 1/4 cup hot tap water
- disposable clear plastic cup
- 3 tablespoons Epsom salts
- cotton swab

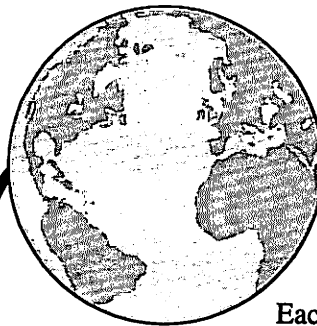
PROCEDURE:

1. Add Epsom salts to the hot water. Mix well.
2. Using the cotton swab, paint on one side of the construction paper with the water/salt solution.
3. Let dry.
4. Punch a hole in the shape with a pencil and use ribbon or yarn to hang the ornament.

WHAT IS HAPPENING:

Crystals are substances made of tiny particles that fit together in a pattern that repeats itself. A crystal will have a certain number of flat sides, sharp edges, and pointy corners. Epsom salt is composed of salt crystals. The crystals break apart and dissolve in the water. After you paint the shape, the water evaporates into the air and leaves behind the reformed salt crystals.

more activities on the next page



Engineers Make A World of Difference

Each February engineering professionals and societies sponsor National Engineers Week to help increase public appreciation and understanding of the profession. National Engineers Week next year will be February 16-22.

This provides an opportunity to cultivate interest in engineering, math, and science among our children. Last year the College of Engineering at the University of Utah sponsored competition events for nearly 3,000 elementary students. This year the event will be moved to the spring. Look for details in your mailbox, or call JoAnn Lighty at 581-5763 for more information.

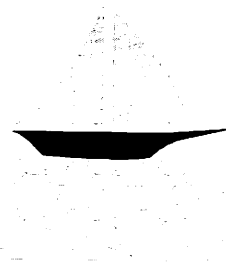
Below is an activity you can do with your students to demonstrate the problem solving process that engineers go through.

Boat Races: *Exploring Air and Motion*

Does the shape of a boat's sail
make the boat go faster or slower?

MATERIALS

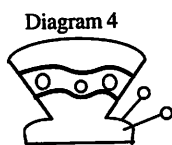
- 4 toothpicks
or coffee stirrers
- clay
- 6-8 straws
- plain bond paper
- manila file folder
- scissors
- cardboard racecourse



activity continued on the back page

Butterfly Ornaments

Adapted from "Beyond the Wow!",
a paper publication from the
American Chemical Society - no
longer in print



MATERIALS (per student):

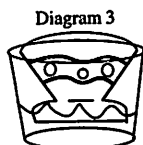
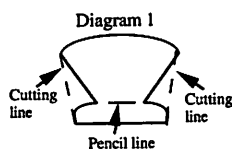
- clear plastic glasses
- No. 4 size white coffee filter (natural brown cone filters do not work as well)
- 2 strips of colored paper 3" x 1/4" (for antennae)
- small quantity of water
- water-soluble markers

PROCEDURE:

1. Give each student a pre-cut filter (Diagram 1) and water soluble marker.
2. Distribute water to each student or group.
3. Have students mark above the pencil line with dots and lines (Diagram 2).
4. Give each student a plastic glass and ask them to put about a centimeter of water into the glass.
5. Place the filter into the glass so that only the bottom of the filter is in the water (Diagram 3).
6. The water will travel up the filter and the colors will spread. When the water has reached the top of the filters, have the students remove them from the glass. What has happened to the colored dots and lines? Have your students think of reasons why the dots and lines have "moved."
7. To make a butterfly, add the antennae (either staple or glue). You can curl them around pencils for added effect.

WHAT IS HAPPENING:

Your students are performing a simple form of chromatography. Chromatography is one way scientist separate solutions. As the water travels up through the fibers in the filter, the markers dissolve in the water and travel with it. Since the markers are made of various colored inks, those inks will separate out as the water moves up the filter. Lighter weight inks often travel the furthest.



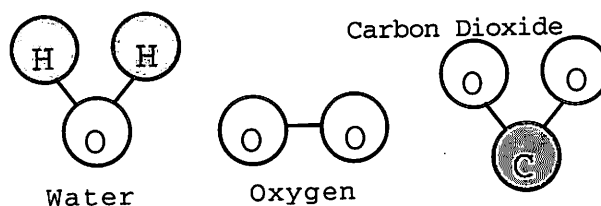
Making Molecule Models

MATERIALS:

- red, green, and orange gum drops
- toothpicks

PROCEDURE:

1. Red gum drops represent oxygen atoms, green ones are hydrogen atoms, and the orange ones represent carbon atoms.
2. The toothpicks represent bonds.
3. Insert the toothpicks into the gum drops to build models representing the common molecules water (H_2O), carbon dioxide (CO_2), & oxygen (O_2).



WHAT ARE ATOMS AND BONDS:

Explain to your students that atoms are the smallest unit of matter. Atoms are attracted to other atoms and form bonds. When two or more atoms combined they are called molecules. Water consists of two hydrogen and one oxygen atoms. Carbon dioxide is one carbon and two oxygen atoms. Oxygen as found in the atmosphere is two oxygen atoms bonded together.

National Chemistry Week

Every year the American Chemical Society sponsors National Chemistry Week during the first full week of November--this year the event was from November 3rd through November 9th. For the week-long event, local chapters of the American Chemical Society planned a week of science experiments at the Children's Museum of Utah, sponsored the "Name the Element" contest, and organized a chemistry quiz for children with a local radio station.

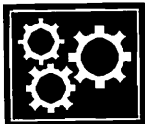
Plan now to participate in next year's event--November 2nd through the 8th--as it will be the tenth anniversary of National Chemistry Week. For more information of National Chemistry Week, you can write to:

Dr. Frankie Wood-Black, Phillips Petroleum,
393 S. 800 W., Woods Cross, UT 84087
801-299-6660

You may visit the ACS National Chemistry Week Homepage as: www.acs.org/pafegen/ncw/home.html or email to: ncw@acs.org.

*It is important that students bring a certain
ragamuffin, barefoot irreverence to their
studies; they are not here to worship what is
known, but to question it.*

Jacob Bronowski



No cars. No bridges. No planes. No computers. No CDs. No Engineers!!

Take away everything that engineers have given us and we're left with a pretty dull life. Children and adults often don't understand engineering. What is engineering? What do engineers do? How does one become an engineer? Fact is, engineers are responsible for many things and are constantly finding solutions to problems in our world. You can find engineers everywhere - in private corporations, government agencies, and universities. Below is a listing of many different types of engineers. Please share this with your students.

Electrical and Electronic Engineers specialize in electronics and electricity. They design electrical components in computers, CD players, and video games, as well as the means to provide electricity to your home, school, and business.

Mechanical Engineers work on a wide variety of products such as cars, space shuttles, and robots.

Bioengineers cover a broad range of interests involving humans and new technologies. At the University of Utah bioengineers develop artificial organs, prosthetic devices, contact lenses, and new vision implants.

Industrial Engineers look at production processes to find the most efficient and safest use of machinery, labor, and raw materials. Some specialize in ergonomics - the increase of human safety and performance in the workplace.

Aerospace Engineers deal with objects that move through the air such as airplanes and space shuttles.

Chemical Engineers look closely at the manufacture of chemicals and other materials. This may include developing products from plastic, metal, food and gasoline. Some chemical engineers study chemical pollutants.

Civil Engineers are called upon to help architects design structures. They also work on highways, bridges, dams, and urban planning.

Computer Engineers are busy producing better computer systems. They also develop computer programs to better solve scientific and engineering problems.

Environmental Engineers deal with issues like waste management, pollution control and irrigation.

Material Scientists and Metallurgical Engineers work with new materials to fit a new product's needs.

Let your students know that to become an engineer you must acquire math and science skills. Not all engineers begin their training at the universities with superb math and science skills. For some, this acquiring these skills requires extra studying, but is well worth the effort. Engineering jobs are expected to increase over the next decade.

Adapted from the Society of Women Engineers brochure. For copies of the brochure, please contact: Society of Women Engineers, 120 Wall Street-11th Floor, New York, New York, 10005-3902.



Science Book Library

Apples, Bubbles, and Crystals: Your Science ABCs

Science Activity Book for K-3 Students

by Frankie Wood-Black,
Associate Environmental Scientist,
Phillips Petroleum

Have you ever wished that preschool, kindergarten, and early elementary school books would have more of a science and discovery focus? Are you trying to instill in young children that science is fun and it is everywhere? Well, Andrea Bennett and James Kessler have put together a book that just might be exactly what you are after--"Apples, Bubbles, and Crystals, Your Science ABC's" copyright 1996 by the American Chemical Society, and published by Learning Triangle Press.

With a wonderful combination of colorful illustrations, fun poetry, delightful characters, and simple to-do-at-home activities, children of all ages will quickly see that science is fun and everywhere. The poems, characters, and experiments are carefully woven together to provide insights into the science demonstrated by each activity. For example, "F" is for float.

We meet Frita the duck who is quickly snapping up peanuts before they sink. Frita has a special tip for

continued on the next page

Boat Races Activity *continued from the front page*

PROCEDURE

1. Make a data sheet like the one shown. Trace four of the boat shapes shown in Figure 1 onto a manila folder. Cut-out each boat.

2. Cut four rectangles from the plain bond paper about 7 centimeters (cm) x 8 cm. Poke two holes in one paper rectangle to make a sail. Fasten the sail on the toothpick as or coffee stirrers as shown.

| Shape and/or size of Sail | Observations | | |
|---------------------------|--------------|---------|---------|
| | Trial 1 | Trial 2 | Trial 3 |
| | | | |
| | | | |
| | | | |

Data Sheet

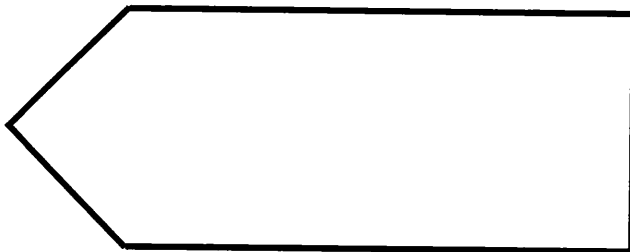
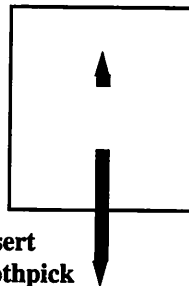


Figure 1: Boat Shape



Insert toothpick or coffee stirrer into sail

- Roll four balls of clay about 1 cm across. Attach the toothpick or coffee stirrer to the boats using the clay ball.
- Cut the other three rectangles into different sail shapes. Attach them to the other boats. Draw a sketch or describe each sail shape on your data sheet.
- Use cardboard strips to create "racing lanes" on a table. Line up the boats on the table, and, using the straws, blow each one once. Try blowing with the same force. Which boat goes the furthest? Record your observations on the data sheet. Do two more trials.

The boats are able to move across the table due to the air "catching" on the sail. When the moving air confronts a larger sail area, it is able to move the boat further. By having your students make sails of common shapes (squares, triangles, rectangles), they can measure the area of the sails and compare their results based on the area.

Adapted from A World in Motion curriculum by SAE, The Engineering Society for Advancing Mobility Land, Sea, Air, and Space.

Apples, Bubbles, and Crystals *continued*

ducks who aren't as fast at snapping the peanuts up. The activity has the child and parent float peanuts in fresh water and salt water--what happens to the peanuts?

The activities, for children ages 4 and up, are designed to use household materials and to be done with the help of an adult. There are step-by-step instructions and questions to help the discovery process along.

Be careful though--at my house we spent our story time reading the poems and I'm now being asked "Can we make a kazoo, can we make bubbles, can we..." My only concern is that the pages aren't waterproof as my copy has already been heavily used. CONGRATULATIONS!! to Andrea Bennett and James Kessler for this fine book. To obtain a copy, check with your local bookstore. We found a copy available at Barnes and Noble Booksellers.

DIAL-A-SCIENTIST



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EXPLORE!

Volume 4, Number 3 March 1997

Science Without Walls

***Science on the road, in
your car, and in your home!***

If you missed the first-time offering of the new telecourse, *Science Without Walls* with Joe Andrade, you are still in luck! The course will air again this spring on Channel 9, beginning March 31 and continuing through June 4.

You may choose to take this course for University of Utah credit or for personal enrichment. To register for credit, look up Liberal Education, Course 144-1 in the University of Utah's Division of Continuing Education (DCE) catalog. The comprehensive syllabus, complete with homework, laboratory exercises, and the *Labless Lab* kit, is available through DCE. Call 581-5752 for details.

If your schedule conflicts with the airing time, you may copy the weekly broadcasts on your VCR and replay them at your convenience. For a complete listing of the 10-week course, call the Center for Integrated Science Education at 581-4171.



Space-Age Wheat Inspire Your Classroom Scientists

The following is reprinted with permission from *Growing Ideas, A Journal of Garden-Based Learning*. For more information regarding this wonderful resource of classroom activities, see the next page. Space-Age Wheat was developed at Utah State University. See end of the article for details about obtaining seeds.

How does a scientist find a food plant that can thrive on space farms where the artificial sun always shines, carbon dioxide levels are high, and space is tight? Through careful work and sheer persistence. A researcher at Utah State University, challenged by the idea of creating a type of wheat that would produce well in space, spent more than a decade repeatedly growing and cross-pollinating wild and domesticated wheat plants. His reward was publicly unveiled last spring: *Apogee* wheat - the first food designed to be grown in space. Its virtues? It's short and compact, loves warmth and light, produces seed heads in no time

continued on page three

Science versus Art in Developing Observation Skills

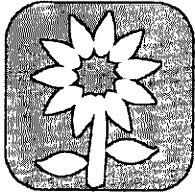
by Mary McDonald, Center for Integrated Science Education

The differences between observing as a scientist and an artist are important when asking your students to record observations during a science activity. You are asking them to make scientific observations, not artistic ones. What is the difference?

continued on next page



Fresh Ideas for the Classroom...



Growing Ideas

A Journal of Garden-Based Learning

Growing Ideas, published three times a year by the National Gardening Association, is a wonderful resource of classroom activities. The recent January issue focused on Soil -- decomposition, components, profile, water, plants, microscopic organisms, and more. We encourage you to obtain a listing of *Growing Ideas* back issues -- Herb Lessons, Nutritious Lessons, Ecosystem Explorations, Lunar Harvest, Turn on Learning with Bulbs, Radishes, Roots and 'Rithmetic, Touch Your Plants?, Biosphere in a Bottle, and more. Back issues are still available!

To subscribe or request a complimentary issue of *Growing Ideas*, please call 1-800-538-7476. You may also write to the National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401. The current subscription rate to *Growing Ideas* is \$6 per year, but is expected to increase soon.

The Children's Museum of Utah Offers Science for K-6 Grades

The Children's Museum of Utah in Salt Lake City offers several science exhibits and programs for you and your students. Leonardo on Wheels' interactive science exhibits will be at the Museum until March 29. You may schedule your school group by calling Bessie at 328-3383. The Frontiers of Knowledge exhibits will arrive in June. These exhibits, built by University of Utah engineering students, are designed to introduce students in grades 4 through 6 to engineering principles.

In addition to the exhibits, the Children's Museum offers after-school science classes, workshops, and a traveling program. Fossils, bones, chemistry, color, slime, and buildings are the themes of several of the workshops for students offered at the Museum. A 5th grade chemistry outreach program travels to districts statewide, and is aligned with the new state core curriculum. To learn more about these programs, call Karey Rawitscher at 328-3383.

Thanks to the Kennecott Corporation for making this issue of EXPLORE! possible. Kennecott supports science education for teachers and students throughout Utah!

Science vs. Art continued

Both artists and scientists are skilled in making careful observations. Both look for careful comparisons in shape, size, color, and texture of an object. But, a scientist and artist differ in their reasons for studying an object closely.

Artists may be interested in recording an object exactly as they see it, or in interpreting the object with their own drawing or painting style. They look closely at how light falls upon an object. Where are the shadows? How does the color of the object change in relation to the light? They look at relationships between the object and the background as well as within the object. Artists are concerned with how an object will be positioned on their drawing or painting surface.

Scientists observe an object to note the relationships between its parts and its physical characteristics. They want to record this information to better understand how an object may work or why an object has certain characteristics. Scientists may be interested in the general color characteristics of an object to understand why there are color variations in an object. Scientists may be interested in comparing an object with similar objects to better understand its workings.

To guide your students through careful, scientific observation, consider leading them through a series of questions. For example, if your class is studying plants, ask them to carefully study and record the leaves and stems of different types of plants or trees. What shape is the leaf? How many leaves are there per stem? How large are the leaves? How are the leaves spaced on the stem? Does the leaf feel different on the underside than on the top surface? Is the leaf thin or thick compared to another type of plant? What color is the stem? How round or thick is the stem? Is the stem hairy? Is it woody? How does the size of a leaf compare with the size of a stem? How does the size of a stem with leaves compare with the overall plant size?

Although artists may ask the same questions, scientists are using this information to learn how the plant functions, how the plant differs from other plants, and why the plant has a particular form. Scientific drawings will have labels and written descriptions of the plant. Leading your students through the observation process during a science activity helps to enhance skills that may be used in their artistic endeavors!

Space-Age Wheat

continued from front page



flat, and thrives on the carbon dioxide that builds up quickly in space vehicles.

Space Wheat Seeds for Classrooms

Since visions of space so readily capture students' imaginations, and wheat plants are so easy to grow, the USU scientists are offering *Apogee* wheat seeds to inspire student investigations. After reviewing the characteristics and preferences of this "human-designed" plant, consider the possibilities for classroom investigations. Here are some ideas to get you started.

☞ Compare the growth of *Apogee* with another variety of wheat, indoors or out. Observe growth rates, development of seed heads, root growth, leaf size, and so on. You might want to do this without revealing which is which type, then have students determine which they think would grow best in space and why. (You'll find normal "earthly" wheat at stores that sell farm and garden seeds or health food.)

☞ Discover how different levels of carbon dioxide affect the growth of *Apogee* and/or invent ways to increase the carbon dioxide that plants receive. (Hint: Consider ways of using human breath or dry ice!)

☞ Explore how different light or heat levels affect the space wheat's growth. Alternatively, share information on the space wheat's preferred growing conditions, then challenge students to design growing setups that will produce seed heads in the shortest length of time.

☞ Try growing the wheat hydroponically, then compare it with that grown in a soilless mix.

☞ Challenge your students to research what *Apogee* means, then infer why it was the name given to this new wheat. Visit the *Apogee* web page at :

<http://www.usu.edu/~cpl/index.html>

for more information to inspire investigations and a glimpse into how scientists think and work.

To request free USU-*Apogee* wheat seeds: Send a request by e-mail or in writing to Gus Koerner, Principal Research Technician, Crop Physiology Laboratory, Dept. of Plants, Soils, and Biometeorology, Utah State University, Logan, UT 84322-4820. E-mail: gus@cc.usu.edu (If you also want seeds of another variety, Veery-10, for comparison, indicate that in your request.)



Science Book Library

Light Action!

*Amazing Experiments
with Optics*

What amazing things happen when you block, bend, bounce, catch or scatter light? Using materials that are readily available, your students can make their own scientific observations about the properties of light. *Light Action! Amazing Experiments with Optics*, written by Vicki Cobb and Josh Cobb, provides easy, fun-to-follow instructions. The activities include making a sunset in a glass of water, discovering how polarized sunglasses block glare, and bending a pencil in water. Look for *Light Action! Amazing Experiments with Optics* at your local bookstore. The publisher is Harper Collins and the ISBN number is 0-06-021436-8. We found our copy at the King's English Book Shop in Salt Lake City for \$15. While at the bookstore, check out these other wonderful books written by Vicki Cobb:

CHEMICALLY ACTIVE!:
**Experiments You Can
Do at Home**

**THE SECRET LIFE
OF COSMETICS:**
A Science Experiment Book

**SNEAKERS MEET
YOUR FEET**

*Be careful what
you teach people...
it takes them a
long time to forget!*



Science Opportunities for Elementary Teachers

TOURS FOR SCHOOL GROUPS

Planning a trip to the University of Utah? **Red Butte Gardens and Arboretum** and the **Utah Museum of Natural History** offer tours for school groups. To schedule a time at the Red Butte Garden and Arboretum, call Adrienne Cachelin at 581-4760. For the Utah Museum of Natural History, call Mary Jane Bush at 581-5567.

SPECIAL EVENTS

■ **National Engineers Week** - During the week of April 7, elementary school students will compete in exciting engineering projects on the U of U campus. For more information and to schedule your group, call JoAnn Lighty or Amy Colton at 581-6911. Hurry -- the number of school groups able to participate is limited!

WORKSHOPS FOR ELEMENTARY TEACHERS

■ **Plate Tectonics: Earthquakes & Volcanoes, Earth Structure, and the Utah Relationship** is a teacher workshop for the 5th grade new science core curriculum. Register now for the next workshop to be held on March 22 and 27 in the Granite School District. Cost is only \$10. You will receive an activity packet, posters, map, Seismic software program, slide set, and classroom activity materials. One-hour inservice credit is available. Instructors for the workshop are Dr. Paula Wilson, geologist; Deedee O'Brien, Earthquake Education Services; and Kathy Ellis, 5th Grade Teacher. Call Deedee O'Brien at 581-6201 for more information.

■ **Geologic Processes That Shape Landforms: Earthquakes, Volcanoes, Erosion, Deposition** is a teacher workshop for the 3rd grade new science core curriculum. Register now for the next workshop to be held on April 12 and 17 in the Granite School District. Cost is only \$10 which includes an activity packet, posters, maps, slide set, and classroom activity materials. One-hour inservice credit is available. Instructors for the workshop are Sandra Eldredge, Utah Geological Survey, and Kathy Heller, 3rd Grade Teacher. Call Deedee O'Brien at 581-6201 for more information.

EARTHQUAKE EDUCATION SERVICES (EES)

EES offers both of the above workshops to 3rd and 5th grade teachers throughout the year. To schedule your district, contact Deedee O'Brien at 581-6201. EES will make arrangements for University credit if the 10 hour workshop is taught. Districts pay a \$150 flat fee plus \$10 per participant along with a minimum of 12 participants and a place to conduct the workshop.

DIAL-A-SCIENTIST



University faculty members are prepared to address your science questions. Please give them a call!! (Day numbers are listed)

CHEMISTRY

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Sid Rudolph.....581-4803

Gale Dick.....581-6408

Bob Kadesch.....583-0123

MATH

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BIOLOGY

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EXPLORE!

A publication of the University of Utah's Center for Integrated Science Education for Utah's Elementary Teachers

Volume 4, Number 4 September 1997

Kids Say the Funniest Things...

Dr. Laura on KALL radio aired several funny comments made by children that we wanted to share with you. If you have humorous science anecdotes or comments from your class, and you would like to share them with Utah teachers, please call or write to us at the address and phone number listed on the back page.

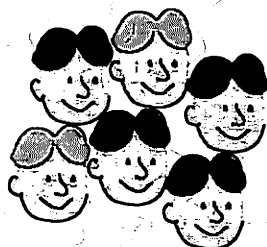
There are 26 vitamins in all, but some of the letters are yet to be discovered. Finding them all means living forever.

Some people can tell what time it is by looking at the sun. But I have never been able to make out the numbers.

Lime is a green tasting rock.

Clouds just keep circling the earth around and around. And around. There is not much else to do.

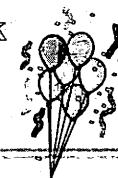
Vacuums are nothing. We only mention them to let them know we know they're there.



Celebrate!

National Chemistry Week

November 2-8, 1997



National Chemistry Week is celebrating 10 years of bringing positive messages about chemistry to the public and supporting classroom science. This year's celebration will feature a unifying event across the country - testing for water hardness on "natural" water sources. ("natural" refers to a local non-treated/softened source of water, examples include: streams, irrigation water, wells, lakes, ponds, etc.) In addition, to this unifying event, the American Chemical Society (ACS) will make available a number of resources for teachers - "Planet Chemistry" a hands on experiment guide with information about the event, calendars, ideas, using volunteers, pencils, pens, beaker buddies, period tables, experiment kits, etc.

Local sections of the ACS may be able to help you plan for this national celebration. If you live in the Salt Lake Valley area, your local ACS contact is Dr. Tom Richmond at 581-7487. Teachers living in Central Utah can contact Dr. Wayne Anderson in Provo at 378-5818. The National Chemistry Week web page at <http://www.acs.org/pafgen/ncw/home.htm> can help you plan your event, or you can send an e-mail to ncw@acs.org.

WATER activities inside!



Funding for this issue was made possible by Phillips 66 Company, Woods Cross Business Unit, as part of its efforts to support National Engineering Week - February 16-22, 1998

Making Hard and Soft Water

MATERIALS

- 1 Piece of Chalk
- 1 Tablespoon Vinegar
- 4 Cups Distilled Water
- Water Hardness Test Strips*
- 4 Tablespoons Water-Softening Agent (*found in the laundry section of many grocery stores*)
- 2 Clear Plastic Bottles (*20 oz. Soda pop bottles work great!*)
- Set of Measuring Cups & Spoons
- 2 Large Containers (*bowls or beakers*)
- 2 Drops of Liquid Hand Soap

* *The experiment guide - which may be obtained from the American Chemical Society's Local Section - will include test strips. Additional test strips may be purchased through the National Chemistry Week office or through scientific suppliers. See Teaching Notes.*

MAKING HARD WATER

1. Using one of the large containers, dissolve the chalk in 15-ml (1 tablespoon) of vinegar. Let this sit for about 10 minutes. Have the students observe the solution and record their observations.

Teaching Notes -

The hardness test strips (and any hardness test) measure calcium and magnesium but reports the value as ppm or parts per million calcium. The test strips provided in the experiment guide from the American Chemical Society will be measuring water hardness as parts per million calcium.

This experiment was "Kid Tested" on Kindergartners. You can also make hard water by dissolving eggshells. If you use broken eggshells - make sure they have been cleaned - the eggshells will dance as the vinegar dissolves them. You can also use the "Dancing Raisin" experiment (raisins in Sprite™ or 7-UP™) while the eggshells are dissolving to explain why the shells are "dancing" and the gas that is being evolved in the experiment - carbon dioxide.

Don't worry, especially for younger children, if you don't have test strips - the soap bubbles at the end will show the difference between "hard" and "soft" water.

2. Add 750 ml (about 3 cups) of water to the dissolved chalk. This is your artificial hard water solution; it contains dissolved calcium from the chalk.

3. Using a test strip, determine the concentration of your hard water. Dip an unused test strip into your water sample for 1 second. After waiting 15 seconds compare the color on the strip with the colors on the reference chart. Record the corresponding value.

SOFTENING THE WATER

4. Put 250 ml (1 cup) of the artificial hard water solution into the other large container. (Be careful that any undissolved chalk is left in the hard water container.) Add 250-ml (1 cup) water and 60 ml (4 tablespoons) of water-softening agent. Stir well and wait for about ten minutes. (Don't worry if all of the water-softening agent does not dissolve.) This is your softened water solution.

Leonardo on Wheels Tours Utah

Leonardo on Wheels, the traveling science exhibits, will be at the following schools this fall. If you are interested in having Leonardo come to your school, please call 585-3128.

OCT 6 & 8

Muir Elementary, Bountiful

OCT 16 & 17

Monte Vista Elementary, Farmington

DEC 4 & 5

Red Rock Elementary, Moab

DEC 8 & 12

Granite Elementary, Sandy

FEB 1-4

Heber Valley Elementary, Heber

Subaru of America, Inc. is the proud sponsor of Leonardo on Wheels.



ALUMINUM A Precious Metal

In September the American Chemical Society will be designating a National Chemical Historic Landmark recognizing the work of Charles M. Hall. Charles M. Hall is the inventor of the process by which we now produce aluminum. Up until his discovery, aluminum was considered to be a precious metal (in fact at one time wealthy women wore aluminum jewelry). As part of this designation, the American Chemical Society is preparing an activity sheet - with experiments - to be handed out to students and teachers. A special note - Julia Hall (Charles Hall's sister) played key roles in the discovery and the awarding of the patent. If you would like more information on the Landmarks Project, or a copy of the activity sheet, you can contact: Frankie Wood-Black, at 801-299-6660 or fwblack@bvemx.pcco.com. While you have Frankie on the phone, you may want to ask her to present her "Chemistry & The Environment" talk to your students.

5. Using a second test strip, determine the concentration of your softened water solution as you did in step 3. Record this value.

SUDS TEST

6. Now, test how easily you can make suds using the two solutions. Carefully add 250 ml (1 cup) of the artificial hard water solution to one of your empty bottles. Add 250 ml (1 cup) of softened water to the other bottle. Add 2 drops of liquid hand soap to each container. Put caps on the containers and shake them. Record your observations

Questions



- Did the artificial hard water solution make soap bubbles?
- Did the softened water solution make soap bubbles?
- Which solution made more soap bubbles?
- In which solution did the soap bubbles last longer?

NATURAL WATER SOURCE

You can also do this with a natural water source. If you have the test strips, measure the hardness of the natural source and have students determine the amount of bubbles/suds that the natural source will produce. If you don't have test strips, you can still qualitatively determine whether the natural source is "harder" or "softer" than the reference water. (Note: A test group of kindergartners could accurately predict the correct answer for the water source measured.)

LATHERS AND HARD WATER

SUPPLIES

- 1 Tablespoon Epsom salts
- 1 cup warm tap water
- bar of soap

1. Mix 1 tablespoon of Epsom salts in 250mL (1 cup) of warm tap water. Look on the label; it has magnesium sulfate- one of the main culprits (along with calcium carbonate) in hard water.
2. Now, grab a bar of soap and wash your hands. Be sure to make a good lather with plenty of bubbles. Then, rinse your hands to remove all of the soap.
3. Ask a partner to pour some of the Epsom salts and water solution into your hands- now try making a lather with the bar of soap like you did before- YUK! Just a little magnesium sulfate can make a big difference.
4. Try mixing 1 teaspoon of Epsom salts with 1 cup of water, and see if you can make lather.
5. What is the minimum amount of Epsom salts that you can mix with a cup of water and still not make lather?



Science Book Library

The World of the Microscope

The World of the Microscope is by far the best book we found for explaining microscopes and preparing microscope slides. The book covers types of microscopes, explains magnification, describes cells, and talks about looking at simple organisms, fungi, sea life, fresh water life, plants, insects, rocks and minerals, and crystals under the microscope!

Written by Chris Oxlade and Corinne Stockley, *The World of the Microscope* is published by Usborne Publishing Ltd. in London. We ordered the book from a local bookstore which took less than 10 days. To order a copy for your classroom, provide your local bookstore with the ISBN number: 0 7460 0289 0. Cost for the book is only \$7.95 and well worth every penny!

NOTE: If your school or classroom doesn't have microscopes, contact your local high school and ask to borrow theirs.

*Give people facts and you
feed their minds
for an hour.*

*Give them curiosity and
they feed their own minds
for a lifetime.*

Anonymous



Science for You at the U

One-stop Science at the University of Utah!

Check our newest web page at the University of Utah. It's a smorgasbord of science workshops, events, courses, lectures, research opportunities, and more for you, your students, and parents. Don't miss it! The URL is:

<http://www.utah.edu/cise>

Earthquake Materials Available!

The seismic lab at the University has earthquake materials available for you! Check out their web page:

<http://www.seis.utah.edu>

Science in the Dark

Show the incredible world of bioluminescence in your classroom! The Center for Integrated Science Education is Utah's only supplier of bioluminescent dinoflagellates. These tiny marine plankton make beautiful blue light and are a perfect way to introduce students to the concept of living light. It is also a great way to spark students interest in science and to demonstrate many science topics. Teacher workshops and classroom presentations are available. For schedule and price information please call 581-4171.

Science Without Walls is Back!

Science Without Walls will air again this fall on Channel 9, Monday's and Friday's at 4 pm. If you are unable to watch the 4 pm show, simply record it for viewing later in the evening! A list of the programs is available on the web page above, or by calling 581-4171. A complete listing of the programs can be found in the August 1996 issue of *EXPLORE!* *Science Without Walls* portrays science in real life and provides friendly explanations of scientific phenomenon and science in the modern world.

ATTENTION Teachers!

Have you ever produced a video or audio tape with your class or involved them in a local radio or TV station? If so, we would like to hear from you. Drop us a postcard at:

CENTER FOR INTEGRATED SCIENCE EDUCATION
UNIVERSITY OF UTAH
DEPARTMENT OF BIOENGINEERING
50 S CAMPUS CENTER DRIVE RM 2480
SALT LAKE CITY UT 84112-9202



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University faculty members are prepared to address your science questions. Please give them a call!! (Day numbers are listed)

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PHYSICS

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Gale Dick.....581-6408

Bob Kadesch.....581-6971

MATH

Peter Alfeld..... 581-6842

BIOLOGY

Rosemary Gray.....585-7869

John Roth.....581-3412

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Sherm Dickman.....532-5644

BIOLOGY-CHEMISTRY

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Paula Wilson..... 585-5613

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Joe Andrade... ..Project Director

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EXPLORE!

Spring 1999

Simple Science with Ice Cream



EXPLORE!

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 Fax 585-5361

Staff

Joe Andrade
Project Director

Mary McDonald
Project Editor



Web Site Connections

Check the Center for Science Education+Outreach web site for science workshops, events, courses, lectures, research opportunities, and more. There are educational pursuits for everyone: K-12 teachers, students, and parents. The URL is: www.utah.edu/cseo

Each year the Center for Science Education+Outreach teaches children a basic science concept about how heat, or energy, moves from a hot place or object to a cold place or object. To apply this concept in a very simple and relevant way, the children have the opportunity to make ice cream. Below is the activity that the Center would like to share with you. You will find it easily adaptable to doing in the classroom and at home. When you do the activity, emphasize the concept! To extend the concept into several activities, there is a book "Ice Cream Making and Cake Baking" by Bernie Zubrowski of the Children's Museum in Boston that is well worth the purchase. Check with your local bookstore about ordering the book. The ISBN number is 0-938587-37-4.

PART A: Observing heat change between hot and cold water.

Materials: (Per Class of 30 Students)

- 16 Thermometers
- 8 styrofoam bowls
- 8 clear cups (7 or 8 oz.)
- 2 Containers- *one for carrying cold water and one for hot water*

Procedure:

Begin by explaining how to use a thermometer. If using one with two scales show the two different scales and choose one to use in this activity. Journals may be used to record the temperature changes. The following chart is suggested.

| Time | Temperature | |
|---------|-------------|------------|
| | Hot Water | Cold Water |
| Initial | | |
| 30 sec | | |
| 60 sec | | |
| 90 sec | | |
| 120 sec | | |
| 150 sec | | |
| 180 sec | | |

Divide students into groups of two. Have two pairs, or four students, work together in Part A. Give each group 1 styrofoam bowl, 1 clear cup, and 2 thermometers. Students will receive 1/2 cup hot water to be placed in the clear cup, and 1 cup of cold water to be placed in the styrofoam bowl. Immediately after receiving the water, students will place one thermometer in the hot water and one in the cold water. After about 15 seconds have the students read the temperature of each water. Record the temperature as the initial one in the journal. Set the clear cup (with the thermometer still in it) inside of the bowl with the cold water. About every 30 seconds have the students read the temperature of each. Record the temperature in the journal. What happens? Why?

continued on other side

Explain that the thermometer measures heat energy and when the temperature drops, heat energy is moving from the hot water to the cold water. You can see this heat transfer by watching the temperature rise in the cold water. **HEAT ENERGY MOVES FROM HOT TO COLD.**

Part B: Making Ice cream

Materials (classroom of 30 students)

| | |
|------------------------------|----------------------------------|
| Ice chest | 3 bags of crushed ice |
| Towels for clean up. | 30 sandwich size zip lock bags |
| 15 Gallon size zip lock bags | 3 quarts of half and half |
| 30 T. Sugar | 15 t. vanilla |
| 5-6 cups salt | Set of measuring cups and spoons |
| 30 plastic spoons | |

Procedure:

Explain that they are going to make ice cream based on the concept that heat moves from hot to cold. The cream mixture is the warm fluid and the salt/ice/water mixture is the cold. Why use salt?

In order for ice cream to freeze, the temperature of the cream must be 32°F or 0°C . But to freeze the cream, the surrounding liquid, or coolant, must be cooler than $32^{\circ}\text{F}/0^{\circ}\text{C}$. Adding salt to an ice-water solution can reduce the temperature as low as 20°F .

(Although heat moves from the cream mixture into the cooler surrounding liquid, the ice-salt-water solution doesn't change temperature. The constant temperature of the solution is due to the ice that is absorbing heat when it changes from a solid to a liquid.)

Key points

- ≈ Salt lowers the freezing temperature of the ice water. Water freezes at 0°C or 32°F .
- ≈ Heat is transferred from the warm cream mixture to the salt/ice-water solution. Heat is a measure of energy. Where it is hot, there is a lot of energy- cold, less energy.

Distribute to each pair of students:

1 large zip lock bag 2 small zip lock bags

Ingredients for ice cream (per bag) :

1/3 cup half and half 1 tablespoon sugar
1/2 teaspoon vanilla 2 spoons

Each student will have a small zip lock bag. In the front of the room have one person designated to measure the half and half, another person for the sugar and another person to measure out the vanilla into each student's small zip lock bag.

Place the small plastic bag (**MAKE SURE IT IS SEALED**) into the larger zip lock bag. Add ice and cold water until the bag is about 1/2 full. Add 1/3 cup of salt. Seal the bag and shake. This part should take about five minutes. **HAVE THE STUDENTS HOLD THE BAG BY THE TOP SO THEIR HANDS DO NOT GET FROSTBITE.** Use the spoons to enjoy!



Science Book Library

Science is...

by Susan V. Bosak

Science is a source book of fascinating facts, projects and activities to use in a classroom or at home. *Science is* is organized into subject areas: Discovering Science, Matter & Energy, Humans, The Environment, Rocks, Plants, Living Creatures, Weather, The Heavens, and Applying Science. Each subject area is further divided into topics. For example, under the subject area Matter and Energy, there are activities specific to air, atmosphere, atoms, chemical reactions, earth, electricity, energy, forces, lights, magnetism, measurement, numbers, problem-solving, scientific method, senses, and states of matter. The organizational arrangement of subject areas and topics makes this an easy to use book for planning science activities. We picked our copy up at the local city library, but you may check with your local bookstore as it is well worth having available in the classroom. Remember, bookstores can order the book for you if it is not on their shelves. The book was co-published by Scholastic Canada LTD. and The Communication Project. The ISBN number is 0-590-74070-9. Pick your copy up soon!

One must learn
by doing the thing;
though you think
you know it, you have
no certainty until you try.

Sophocles

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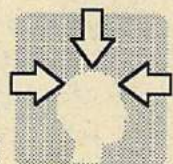
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and more. There are
educational pursuits
for everyone: K-12
teachers, students, and
parents. The URL is:
www.utah.edu/cseo

EXPLORE!

Spring 2000

Molecule Models

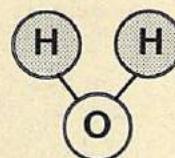
Are you looking for a simple activity to do with younger children at home or in the classroom? While young children are unable to fully understand that the world is made up of atoms, you can begin exploring the idea with them by building molecules. The following activity builds simple but common molecules that they are likely to hear about.

MATERIALS:

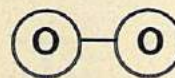
- red, green, and orange gum drops
- toothpicks

PROCEDURE:

1. Red gum drops represent oxygen atoms, green ones are hydrogen atoms, and the orange ones represent carbon atoms.
2. The toothpicks represent bonds.
3. Insert the toothpicks into the gum drops to build models representing the common molecules water (H_2O), carbon dioxide (CO_2), & oxygen (O_2).



Water

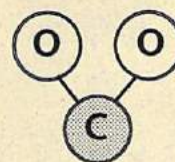


Oxygen

WHAT ARE ATOMS AND BONDS:

You can explain to your child or classroom that atoms are the smallest unit of matter. Atoms are attracted to other atoms and form bonds. When two or more atoms combined they are called molecules. Water consists of two hydrogen and one oxygen atoms. Carbon dioxide is one carbon and two oxygen atoms. Oxygen as found in the atmosphere is two oxygen atoms bonded together.

Carbon Dioxide



If you would like to pursue more activities on molecules and chemistry, check out the American Chemical Society's web site at www.acs.org. If you are helping to do science activities in the classroom, you may want to know that matter is in the state science core curriculum in the second and fifth grades.

Summer Opportunities for Parents and Children

Looking for summer enrichment for yourself and your children? Or, want to recommend science workshops to teachers at your school? These organizations affiliated with the University of Utah offer a variety of programs that you may want to look into.

Utah Museum of Natural History
Hansen Planetarium
AOCE/DCE, University of Utah
Red Butte Garden and Arboretum

<http://www.umnh.utah.edu/>
<http://www.utah.edu/Planetarium/>
<http://youth.utah.edu/>
<http://www.redbutte.utah.edu/>

Kids Say the Funniest Things...

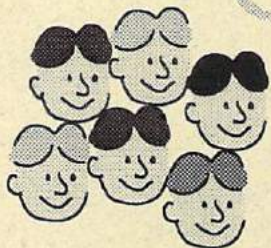
There are 26 vitamins in all, but some of
the letters are yet to be discovered.
Finding them all means living forever.

Some people can tell what
time it is by looking at the sun.
But I have never been able to
make out the numbers.

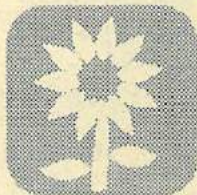
Lime is
a green
tasting rock.

Clouds just keep circling the earth
around and around. And around.
There is not much else to do.

Vacuums are nothing.
We only mention
them to let them
know we know
they're there.



Fresh Ideas for the Home and Classroom...

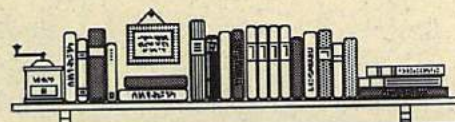


Growing Ideas

A Source for Garden-Based Learning

The National Gardening Association is a great source of ideas and activities related to growing plants. Go to their web site at <http://www.garden.org/Home.html> and check into the Kid's and Classrooms, Kid's Gardening Catalog, and Youth Garden Grants areas. Under Kid's and Classrooms you will find subsections for parents and families. Under Kid's Gardening you will find a Kidsgarden email newsletter (<http://www.kidsgardening.com/>).

You may want to inquire about their *Growing Ideas* journal. Past issues have had articles on Herb Lessons, Nutritious Lessons, Ecosystem Explorations, Lunar Harvest, Turn on Learning with Bulbs, Radishes, Roots and 'Rithmetic, Touch Your Plants?, Biosphere in a Bottle. To subscribe or request an issue of *Growing Ideas*, please call 1-800-538-7476. You may also write to the National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.



Science Book Library

The World of the Microscope

The World of the Microscope is by far the best book we found for explaining microscopes and preparing microscope slides. The book covers types of microscopes, explains magnification, describes cells, and talks about looking at simple organisms, fungi, sea life, fresh water life, plants, insects, rocks and minerals, and crystals under the microscope!

Written by Chris Oxlade and Corinne Stockley, *The World of the Microscope* is published by Usborne Publishing Ltd. in London. We ordered the book from a local bookstore which took less than 10 days. To order a copy for your classroom, provide your local bookstore with the ISBN number: 0 7460 0289 0. Cost for the book is only \$7.95 and well worth every penny!

NOTE: If your school or classroom doesn't have microscopes, contact your local high school and ask to borrow theirs.

*It is important that
students bring a certain
ragamuffin, barefoot irrev-
erence to their
studies; they are not here
to worship what is known,
but to question it.*

Jacob Bronowski



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EXPLORE!

Professional Publication
of the

CENTER FOR SCIENCE
EDUCATION+OUTREACH

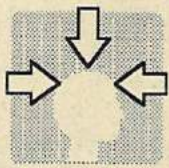
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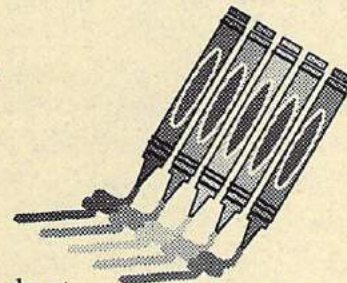
Web Site Connections

Check the Center for Science Education+Outreach web site for science workshops, events, courses, lectures, research opportunities, and more. There are educational pursuits for everyone: K-12 teachers, students, and parents. The URL is: www.utah.edu/cseo

EXPLORE!

Spring 2001

What Color is It?



Here is a simple and colorful activity that you can do at home with ordinary household items. Try to predict what will happen to the marker line first!

Materials:

- 1 clear plastic cup (7 or 8 oz., or use a glass cup)
 - 1 coffee stirrer
 - 1 paper clip
 - coffee filters or absorbent paper towels
 - water-based markers (fruit scented markers work well)
- (you may substitute other materials for the coffee stirrer and paper clip)*

What to do:



Step 1: Cut the filters or paper towels into 1" x 4" strips.

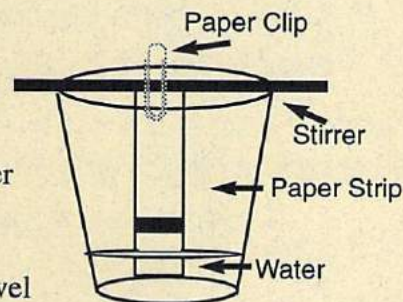
Step 2: Using a marker, place a horizontal line on the paper strip about 1" from the end.

Step 3: Place the coffee stirrer across the top of the cup and fasten a paper strip to it using a paper clip. Note: The paper strip, with the horizontal line towards the bottom of the cup, should be in the cup just above the bottom. You may have to fold the paper strip at the top to fit.

Step 4: Remove paper strip and add about 1/2" of water to the cup. Lower the strip into the water keeping the marker line about 1/2" above the water line.

Step 5: Let the strip sit in the cup until the water is absorbed at least 3/4 of the way up the strip. What happens?

Step 6: Remove paper strip and set on paper towel or newspaper to dry. Try other colored markers, especially black and brown.



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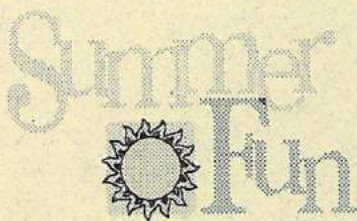
What Color is It?

What happened?

The water moves upward through the paper strip. As it moves upward, the dye used in the marker is carried upward too. Some dyes are a combination of different colors. As the water moves upward, the individual colors used to make the dye are separated. The heavier and larger dye molecules will settle out first leaving the lighter and smaller dye molecules to travel further up the strip.

Water moves up through the paper strip by capillary action. The water molecules are attracted to each other but they are more attracted to the fibers in the paper strip. Capillary action is the reason sponges absorb water, blotters absorb ink, and plants draw water from the soil. The dye used in the marker is carried upward by the capillary action between water and the paper fibers. Why does the water stop or slow as it travels up the paper strip? (This is where the force of gravity pulling down and the capillary action pulling up are equalized.)

Scientists work with paper chromatography to separate the molecules, such as drugs or dyes present in the test substance. M.S. Tswett, a Russian botanist (plant scientist) invented chromatography in 1903 while studying the coloring materials in plant life.



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Utah Museum of Natural History
Academic Outreach & Continuing Ed.
Red Butte Garden and Arboretum

<http://www.umnh.utah.edu/>
<http://youth.utah.edu/>
<http://www.redbutte.utah.edu/>



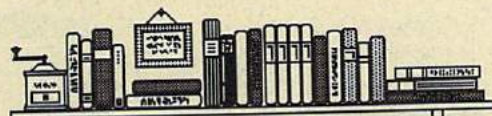
Traveling this summer?

Check out the museums and science centers, zoos, aviaries and aquariums, nature centers, parks and gardens, and planetariums near your travel destination -

<http://www.scienceadventures.org>

The important thing is not to stop questioning.

Albert Einstein



Science Book Library

Blood and Guts Gee, Whiz! Make Mine Music!

The Brown Paper School book series by Little, Brown, and Company is about big ideas, written and designed for kids and grownups together. The series comes from a group of teachers, writers, and artists who get together every now and then to work on activities for children and to have a good time. They believe learning only happens when it is wanted; that it can happen anywhere and doesn't require fancy tools.

Blood and Guts by Linda Allison is a working guide to your own insides. You and your child will learn about skin, bones, teeth, muscles, heart, lungs, cells, digestion, kidneys, eyes, ears, balance, brain and nervous system, and reproduction.

Gee, Whiz! by Linda Allison and David Katz is a mix of art and science. The topics include science of colors, elastics, water and capillary action, surface tension, unmixable liquids, brain movies, vision, magnifiers, symmetry, weight and balance, and bodies in motion.

Make Mine Music! by Tom Walther is filled with ideas for sound devices that you and your child can make. It includes sound discoveries, music alphabet, tools for making music, idiophone, body music, and musical notations.

The Brown Paper School books cost approximately \$10 each. Inquire at your local bookstore or look on the internet to purchase the books. Check out their other titles too!