Center for
Integrated Science
Education (CISE)

Master List of CISE Activities

1993-'94 Inservices on Integrated Science Concepts and Themes

Dates	Time	Location	Coordinator	District
Jan. 15-16, '93	Fri. 4:00-7:00 pm Sat: 9:00 am - 3:00 pm	Tooele High School	Joe Trujillo 355-4740 Bob Young 833-1961	Tooele
Jan. 22-23, '93	Fri. 4:00-7:00 pm Sat: 9:00 am - 3:00 pm	Tooele High School	Joe Trujillo 355-4740 Bob Young 833-1961	Tooele
Feb. 16-18, '93	Tues, Weds, Thurs 3:30-6:45 pm	Roy High School 2150 W. 4800 S., Roy, 84067	Brett Moulding 774-4922, 731-4564 h	Weber
Feb. 26-27, '93	Fri. 4:00-7:00 pm Sat. 9:00 am - 3:00 pm	Tooele High School	Joe Trujillo 355-4740	Tooele
Mar 4, 11 Apr. 1, '93	4:00-7:30 pm	Amer. Fork Jr HS	Lynn Haskell 756-8477	Alpine
Apr. 15-16, '93	Fri. 3:30-6:30 pm Sat. 8:00 am - 3:30 pm	Granger High School 3600 W 3690 S	Nola Ostroff 268-8530	Granite
Apr. 20-22, '93	4:00-7:30 pm	Farmington Elem.	LaMont Jensen 451-1251	Davis
Sept. 25, '93	Sat. 9:00-12:00	Weber State	R. Vineyard	Weber
Oct. 9-10, '93	Fri. 4:00-7:30 pm Sat. 8:00-4:00 pm	Orangeville	Roma Powell 687-9846	Emery
Nov. 2-4, '93	T,W,Thu. 4:00-7:30 Rm 110 & 111	Park City High School P.O. Box 680310	Pat Horny 645-5600 X 120	Park City
Feb. 8, 9, '94	Tues. 12:00-5:00 pm Weds. 12:00-5:00 pm	Oak Hills Elementary	V. Major 298-5838	Davis
Spring, '94	Weekly/10 weeks Projects Course	Bonneville Elementary	K. Lambert K. Spencer	Salt Lake
June 14,21,28 '94	Tues. 9:00 am-12:00 pm	Layton Elem. 4th grade class	M. Morrisson	Davis

1994-'95 (Tentative -- to be scheduled)

Location	Coordinator	District
Bonneyview High School	S. Ballou 264-7470	Murray
Libby Edward Elementary School	R. Roloff 584-5347	Granite
Spanish Fork Intermediate School	Nedra Kalk 79804000 X 21 Leslie Jorgensen	Nebo
Weber State University (Sept 23-24, '94)	Richard Vineyard	

Other Activities:

Sept. 17, '93		Girl Scout Leaders Workshop		Provo
Oct. 13, '93	Sat am	Girl Scout Leaders Workshop	Contact: Debbie Hoffman	Davis
Jan/Feb, '94		Museum Madness --Children's Museum Girl Scout Program	Contact: Shiela Mirror	Salt Lake
June 16, '94	Thurs. pm	Utah State Univ. Ut Assoc Elem School Principles	Contact: Ray Timothy	State

Cont/...

Integrated Science Concepts and Themes*

A 10-Hour, Hands-On, Discovery-Based Inservice

Instructor: Joe Andrade, Professor of Bioengineering and Director of the Center for Integrated Science Education (CISE), University of Utah.
Phones: 581-4379 (office), 277-1259 (home).

Participants: This inservice is designed for elementary and middle school teachers wishing to improve their science skills, knowledge, and comfort level. It is designed to eliminate science "fears" and "anxieties".

Outline:**

-- Introductions: Your background and interests
-- If science is integrated, then why are there so many courses and majors?
-- The scientific process
-- Bioluminescence? Where did the light come from? What made it? Why did it stop? Why is it blue? How do I turn it on?
-- Video on bioluminescence
-- Your kit, your experiments
-- Let's see them! What are they "doing"? What do they eat?
-- So, what affects them? Why seawater? What is pH? Who cares?
-- How long do they live? Who's the mother? Seven days -- plus or minus two? Give me a break!
-- Why do they need light? What kind? How much? What is photosynthesis?
-- What do they do at night? Biorhythms
-- How can they live in that little bag? How do they eat?
-- System? Ecosystem?
-- What concepts? What about Biology, Chemistry, Physics?
-- My classroom, my kids?
-- Me?! A scientist!

* Concepts and themes are based on:

1. F.J. Rutherford and A. Ahlgren, Science for All Americans (The Project 2061 Report), Oxford University Press, 1990.

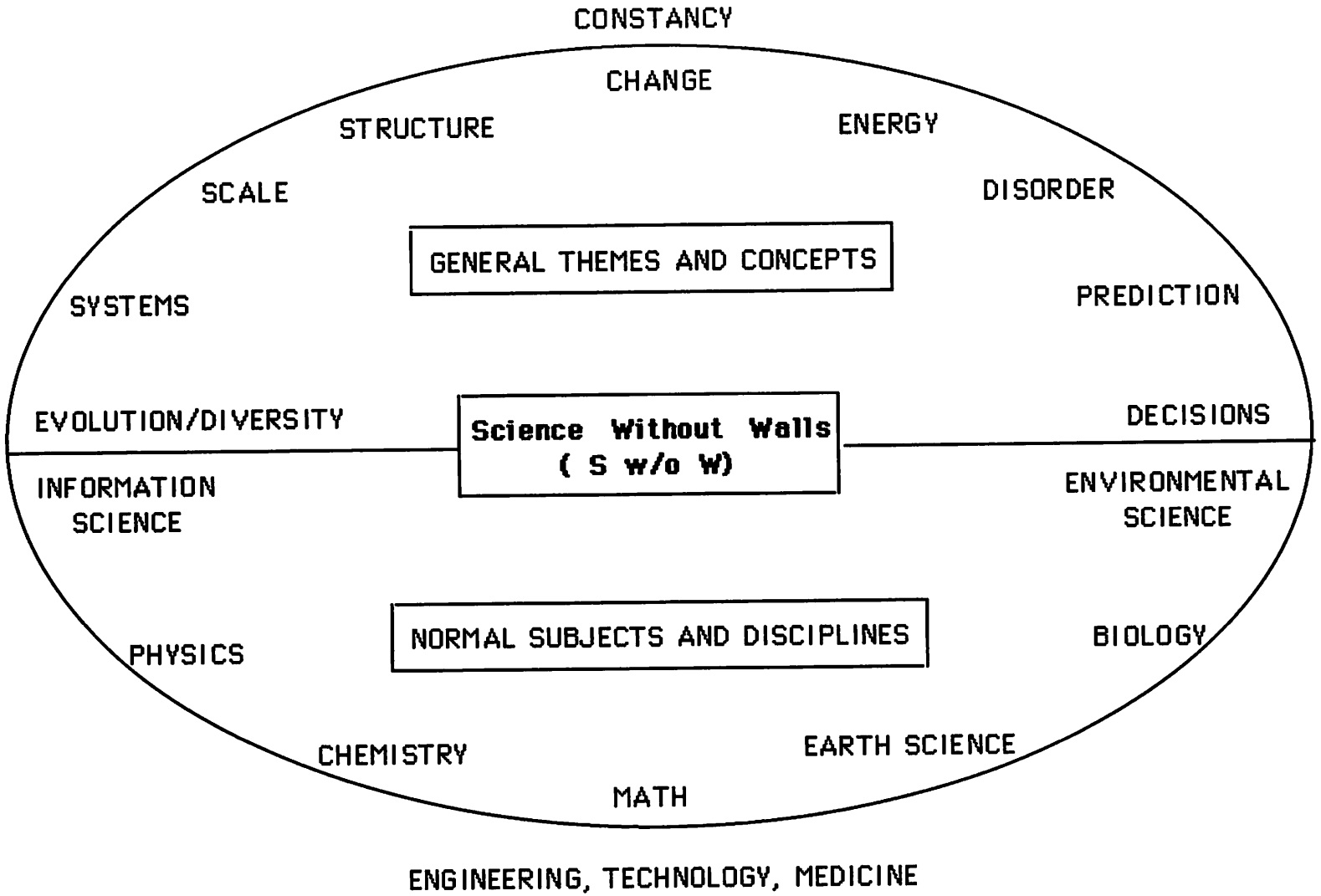
2. National Center for Improving Science Education, Getting Started in Science: A Blueprint for Elementary School Science Education, Washington, DC 1989.

3. Loucks-Horsley, et al., eds., Elementary School Science for the 90's, The Network, Andover, MA, 1991.

** Each inservice will be different and will depend on the questions, interests, and background of the participants.

General Themes and Concepts in Science, Mathematics, and Technology

EVOLUTION & DIVERSITY:	How does life change? Interdependence -- ecology -- ecosystems.
SYSTEMS:	The Universe, the Earth, your little toe, a bacteria? What to focus on.
SCALE:	Size, dimensions, measurement
STRUCTURE:	What is matter? How are things organized? What is their function? What is their shape?
CONSTANCY:	What is constant? How is it constant? Properties. "Constants".
CHANGE:	What is changing? How much? How fast? Why? Forces, Variables?
ENERGY:	What is it? Are there different kinds? How can we change it, use it?
DISORDER:	How are things disorganized? Why are most things statistical? What is entropy?
PREDICTION:	Models and theories -- experiments -- hypotheses -- the scientific process.
DECISIONS:	What and who is right? wrong? How can complex decisions be made? Who makes decisions?


CONSTANCY
CHANGE
STRUCTURE
ENERGY
SCALE
DISORDER
GENERAL THEMES AND CONCEPTS
SYSTEMS
PREDICTION
EVOLUTION/DIVERSITY
Science Without Walls
(S w/o W)
DECISIONS
INFORMATION SCIENCE
ENVIRONMENTAL SCIENCE
NORMAL SUBJECTS AND DISCIPLINES
PHYSICS
BIOLOGY
CHEMISTRY
EARTH SCIENCE
MATH
ENGINEERING, TECHNOLOGY, MEDICINE

Center for Integrated Science Education (CISE)

Other Activities (Cont.):

Aug 1, '94	Mon.	Univ. of UT Alumnit Association 50 Jap-Amer. Alumni Science in the Dark & the Leonardo Project	Presenters: Joe Andrade & James Biggs	CISE workshop
Aug 10, '94	Weds.	Mini-Inservice/Integrated Science Education & Science in the Dark 12 Teachers	Presenter: J. Andrade Organizer: Don Daugs as video matl for State Board of Educ.	CISE workshop
Fall, 1994		PBS Video Inservices		
Aug 18, '94	Thurs.	CISE Educ. Presentation to a group of Potential legislators	Presenter: J. Andrade Organizer: Ray Heckles' Office & Faculty Committee on Community & External Relations	CISE workshop

The Center for
Integrated Science Education
(CISE)

University of Utah, 2480 MEB
Phone: (801) 581-4171 SLC, UT 84112 FAX: (801) 585-5361
E-Mail: JDANDRAD@CC.UTAH.EDU
Mara Lisonbee: (801) 585-3128 Eric Stroup: (801) 581-8611 Mary McDonald (801) 581-4171

1993-'94 Inservices on
Integrated Science Concepts and Themes

Dates	Time	Location	Coordinator	#	Course
Sept. 17	Fri. 7:30-9:30	Provo Canyon Girl Scout Camp	Debbie Hoffman 265-8472 X 24	20 leaders	C
Sept. 25	Sat. 9:00-12:00	Weber State	R. Vineyard	20 teachers	B:
Oct. 9-10	Fri. 4:00-7:30 pm Sat. 8:00-4:00 pm	Orangeville	Roma Powell 687-9846	20 teachers	A:
Oct. 13	Wed. 7:00-9:30 pm	SLC -- Girl Scouts Center	Debbie Hoffman 265-8472 X 24	? leaders	C
Nov. 2-4	T,W,Thu. 4:00-7:30	Park City P.O. Box 680310	Brenda Sarpolos 645-5600 X 120	? teachers	A
~~Nov. 5~~	~~Fri. 8:30-10:00 pm~~	~~Childrens Museum Museum Madness~~	~~Sharon Mirror 262-8472 X 21~~	~~60 girl scouts~~	~~C: Mara and Mary~~
~~Nov. 10~~	~~Wed. 7:00-9:30 pm~~	~~SLC~~	~~Debbie Hoffman 265-8472 X 24~~	~~GS 20 leaders~~	~~D: Eric Stroup~~
Jan. 7	Fri. 8:30-10:00 pm	Childrens Museum Museum Madness	Sharon Mirror 262-8472 X 21	60 girl scouts	C
Jan. 28	Fri. 8:30-10:00 pm	Childrens Museum Museum Madness	Sharon Mirror 262-8472 X 21	60 girl scouts	C: Mara and Mary
Jan 28-29	Fri. 4:00-7:30 pm Sat. 8:00-4:00 pm	Spanish Fork 350 So Main, 84660	Nedra Kalk/ Leslie Jorgansen 798-4000 X 21	20 teachers	A
Feb. ?	?	Red Rock 6th Grade Center, 43 N. 300 W. Cedar City, 84720	Karla Williams 586-1140 (h)	20 teachers	A
Mar. 4-5	Fri. 4:00-7:30 Sat. 8:00-4:00	SLC District	L. Burton 272-5971	25 teachers	A

Key of Courses

A = 10 hr: Integrated Science Concepts & Themes (kits & literature).
B = 3 hr: Integrated Science Concepts & Themes (literature)
C = 1 hr: Bioluminescence Science Activities (literature)
D = 1 hr: Megamolecules

LIGHT FROM LIFE

- or -

Science in the Dark!

Davis InService on

Bioluminescence and Integrated Science Concepts

September 14-15, 1991

Joe Andrade
Department of Bioengineering
Room 2480 MEB
University of Utah
Salt Lake City, Utah 84112
(801) 581-4379 (office)
(801) 277-1259 (home)

Outline:

September 14:

Welcome
Objectives
Introductions
Hand Outs -- homeworks!
What is Bioluminescence?
Video
Kit Assembly

September 15:

Questions/Hypotheses
Sea "Fireflies"
Light
Luminescence? Lite-Stik
Why *Bio*luminescence?
Light in the *Dark* -- Circadian Rhythms
Your Kit -- Action! *LIGHT!* Camera!
Let's *see* them
Numbers/Growth/Cycle/Photosynthesis
Care and Feeding
Writing/Finger "Painting"
My Classroom?
Follow Up
Science: Interest-Motivation-Integration
Thanks!

Date:_____ Your Name: _____

Bioluminescent
NIGHT-COLONY
Report

Care and Observation of Pyrocystis Lunula Dinoflagellates

The cultures you have received are plants so you must provide them with light. They are somewhat temperamental so you have to try and control the temperature. The best temperatures for growth are between 15°-25°C (about 55°-80°F). If the room temperature is above 80°F, put the flask in a cooler area. Please use the back of this sheet is you need additional space for your observations.

1. Where do you locate NIGHT-COLONY? What were its light conditions (direct sunlight, bright, moderate, dim)?

2. When were the lights on (hours)? Off? Did they see complete darkness? For how long?

3. Bioluminescence: Tap the flask and swirl it gently every day during its "night." Describe the bioluminescence. Is the intensity increasing or decreasing?

4. Concentration: Observe the cells and colonies in the culture. Are their numbers increasing? Try to describe the culture each week.

5. Describe the experiments of demonstrations you performed.

6. How did your students or family respond to NIGHT-COLONY? What questions did they ask?

7. What additional questions do you have?

Please return to:

J. Andrade
2480 MEB
University of Utah
Salt Lake City, Utah 84112

Thanks!

Davis InService
September 14-15, 1991

LIGHT FROM LIFE:
Science Concepts via Bioluminescence

EVALUATION

1. Summarize the essence of the Workshop.

2. Critique the Workshop -- What was unclear? Unnecessary? Suggest improvements and enhancements.

3. What would you like to see added?

4. What would you like to see deleted?

5. Other suggestions.

Thanks!

Where to get
Bioluminescent Materials

Carolina Biological Supply Co.
Gladstone, Oregon 97027
(501) 656-1641
(800) 547-1733

Firefly (Cypridina)
10-3430 0.5 gr. $22.45

Connecticut Valley Biological
P.O. Box 326, 82 Valley Road
Southampton, MA 01073
(413) 527-4030

Bioluminescent Organism Kit
L-8085 – $16.25

NIGHT-COLONY, supplies, and accessories are also available from

Protein Solutions, Inc.
6009 Highland Drive
Salt Lake City, Utah 84121
(801) 277-1259 (evenings)

These products should be available through Gregory's Toys and Adventures stores in Salt Lake City and Ogden beginning early November, 1991.

Magnifiers/Small Microscopes

Edmund Scientific Co.
101 East Gloucester Pike
Barrington, NJ 08007-1380
(609) 573-6260

Wards Biology
11850 East Florence Avenue
P.O. Box 2567
Santa Fe Springs, CA 90670-0567
(800) 962-2660

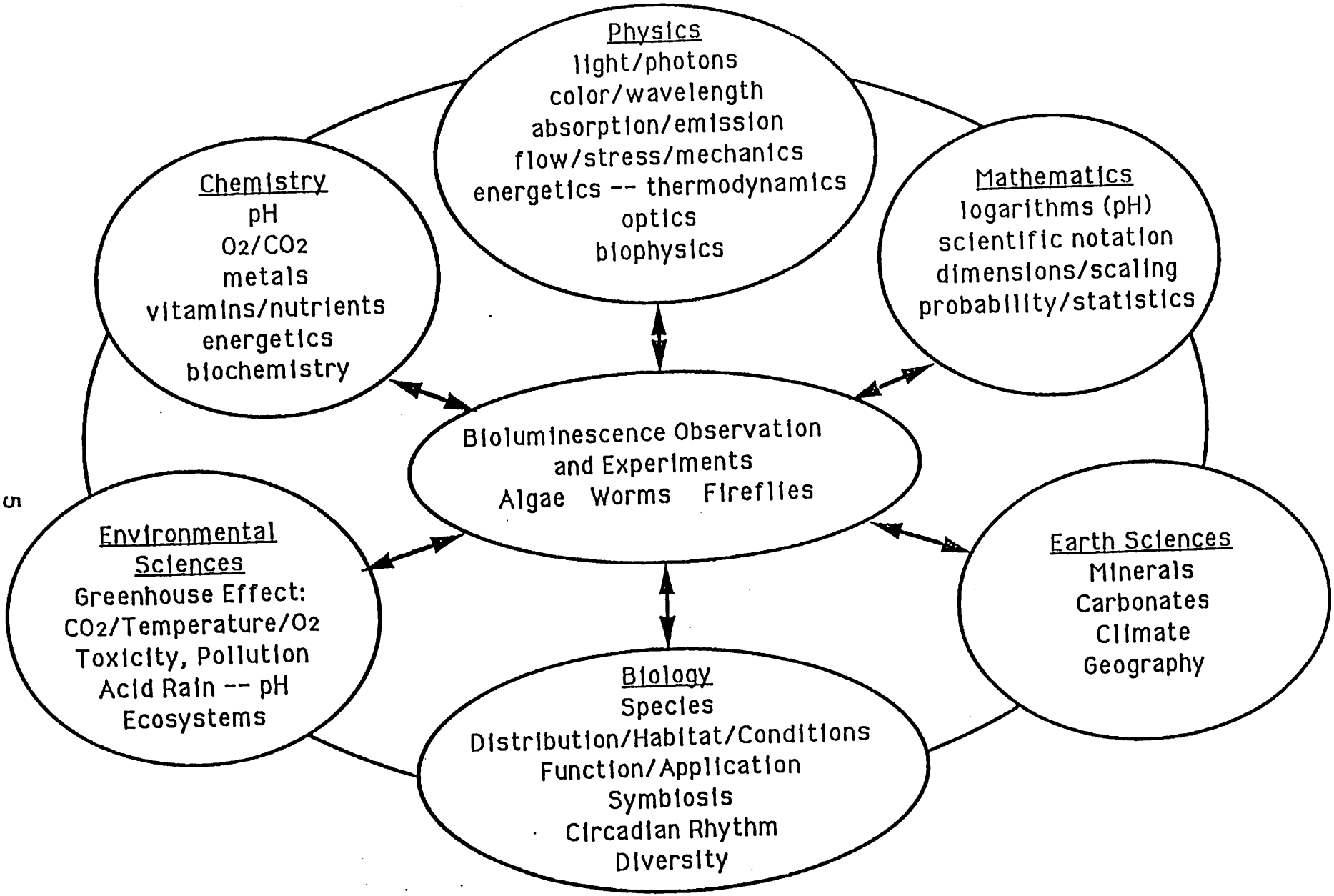
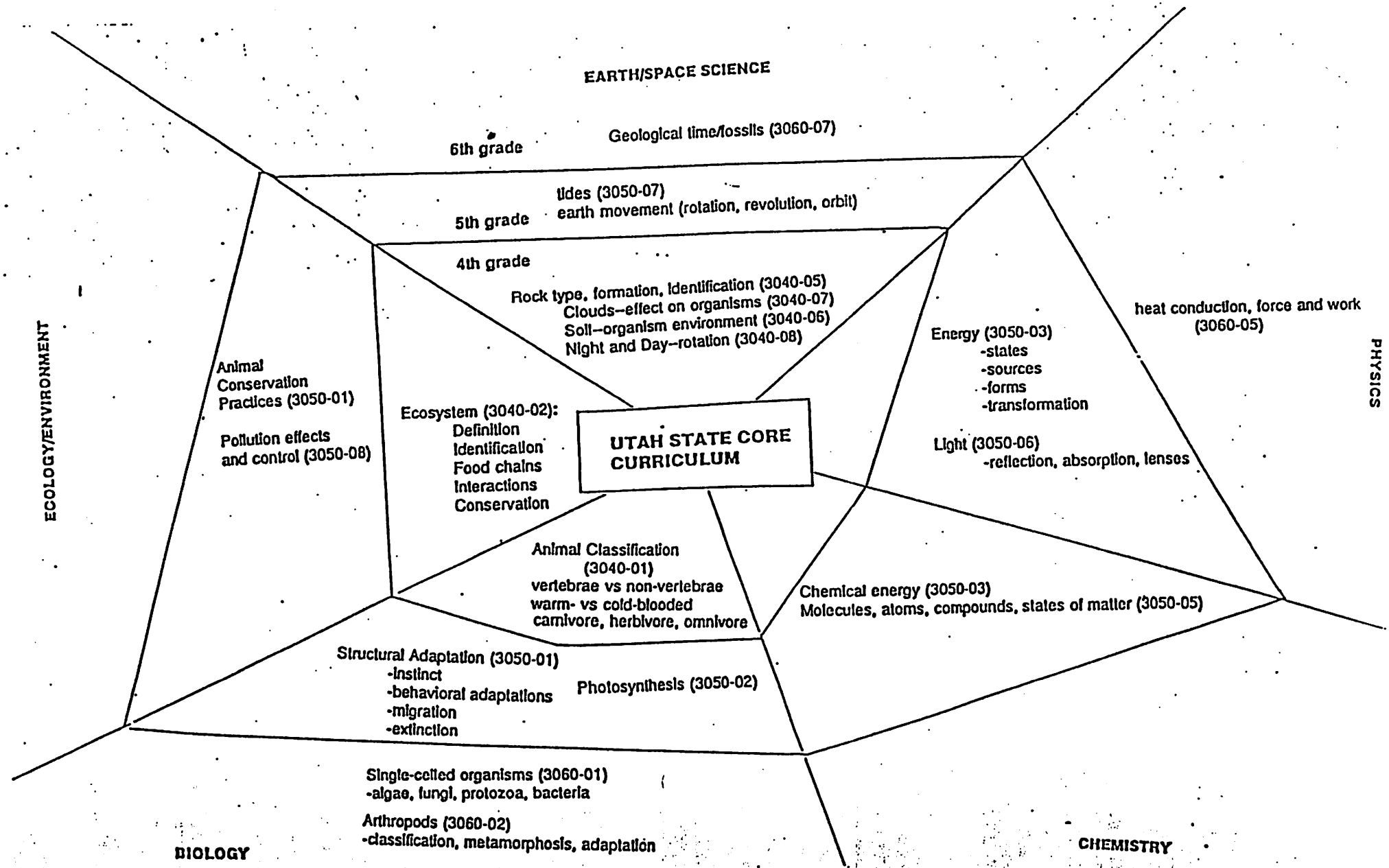


Figure 1: Bioluminescent organisms and their observation are shown as the center of an integrated science "wheel". Each of the classical specialties or disciplines are indicated with selected subject examples. These subjects and topics can all be directly observed and experimentally studied via bioluminescence.


EARTH/SPACE SCIENCE
6th grade
Geological time/fossils (3060-07)
5th grade
tides (3050-07)
earth movement (rotation, revolution, orbit)
4th grade
Rock type, formation, identification (3040-05)
Clouds--effect on organisms (3040-07)
Soil--organism environment (3040-06)
Night and Day--rotation (3040-08)
ECOLOGY/ENVIRONMENT
Animal
Conservation
Practices (3050-01)
Pollution effects
and control (3050-08)
Ecosystem (3040-02):
Definition
Identification
Food chains
Interactions
Conservation
UTAH STATE CORE
CURRICULUM
Energy (3050-03)
-states
-sources
-forms
-transformation
Light (3050-06)
-reflection, absorption, lenses
heat conduction, force and work
(3060-05)
PHYSICS
Animal Classification
(3040-01)
vertebrae vs non-vertebrae
warm- vs cold-blooded
carnivore, herbivore, omnivore
Chemical energy (3050-03)
Molecules, atoms, compounds, states of matter (3050-05)
Structural Adaptation (3050-01)
-instinct
-behavioral adaptations
-migration
-extinction
Photosynthesis (3050-02)
Single-celled organisms (3060-01)
-algae, fungi, protozoa, bacteria
Arthropods (3060-02)
-classification, metamorphosis, adaptation
BIOLOGY
CHEMISTRY

Bacteria Reviews (5)

Seafood That Glows In The Dark

Food technology texts mention that certain bacteria can cause seafood to glow in the dark, but they claim that glowing seafood is uncommon and not widespread. Actual occurrences of glowing seafood may be more common than believed because the "glow" is difficult to see except in complete darkness. Most reports of glowing seafood are from restaurants that have large refrigerated storage rooms with light switches, or from consumers seeking a late night snack in the dark.

Marine bacteria including *Alteromonas hanedai*, *Photobacterium phosphoreum*, *P. leiognathi*, *Vibrio fischeri*, *V. harveyi*, *V. logei*, and *V. splendidus* can cause glowing or luminescence when they grow on seafood products. These luminous marine bacteria are common in the marine environment, and on the outer surfaces and in the intestines of marine animals. Some species of *Photobacterium* are in specialized luminous organs of marine fish.

Most of the luminous marine bacteria can grow at temperatures as low as 39°F, and *P. phosphoreum* and *V. logei* can grow at 32°F. These bacteria are able to grow on seafood in the refrigerator, but they require sodium or salt to multiply.

Luminous marine bacteria will not grow on most seafood products because they do not contain enough salt. Some seafood products such as cooked crabmeat, cooked shrimp, and simulated seafood made from surimi have salt added during processing. The added salt is enough to allow luminous marine bacteria to grow on these products.

When seafood glows it means that many luminous bacteria are present. This suggests that the seafood was held for a time and at a temperature where these bacteria could grow. It does not mean the seafood is unsafe or low quality. There are no reports of illness from luminous marine bacteria growing on seafood.

Keep cooked crabmeat, cooked shrimp and simulated seafood products as close to 32°F as possible to slow the growth of luminous bacteria. Consume these products within a day or two after purchase.

The author is Robert J. Price, Ph.D., Extension Seafood Technology Specialist
Department of Food Science & Technology, University of California, Davis, California 95616-8598.

August 1990

UCSGEP 90-8

This work is sponsored in part by NOAA, National Sea Grant College Program, Department of Commerce, under grant number NA89AA-D-SG138, project number A/EA-1, through the California Sea Grant College Program, and in part by the California State Resources Agency. The U.S. Government may reproduce and distribute reprints for governmental purposes.

University of California Cooperative Extension
Sea Grant Extension Program Publication

Bioluminescence in Sea Fireflies

Instructions

Cypridina hilgendorfii is a bioluminescing ostracod crustacean native to the Sea of Japan. Known to the Japanese as *umi botaru* (sea fireflies), these small crustaceans live on the sea bottom during the day and venture out to feed at night. Measuring only 0.5 to 5 mm in length, the body of the sea firefly is enclosed within hinged bivalve shells. It has two pairs of legs on its abdomen and moves via two pairs of antennae on its head.

Cypridina presents a simple model for studying an enzyme system. The presence of the required components (luciferin and luciferase) is easily demonstrated, and the product (light) is readily observed and measured. This model is used in research to study the effects of drugs, temperature, pressure, and other variables on enzymatic systems.

PROCEDURES

1. To get light, simply grind dried *Cypridina* into powder, place the powder on a watch glass, and add enough water to moisten it. Observe in a darkened room or box. The light will glow a blue color for a brief period, dim, and disappear.
2. Set the watch glass aside for later use. The luciferin has been converted to oxyluciferin, a nonluminescent product. Luciferase is still present, however.
3. Place 10 to 20 *Cypridina* in a test tube and cover them with water. Place the test tube in a boiling water bath.
4. After several minutes of boiling, remove the test tube from the water bath and allow it to cool.
5. Use a glass rod to crush the sea fireflies in the test tube. No glow is observed because the luciferase has been denatured by the heat.
6. Now add some of the cooled water containing the boiled *Cypridina* to the "used-up" powder in the watch glass. Since the luciferase in the "used-up" powder is functional and since luciferin is heat-stable, the mixing of these two preparations produces light. Note that no ATP is added, and, in fact, none is required.

Carolina Biological Supply Company

2700 York Road
Burlington, North Carolina 27215

Box 187
Gladstone, Oregon 97027

DISCUSSION

Raphael Dubois, who studied bioluminescence in the clam *Pholas dactylus* in 1887, coined the names luciferin and luciferase for two components of bioluminescent systems. Dubois found that a cool water extract of *P. dactylus* would glow for several minutes. When a nonluminescing hot water extract of the clam was cooled and added to the cool water extract that had ceased glowing, light was again emitted. Dubois concluded that a heat-labile component, which he named luciferase, was present along with a heat-stable component, luciferin, that was "used up" in luminescence. Luciferin is a species-specific pigment, while luciferase is an enzyme that catalyzes the oxidation of luciferin.

Luciferin and luciferase occur in the submaxillary gland of the sea firefly and are released into the seawater as granules. If the water is disturbed, the granules dissolve, and blue light is emitted. Luciferin acts directly as a substrate in the generation of light. Luminescence occurs with the addition of oxygen in the presence of luciferase and salts. *Cypridina* was studied extensively by Professor Newton Harvey, the "Dean of Bioluminescence," who found that the dried organisms would luminesce even after storage of 30 years simply by crushing them and adding water.

The light emitted by sea fireflies is bright enough to read by. During World War II Japanese soldiers used the dried powder as a low-intensity light source for reading at night. The dark-adapted eye can detect light from the powdered ostracods in a concentration as low as 1 part in 400 million parts water!

FURTHER READING

DeLuca, M. A., editor, Methods in Enzymology, Volume 57, Bioluminescence and Chemiluminescence, Academic Press, New York, 1978.

Hastings, J. W., Bioluminescence, *Annual Review of Biochemistry,* 1968, **37,** 597-630.

Poole, L. and Poole, G., Fireflies in Nature and the Laboratory, Thomas Y. Crowell Company, 1965.

Part 4: References

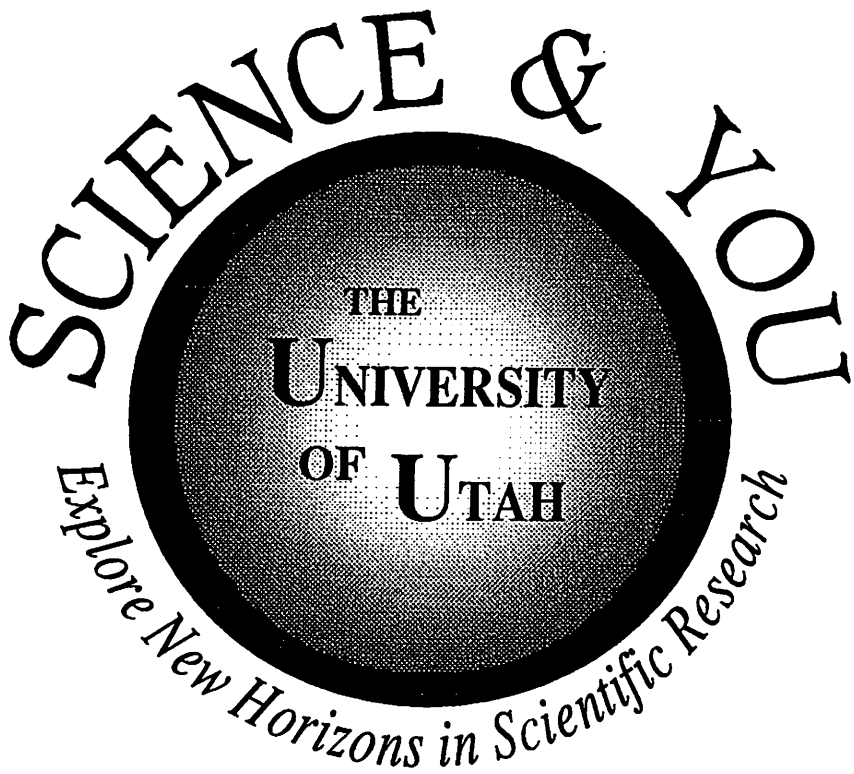
Bioluminescence:

1. *National Geographic Magazine* has many articles and photos of bioluminescence:
   P.A. Zahl, "Nature's Night Lights," July, 1971, p. 45.
   P.A. Zahl, "Fishing in the Whirlpool," Nov, 1973, p. 579.
   D.L. Teimann, "Nature's Toy Train, The Railroad Worm," July, 1970, p. 58.
   P.A. Zahl, "Fireflies," July, 1962, p.48.
2. Several Major encyclopedias include articles on bioluminescence:
   Encyclopedia Britannica
   McGraw Hill Encyclopedia of Science and Technology
3. Popular science articles include:
   K.H. Nealson and C. Arnesan, "Marine Bioluminescence: About to See the Light," *Oceanus* *28*(3)(1985)13.
   P. Hughe, "Wheels of Light, Sea of Fire," *Oceans*, Dec, 1987, p.21.
   M. Root, "Glow-in-the-dark Biotechnology," Biological Science *38* (11)(1988)745.
   A.K. Campbell, "Living Light," *Trends in Biological Sci. 11* (1986)104.
   A.P. Neary and C.S.J. Walpole, "Bioluminescence-Chemical Light," *Science Progress* *70*(1986)145.
   P.J. Herring, "How to Survive in the Dark: Bioluminescence in the Deep Sea," in M.S. Laverack, ed., Physiologic *Adaptation of Marine Animals*, Soc. of Experimental Biology of Great Britain, *39*(1985)323-351.
   F.A. Brown, Jr., "Bioluminescence," in Comparative Animal Physiology, (Cladd Prosser, ed.), 3rd Edition (1973), pp. 951-966.
4. There is a limited discussion of bioluminescence in science and nature books for children. The most complete is:
   A. and U. Silverstein, *Nature's Living Light*, Little, Brown, & Co., 1988.
5. Although bioluminescence is largely unknown in the K-12 and college curricula, there is an extensive scientific literature:
   A.K. Campbell, *Chemiluminescence*, VCH Publ.,1988
   F.H. Johnson and Y. Haneda, *Bioluminescence in Progress*, Princeton Univ. Press, 1966.
   J.W. Hastings and J.G. Morin, "Bioluminescence," in C.L. Punsser, ed., *Neural and Integrative Animal Physiology*, Wiley-Liss (1991), pp. 131-170.
   P.J. Herring, *Bioluminescence in Action*, Academic Press, 1978.
   P.J. Herring, A.K. Campbell, M. Whitfield, and L. Maddock, *Light and Life in the Sea*, Cambridge University Press, 1990.
   P.J. Herring, "Systematic Distribution of bioluminescence in Living Organisms," *J. Biolu. Chemilum. 1* (1987) pp.147-163.
   E.N. Harvey, *Bioluminescence*, Acad. Press, 1952.
   F.H. Johnson, *Luminescence, Narcosis, and Life in the Deep Sea*, Vantage Press, 1988.
   ~~S. Spotte, *Marine Aquarium Keeping*, Wiley, 1973.~~
   Much of the current scientific information is being published in the *Journal of Bioluminescence and Chemiluminescence*, John Wiley and Sons.

Closed Ecosystems and Microcosms:

6. M.M. Averner, "Controlled Ecological Life Support System," in *Lunar Base Agriculture*, 1989, p. 1
7. D.B. Botkin, S. Golubic, B. Maguire, B. Moore, H.J. Morowitz, & L.B. Slobodkin, "Closed Regenerative Life Support Systems for Space Travel: Their Development Poses Fundamental

The Center for Integrated Science Education presents



A series of lectures featuring current research topics for you and your students. Inservice credit will be offered for the series and an accompanying workshop. Details will be available at the first lecture, or by calling the Center for Integrated Science Education at (801) 581-4171.

- **September 27, 1995**
  Embryos and Evolution: New Bodies from Old Parts
  Joe Dickinson, Professor of Biology

- **October 20, 1995**
  The Physics of Hi-Fi
  Orest Symko, Professor of Physics
  (NSTA Conference, Red Lion Hotel, 2 pm)

- **November 15, 1995**
  Experiments in Photoluminescence, Chemiluminescence and Electro-chemically-generated Luminescence
  Henry White, Professor of Chemistry

- **December 13, 1995**
  Molecular Motors: Motility at the Cellular Level
  Dave Blair, Professor of Biology

- **February 8, 1996**
  Geology of the Yellowstone Region
  Bob Smith, Professor of Geology and Geophysics

- **March 7, 1996 (tentative)**
  Genetic Susceptibility to Cancer
  Mark Skolnick, Medical Informatics and Myriad Genetics

Lectures for April 11, 1996 and May 9, 1996 will be scheduled later. Lectures will be held at 4:00 pm in Room 130 of the James Talmage Building (JTB) on Presidents Circle of the University of Utah Campus unless specified otherwise (Lecture on October 18 will be at the NSTA Conference).

SCIENCE & YOU...

- *Presentations will feature University faculty whose research is significant, interesting and accessible to the general public.*
- *Speakers will review recent advances in diverse areas of science and technology in addition to highlighting work done at the University of Utah.*
- *All interested parties (including student groups) are invited. Inservice credit is available to teachers.*

UNIVERSITY OF UTAH
COLLEGE OF SCIENCE
SALT LAKE CITY, UTAH 84112

September 27, 1995

Embryos and Evolution: New Bodies from Old Parts

by Joe Dickinson, Professor of Biology

We all use things in ways not originally intended - newspapers to start a fire, a chair to reach something high on a shelf - and we may even know someone who systematically "tinkers" with cast off parts to create new devices. Evolution sometimes is likened to such tinkering; most often, new challenges are met by modifying existing structures. A bat's wing, the flipper of a whale, and a human hand are all modified from an ancestral "design" used for walking.

Recently, it has become evident that this principle extends right down to the molecules that guide embryonic development and, thereby, determine the shape and structure of the individual. A fly and a mouse use similar molecules to "mark" front and back and to determine where to make an eye.

But if their molecules are so similar, what makes a fly different from a mouse? One idea is that the key is in the regulation of molecules - when, where and how much are made - rather than in their structure. Join Joe Dickinson as he explores embryos and evolution on September 27. *Details inside...*