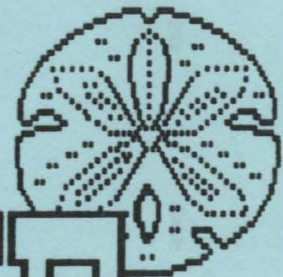
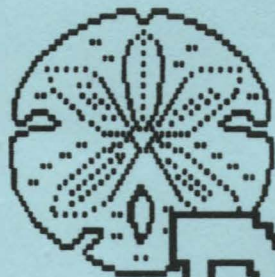
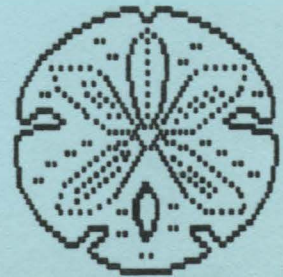
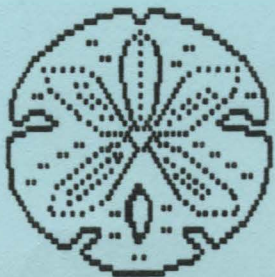
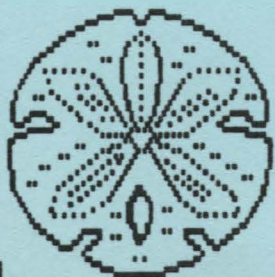
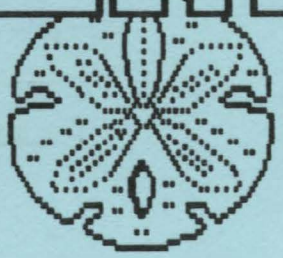
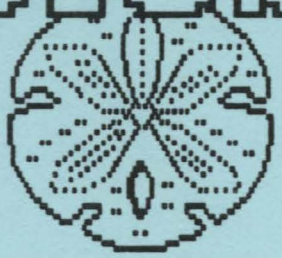


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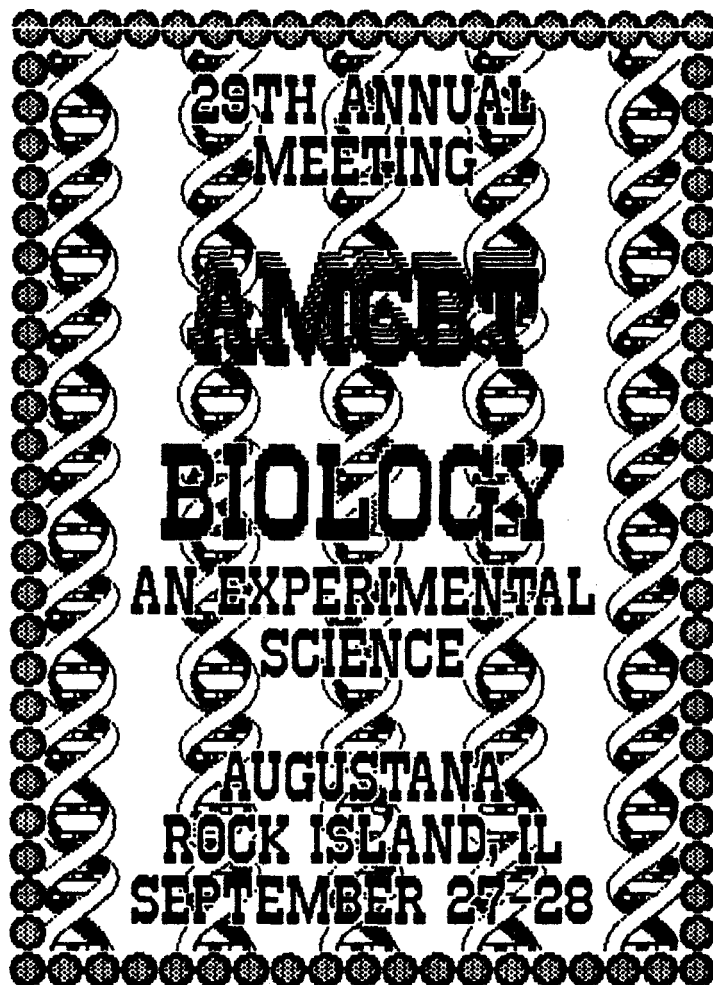


TO THE MEMBERS OF AMCBT

It's time to once again plan to attend the Annual Meeting of AMCBT. As you will read, this year the meeting will be held at Augustana College in Rock Island, IL. From the program you can see that Harold Wilkinson of Millikin has worked hard to put together something that should be of interest to all. You will note the addition of a new feature this year, Poster Sessions, which promise to be quite interesting.

As usual, what kind of meeting we have is ultimately going to depend on you the members. Many people have spent time and have committed themselves to make presentations at this meeting. Your attendance and support will assure that these efforts will not be wasted. Each of you should make every effort to attend, and should try to bring along a non-member guest. Spread the word in your departments and at your local organizations. AMCBT depends on you.

From the ExecSec





WEST MIDWEST BIOLOGY



**EDITORIAL OFFICES
WABASH COLLEGE
CRAWFORDSVILLE, IN 47933**

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ATTEND THE ANNUAL MEETING



**AUGUSTANA COLLEGE
ROCK ISLAND, IL**

**TWENTY-NINTH ANNUAL MEETING
OF THE
ASSOCIATION OF MIDWESTERN COLLEGE
BIOLOGY TEACHERS**

**AUGUSTANA COLLEGE, ROCK ISLAND, ILLINOIS
SEPTEMBER 27-28, 1985**

THEME: BIOLOGY-AN EXPERIMENTAL SCIENCE

Thursday, September 26.

8:00 P.M. STEERING COMMITTEE Seminar room 103

Friday, September 27.

9:00 A.M. - 4:00 P.M. REGISTRATION Foyer 1st floor

9:00 A.M. - 5:00 P.M. EXHIBITS & DISPLAYS Room 114

9:00 A.M. - 12:30 P.M. FIELD TRIPS
*Blackhawk State Pk
*Rock Island Arsenal
*Fresh Water Workshop

9:00 A.M. - 12:30 P.M. FILM FESTIVAL Room 120

12:00 A.M. - 1:00 P.M. LUNCH Open

1:00 P.M. - 3:00 P.M. 1ST BUSINESS MEETING *John Deere
Lecture Hall

President Ray Reed - presiding

Opening Address - Dr. Joseph R. Larsen
Professor of Entomology & Director of the
Dept. of Rehabilitation Education Center
University of Illinois

"The Importance of Laboratory Education in Life Science"

3:00 P.M. - 3:45 P.M. CONCURRENT SESSIONS I

Series A Learning - Is it possible? Room 112

B Bioethics and Perception Room 118

C What's going on in the lab? Room 20

D Old, New and Different Room 1

E Writing - Creative Thought
who needs 'em? Room 3

3:00 P.M. - 5:15 P.M. FILM FESTIVAL Room 120

POSTER SESSIONS Lounge

4:15 P.M. - 5:15 P.M. CONCURRENT SESSION II
See topics and rooms listed under session I

5:30 P.M. - 7:00 P.M. SOCIAL HOUR *College Board Rm.
College Center
FILM FESTIVAL Room 120

7:00 P.M. - 9:00 P.M. BANQUET & 2ND BUSINESS MTG *Dining Room
College Center

Banquet Address - Robert Motz
Biology Teacher at Rock Island High School
Chairman of Citizens to preserve Blackhawk Park

"A Stroll Through The Seasons at Blackhawk Park"

Saturday, September 28

7:00 A.M. - 8:30 A.M.	RESOLUTION COMMITTEE INTEREST GROUPS	*Dining Room College Center
8:00 A.M. - 11:00 P.M.	ELECTION OF OFFICERS	Foyer 1st Floor
	EXHIBITS AND DISPLAYS	Room 114
	FILM FESTIVAL	Room 20
8:00 A.M. - 8:45 A.M.	DEMONSTRATION-WORKSHOPS I	Room 120
	DW1 A program for writing tutorials	
	DW2 Slide-Tape-Computer interfacing	
8:00 A.M. - 10:15 A.M.	POSTER SESSION II	Lounge
8:45 A.M. - 9:30 A.M.	CONCURRENT SESSIONS III	
	Continuation of Topics from Friday See Friday schedule for topics and rooms	
9:30 A.M. - 10:15 A.M.	DEMONSTRATION-WORKSHOPS II	Room 120
	DW3 Useful software for Gen. Bio. Labs	
	DW4 Physiology Instrumentation Workshop	
	DW5 Videotapes of Cat Dissection	
10:15 A.M. - 11:00 A.M.	CONCURRENT DISCIPLINES	
Series F1	<u>Biology of the Cell.</u>	
	Microbiology, Cell Biology, Genetics, Protozoology etc. Discussion Leader - Bill Doemel	Room 112
F2	<u>Biology of Organisms - Plants.</u>	
	Botany, Plant Physiology, Algology, Mycology etc. Discussion Leader -	Room 118
F3	<u>Biology of Organisms - Animals.</u>	
	Anat. and Physiol., Histology Entomology, Invertebrate Bio., Anatomy etc Discussion Leader - Joseph Kapler	Room 12
F4	<u>Biology of Populations.</u>	
	Ecology, Evolution, Taxonomy, Field Biology, Systematics etc. Discussion Leader - Norman Jensen	Room 1
F5	<u>Methods and Issues.</u>	
	Bioethics, Ethnology, Secondary Education, Community College, Laboratory Methods Discussion Leader - Paul Mayes	Room 3
11:15 A.M. - 12:30 P.M.	3RD BUSINESS MEETING	Room 112
12:30 A.M. - 1:00 P.M.	LUNCH	Open
1:00 P.M. - 2:00 P.M.	STEERING COMMITTEE MEETING	Seminar room 103

(*) Starred locations are not in Biology Bldg

AMCBT 1985 TIME TABLE OF MEETINGS

Friday
Sept. 27

1st Floor Foyer	Room 114	Local Facilities	Room 120	John Deere Lecture Hall	Room 120	Room 118	Room 20	Room 1	Room 3	Lounge	College Board Room	Foyer & Lounge Student Tables	Dining Room	College Center
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9:00 am
9:30
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REGISTRATION	EXHIBITS - DISPLAYS	FIELD TRIPS	FILM FESTIVAL							
				BUSINESS MTG. I						
				Able Disc.						
				Concurrent Session I						
				A1	B1	C1	D1	E1	POSTER SESSION I	Coffee Donuts Avail
				Visit exhibits & posters						
				Concurrent Session II						
		FILM FESTIVAL		A2	B2	C2	D2	E2	POSTER SESSION II	
									SOCIAL HOUR	
										Banquet And Business Mtg. II

AMCBT 1985 TIME TABLE OF MEETINGS

Saturday
Sept. 28

1st Floor Foyer
Room 114
Room 20
Room 120
Room 112
Room 118
Room 12
Room 1
Room 3
Lounge
Foyer & Lounge
Seminar Room
Dining Room
College Center
John Deere
Lecture Hall

7:00 am

7:30

8:00

8:30

9:00

9:30

10:00

10:30

11:00

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12:00 pm

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4:00

4:30

5:00

5:30

Election of Officers	Exhibits & Displays	Film Festival	DW I	Concurrent Session III					Poster Session #2	Resolutions, Interest Groups
				A3	B3	C3	D3	E3		
			DW II	Visit DW & Posters						
				Concurrent Disciplines					Coffee & Donuts	
				F1	F2	F3	F4	F5		
									Business Mtg. III	

Steering Committee

PARKING

Park anywhere along campus streets or in campus parking lots (see guide to campus) EXCEPT fire lanes, loading zones, and restricted areas.

MEALS

Meals or snacks may be obtained at the College Center or at several fast food places along 38th Street.

College Cafeteria: Breakfast 7-8:45

Noon 11-1:15 (after 12:15 to avoid rush!)

Evening 4:30-6:00

The Friday evening banquet will be buffet style served at 7:00 p.m. in the College Center Cafeteria. The banquet will be preceded by the social hour held in the College Board Room at 5:30 p.m. The ticket for the banquet (\$7.75) will also be used for the social hour.

PHONE CONTACTS

Augustana Switchboard: (309) 794-7000

Biology Department Secretary: (309) 794-7356

Dr. Ingemar Larson, local chairman: office (309) 794-7361

home (309) 788-9668

Messages will be posted in the registration area.

FIELD TRIPS AND SPECIAL EVENTS

9:00 Black Hawk State Park (including Black Hawk Forest, Watch Tower Inn, and Hauberg Indian Museum). Illinois Nature Preserve. 5 miles from A.C. campus. Maps at registration desk. Carpool. Leave from registration area. Dr. Bohdan Dziadyk.

9:00 Rock Island Arsenal. Points of interest include Browning Memorial Museum (open 10-4:00), Confederate Cemetery, National Cemetery. Map at r. desk; visitor's pass and map issued at guard station. 1½ mile from campus. Meet at desk for carpool or visit at your convenience. No leader.

9:00 - 12:00 Freshwater Workshop. An opportunity to study (light and phase microscopy) freshwater organisms, especially rotifers, from the Augustana Slough. Techniques for preparation and identification of specimens. Biology Bldg. room 3 (Invertebrate Zoology Lab). Dr. Ingemar Larson.

Augustana Campus Facilities. Two campus facilities are recommended to AMCBT meeting participants:

Fryxell Geology Museum. New Science Hall (next door to the John Deere Planetarium Building where the first business meeting will be held). Open Friday 8-5.

Special Collections Room, Denkmann Library, 3rd floor.

A variety of rare books such as several books by Carl Linnaeus; incunabula; books in English literature such as first editions by Milton, Spenser, Walton and Cotton, Sheridan, Scott, Thoreau, and others; old cook books; natural histories; and numerous books on Mississippiana. Open Friday 9:00-Noon, 1:30-4:30 p.m.

Other activities which AMCBT members and families may enjoy:

-Deere and Co. Administrative Center. Moline. Rte. 5; 8 mi. E. of campus

-Niabi Zoo. Moline. Rte. 6; 3 mi. E. of QC Airport

-Deere-Wiman House. Moline. Audubon's "Birds of America"

-Lock and Dam No. 15. Visitors center; Arsenal Island

-River excursions on the Mississippi River

W E L C O M E !

THE TWENTY-NINTH ANNUAL MEETING
THE ASSOCIATION OF MIDWESTERN COLLEGE BIOLOGY TEACHERS

Augustana College, Rock Island, Illinois
Friday, September 27 and Saturday 28, 1985

TRAVEL

Please refer to the guide to the campus. The Quad City Airport in Moline is served by United, Ozark, Air Wisconsin, Britt, American Central, and Air Midwest Airlines.

QUAD CITY MOTELS

<u>Name/Rate</u>	<u>Address</u>	<u>Phone Number</u>	<u>Time from Campus</u>
The following four motels have given the special rates listed for the AMCBT conference. Rooms have <u>not</u> been set aside or reserved for AMCBT. (Contact persons who offered the rates are also listed.)			
<u>Holiday Inn</u>	QC Airport Junction (Rtes. 6 & 150) Moline, IL 61265 (Jeane Kroneberger)	(309) 762-5592	15 minutes
Single - \$37.00 + tax			
Double - 42.00			
<u>Howard Johnson's</u>	Quad City Airport Moline, IL 61265 (Tom Adams or Patty Atwell)	(309) 797-1211	15 minutes
Single - \$35.00 + tax			
Double - 39.00			
<u>Sheraton-Rock Island</u>	17th St. & 2nd. Ave. Rock Island, IL 61201 (downtown Rock Island) (Sherry Clancy)	(309) 794-1212	10 minutes
Single - \$36.00 + tax			
Double - 38.00			
<u>Stardust Motel</u>	19th St. & 12th Ave. Moline, IL 61265 (east of A.C. campus) (Pam Swiatkiewicz)	(309) 764-9644	10 minutes
Single - \$34.00 + tax			
Double - 38.00			
<u>Excel Inn</u>	2501 - 52nd Ave. Moline, IL 61265 (next to South Park Mall)	(309) 797-5580	15 minutes
Single - \$25.95 + tax			
Double - 30.95			
<u>Regal 8 Inn</u>	Rte. 92 Moline, IL, 61265 (entrance to QC Airport)	(309) 764-8711	15 minutes
Single - \$21.88 + tax			
Double - 26.88			
<u>La Quinta Motel</u>	QC Airport Junction (Rte. 150 & I-280) Moline, IL 61265	(309) 762-9008	15 minutes
Corporate rate:			
Single - \$30.50 + tax			
Double - 39.50			

REGISTRATION AND MEAL RESERVATION
for
TWENTY-NINTH ANNUAL MEETING
THE ASSOCIATION OF MIDWESTERN COLLEGE BIOLOGY TEACHERS

Augustana College, Rock Island, Illinois
September 27, 28, 1985

Last Name _____ First Name _____ Title _____

Institution _____

City _____ State _____ Zip _____

List name the way you want it to appear on your name badge:

List spouse's name the way you want it to appear on name badge:

REGISTRATION FEE:

Amount:

AMCBT Member	\$5.00	# _____	_____
Nonmember	\$8.00*	# _____	_____
	(* \$3.00 towards membership dues in AMCBT)		

MEAL RESERVATION:

Banquet (and Social Hour)	\$7.75	# _____	_____
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\$ _____

Total Amount Enclosed

Make check payable to Augustana College and mail to:

Dr. Ingemar Larson
Biology Department
Augustana College
Rock Island, IL 61201

Rec'd: / /

Please make your reservations by September 3, 1985. Early registration would be helpful for registration and other purposes and would be appreciated. Thanks! The College Food Service requires a tentative count for the Banquet by September 3 and the guaranteed count by September 25, 1985.

FIELD TRIPS/EVENTS

Please indicate if you plan to take part:

Black Hawk State Park. 9:00 a.m. Friday # _____

Rock Island Arsenal. 9:00 a.m. Friday # _____

Freshwater Workshop. 9:00 a.m. Friday # _____

The Executive Committee proposes changes in the constitution that need to be published before the fall meeting.

Proposed Wording in Bylaws: Article 1, Section 1.

The term of office of the president, president-elect, first vice-president, first vice-president elect, and second vice-president shall be for one year. The term of office of the secretary shall be for two years. All terms of office will begin immediately following election.

Present Word in Bylaws: Article 1, Section 1.

The proposed deletion is underlined.

The term of office of the president, president-elect, first vice-president, first vice-president elect, and second vice-president shall be for one year. The term of office of the secretary shall be for two years. The election for secretary shall be held in odd numbered years. All terms of office will begin immediately following election.

The change deletes the special designation given to the secretary's office requiring the election of this position to be in odd years.

History: Don Wilson was elected to his first term as secretary in 1982 to fill a resignation. His election was not to the completion of a term but to a full two year term. Last fall he informed the election committee that he had served his full two year term and the position was added to the ballot.

This year the executive committee realized that the constitution had been violated for 1984 was an off year only when the events that occurred in it are analyzed. Following discussion, it became apparent that the choice of the committee was to write a complex amendment dealing with all the alternatives that can arise with the secretary's position, to treat the position as much as possible as all of our other officers and delete the odd year designation or to suggest that the term of duty be one year and identical to the others. The last alternative was only mentioned in passing because of the difficulty of transferring the records each year. The parliamentary manipulation to either extend or reduce Don's present term would be prodigious. The discussion focused on the value to the organization of the odd year designation for the position of secretary. Some of the committee remembered the original reasoning which was it guaranteed that the election committee would find a candidate for the position as they did not need to find someone to fill it every year. This was balanced against the problems to find someone to fill it every year. This was balanced against the problems that resignations midterm can cause. After some deliberation, the committee decided that the removal of the odd year designation was the best application of Ochem's razor and I submit the changes for your consideration.

USING CADAVERS TO TEACH HUMAN ANATOMY IN A SMALL COLLEGE

Dr. David Dapkus, Department of Biology
Winona State University, Winona, MN

The ideal way to teach human anatomy labs is to have a small group of students doing their own cadaver dissection. This is not feasible in small colleges because of expense and space limitations. So students usually dissect cats.

In this paper, I would like to discuss the method we use at Winona State University. Here we use prosecuted cadaver demonstrations along with cat dissections. This compromise allows students many of the benefits of cadaver dissections without the space and expense problems.

Our present teaching method involves demonstrations on two prosecuted cadavers. Usually three demonstrations are arranged each quarter at the conclusion of the Muscular, Circulatory and Internal Organ System Units. The demonstrations are given when students have thoroughly learned the structure and relationships of the organs by dissecting their own cats (two students per cat). The instructor then demonstrates the organs to groups of about twelve students. Names, relations and functions of organs are reviewed. Special attention is given to the differences between cat and human organs. Later in the lab period, students are encouraged to re-view the organs demonstrated in small groups. This allows them to get a closer look than they could in the large group. Notes on the cadaver demonstration and a checklist are distributed to facilitate this review. We also encourage review by asking laboratory practical questions on the cadavers.

Initially, we had a single male cadaver. This specimen was dissected so that muscles, thoracic organs and abdominal organs could all be demonstrated. In order to do this, we had to leave half of the chest wall and abdominal wall intact. This compromise resulted in the destruction of some muscles and difficulty in fully viewing some internal organs.

Currently we use two cadavers. A male is used to demonstrate muscles and male reproductive organs. The female cadaver has had the entire chest and abdominal wall removed. Circulatory, internal and female reproductive organs are demonstrated on this specimen. We find the present system to work much better than a single cadaver, but the expense and space required for two tanks may make it impossible for some schools. We got along perfectly well for several years with a single cadaver.

We have found that almost all students accept the cadaver demonstrations very well. We thoroughly prepare the students for the first demonstration by discussing where the cadavers come from and how they are embalmed. We emphasize that students must treat the cadavers respectfully. The students' intense curiosity along with this preparation helps them get over any initial difficulties they have in viewing a dead body.

The cadavers were obtained from the University of Minnesota Department of Anatomy with the cooperation of David Lee. We had to demonstrate that we could maintain good security, that we would be respectful of the bodies and that we would make good use of them for teaching purposes.

It has been my experience after some twenty years of teaching, both at the

University of Wisconsin-Platteville
James R. Holler, Biology Department
ON THE SUBJECT OF FERNS

If I can be of help to anyone who might be considering getting cadavers for your school, please let me know.

We have found the benefits of having the cadaver demonstrations have been great. It has allowed students to get a much better perspective on the structure and relations of human organs. I also have the impression that the cadavers have added considerably to the status of our anatomy courses and have made students more serious about learning anatomy.

As you can see, the expense is not great after the initial purchase of the tank. If a reasonable number of students take the course, the expense is small compared to the yearly cost of cats.

I would like to give interested readers some idea of the initial and maintenance costs involved. The big item, of course, is the tank which lists at about \$3,500. Next comes the partial cost of preparing the body which is paid to the medical facility involved. We estimate this cost at about \$500. This expense might be anticipated to occur every five years or so. The only other expense is a yearly change of ethylene glycol; 15 gallons at about \$6.00 per gallon.

Our first male cadaver was well preserved after five years. It was finally replaced because of discoloration produced by a mold inhibitor we no longer find necessary. Some arm muscles also had become torn by repeatedly turning the cadaver over. The present specimens are in their second and third years and are doing well.

This method of preservation was developed by Dr. Calvin Fremling for the Nasco Company which uses a similar method to preserve animal specimens.

The cadavers are kept immersed in a solution of 25% ethylene glycol and 1/2% formaldehyde in water. During viewings, a lever mechanism allows us to hoist the cadavers out of the fluid. This method allows the cadavers to be kept for repeated viewings over a period of years. It is also more aesthetically pleasing than the usual embalming method because ethylene glycol is odorless and the formaldehyde in the room is minimal.

The cadavers are each kept in their own stainless steel tank. Each tank is about three feet by six feet long. We wheel the tanks out to an open area for demonstrations and then store them in a corner. We keep the tanks secure with hasps and padlocks when not in use.

The cadavers were prepared at the University by the usual "heavy duty" embalming procedure used for medical school specimens. The specimens were delivered intact in heavy plastic bags. We planned and carried out our own dissections (without previous human dissection experience). The dissection for purposes of demonstration is very time consuming, but is a great learning experience in itself.

secondary and college level, that the ferns have been given short shrift. With that in mind, it is the author's goal to rectify this situation.

My interest in ferns was piqued a year ago when my wife and I purchased some property near the Mississippi River at what is locally known as McCartney's Landing. Not long after the Railsplitter's birthday, my wife and I ventured over to the "property". Lo and behold, we noticed, peeking through the snow, a small patch of green, and not too dull a green at that. It turned out to be a few leaves of the Walking Fern, Camptosorus rhizophyllous (L) Link.(2) Imagine our ecstasy in finding an evergreen herbaceous plant in February in Wisconsin! The author's previous contact with this fern had been in the form of dried specimens in Riker mounts.

This interesting little fern grows on limestone rocks or soil with high limestone content. It is called the Walking Fern because the long tapering apex of the leaf will root when it touches a favorable substrate. According to Parsons (3), occasionally a plant is found which will keep up its connection with two or three successive generations. Imagine an organism which can give birth to its grandchildren and great grandchildren!

About nine months later while visiting my mother in Brown Co., Ill., the author stumbled across another interesting specimen of fern. This occurred on the Saturday after Turkey Day. This denizen of the woods was a species of Botrychium. It was subsequently identified as Botrychium dissectum Spreng., one of the grape ferns. At the time of discovery, this particular specimen was in the process of sporulation. The author knows this to be true because when he stumbled across this fern, he kicked it. An ephemeral brown mist flew out from the fertile spike. According to Cobb (1), this fern is partially evergreen since the fertile leaf will persist through the winter and spring.

These two plants are examples of a group that can be used as models to teach several different biological concepts. For example, the Walking Fern can be used as an example of vegetative propagation by leaves. As with many other ferns, it can be used as an example of propagation by rhizomes.

The late "blooming" grape fern is a good example of a plant which produces its propagules very late in the growing season. Not many herbaceous plants "fruit" so late in temperate climates.

Ferns can be used in ecological studies. The Walking Fern is a good indicator species of certain substrate conditions. Ferns can be used as examples of aggregation in populations because of the manner in which they reproduce vegetatively.

In my mind, one of the more difficult concepts to teach in general biology, is alternation of generations. Perhaps, this is because plants in which one generation is microscopic are used. Why not use a fern in which both sporophyte and gametophyte generations are macroscopic?

In summary, perhaps it behooves us as biologists to attempt to use more of the unusual to teach the usual. We are fortunate to be in a discipline where nature can serve as a source of supply and as a laboratory. Maybe we should make more use of wildlife before it disappears.

References Cited

- 1 Cobb, Boughton, 1963. A Field Guide to the Ferns, Houghton Mifflin Company, Boston.
- 2 Gleason, Henry A., 1958. Illustrated Flora of the Northeastern United States and Adjacent Canada. Lancaster Press, Inc., Lancaster, Penna.
- 3 Parsons, Frances Theodora, 1961. How to Know the Ferns. Dover Publications, Inc., N.Y., N.Y.

WRITING IN BIOLOGY; ONE WAY TO CONSIDER BIOETHICAL ISSUES

E. Russell TePaske
Cedar Falls, IA

Almost everyone, teachers and citizens alike, would agree that it is desirable, even necessary, that students express themselves cogently in writing. These same persons usually agree that it is desirable that there be ethical assessment of biological issues in the classroom. This article proposes to do both simultaneously - to write about bioethical issues.

Under the very real pressures of unmanageable class sizes and unmanageable classroom discipline of the past 2 decades, some adjustments in classroom teaching and management have become practical necessities. Common adjustments in biology have been to cut back on experiences both in laboratory-type activity and in writing and to expand lecture-type, self-directed, computerized and learning-packet activities. Objective tests are progressively becoming the norm and slowly but unmistakably, most written expression is moving out of biology classrooms. The English teacher, who has always been a teacher of writing has sometimes become the only teacher of writing in the school.

Within biology classrooms, there has been a healthy emphasis on acquisition of objective information. But along with this emphasis have been shifts away from the laboratory as the learning and activity center of science and a shift away from subjective evaluation of data or experience. Evaluation in biology has come to have the objective test as its norm. This article does not intend to suggest that the clock be run backwards on student evaluation. Many teachers have already mastered the art of writing excellent objective examinations; many more are learning how to do so. In my opinion the objective examination is not only efficient, it is also the best way to assess whether information has been mastered. What the objective examination fails to do well is to assess laboratory performance or to assess the student's ability to think, analyze and synthesize. Research paper writing and position paper writing allow the learner to demonstrate skill in all three. I submit that when there has been effective objective testing, the classroom teacher acquires a good sense of whether or not information has been mastered. This then need not be a primary objective in writing assignments in biology. Rather writing assignments can focus somewhat narrowly on an issue, idea, concept, or point of view of science. Especially effective, for me, has been student writing on issues that are simultaneously ethical and biological. Following are 2 sample assignments:

1. The synopsis that follows is a summary of one family's medical dilemma. Read the scenario, specify your position on it and prepare a written defense and discussion of that position. The defense/discussion should not exceed 2 pages in length.

1. Baby Girl S, the first born to her parents, had a high lumbar meningomyelocele, hydrocephalus, and paralysis and deformities of her legs. Mrs. S, a social worker who was acquainted with the condition from her work, refused to sign the operation permit for back closure. Her husband supported her position, but the physicians and hospital staff obtained a court order for a series of operations. The parents openly expressed their feelings to the staff, and in turn the staff was hostile to them. After surgery, complications were numerous and the child's brain was damaged severely, but Mr. and Mrs. S resolved to do their best for their baby. They took her home hoping that they had been wrong (as they knew they could have been) and that the best choice had been made. As complications arose, they brought the baby into the hospital several times for further treatment. Each time, they felt the hostility of the staff whom they would like to avoid but couldn't. When the baby died at 10 months of age, they were questioned by physicians and the police about whether they had deliberately delayed seeking treatment for "heavy breathing" (diagnosed at autopsy as pneumonia) until their baby was near death.

Subsequently, two healthy children were born, but Mrs. S had to work to help pay the large debt incurred in the care of the first baby. She was away from the children much of the time and was always tired when she was at home. Her husband felt neglected, and the children developed behavioral disorders. When one of the children was diagnosed as suffering from maternal deprivation, Mrs. S was hospitalized for treatment of severe depression. She later reported, "It was just more than I could take." She and Mr. S felt that their first baby should have been "helped to die." They considered that much of the suffering of their baby, themselves, and their other children was senseless and destructive. They doubted that they or their living children would ever fully recover from the court-ordered treatment of their first child.

2. Using a printed example from within the past 5 years, discuss a bioethical controversy/question of your own choosing. It must be an actual (not hypothetical) example or situation and both biology and ethics must be involved in it. Include your position on the situation summarized and list the reference(s) read. The assignment should not exceed 2 pages in length.

Students in my classes select medical and health sciences controversies approximately two-thirds of the time for their discussions. Sperm banks, abortion, amniocentesis testing, womb lending, euthanasia and test-tube fertilization are the most frequently used topics. The remaining third are divided more or less evenly among environment/conservation issues, recombinant DNA research, cloning, and agricultural/agronomy issues. I expect that the example provided by the first part of the assignment molds the pattern for topic selection in the second part. I've never tested whether this is so, because I have liked the topics the students have chosen. But I've been suspicious that printing an article on say, depletion of the Ogallala aquifer, would elicit quite different controversies as student examples of bioethical issues for part 2 of the assignment.

It may cause anxiety in some instructors to move this far from a library and term paper focus with student writing. My bias has been to use testing as the means of evaluating mastery of information and thus to free up the writing process to demonstrate the student's capability to express himself; to think, to perceive sensitively, to analyze and to synthesize. While students do use the library to collect ideas for these biological writing assignments, much more could be done with this than I have chosen to do. Merely requiring a bibliography of a specified number of references would take students to the literature. Asking that a student research the historical

origins of the issue or topic would require a literature review also. But a decision to focus on scientific content or on library-search aspects of a problem is also a decision to defocus the student's original thinking, his/her analysis of the bioethical dilemma as well as his/her emotional involvement with the problem. There is of course merit in both kinds of writing, but each kind serves a different objective.

Some students are happily surprised to discover their ability to write. The two rules for student writing that I've found that lead to this discovery are:

1. Select a topic in which you feel sufficient interest that there is something you want to say about it.

2. Read the paper aloud (preferably to someone), as soon as the rough draft has been completed. Run on, and incomplete sentences as well as artificial or stilted expressions will be immediately exposed.

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CAN TEACHING BE REWARDING?

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Anyone who is in the teaching profession or who is contemplating entering the profession should be aware of an economic fact of life: teachers are not compensated for their efforts at a level equal to that of members of other professions requiring the same or a lesser formal education. In fact, although college and university teachers rank 35 in a list of 169 occupations ranked by weekly earnings, secondary and elementary teachers are listed 768 and 106 respectively with a significant number of occupations requiring no formal education listed ahead of them (1). The situation is not improving. There was a 10% drop in average salaries of teachers in the 10 years from 1972 to 1982 (2). A preliminary report by the Bureau of Placement at Indiana State University for December of 1984 groups employers into three categories: business, manufacturing and industry, and government and non-profit with educational institutions listed under the non-profit and showing lower monthly salaries for all types of bachelor's degrees (3). Most of society is well aware of this fact; parents suggest that their children go into fields of business, engineering, law, or medicine, but not into teaching, even though one or both of the parents may be in the teaching profession. Average salaries of 1984 college graduates show teaching at the bottom with such fields as statistics, chemistry, computer sciences, and engineering averaging 54% to 85% higher (4). Therefore, salary is a given negative and has been offered as one of the major factors explaining the decline in number of students entering the profession. Another factor is the degraded status of what ought to be a richly honored profession (5). The estimated supply of new teacher graduates has decreased from 313,000 in 1973 to 149,000 in 1985 (4). At our university, the number of graduates from the College of Arts and Sciences declaring teaching as their major has decreased from 49% in 1973 to 10% in 1984 (6). Nationwide this is evidenced by 2 in 5 students indicating an interest in teaching in 1970 as compared to 1 in 20 in 1984 (4). But still many do choose to enter the profession. Why? One reason given is that students who can't make it into better paying professions end up as teachers. It is correct that SAT scores of college-bound high-school seniors intending to major in education are about 80 points lower than the average for all seniors taking the test (4); but a significant number of declared education majors possess SAT scores which qualify them for entrance into any of the more "elite" majors. Another reason, and an important one, appears to be similar to that of workers in the other "helping

professions": prospective teachers like to work with people and believe they will enjoy helping young people learn. In turn they believe they will obtain recognition and reward for doing so. Cognizant of the fact that teaching will not provide them with the monetary returns to earn them recognition in our materialistic society, they must expect to obtain this recognition and reward in ways other than money and from other sources than society in general. It is the sources of recognition and reward for teachers that will be addressed in this article.

While there are attempts to recognize and reward "exceptional" teaching, most of these occur within the profession itself. Although "Teacher of the Year" at the local, state, and national levels generates recognition outside the school community, in most cases the "contest" is generated by teaching societies or groups closely aligned with teaching, i.e., PTAs and alumni associations. This is borne out by Charles Hardaway's study in 1966 to identify the types of teacher-recognition programs conducted by colleges and universities in the United States (7). He found that 75% of the schools responding made annual awards with about 2/3 of the awards provided by teacher-related groups. The chances for an individual teacher to receive "Teacher of the Year" at the national level are about equal to a junior high-school basketball player making it to the NBA. At the university level the chances increase considerably, but this still leaves the majority of the faculty without recognition: "I've been at this institution for 20 years and have never received the award." Some student teaching societies select a "Faculty Member of the Month," and in some schools the student body votes for "Favorite Teacher of the Year" to give recognition and thanks for a job well-done. The need for rewarding quality teaching is recognized by other than educational institutions as indicated by an article in the Hoosier Farmer, which states "Confidence and quality must be recognized, sought and rewarded. Outstanding teachers must be rewarded in order to encourage first rate people to choose teaching as a profession (8)." Many school boards have supported the concept of merit pay for superior service, and recently some state legislatures have endorsed the concept of merit increases in salary for exceptional teachers. All of these methods attempt, sometimes successfully, to recognize and reward the contributions of the teacher. My objective is not to belittle these efforts but to suggest they are neither numerous nor frequent enough to satisfy the needs of the large number of teachers.

The statistics presented above amply demonstrate that a teaching career is becoming less and less attractive. Even more of a problem is the attitude of people already in the teaching field. A survey conducted by the National Education Association shows that in response to the question "If you could start over would you still become a teacher?", only 2.8% responded "certainly would not" and 7.9% responded "probably would not" in 1960, but this increased to 12% and 24% in 1980 (4). A large number of younger teachers are leaving the field; and although a higher paying position is often cited as the reason, these same individuals were aware of the salary discrepancy before they entered the field. It would appear, therefore, that leaving the field and dissatisfaction with teaching must involve factors other than money. Prime candidates are inadequate recognition from others and little evidence of a job well done. These factors also lead to burn-out, which appears to be an occupational hazard of many professions including teaching. It is an interesting fact that symptoms of burn-out show up more frequently in our teaching faculty than in our teaching-research faculty. Researchers receive rewards and recognition as they collect "new" information, publish papers, and obtain grants. The majority of the teaching faculty lack similar recognition and rewards. It is important then to develop ways for the teacher to receive positive reinforcement for a job well done with the frequency each teacher needs. At first glance this might appear to be not

only too difficult but even unnecessary. However, we will offer suggestions to show that it is neither. Four aspects of the problem must be considered before solutions are discussed. First, students are the only source of recognition for teaching who can provide it with adequate frequency. Second, it is the unusual student who takes the time or effort, or for that matter even believes it is important or desirable, to compliment an instructor when the instructor has done a good job. Third, the individual faculty member knows best what he or she is trying to accomplish and therefore where recognition is desired. Fourth, it is largely the responsibility of the individual faculty member to provide the students with an opportunity to recognize and appreciate her or his efforts.

The Life Sciences Department at Indiana State University has a requirement that all courses and instructors be evaluated by the students each semester. The evaluation form is separated into three parts: Student Background, Course Rating, and Instructor's Rating. The response for Instructor's rating is based on a scale of 1 to 9 with 9 the highest (9). The student is also provided with a general comment sheet that permits one to make additional comments not covered in the evaluation form or to expand on any aspect of the evaluation items. Included in items covered on Instructor's Rating are: quality of course organization, instructor's preparation for class, quality of examinations or quizzes, clarity of assignments, type of and amount of class participation, use of visual aids, attitude toward students, availability of instructor for consultation outside the classroom, apparent enthusiasm of instructor, ability to stimulate intellectual curiosity, instructor's command of the subject matter, and the last item, effectiveness of the instructor as compared to all other instructors (high school and college). The results from these evaluations have been useful and, it might be added, ego-shattering at times. Students tend to be generous with their evaluation and comments. They appear to be most disturbed when they sense that an instructor is not sympathetic to the student or doesn't seem to care about teaching. They frequently question whether their input will have any effect on the teaching effort of the instructor. This points out a problem with an end-of-the-semester evaluation; although an instructor can utilize it to improve in the future, the students from that class do not benefit directly from the evaluation. Also there is a tendency for instructors to forget last semester's or last year's evaluation when presenting the present semester's course. Therefore, we would suggest that certain of the questions in this evaluation form and some additional ones be presented to the students at various times during the semester. Responses at the end of the semester such as "I had no idea how my grade was to be determined in this class", "Assignments were given hurriedly and usually just prior to the assigned completion", "The lab is very hard to interpret because of not having the lab handouts ahead of time to enable us to review for the lab in advance", "Doesn't take control of the class", "He goes too fast", and "Dr. X's attitude toward students is sometimes intimidating, therefore making some students feel discouraged and lose interest in the subject" come too late to be remedied. This is unfortunate because these complaints could be corrected rather readily.

A solution is to 1) determine from the students early in the semester how you are coming across as an instructor and 2) make sure they understand what is required of them and how they will be evaluated. Several questions could be asked beneficially after the first lecture or first couple of lectures: Do you understand the grading system? Does it seem fair, and if not, how would you suggest it be changed to make it more nearly fair? Are the objectives of the class clear? Can you read my notes on the board; if not, what would help? (You will get some wise answers such as "Learn to write" or "Get a secretary to do your writing for you", but most of the students are interested in helping you to help them.) Are you clear as to my office hours? Do you

have difficulty making these hours, and if so, how could they be arranged so you will be able to meet with me to discuss any questions or problems you have with the course material? How can I best present the material in order for it to be more interesting to you and easier for you to understand? Some of these questions may seem unnecessary; however, we can assure you, from reading a large number of evaluation forms, that students would benefit from such a questionnaire early in the semester. These questions do not have to be answered during the class period, but can be given to the students at the end of the period to be returned at the next class meeting. One of the complaints that instructors make about evaluation forms is that they take time away from the main objective of the course, learning biology. Yet the point must be made that an inadequate learning environment takes away from the learning of biology.

Following the early questionnaire, the regular evaluation form should be given 1/3 to 1/2 way through the semester. This accomplishes two important things. It permits the teacher to adjust the method of presentation in order to benefit the students; and it permits him to compare the results with those obtained at the end of the semester to determine the amount of improvement. It is desirable to involve the students in the methods of presenting material. Although one method of presentation may work well for an individual instructor or for a specific unit of a course, it may not be as successful for another instructor or unit. A suggestion is to present two rather similar units, i.e., Respiration and Photosynthesis, by two different methods and then provide the students with the opportunity to evaluate and comment on which method they prefer. This permits the students to play an important role in the method of presentation, but not in what material is presented.

Another technique of teaching that deserves special mention is the pre-test. Teachers utilize SAT scores from high school students and GRE scores from undergraduate college students to provide them with an evaluation of what the student has learned or is capable of learning, but most instructors do not utilize a similar method with their own courses. The tests commonly given to evaluate students often provide a type of negative feedback, because they indicate what and how much the student has not learned. A positive feedback would indicate how much a student has learned. A pre-test permits the teacher to determine the gain that has been made by each student during the course. A 60% on the final exam may show that the student learned a significant amount of biology, rather than indicate the student almost failed the instructor's teaching effort. The results of the pre-test may also suggest where more effort should be directed to produce better results.

A spin-off of improving one's teaching methods and involving the students in the process could be recognition beyond the classroom. As mentioned earlier in this article, many schools, educational societies, and alumni groups do present awards for teaching. At Indiana State there are monthly and annual awards, but most students are unaware of these awards. If they are aware, they do not know the method of faculty selection. Consequently they do not nominate faculty. Although we have received teacher evaluation forms in which most of the students rated an instructor a 9 in all categories, it has not occurred to these students to recommend this teacher for an award. It is appropriate for chairpersons or division heads to inform students of the teaching awards available and the procedure for recommending a particular instructor for the award. Some chairpersons place notices on the bulletin boards notifying the students of the awards and nomination procedures. Other chairpersons include this information with the explanation of course and faculty evaluations at the beginning of the semester.

At this point you may be saying "I thought the authors were going to tell us how to receive more recognition and reward for our teaching; instead they have both insinuated we may need to change our teaching methods and suggested we make sure the students are aware that we are trying to help them learn." And certainly you are correct, for we firmly believe that the recognition teachers desire must come from their students. Doing a better job of teaching and permitting the students to know this and to tell us so is the reward that we all need. The professional entertainer often holds up an applause sign encouraging the audience to show their appreciation. Perhaps this might be appropriate for the teacher who has just completed an excellent demonstration, but it isn't appropriate for most teaching efforts. On the other hand, it is suitable to permit the students to evaluate our work and to give them the opportunity to recognize our efforts. Following these simple suggestions will not turn all instructors into master teachers; but it should permit us to provide the students with a better learning experience and to obtain more enjoyment from our teaching efforts. It will also ensure us that at the end of the semester the evaluation form will not read, "The instructor does not care about the student and doesn't seem to be interested in teaching."

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Council on Undergraduate Research - Colgate Conference
"The Education of Scientists: The Role of Funding
of Research at Undergraduate Institutions"

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General Impressions:

The central focus of the CUR-Colgate Conference, held at Colgate University July 23-July 25, was the support of science at undergraduate institutions. Participants included representative scientists and development officers from both public and private undergraduate and small graduate institutions; program directors from the National Institutes of Health (NIH), the National Science Foundation (NSF), the Petroleum Research Foundation (PRF), and the Research Corporation; and directors of educational grants from private industries (see attached program). Central to all of the discussions was the report for the Conference on "The Future of Science at Liberal Arts Colleges" which was held at Oberlin College, June 9 and 10. Each of us attending the CUR conference received a copy of this report. That report emphasized the significant role played by undergraduate liberal arts colleges in supplying the country with Ph.D.'s. Much of the data for that report came from a study done by Carol H. Fuller for the Great Lakes Colleges Association: "An Analysis of Leading Undergraduate Sources of Ph.D.'s, adjusted for institutional size. The Ph.D. productivity of the top 50 institutions in the life sciences is attached to this report. In this brief report, I will outline the fundamental issues of the CUR conference.

BEST SCIENCE -

All of the potential donors of research funds who were present at this meeting are interested in supporting only "best science" programs. While individuals at any school are eligible for funding, they must be able to demonstrate to NIH and NSF that their research has scientific merit and that they are competent scientists who can complete the proposed research on time. The criteria for funding by Research Corporation are less stringent, but still only the "best science" proposals are funded.

For industry, best science also means that the research serves the perceived needs of the industry, either through the development of basic knowledge or future employees. Support for departmental and inter-departmental programs also are judged by "best science" criteria. Industries are interested in funding those institutions who have successfully placed students into graduate programs. DuPont and Shell both keep lists of these institutions - if you aren't on the list, you won't get funded. Clearly, the Oberlin Report caught their attention and was mentioned by one industrial representative as a valuable identifier.

At the same time, such a "best science" policy effectively excludes many departments and individuals from obtaining outside support to develop research programs. With internal funds, they will have to demonstrate their competence by establishing either a publication record or a significant cohort of successful doctoral students.

"Best Science" also may strain both the college budget and the faculty in other sectors of the college. Robert Edwards, President of Carleton College, believes that colleges will have to support the research of young investigators, provide matching funds for equipment, provide funds to maintain equipment, and provide salaries to attract the best scientists. Industry, NSF and Research Corporation are very interested in increasing the impact of their dollars by requiring a 50% match of their funds from the institution or other sources. Note, however, that matching funds need not be dollars to support the research - provisions of space, time and students may be utilized. For the undergraduate colleges, research by faculty and students is going to be expensive and while there are funds to support this research, colleges are going to have to provide significant internal support.

LONG TERM DEPARTMENTAL AND COLLEGE POLICIES -

R. Scott Pyron of Research Corporation addressed the impact of institutional policies on the future of undergraduate science. He believes that institutions must begin to assess their utilization of research dollars. Long term plans should be a part of this process. When equipment is to be purchased, the institutional users of that equipment need to be identified. In some communities cooperative agreements can be worked out between institutions and/or industries to increase use and thus decrease individual cost through cost-sharing. Department chairmen must be able to demonstrate convincingly that a "state of the art" instrument is really necessary. Sources of older equipment should be investigated and considered.

For Scott, and I assume Research Corporation, people are the most important asset of an institution. He is concerned that institutions do not spend sufficient time developing faculty. Also, the tenure decision for the institution is very important. At small institutions, the evaluation process is complicated because the faculty are close friends. Nevertheless, administrators must view each tenure decision as a "window of opportunity". Through tenure, the institution is making a decision that will affect the future of that institution for 30 years. The tenure process must be tough. At the same time, we must have a consistent policy that is honest with faculty and must be explicit in its goals for faculty. New people must know what is expected of them. Evaluations should be ongoing, consistent and plainly spoken.

We should be expecting more of our faculty. Examine the budget process - through this process you can force faculty to think into the future and to carefully assess the needs of the department and the institution. When you provide funds, demand accountability - "what did you do with the funds last year and why should we give them to you this year should be a standard question". Faculty should be encouraged to increase the impact of college funds by seeking matches.

Administrators should encourage faculty to seek outside evaluation through publication and requests for funds. There is personal risk involved in going outside the institution, but denials of requests are positive statements not negative. To be denied a request for funds indicates that you are seeking funds and if you continue, eventually you will refine the request and obtain the funds. Outside agencies then see the institution and see that it is supporting its faculty. Of course, the institution has an important role to play because it is to its advantage to help faculty obtain funding by providing professional support.

Colleges can use the overhead obtained from grants creatively to support programs in departments. This money is an add-on to the grant and does not detract from the grant.

PETROLEUM RESEARCH FUND -

Joe Rogers, formerly of Earlham and Great Lakes Colleges Association (GLCA), now administrates this fund. This fund is primarily for chemists. Like Research Corp., The Petroleum Research Fund has a grant program that focuses on undergraduate research. Joe's primary message again was to urge institutions to apply for funds and to seek innovative ways of obtaining funds - cost sharing, discounted equipment, combination of proposals among several sources. He believes that the funding process is very dynamic and that colleges must remember that funds will not increase unless the demand increases. With the "best science" principle operating this means that many funding groups are interested in funding between 25% and 50% of the requests - the better the requests and the more numerous the requests the greater the opportunity to increase support budgets. Budgets will not be increased if there are not requests.

RESEARCH CORPORATION -

The Research Corporation focuses a significant portion of their funds to faculty at private 4 year institutions. They too are interested in "best science" and pay attention to the various surveys that document excellence and productivity. While all of their regional representatives expressed their continued support for these programs, they are concerned that while the number of grants is constant, the numbers of requests have decreased. The message was clear - faculty working in areas funded by Research Corporation should apply for funds. These areas include chemistry, physics and biology. Projects in psychology are funded if they have a strong biological component. Projects in mathematics are not funded.

NATIONAL INSTITUTES OF HEALTH -

Like Research Corp. and the Petroleum Research Fund, NIH has set up a focused program - Academic Research Enhancement Awards (AREA). 5 million dollars has been set aside to support these programs. The evaluation of these programs is different from others and includes in the panel an evaluator from a peer group institution. The evaluation is two tiered like other NIH projects. Bill Raub is the Deputy Director of these programs and is willing to help organize on-site workshops for several institutions. These will be continued next year and while the fund remains constant, they are hoping for more applications. At most of the small institutions present, NIH was providing the majority of the funds to biology programs, not NSF. The plan for next year is to move the cycle forward so that announcements can be made in May. This means that potential applicants should begin the process now.

NATIONAL SCIENCE FOUNDATION -

For undergraduate institutions there are three focused sources of funds - RUI, ROA and CSIP. RUI is a set aside program in which an amount of funds is set aside as a target. Proposals proceed through the normal channels at NSF. To obtain access to these funds it is very important to initiate a conversation with the program officer of the section to which you are applying. Last year, the RUI targets were achieved and while not all programs are fully participating in this project, Danek, the director, believes that the level of cooperation is increasing. To apply for RUI funds, you must learn the program conventions - average size of grant, duration, eligibility, size, commonality. In the future, cost sharing will be required.

There is also an RUI equipment fund, but a central message here was that opportunities for our institutions are greater through CSIP, particularly in the biological sciences.

The ROA program which provides funds for faculty at undergraduate institutes through add-ons to existing NSF grants is an underutilized program. While the funds are limited, it is a good way to begin to establish a track record.

CSIP is a program established to support equipment purchase by the NSF group of "predominately undergraduate institutions". Note that the University of Alaska is considered to be a predominately undergraduate institution. The major focus of these grants is the support of undergraduate education, however the wording of the objectives should enable us to apply - "projects to improve undergraduate honors programs, student research, and independent study." They are interested in a greater good being served by the addition of the equipment. Hopefully standards will be set that other institutions can emulate.

INDUSTRIAL RESEARCH -

Representatives from E.I. du Pont de Nemours & Co., Merck, Sharpe and Dohme, Dow Chemical, Hewlett-Packard Company and the Shell Companies addressed the conference. Of these, only HP and Shell provide tangible support for undergraduate research.

du Pont does have a grant to "best science" departments which is an annual grant of about \$7000 given to feeder schools identified by four criteria: PhD productivity, admission selectivity, reputation (cited the Oberlin study) as determined by publications, research programs, faculty standing. They are particularly interested in "feeder schools" who are significant sources of their employees.

Dow Chemical has a small program as well that focuses on "best science". Like du Pont, Dow wants to give money and obtain a return either in new knowledge or in employees. Their criteria include:

1. Number of hires from institution in the last five years.
2. Performance of new hires.
3. High levels of leadership in company.
4. Rating and Reputation of the institution.
5. Number of graduates at DOW.

John Billingsley, the Director of Personnel Resources described this process as "enlightened self-interest." On the other hand, DOW did support a program at predominately women colleges. This proposal was initiated by a request from those

Last year 14 schools received support. The plan is to increase this contribution to 116 schools.

Strong departments in the Physical Sciences
Fraction receiving advanced degrees
Institutional competitiveness
Proximity of Shell centers of employment

allocated on the following criteria:
institutions and amount to 10,000 per year to a department. The grants are
They will support scholarships, assists and grants. The grants are for private
contributed in 1984 went to undergraduate institutions. Their match is also 2:1.
support is limited to selected undergraduate institutions - 27% of 16,741,937
Shell Foundation is another large supporter of undergraduate science but again their
support is limited to selected undergraduate institutions - 27% of 16,741,937
HP also has a strong program of matching cash or equipment contributions by
employees. The match is a 2 to 1 match in both instances. On equipment the same is
true. An employee can donate equipment and the company will match the equipment in
a 2:1 ratio. HP is clearly a leader and has held workshops for other companies
concerning donations to colleges.

Emery Rogers
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The HP program is primarily an equipment supply program. Unlike the other
companies, HP does not use "self-interest" criteria and will not use these funds to
support research that directly benefits the company. For next year, their target
is 60 million. A central feature of their program is an in-house "champion" of the
proposal. The "champion" is usually but not necessarily an alumnus of the
institution. At this company you begin with the Champion and then proceed to seek
funds. The proposal may originate from within the company or come from outside the
company. Proposals are short - an example cited was 2 pages. The proposal should
include a description of the purpose, the equipment being requested, uses of the
equipment and the names of "Champions". The proposals should be sent to

colleges and has lasted for five years. John Billingsley did encourage groups of
institutions to present proposals to DOW and indicated that these would receive far
more attention than individual proposals.

	Empirical Science Ph.D.'s		Life Science Ph.D.'s		Social Science Ph.D.'s	
	Total	Ratio	Total	Ratio	Total	Ratio
Massachusetts Institute of Technology	4481	17.1	375	1.4	305	1.2
New Mexico Institute of Mining	87	5.5	23	1.4	1	0.1
Bates (ME)	99	1.7	77	1.3	70	1.2
C. of Charleston (SC)	37	1.4	34	1.3	7	0.3
Rice (TX)	886	7.3	162	1.3	144	1.2
Saint Mary's (MN)	93	2.0	58	1.3	46	1.0
Wesleyan (CT)	187	2.6	91	1.3	233	3.3
Wooster (OH)	247	3.0	111	1.3	159	1.9
UC-Berkeley (CA)	2971	2.2	1596	1.2	1927	1.4
Cornell (IA)	76	1.6	55	1.2	44	1.0
Goshen (IN)	48	0.8	73	1.2	27	0.4
Hope (MI)	152	1.9	85	1.2	77	1.0
Kenyon (OH)	81	1.8	51	1.2	70	1.8
Knox (IL)	125	2.1	76	1.2	109	1.8
Mount Holyoke (MA)	85	0.8	124	1.2	156	1.5
North Central (IL)	31	0.8	80	1.2	47	1.0
Oklahoma State	532	0.9	677	1.2	239	0.4
Radcliffe (MA)	69	0.8	105	1.2	295	3.3
Western Maryland	39	0.7	82	1.2	35	0.7
Group	21375	3.2	11107	1.9	11326	1.8

All institutions were ranked on the productivity ratio, and those with an overall ratio greater than 3.49 were identified (a total of 277 institutions). Complete data for baccalaureates awarded, 1946-1976, were compiled for those institutions, and for the top 50 in total numbers of Ph.D.'s awarded. The lists of 50 leading institutions by productivity ratio for Ph.D.'s in various fields were constructed from these data.

The total Ph.D.'s numbers were obtained directly from data supplied by the National Academy of Sciences. The productivity ratio was computed by dividing the average number of Ph.D.'s produced (1951-1980) by the average number of bachelor's degrees conferred (1946-1976). The higher the resulting ratio, the more productive the institution.

Average numbers per year were computed to make the Ph.D. figures comparable for institutions of different ages. The average baccalaureate-Ph.D. lapse is ten years.* Those receiving their baccalaureate degrees in 1971 or later would not, on average, have completed a Ph.D. by 1980. Thus, institutions awarding their first baccalaureate in 1971 or later were not included in this study. For those institutions awarding their first baccalaureate after 1941, the number of years over which the Ph.D. totals were averaged was computed by subtracting the date of first baccalaureate from 1971. For institutions which awarded their first baccalaureate degree prior to 1942, the number of years used for the average was 30.

An average was also computed for each institution for the number of bachelor's degrees conferred to take into account both the varying dates of first-baccalaureate and, in a few cases, missing data. The number of years used for this average was the actual number of years for which data were

Science Ph.D. Productivity

Ph.D.'s Conferred, 1951-1980/Bachelor's Degrees Conferred, 1946-1978

Top 50 Institutions: Life Science

Institution ^a	Empirical Science Ph.D.'s		Life Science Ph.D.'s		Social Science Ph.D.'s	
	Total	Ratio	Total	Ratio	Total	Ratio
UC-San Diego (CA)	143	5.8	134	5.2	48	1.9
UC-Irvine (CA)	79	3.0	123	4.8	51	1.9
Philadelphia C. of Pharmacy (PA)	69	1.8	182	4.3	1	0.0
Reed (OR)	334	8.7	154	4.0	278	7.3
California Institute of Technology	1531	33.7	173	3.8	77	1.7
Delaware Valley C. of Science & Agriculture (PA)	8	0.4	83	3.8	2	0.1
Swarthmore (PA)	351	5.2	209	3.1	415	8.1
Harvey Mudd (CA)	217	34.4	18	2.9	12	1.9
Wabash (IN)	134	3.5	112	2.9	78	2.0
UC-Riverside (CA)	263	3.5	211	2.8	215	2.8
Haverford (PA)	178	4.9	94	2.8	143	3.9
New College of the U. of South Florida	18	4.1	10	2.8	22	5.6
Pomona (CA)	288	3.7	190	2.4	235	3.0
UC-Santa Cruz (CA)	42	1.4	68	2.3	82	2.8
Earlham (IN)	102	2.0	124	2.4	82	1.8
Cornell (NY)	1846	3.1	1372	2.3	995	1.7
Brandeis (MA)	115	1.7	133	2.0	330	5.0
Chicago (IL)	1011	4.1	510	2.1	1071	4.4
Kalamazoo (MI)	144	3.1	91	2.0	72	1.8
Blackburn (IL)	20	1.3	31	2.0	20	1.3
Oberlin (OH)	459	3.5	251	1.9	637	4.9
Carleton (MN)	287	4.0	139	1.9	205	2.8
Amherst (MA)	284	3.2	150	1.8	228	2.8
Bryn Mawr (PA)	71	1.4	87	1.8	118	2.4
Juniata (PA)	110	2.2	92	1.8	36	0.7
Berea (KY)	98	1.4	120	1.7	79	1.1
Johns Hopkins (MD)	852	3.7	292	1.7	263	1.5
Utah State	268	0.8	538	1.7	218	0.7
Eckerd (FL)	19	1.8	17	1.8	41	3.9
Grinnell (IA)	153	2.5	99	1.6	198	3.2
Warren Wilson (NC)	2	1.8	2	1.8	2	1.8
Antioch (OH)	171	2.2	121	1.5	328	4.1
Hiram (OH)	59	1.2	70	1.5	40	0.8
Iowa State	1147	2.0	889	1.5	388	0.8
Muhlenberg (PA)	108	1.5	108	1.5	44	0.8
SUNY: Stony Brook (NY)	227	2.4	149	1.5	221	2.3
Draw (NJ)	71	1.3	80	1.4	80	1.4