PROCEEDINGS

of the

Indiana Academy of Science

Founded December 29, 1885

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Volume 86
1976

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BENJAMIN MOULTON, *Editor*
Indiana State University
Terre Haute, Indiana

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Spring Meeting
April 23, 1976
NEW HARMONY INN
New Harmony, Indiana

Fall Meeting
November 4, 1976
VALPARAISO UNIVERSITY, Valparaiso, Indiana

Published at Indianapolis, Indiana
1977

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SPRING MEETING

MINUTES OF THE EXECUTIVE COMMITTEE MEETING

April 23, 1976

The meeting was called to order by President Donald J. Cook at 5:15 p.m. in the Game Room of the Entry House, New Harmony Inn, New Harmony, Indiana. The minutes of the Executive Committee and of the General Session of the Fall 1975 meeting were approved.

TREASURER'S REPORT

Treasurer Stanley L. Burden presented a financial report for the period January 1 through April 19, 1976, a summary of which follows:

	Academy Accounts	Administered Accounts	Total
Balance: January 1, 1976	$6,666.36	$15,171.59	$21,837.95
1976 Income	4,628.87	2,978.00	7,606.87
1976 Expenditures	4,050.67	2,156.53	6,207.20
Balance: April 19, 1976	$7,244.56	$15,993.06	$23,237.62

The Treasurer also reported that approximately one-half of the 1976 membership dues have been received. He also presented a numerical analysis of the current membership categories. The Treasurer's report was accepted.

STANDING COMMITTEE REPORTS

Academy Foundation Committee: William A. Daily, Chairman, reported that the John S. Wright Invested Income Account held $7,000 as of March 31, 1976. He also reported that the market value of the Foundation Account was $20,432 and that of the John S. Wright Fund was $565,070, up 20.3 and 11.9%, respectively, since September 30, 1975.

Research Grants Committee: Kenneth E. Nichols, Chairman, reported that $2817 has been granted for nine individual research projects this year.

Representative to Association of Academies of Science (AAS): Willis H. Johnson presented a report including statements of Principles and Objectives of Affiliation with AAAS and a review of the AAAS-AAS Workshop held at the Boston Annual Meeting in response to a request initiated by the Academy Budget Committee at its December meeting. He also summarized the Section X meeting and presented suggestions concerning selection of the Academy representative to AAS and Section X.

Youth Activities Committee: Walter A. Cory reported that 22 finalists in the Indiana Science Talent Search were introduced at Indianapolis on March 12; the eleven winners were awarded Scientific

American subscriptions. He also reported that, of the top 300 entrants in the Westinghouse Science Talent Search, ten were from Indiana.

Newsletter: Walter A. Cory, Director of Public Relations, reported that Newsletter 14 was sent to over 1200 members. He presented the results of the questionnaire on proposed newsletter contents and noted that a second such request will appear in Newsletter 15.

Membership Committee: Clarence F. Dineen, Chairman, presented brief comments on suggestions to maintain and increase Academy membership.

Science and Society Committee: Donald J. Cook, reporting for Chairman Otto Behrens, stated that the Academy provided $380 in support of the report "Indiana Natural Gas: Accommodation to Reality." Two further requests for reports have been received from state agencies.

Biological Survey Committee: Jack R. Munsee, Chairman, stated the formal report of the committee will appear in Volume 85 of *Proceedings* and that the committee is preparing a history of the Biological Survey Committee.

SPECIAL COMMITTEE REPORTS

Emeritus Member Selection Committee: Robert H. Cooper, Chairman, presented the following persons for Emeritus Membership (initial membership year shown in parentheses):

FLORA A. HAAS, Crawfordsville, Indiana (1927)
MILDRED CAMPBELL, Indianapolis, Indiana (1931)
ESTHER K. JORDAN, Kerrville, Texas (1931)
HUBERT M. JAMES, West Lafayette, Indiana (1936)
KENNETH N. CAMPBELL, Indianapolis, Indiana (1938)
ERNEST H. GERKIN, South Bend, Indiana (1951)

Motion: That the persons presented be elected to Emeritus Membership. Seconded and carried.

Preservation of Natural Areas Committee: William B. Barnes, Chairman, reported that three state nature preserves have been dedicated by action of the Natural Resources Commission, bringing the total to 40 preserves containing 6,384 acres. Newly dedicated areas are the Olin Lake, Donaldson Cave, and Virginia Pine-Chestnut Oak Nature Preserves. The dedication of the Dunes Nature Preserve and the Indiana Dunes State Park as National Natural Landmarks in June 1976 was announced.

Representative to Natural Resources Commission: Damian V. Schmelz reported on Commission meetings to examine legislation on flood control and related topics.

Motion: That all Standing and Special Committee reports be accepted. Seconded and carried.

NEW BUSINESS

H. E. McReynolds, President of the Indiana Chapter of the American Fisheries Society, discussed a preliminary research proposal dealing with endangered species. James Gammon supported the proposal by outlining activities in other states with regard to Endangered Species Programs. After considerable discussion, the Executive Committee supported the suggestion that the proposal be formally prepared and submitted to the Research Committee for consideration.

The question of the number and type of copies of *Proceedings* to be published was discussed at length.

Motion: That the order be for 600 paper-bound copies of *Proceedings* for exchange and no fewer than 800 hard-bound copies for members and others entitled to receive copies. Seconded.

Amendment: That the number of hard-bound copies to be published be changed to 700. Seconded and carried.

The amended motion carried.

The meeting was adjourned at 7:40 p.m.

Respectfully submitted,
ROBERT E. VAN ATTA, Secretary

SPRING MEETING

MINUTES OF THE GENERAL SESSION

April 23, 1976

The meeting was called to order by President Donald J. Cook at 10:15 PM in the Entry House of New Harmony Inn, New Harmony, Indiana.

The Secretary of the Academy presented a brief summary of committee reports received by the Executive Committee on April 23, 1976.

President Cook made several announcements concerning the Saturday morning walking tour of New Harmony, the ecology tour of Hovey Lake and Gray's Woods, and the ornithology field trip. He also introduced Program Chairman Gayton C. Marks and the tour and field trip guides.

President Cook recognized John Favinger, Bicentennial Committee Chairman, who introduced the speaker of the evening, Dr. B. Elwood Montgomery, Professor Emeritus of Entomology, Purdue University. Dr. Montgomery presented an extremely informative illustrated lecture entitled "The Life and Times of Thomas Say." The lecture detailed important events in the life of Say, called the Father of American Zoology, and included much of the historical background of New Harmony.

Following Dr. Montgomery's lecture, a short motion picture on New Harmony was shown.

President Cook announced that there would be a brief meeting of the Division Chairmen with the Secretary immediately following the business meeting.

The meeting was adjourned at 11:45 PM.

Respectfully Submitted,
ROBERT E. VAN ATTA, Secretary

FALL MEETING

MINUTES OF THE EXECUTIVE COMMITTEE MEETING

November 4, 1976

The meeting was called to order by President Donald J. Cook at 7:15 p.m. in Room 224 of Neils Science Center at Valparaiso University, Valparaiso, Indiana. The minutes of the Executive Committee and of the General Session of the Spring 1976 meeting were approved.

TREASURER'S REPORT

Treasurer Stanley L. Burden presented a financial report for the period January 1, 1976 through October 26, 1976, summarized as follows:

	Academy Accounts	Administered Accounts	Total
Balance: January 1, 1976	$6,666.36	$15,171.59	$21,837.95
1976 Income	8,608.79	6,181.60	14,790.39
1976 Expenditures	5,520.47	5,175.72	10,696.19
Balance: October 26, 1976	$9,754.68	$16,177.47	$25,932.15

The Treasurer's report also indicated that there are 963 paid-up members, including 265 senior members, and 163 unpaid members on file. Applications were received from 80 new members in 1976, while 130 members were dropped for nonpayment of dues. The Treasurer's report was approved.

ELECTED COMMITTEE REPORTS

Academy Foundation Committee. William A. Daily, Chairman, presented the following summary report:

I. *Foundation Account*	
Balance as of September 30, 1975	$ 853.59
Income as of September 30, 1976	1,006.35
Disbursements to Academy	300.00
Transferred to Principal	1,000.00
Cash Balance	559.94
II. *John S. Wright Fund*	
Balance as of September 30, 1975	$ 12,000.00
Income as of September 30, 1976	16,763.57
Cash Balances as of September 30, 1976	3,972.18
Disbursements from Invested Income Account:	
Research Grants	4,317.00
Publication of Proceedings, Volume 84	11,000.00
Indiana National Bank Fee	2,494.00
Cash Balance	924.75
Balance in Invested Income Account	14,000.00
III. *Market Value of All Securities*	$580,102.00

Bonding Committee. No report.

Research Grants Committee. Kenneth E. Nichols, Chairman, reported that 3 research grants totaling $2,060 have been awarded in addition to the 9 proposals totaling $2,817 which were approved at the spring meeting.

The reports of elected committees were approved.

PRESIDENTIAL APPOINTIVE COMMITTEES

Science and Society Committee. Otto K. Behrens, Chairman, briefly reviewed the current activities of the committee. He then introduced Ralph A. Llewellyn, chairman of the *ad hoc* panel appointed to prepare the First Annual Report to the Academy. Mr. Llewellyn presented the 31-page report entitled "Indiana Energy 1977—A Status Report with Suggestions for Policy Action" and briefly summarized the document, which is the result of discussions among the panelists, their review of pertinent literature, and their collective scientific judgments. The report includes discussion on electricity, solar energy, natural and liquefied petroleum gases, crude oil, and coal; it also includes suggestions for policy considerations by the State of Indiana.

In approving this report, a truly significant development in the activities of the Indiana Academy of Science, the Executive Committee reaffirmed the recommendations of the Science and Society Committee with regard to the distribution and dissemination of this and future reports of the committee (see Minutes of the Executive Committee Meeting, October 30, 1975).

Representative to AAAS and AAS. No report.

Auditing Committee. No report.

Youth Activities Committee. Walter A. Cory, reporting for Chairman Donald R. Winslow, presented a status report on the activities of the three youth activity programs sponsored by the Academy: the Science Fair Program, the Science Talent Search, and the Indiana Junior Academy of Science.

Eleven Regional Science Fairs were held last year; 22 state finalists and their sponsoring teachers made the trip to Denver to participate in the International Science and Engineering Fair; over 200 organizations contributed financial support for this trip. The 22 student representatives received a total of 38 awards—a record for any state delegation in any year!

The 29th Annual Indiana Science Talent Search produced 57 participants, 22 of which were chosen to appear in the honors program; 8 of these won national honors in the Westinghouse National Science Talent Search and one, Stephen J. Budak of Marquette High School, Michigan City, was declared a national winner (one of the top 40 in the country). Eleven of the 22 state finalists were designated as winners.

Robert H. Rivers, Purdue University, Hammond, has succeeded Lawrence Poorman as Director of the Junior Academy, which meets in Christ College of Valparaiso University this year.

The Youth Activities Committee strongly supports the request to the Academy, to be presented subsequently, for support of annual scholarships.

Library Committee. Donald J. Cook, presenting the report of Lois Burton, Chairwoman, reported that Volume 85 of *Proceedings* will be in the mail very soon, and that exchange arrangements have been made with five additional organizations in Argentina, Brazil, Germany, and Spain. Seventy-nine new journals, received in exchange, have been added to the collection. The Academy library's bibliographic records is now a part of the Ohio College Library Center (OCLC) computer-based network for furnishing on-line union catalog information to more than 700 libraries. The building expansion program of the State Library provides for relocation of the Academy library and greatly increases space available to it.

Publications Committee. Marion Jackson, Chairman, reported that 700 bound copies are included in the Volume 85 printing run. He also reported that *Natural Features of Indiana* has been reprinted by the University of Notre Dame Press, from which it may be ordered. Manuscripts for Monograph IV are being considered.

Program Committee. Gayton Marks, Chairman, made several announcements pertinent to operations during the current meeting.

Newsletter and Public Relations. Walter A. Cory, Director, announced that the next edition of the Newsletter would be completed in mid-November. He requested that information on address changes be passed on to the Secretary, the Treasurer, or the Newsletter editor. He also announced that a questionnaire on Newsletter and other Academy functions would be available at the registration desk during the meeting.

Membership Committee. Clarence F. Dineen, Chairman, made several comments on the annual gain and loss of members and suggested that the committee analyze membership trends during the coming year.

Fellows Committee. Benjamin Moulton, editor of *Proceedings*, presented the first copy of Volume 85 to President Cook. As Chairman of the Fellows Committee, Mr. Moulton made the following motion:

Motion: That the following persons, recommended by the Fellows Committee, be elected as Fellows of the Academy:

Torsten K. E. Alvager	Marion Jackson
Thomas A. Cole	Ralph A. Llewellyn
Norville M. Downie	Lawrence E. Poorman
Harry M. Galloway	Carl C. Sartain
M. E. Hodes	Robert E. Van Atta
Malcom E. Hults	John O. Whitaker, Jr.

Seconded and *carried.*

Resolutions Committee. No report.

Invitations Committee. Philip A. St. John, Chairman, reported that the sites for the next two fall Academy meetings are: 1977—Indiana

University-Purdue University-Indianapolis, 1978—Anderson College. An invitation was extended to the Academy to meet at Manchester College in 1979. The Academy will entertain invitations for 1980 and 1981.

Necrologist. No report.

Parliamentarian. No report.

The reports of presidential appointive committees were approved.

SPECIAL COMMITTEE REPORTS

Biological Survey Committee. Jack R. Munsee, Chairman, reported that the committee report for Volume 85 of *Proceedings* includes 55 titles representing 14 biotic groups for the period 1974-75. The committee is preparing a historical review of the committee from 1891 through 1976. Theodore Crovello presented brief reports of the two sub-committees: Flora Indiana and Endangered Plant Species.

Emeritus Member Selection Committee. Robert H. Cooper, Chairman, reported that no applications for Emeritus status were received since the spring meeting.

Preservation of Natural Areas Committee. William B. Barnes, Chairman, reported that one more nature preserve—Scout Mountain Nature Preserve, a 40-acre tract located in Harrison County—has been dedicated by the Natural Resources Commission. The total is now 41 nature preserves containing 6,430 acres. Two other areas are in various stages of acquisition or dedication.

Speaker-of-the-Year Committee. Damian V. Schmelz, reporting for Frank A. Guthrie, Chairman, announced that Dr. Derek A. Davenport, Professor of Chemistry at Purdue University, had been selected as Speaker-of-the-Year and and would deliver the lecture at the General Session of the Academy.

Representative on Natural Resources Commission. Damian V. Schmelz reported on the Commission's activities for the year, including the following: The 1977-79 Budget request for the Department of Natural Resources is the largest ever submitted; the Indiana State Park System has shown a 14% attendance increase during the past year compared with a national average of 3.2%; monthly meetings of the Commission involve discussion and decision on about 75 individual items dealing with the use of the State's natural resources: land, water, minerals, forests, wildlife, and State properties. He also briefly reviewed legislative recommendations of the Commission.

The reports of the special committees were approved.

The Nominations Committee, John B. Patton, Chairman, submitted the following slate of nominees for presentation before the General Session of the Academy:

President: ..... CLARENCE F. DINEEN—1977
President-Elect: ..... JERRY J. NISBET—1977
Director of Public Relations: .... WALTER A. CORY, JR.—1977-78

Academy Foundation: ..... WILLIAM A. DAILY—1977-78
Bonding Committee: ..... ROBERT M. BROOKER—1977
EARL A. HOLMES—1977
Research Grants Committee: .... MARK RESHKIN—1977-81

The slate of nominees was approved by the Executive Committee.

President Cook acknowledged the efforts of the outgoing Chairman of the Research Grants Committee, Kenneth E. Nichols.

NEW BUSINESS

Harry M. Galloway presented a discussion of current problems associated with publication of papers in *Proceedings* dealing primarily with the need for more publication space with higher costs. He also presented several suggestions for alleviation of these problems. After some discussion, the following was presented:

Motion: That all suggestions and recommendations for alleviation of problems associated with the publication of papers in *Proceedings* be transmitted to the Publications Committee for its consideration and appropriate recommendations at the earliest feasible time.

Seconded and *carried.*

Walter A. Cory presented the recommendations of the Youth Activities Committee with regard to the establishment of Academy-financed annual scholarships. By general consensus, the Executive Committee suggested that the Budget Committee address itself to the prospects for financing such a worthy endeavor with the hope that positive accomplishment might be achieved prior to the 1977-78 academic year.

Robert E. Van Atta presented the following constitutional amendment:

Motion: That the Academy amend the constitution, Article VII. MEETINGS. Sec. 1 so as to designate the *annual* meeting as the *spring* meeting, replacing the word *fall* with *spring* and the words *spring* with *fall* where they appear.

That the Academy further amend the constitution by changing the last sentence in Article VI. EXECUTIVE COMMITTEE, COUNCIL, AND BUDGET COMMITTEE. Sec. 4 to read as follows:

"The Budget Committee shall meet during the regular fall meeting of the Academy."

Seconded.

After considerable discussion, the motion to amend was *tabled* until the spring meeting of the Executive Committee in order that Academy officers and Division Chairman might receive input from Academy members on their opinions on this matter. The Secretary was directed to mention this desire in the General Session meeting and to implement an appropriate survey of the membership in a feasible manner.

Theodore Crovello presented a discussion with regard to public responsibilities of biologists and recommendations relative to a second Academy resolution concerning mosquito control in Indiana. After considerable discussion, the matter was referred by common consent to the Resolutions Committee for an appropriate recommendation.

The meeting was adjourned at 11:00 p.m.

Respectfully submitted,
ROBERT E. VAN ATTA, Secretary

FALL MEETING

MINUTES OF THE GENERAL SESSION

November 5, 1976

The Business Session of the 92d Annual Meeting of the Academy was called to order by President Donald J. Cook at 3:15 p.m. in Room 234, Neils Science Center, Valparaiso University, Valparaiso, Indiana.

Professor Fred Kruger, Vice President of Business Affairs, Valparaiso University, welcomed the Academy on behalf of Valparaiso University.

The Secretary of the Academy presented a summary of committee reports and informed the membership of official actions taken by the Executive Committee on April 23, 1976 and on November 4, 1976.

The names of individuals who were elected 1977 Divisional Chairmen and Chairmen-Elect includes:

ANTHROPOLOGY
- Chairman: Edward M. Dolan
- Chairman-Elect: Russell E. Lewis

BOTANY
- Chairman: Gary E. Dolph
- Chairman-Elect: Larry R. Yoder

CELL BIOLOGY
- Chairman: Ralph Jersild, Jr.
- Chairman-Elect: Betty D. Allamong

CHEMISTRY
- Chairman: Pang-Fai Ma
- Chairman-Elect: Clyde R. Metz

ECOLOGY
- Chairman: Thomas S. McComish
- Chairman-Elect: Robert B. Priddy

ENGINEERING
- Chairman: Milton E. Harr
- Chairman-Elect: Ramachandra A. Rao

ENTOMOLOGY
- Chairman: Jack R. Munsee
- Chairman-Elect: Richard F. Wilkey

GEOLOGY AND GEOGRAPHY
- Chairman: Mark Reshkin
- Chairman-Elect: Gerald R. Showalter

HISTORY OF SCIENCE
- Chairman: Gertrude L. Ward
- Chairman-Elect: William W. Bloom

MICROBIOLOGY AND MOLECULAR BIOLOGY

Chairman:	RALPH L. NICHOLSON
Chairman-Elect:	DEBBIE GAYDA

PHYSICS

Chairman:	ELMER NUSSBAUM
Chairman-Elect:	CARL C. SARTAIN

PLANT TAXONOMY

Chairman:	VICTOR RIEMENSCHNEIDER
Chairman-Elect:	THEODORE J. CROVELLO

SCIENCE EDUCATION

Chairman:	JON R. HENDRIX
Chairman-Elect:	STANLEY S. SHIMER

SOIL AND ATMOSPHERIC SCIENCES

Chairman:	LAWRENCE A. SCHAAL
Chairman-Elect:	STEPHEN A. JUSTHAM

ZOOLOGY

Chairman:	JOHN O. WHITAKER, JR.
Chairman-Elect:	JACKSON L. MARR

The Secretary then presented the following motions:

Motion: That the individuals who have applied for membership in the Academy be elected to the types of membership for which they have applied. Seconded and *carried.*

Motion: That the individuals recommended by the Emeritus Member Selection Committee and approved by the Executive Committee be elected to Emeritus Membership. *Carried.*

Motion: That the individuals recommended by the Fellows Committee and approved by the Executive Committee be elected as Fellows of the Academy. *Carried.*

President Cook introduced Ralph A. Llewellyn, Chairman of the *ad hoc* panel of the Science and Society Committee, who summarized the first annual report of that committee entitled "Indiana Energy 1977—A Status Report with Suggestions for Policy Action". Mr. Llewellyn indicated that copies of this report are available to Academy members on request.

Faye Kenoyer Daily presented the Necrologist's report which included the names of ten members:

EDNA BANTA	JACOB RICHARD SCHRAMM
THOMAS M. BUSHNELL	RUSSELL E. SIVERLY
ANSEL GOODING	NED MYRON SMITH
WILLIAM P. MORGAN	ELMER G. SULZER
MARION A. RECTOR	PAUL WEATHERWAX

John B. Patton, Chairman of the Nominating Committee, placed the following slate, previously approved by the Executive Committee, in nomination:

President:	CLARENCE F. DINEEN—1977
President-Elect:	JERRY J. NISBET—1977
Director of Public Relations:	WALTER A. CORY, JR.—1977-78
Academy Foundation:	WILLIAM A. DAILY—1977-78
Bonding Committee:	ROBERT M. BROOKER—1977
	EARL A. HOLMES—1977
Research Grants Committee:	MARK RESHKIN—1977-81

The slate was accepted; no nominations were made from the floor.

Motion: That the Secretary cast a unanimous ballot for the slate. Seconded and *carried.*

President Donald J. Cook introduced the Academy Speaker-of-the-Year, Dr. Derek A. Davenport, Department of Chemistry, Purdue University, who presented a superbly entertaining and interesting lecture entitled "From Genesis to the Book of Revelations: 200 Years of General Chemistry Texts Written in America(n)."

The Chairman of the Resolutions Committee, William A. Daily, presented the following resolution which was adopted by the assemblage:

BE IT RESOLVED:

Members of the Indiana Academy of Science here assembled wish to express our sincere thanks to the president, vice-president and faculty of Valparaiso University for providing us with functional and delightful meeting facilities.

We also thank our program chairman, Dr. Gayton C. Marks, the divisional chairpersons and students for the careful planning of their instructive meetings.

Our Academy "Speaker of the Year", Dr. D. A. Davenport, deserves special recognition for his extremely interesting slide lecture concerning a history of chemical texts and books during the past 200 years.

The meeting was recessed at 5:20 p.m. and was reconvened at 6:30 p.m. with President-Elect Clarence F. Dineen presiding at the annual banquet held in the Great Hall of the Student Union.

Following introduction of the Academy officers and guests at the speakers' table, Dr. Dineen introduced President Donald J. Cook who presented the annual Presidential Address entitled "Chemistry and Culture," an interesting and thought-provoking discussion.

The meeting was adjourned at 9:00 p.m.

Respectfully submitted,
ROBERT E. VAN ATTA, Secretary

FINANCIAL REPORT

JANUARY 1-DECEMBER 31, 1976

I. ACADEMY ACCOUNTS

	Income	Budgeted	Expenditure	Budgeted
Dues	$6,585.00	$ 5,950.00		
Reprints: Vol. 84	1,691.53			
85	40.10	3,300.00	$ 2,660.25	$ 3,000.00
Interest	995.16	1,100.00		
Miscellaneous	10.25			
Secretary			465.80	500.00
Treasurer			361.71	400.00
General Office			142.40	250.00
Travel, AAS Dues, etc.			169.90	225.00
Membership Committee			0.00	200.00
Transfer to Administered Accounts			2,750.00	2,750.00
Junior Academy ($300.00)				
Science and Society ($1,000.00)				
Natural Areas (—$500.00)				
Library Binding ($1,000.00)				
Proceedings: Publication ($750.00)				
Proceedings: Mailing ($200.00)				
Publications: Clerical ($3.00)				
President's Fund			100.00	100.00
Newsletter			500.00	500.00
Speaker of the Year Honorarium			500.00	500.00
Program Committee			616.41	1,000.00
Publications Editor's Expenses			518.67	500.00
Youth Activities			71.70	50.00
Biological Surveys Committee			4.00	150.00
Representative to AAAS Meeting			260.73	300.00
Public Relations			57.15	100.00
Section Chairman Expenses			0.00	150.00
CPA Fees for Tax Return Preparation			400.00	500.00
Lawyer's Fees			50.10	100.00
Miscellaneous	$9,322.04	$10,350.00	$ 9,628.82	$11,525.00

II. ADMINISTERED ACCOUNTS

	January 1 Balance	1976 Income	1976 Expenditures	December 31 Balance
Junior Academy	$ 212.92	$ 300.00	$ 457.14	$ 55.78
Science Talent Search	2,315.38	124.10	1,713.93	725.55
Science and Society	1,572.62	1,000.00	647.29	1,925.33
Research	286.60	4,845.00	4,877.00	254.60
Natural Areas	1,026.50	−500.00	0.00	526.50
J. S. Wright Library	134.28	0.00	0.00	134.28
Lilly III Library	2,632.76	0.00	0.00	2,632.76
Lilly V Library	4,513.20	0.00	0.00	4,513.20
Library Binding	—4.45	1,000.00	0.00	995.55
Science Fairs	0.00	0.00	0.00	0.00
Publications:				
Proceedings	148.83	4,764.00	4,866.56	46.27
Mailing of Proceedings	579.43	200.00	0.00	779.43
Monographs	1,253.52	248.50	5.50	1,496.52
Natural Features	0.00	0.00	0.00	0.00
Clerical	500.00	0.00	0.00	500.00
	$15,171.59	$11,981.60	$12,567.42	$14,585.77

III. SUMMARY

	Academy Accounts	Administered Accounts	Total
Balance: January 1, 1976	$6,666.36	$15,171.59	$21,837.95
1976 Income	9,322.04	11,981.60	21,303.64
1976 Expenditures	9,628.82	12,567.42	22,196.24
Balance: December 31, 1976	6,359.58	14,585.77	20,945.35

IV. BANK BALANCES

Upland United Bank, Upland, Indiana	$ 5,967.47
Great Western Savings and Loan, Los Angeles, California	5,626.91
First Western Savings and Loan, Las Vegas, Nevada	9,350.97
	$20,945.35

V. SUMMARY OF TRUST FUNDS

A. Foundation Account (00430-00-0)			
Income cash balance (1/1/76)		$ 809.55	
Total dividends and interest for 1976		1,009.13	
Disbursements for 1976			
Research grants	$ 300.00		
Transfer to principal cash	1,000.00		
	$ 1,300.00	−1,300.00	
Income cash balance (12/31/76)		$ 518.68	$ 518.68
Principal cash balance (1/1/76)		485.94	
Total receipts for 1976		1,000.00	
Total disbursements for 1976		−1,000.00	
Principal cash balance (12/31/76)		485.94	$ 485.94
Market value of investments (12/31/76)			$ 21,882.00
Total value of account (12/31/76)			$ 22,886.62*

*Carrying value is $23,206.53

B. John S. Wright Fund (00430-01-9)			
Income cash balance (1/1/76)		$ 687.51	
Total dividends, interest, and other income for 1976		18,989.47	
Disbursements for 1976			
INB fee	$ 2,494.00		
Transfer to 00430-02-8	16,400.00		
Transfer to Principal Cash	0.00		
	$18,894.00	−18,894.00	
Income cash balance (12/31/76)		782.98	$ 782.98
Principal cash balance (1/1/76)		831.77	
Total receipts for 1976		39,287.81	
Total disbursements for 1976		−39,909.25	
Principal cash balance (12/31/76)		$ 210.33	210.33
Market value of investments (12/31/76)			$536,937.80
Total value of account (12/31/76)			$537,931.11*
*Carrying value is $334,253.01			
C. John S. Wright Invested Income Account (00430-02-8)			
Income cash balance (1/1/76)		$ 190.36	
Total interest for 1976		489.48	
Disbursements for 1976			
Transfers to principal	$ 0.00		
	$ 0.00	$ 0.00	
Income cash balance (12/31/76)		$ 679.84	$ 679.84
Principal cash balance (1/1/76)		472.18	
Total receipts for 1976		30,400.00	
Disbursements for 1976			
Purchase of investments	$22,000.00		
Research grants	4,317.00		
Proceedings, Vol. 85	4,000.00		
	$30,317.00	−30,317.00	
Principal cash balance (12/31/76)		$ 555.18	$ 555.18
Market value of investments			$ 12,000.00
Total value of account			$ 13,235.02

VI. NOTES

Membership Dues:

According to the Treasurer's records, the current status may be summarized as follows:

1019 paid (524 member, 288 senior member, 63 student, 20 family, 15 senior family member, 7 sustaining member, 1 family sustaining, 1 student family member, life (4), honorary (4), emeritus (74), and 19 club members.
111 on file from 1975, but not yet paid for 1976
85 new members for 1976 (included in above totals)
3 previous members reinstated during 1976 (included in above totals)
130 members and clubs dropped for nonpayment of 1975 dues

Dues Structure for 1976:

$ 2.00 for student memberships
5.00 for memberships and club memberships
10.00 for senior memberships
25.00 for sustaining memberships
2.00 additional for family memberships
300.00 for life memberships

150.00-500.00 corporate memberships
50.00-100.00 institutional memberships
1.00 initiation/reinstatement fee ($2.00 for family membership)

Savings:

The treasurer, from the total assets of both Academy and Administered accounts, has maintained sufficient funds in the checking account to pay current bills throughout the year; the remaining funds have been invested in savings certificates.

Certificates redeemed in 1976

NONE

Certificates current

1. (GWSL) $5,000.00 invested at 6.75% April 1975; 31 December value $5,626.91; Maturity at October 1977.
2. (FWSL) $3,000.00 invested at 6.75% October 1976; 31 December value $3,053.46; Maturity at April 1978.
3. (FWSL) $2,000.00 invested at 6.50% April 1976; 31 December value $2,100.47; Maturity at April 1977.
4. (FWSL) $1,000.00 invested at 6.50% June 1976; 31 December value $1,049.26; Maturity at June 1977.
5. (FWSL) $1,000.00 invested at 6.50% June 1976; 31 December value $1,049.26; Maturity at June 1977.
6. (FWSL) $1,000.00 invested at 6.50% June 1976; 31 December value $1,049.26; Maturity at June 1977.
7. (FWSL) $1,000.00 invested at 6.50% June 1976; 31 December value $1,049.26; Maturity at June 1977.

Total $14,977.88

Reprints:

Reprint charges to authors for Vol. 83 are being collected with 1 billing outstanding for $61.55 giving a net profit to the Academy of $123.13 in excess of printing costs. Reprint charges to authors for Vol. 84 are being collected with 2 billings outstanding for a total of $252.12 and will give a net profit to the Academy (1975 and 1976) of $223.81 in excess of printing costs when all bills have been collected. Reprint charges to authors for Vol. 85 are being collected with $2,620.15 outstanding and will give a net profit to the Academy of $225.93 when all bills have been collected.

Attorney Fees:

Ice, Miller, Donadio & Ryan of Indianapolis have been advising the Academy in matters concerning the reprinting and roles of various publications. The executive committee voted at the Fall Meeting of 1973 to delay the transferring of $4,226.87 for attorney fees concerning the tax classification problems to the Academy operating funds from the J. S. Wright fund until these funds are needed for operating expenses.

Publications:

Sales to date during 1976 have been $14.00 for the *Proceedings*, Vol. 84 and $248.50 for Monographs. The total cost of publishing Vol. 85 of the *Proceedings* was $12,866.25 of which the State of Indiana paid $8,000 leaving a balance of $4,866.25 to be paid from Academy funds.

Research Grants:

Funds totaling $4,877.00 have been awarded to: Betty I. Tarnowski (Butler), Anne A. Susalla (St. Mary's), Cindy B. Patterson (I.U.), Lawrence M. Grocki (Ball State), Harold Eddleman (Indiana Biolab), Peter Calengas (I.U.), David F. Brakke (I.U.), Douglas Bauer (DePauw), Scot C. Adams (Purdue), Andreas R. Richter (Earlham), Dona Thampson-Jacob (I.U.), John O. Whitaker (Indiana State), James R. Gammon (DePauw).

VII. BUDGET FOR 1977

The following budget was approved by the Budget Committee at their meeting at the Indiana State Library, Indianapolis, on December 13, 1975:

Academy Accounts		
Anticipated Income		
Dues, Initiation and Reinstatement Fees (70 @$2, 600 @$5, 300 @$10, 100 @$0)		$ 6,140.00
Interest on Savings		1,300.00
Reprint Charges to Authors		2,886.00
		$10,326.00
Budgeted Expenditures		
Secretary		$ 500.00
Treasurer		400.00
General Office		250.00
Officer Travel, AAAS Dues		225.00
Membership Committee		200.00
President's Contingency Fund		100.00
Newsletter		500.00
Speaker of the Year Honorarium		500.00
Program Committee		1,000.00
Publication Editor's Expenses		500.00
Youth Activities Committee		50.00
Biological Surveys Committee (including Endangered Plant Species and Flora Indiana Project Committees)		150.00
Representative to AAAS Meeting		300.00
Reprint Charges to Academy		2,700.00
Public Relations		100.00
Section Chairmen Expenses		150.00
CPA Fees for Tax Return Preparation		500.00
Lawyer's Fees		250.00
Miscellaneous		100.00
Transfers to Administered Accounts		2,923.50
Junior Academy	$1,000.00	
Science and Society Committee	500.00	
Natural Areas Committee	-526.50	
Library Binding	1,200.00	
Proceedings: Publication	750.00	
Proceedings: Mailing	0.00	
		$11,398.50
Endowment Funds		
Anticipated Income		
IAS Foundation		$ 300.00
J. S. Wright Investment Income		15,500.00
		$15,800.00
Budgeted Expenditures		
Bank Fee		$ 2,700.00
Research Grants ($6,000–$350 AAAS)		5,650.00
Publications		
Proceedings, Vol. 86 ($13,750–$8,000 Ind. —$750 transfer)		5,000.00
Monograph #4 ($12,000–$1,500 Wright balance from 1975–$1,200 sales)		(9,300.00)*
		$13,350.00
Restricted Accounts		
Anticipated Income		
Research Grants Committee (AAAS)		$ 350.00 (part)
Science Talent Search (Tri Kappa)		2,000.00

*Suggest waiting until later for more Wright balance, sales, etc. to justify this.

Publications			
Proceedings	$ 50.00		
Monographs and Nat. Feat.	250.00		
			$ 2,650.00
Budgeted Expenditures			
Research Grants Committee			$ 350.00 (part)
Science Talent Search			2,000.00
Publications			300.00
Proceedings	$ 50.00	(part)	
Monographs	250.00	(part)	
			$ 2,650.00

Respectfully submitted,

Stanley Burden, Treasurer

We, the undersigned, have audited the Treasurer's records for the Indiana Academy of Science for the year 1976 and have found them to be accurate and in order.

March 1, 1977

Timothy J. Burkholder
A. Gilbert Cook

THE INDIANA JUNIOR ACADEMY OF SCIENCE

44th Annual Meeting, November 5, 1976

The 44th annual meeting of the Junior Academy began with a welcome from George Jones, President and Dr. Robert Rivers, Director. At 9:15, students, teachers and sponsors were dismissed to hear paper presentations. This year was the first for a division between papers dealing with the Physical Sciences and papers dealing with the Biological Sciences. This year was also the first for paper presentations in the Junior High Division. At 11:30, everyone adjourned to Dau Hall for lunch and the Junior Academy Meeting. After the meal, George Jones informally asked the clubs to consider nominees for President and Secretary-Elect. At 12:20, George called the Junior Academy Meeting to order. He listed the qualifications for President-Elect and Secretary-Elect as listed in the Constitution of the Indiana Junior Academy of Science. The nominations were then open for the offices of President and Secretary.

PRESIDENT-ELECT

Lori Ellen Rhodes—East Noble High School (Tom Ault—East Noble High); Greg Rondot—Bishop Luers High School (Jamie Oxley—Bishop Luers High); Craig Warner—Morton High School (Mick Maslar—Morton High).

SECRETARY-ELECT

Stacy Fox—East Noble High School (Tom Ault—East Noble High); Jamie Sibbit—Paoli High School (Ann Pfauth—Marquette High).

A motion was made to close the nominations, the motion was seconded. Dr. Rivers then introduced Mr. Dean Christakis from Marquette High School, who was to show a slide presentation of his trip to Sweden for the Nobel Prize Presentations. When he had finished the presentation, Mr. Christakis turned the meeting back to George. George then called the nominators to the podium to list the qualifications of his candidate. The nominators were given a few minutes to write down the candidate's qualifications, as they had not prepared a list before this time. During this time, Dr. Mary Pettersen made an announcement regarding the lunch fee. A few minutes after her announcement, the nominators came to the podium to list the qualifications of the candidates—first for President, then for Secretary. George then called for a representative of the Science Clubs who had paid their Academy dues to cast their delegate vote, when called upon.

RESULTS OF VOTING (President)

Morton—Craig Warner
Paoli—Greg Rondot
Madison—Lori Rhodes
Marquette—Craig Warner
New Haven—Greg Rondot
East Noble—Lori Rhodes
Yorktown—Lori Rhodes
Floyd Central—abstain
Floyd County—abstain
Bishop Luers—Greg Rondot
Bishop Dwenger—Greg Rondot

RESULTS OF VOTING (Secretary)

Morton—Jamie Sibbitt
Paoli—Jamie Sibbitt
Madison—Stacy Fox
Marquette—Jamie Sibbitt
New Haven—Stacy Fox
Bishop Dwenger—Stacy Fox
East Noble—Stacy Fox
Yorktown—Stacy Fox
Floyd County—Jamie Sibbitt
Floyd Central—Jamie Sibbitt
Bishop Luers—Stacy Fox

George turned the meeting over to Dr. Rivers for award presentations, while he and Secretary Cheryl Pauer tallied the votes.

AWARD PRESENTATIONS

Junior Division

First Place

Bradford Beaver—Yorktown Middle School
Wendy Rhodes—East Noble High School

Second Place

Greg Gesler—Madison Junior High
Jamie Sibbitt—Paoli Junior-Senior High

Third Place

Kurt Ehrman—St. John the Baptist (Fort Wayne)
David Johnson—Daltz High School (Muncie)
Tammi Hedges—St. John the Baptist (Fort Wayne)

SENIOR DIVISION—PHYSICAL SCIENCES

First Place

Greg Rondot—Bishop Luers
Patty Wolfe—New Albany

Second Place

John Stark—East Noble
Mike Patterson—East Noble

Third Place

Jamie Oxley—Bishop Luers

SENIOR DIVISION—BIOLOGICAL SCIENCES

First Place

Lori Rhodes—East Noble
Paul Kmak—Marquette

Second Place

Mary Wombles—Floyd Central
John Evans—Floyd Central

Third Place

Bradford Stephens—New Haven

George Jones then announced President-Elect and Secretary-Elect. President—Greg Rondot; Secretary—Stacy Fox. Dr. Rivers offered a closing statement, and Dr. Pettersen then introduced Mr. Davis of the admissions office of Valparaiso University who discussed the qualities of the school. George then declared the meeting adjourned; everyone was free to choose one of the following: A tour of Valparaiso University, either with a guide or on his own; Working with Science computers; Attending the Senior Academy Paper Presentations.

BIOLOGICAL SURVEY COMMITTEE REPORT—1975-76

Jack R. Munsee, Chairman, Indiana State University

Theodore Crovello
University of Notre Dame
James R. Gammon
DePauw University
Morris Levy
Purdue University
Gayton C. Marks
Valparaiso University
Victor Riemenschneider
Indiana University, South Bend
David S. Woodruff
Purdue University
Willard F. Yates, Jr.
Butler University
Frank N. Young
Indiana University

(A, B, or C accompanying title refers to: Publication; Thesis on File; or Work in Progress, respectively.)

Biota:

*1. Haag, B. 1974. Biological magnification of DDT in plants and animals in Jefferson County. B.A. Thesis. Hanover Coll. (B).

2. Helms, Ronald L., and Marion T. Jackson. 1976. A biotic inventory of Dobbs Park Natural Area. Proc. Indiana Acad. Sci. 85:208-216. (A).

Fungi:

1. Fahey, T., and J. D. Schoknecht. Indiana State Univ. Developmental studies of *Coprinus* and its ozanium and oidium states. (C).

2. Hasselbring, T. S., Tansey, M. R., and M. A. Jack. 1975. Fungi associated with growing stalactites. Mycologia 67:171-172. (A).

3. Huber, D. M., and G. R. Anderson. 1976. Effect of organic amendment on snowmold of winter wheat. Phytopathology 66:1028-1032. (A).

*4. Huber, D. M., and B. J. Hankins. 1974. Effect of fall clipping on snowmold of winter wheat. Plant Dis. Rept. 58:432-434. (A).

5. Laviolette, F. A., and K. L. Athow. Purdue Univ. Three new physiologic races of *Phytophthora megasperma* var. *sojae*. Phytopathology. (In Press).

6. Schoknecht, J. D. Indiana State Univ. Myxomycetes of Indiana: Macrofungi of the Wabash Valley. (C).

7. Tansey, M. R., and M. A. Jack. Indiana Univ. Thermophilic fungi in sun-heated soils. Mycologia 68: (In Press).

Algae:

Brooks, Austin E., and William N. Doemel. Wabash Coll. Fluorescent whitening agents: Effects on selected algae. Proc. Indiana Acad. Sci. (In Press).

Tracheophyta:

1. Abrell, D. Brian, and Marion T. Jackson. Indiana State Univ. A decade of change in an old-growth beech-maple forest in Indiana. Amer. Midland Natur. (In Press).

2. Burgette, Daniel L. 1975. Vegetational analysis of Portland Arch Nature Preserve, Fountain County, Indiana; comparing the Ohmann-Ream method with stratum ranking. M.S. Thesis, Purdue Univ. 204 pp. (B).

3. Burgette, Daniel L., and Douglas M. Knudson. 1976. Plants of Portland Arch Nature Preserve. Purdue Ag. Exp. Sta., Sta. Bull. No. 141. 23 pp. (A).

*4. Dilcher, D. L., and R. N. Pheifer. 1974. Stump casts of arborescent lycopods. Proc. Indiana Acad. Sci. 84:114-121. (A).

5. HOLLETT, BYRON P., and M. T. JACKSON. 1976. Quantitative aspects of the association of *Cenococcum graniforme* with *Fagus grandifolia* in Indiana. Forest Sci. 22:127-130. (A).
6. JACKSON, MARION T., RONALD L. HELMS, and JOHN O. WHITAKER, JR. 1976. Additions to the flora of Vigo County, Indiana. I. Proc. Indiana Acad. Sci. 85:354-359. (A).
7. LEVY, M. 1976. Phenetic:genetic correlations and reproductive output among local populations of *Oenothera biennis*. Amer. J. Bot., A.I.B.S. Abstracts:57. (Abstr.).
8. LEVY, M., and P. L. WINTERNHEIMER. Purdue Univ. Allozyme linkage disequilibria among chromosome complexes in the permanent translocation heterozygote *Oenothera biennis*. Evolution. (In Press).
9. SHIFLEY, S. R., and K. M. BROWN. Purdue Univ. A bibliography of the elm-ash-cottonwood forest type. (C).
10. STIVERS, R. K., and M. L. SWEARINGIN. Purdue Univ. Soybean yield compensation with different populations and missing plant patterns. (C).
11. WILLUT, J., G. MARKS, and G. HICKS. Valparaiso Univ. Naturally occurring mature American chestnut trees (*Castanea dentata*) in northwest Indiana. (C).
12. WILSON, KATHRYN J. 1976. Developmental anatomy of the non-articulated branched laticifer system of *Asclepias syriaca* L. Ph.D. Thesis. Indiana Univ. (B).
13. WILSON, KATHRYN J. Indiana Univ.-Purdue Univ. Indianapolis. Ultrastructure of *Asclepias syriaca* L. laticifers and tissue culture of this species. (C).
14. WILSON, KATHRYN J., and P. G. MAHLBERG. 1975. Ultrastructure of the non-articulated laticifer in embryos and seedlings of the common milkweed, *Asclepias syriaca*. Amer. J. Bot. 62 (Supplement):48-49. Abstr. (A).
15. WILSON, KATHRYN J., and P. G. MAHLBERG. Indiana Univ.-Purdue Univ. Indianapolis. Investigations of laticifer differentiation in tissue cultures derived from *Asclepias syriaca* L. Ann. of Bot. (In Press).
16. WILSON, KATHRYN J., and P. G. MAHLBERG. Indiana Univ.-Purdue Univ. Indianapolis. Ultrastructure of non-articulated branched laticifers in mature embryos of *Asclepias syriaca* L. (C).
17. WILSON, KATHRYN J., C. L. NESSLER, and P. G. MAHLBERG. 1976. Pectinase in *Asclepias* latex and its possible role in laticifer growth and development. Amer. J. Bot. 63:1140-1144. (A).
18. WILSON, KENNETH S. 1976. The antecology of *Spiranthes cernua* in a grassland community. Symposium on the scientific aspects of orchids. Detroit, Mich. (Southfield). Oct. 25, 1974. Univ. of Detroit. Published Proc. (Abstr.).

Protozoa:

1. ALBRIGHT, J. F., and D. G. DUSANIC. 1976. Splenomegaly and suppression of humoral immunity in mice infected with *Trypanosoma musculi*. Fed. Proc., 35:250. (A).
2. ALBRIGHT, J. F., J. W. ALBRIGHT, and D. G. DUSANIC. Indiana State Univ. Trypanosome-induced splenomegaly and suppression of mouse spleen cell responses to antigens and mitogens. J. Ret. Soc. (In Press).
3. CHERIAN, P. V., and D. G. DUSANIC. 1975. Electron microscopic localization of surface antigens of *Trypanosoma lewisi* with ferritin labeled antibody. J. Parasitol., 61:98. (A).
4. CHERIAN, P. V., and D. G. DUSANIC. Indiana State Univ. Studies on the surface antigens of trypanosomes. I. Electron microscopic localization of antigens of *Trypanosoma lewisi* with direct and indirect immunoferritin techniques. Exp. Parasitol. (In Press).

5. DUSANIC, D. G. 1975. Immunosuppression and ablastin. Exp. Parasitol. 38:322. (A).
6. DUSANIC, *D. G.* VTGE. *Trypanooma muculi infection* in com. plement deficient mice. Exp. Parasitol. 37:205. (A).
7. DUSANIC, D. G. 1974. The effects of homologous and heterologous ablastic antisera on the *in vitro* growth of *Trypanosoma musculi.* J. Protozool. 21:43. (A).
8. LONG, G. and D. G. DUSANIC. Indiana State Univ. Precipitation and agglutination reactions of *Trypanosoma lewisi* isolated from untreated and immunosuppressed hosts. Exp. Parasitol. (In Press).
9. SORIA, C. A., and D. G. DUSANIC. 1975. Comparative studies on *Trypanosoma dionisii* and *Trypanosoma vespertilionis.* J. Protozool. 22:509. (A).
*10. SORIA, C. A., and D. G. DUSANIC. 1974. Morphologic, physiologic, and serologic studies of *Trypanosoma vespertilionis* and *Trypanosoma dionisii.* J. Parasitol. 60:30. (A).
11. TAMAR, HENRY. 1975. Movements of saltatory ciliates. J. Protozool. 22(3):45A. (A).

Nematoda:

1. CALLAHAN, CLARENCE A. 1976. An evaluation of nematode community structure as a method for quantifying and interpreting ecological changes in water resource environments. Ph.D. Thesis. Purdue Univ. (B).
*2. GOSECO, CELSO G. 1974. Review of the superfamily Leptonchoidea (Nematoda: Dorylaimida). Ph.D. Thesis. Purdue Univ. (B).
*3. JOHNSON, STEPHEN R. 1971. Nematode community structure of selected deciduous woodlots. Ph.D. Thesis. Purdue Univ. (B).
*4. TJEPKEMA, JAMES P. 1971. Revision of the genus *Aporcelaimellus* Heyns, 1965 and six species groups of the genus *Eudorylaimus* Andrassy, 1959 (Nematoda: Dorylaimida). Ph.D. Thesis. Purdue Univ. (B).

Arthropoda:

1. FAIN, A., and JOHN O. WHITAKER, JR. 1976. Notes on the genus *Acanthopthirius* Perkins (Acarina: Myobiidae) in North America. Bull. de la Soc. Belge. Entom. 112:127-143. (A).
2. STANLEY, ALESA L. 1975. Invertebrates of three southern Indiana streams. B.A. Thesis. Hanover Coll. (B).

Crustacea:

WHITAKER, JOHN O., JR., and R. A. SCHLUETER. 1975. Occurrence of the crustacean parasite, *Lemaea cyprinacea,* on fishes from the White River at Petersburg, Indiana. Amer. Midland Natur. 93:446-450. (A).

Insecta:

*1. ANDERSON, MICHAEL J. 1972. A pitfall trapping study of the adult carabid beetles found in two different corn tillage-planting systems. M.S. Thesis. Purdue Univ. (B).
2. BALLARD, THOMAS O. 1975. The biology and control of the eastern pine-shoot moth, *Eucosma gloriola* Heinrich, in Christmas tree plantings in northern Indiana. M.S. Thesis. Purdue Univ. (B).
*3. BURGESS, J. W. 1974. Review of findings on the taxonomic status of *Culex pipiens* L. and *Culex fatigans* Wiedemann in the United States. Proc. Indiana Acad. Sci. 83:214. (A).
4. BUSCHING, MILAN K. 1975. Field vegetation affecting the potential for black cutworm damage to corn in Indiana. M.S. Thesis. Purdue Univ. (B).
5. CALDWELL, DOUGLAS L. 1975. The life cycle and description of the three forms of *Phylloxera caryaecaulis* (Fitch) (Phylloxeridae: Homoptera) on shagbark hickory, *Carya ovata* (Mill.) K. Koch. M.S. Thesis. Purdue Univ. (B).

*6. CARLSON, NORMAN P. 1970. Aldrin susceptibility in Indiana populations of the northern corn rootworm, *Diabrotica longicornis* (Say). M.S. Thesis. Purdue Univ. (B).

*7. CHANDLER, LELAND. 1971. Parasitic Lepidoptera in Indiana. Proc. Indiana Acad. Sci. 80:245. Abstr. (A).

*8. CHANDLER, LELAND. 1971. Underground nests of *Augochlora pura* (Say) (Hymenoptera: Halictidae. 2 Proc. Indiana Acad. Sci. 80:245. (A).

*9. CHANDLER, LELAND. 1971. *Vespa crabro* L. and *Polistes hunteri* Bequaert in Indiana (Hymenoptera: Vespidae). Proc. Indiana Acad. Sci. 80:245-246. (A).

10. CHANDLER, LELAND. 1975. Eusociality in *Ceratina calcarata* Robt. (Hymenoptera: Anthophoridae). Proc. Indiana Acad. Sci. 84:283-284. (A).

*11. CHANDLER, THOMAS L. 1973. The effect of synthetic juvenile hormones on selected species of Diptera and Coleoptera in bovine feces. M.S. Thesis. Purdue Univ. (B).

*12. CHRISTENSEN, CHRISTIAN M. 1970. A biological study of *Aphodius fimetarius* (Linné) and *A. distinctus* (Mueller) in central Indiana. (Coleoptera: Scarabaeidae) M.S. Thesis. Purdue Univ. (B).

13. COYLE, CATHY. 1975. Transport of fungi by *Reticulitermes flavipes* (Kollar) (Isoptera: Rhinotermitidae). Proc. Indiana Acad. Sci. 84:284-285. (A).

*14. CROVELLO, THEODORE J. 1973. Modabund: the computerized mosquito data bank at the University of Notre Dame. Proc. Indiana Acad. Sci. 82:229. (A).

*15. CUMMINS, ROBERT B. 1973. Cereal leaf beetle parasitoid release program. Proc. Indiana Acad. Sci. 82:229. (A).

*16. DOLPHIN, R. E., M. L. CLEVELAND, and T. E. MOUZIN. 1971. *Trichogramma minutum* relationship to codling moth and red-banded leaf roller eggs. Proc. Indiana Acad. Sci. 80:305-309. (A).

*17. DOLPHIN, ROBERT E. 1972. Observations of *Halictus confusus* Smith (Hymenoptera: Halictidae) on woodland and field flowers. Proc. Indiana Acad. Sci. 81:182-185. (A).

*18. FAVINGER, JOHN J., and CLAUDE F. WADE. 1973. Telephone cable penetration by *Xylobiops basilaris* (Say) (Coleoptera: Bostrichidae). Proc. Indiana Acad. Sci. 82:230-231. (A).

*19. FINNI, GARY R. 1969. Developmental patterns in winter stonefly species. (Insecta: Plecoptera: *Allocapnia, Taeniopteryx*). M.S. Thesis. Purdue Univ. (B).

*20. FINNI, GARY R. 1972. Ecological separation of coexisting species of winter stoneflies, *Allocapnia* spp. (Plecoptera: Capniidae). (Indiana populations). Ph.D. Thesis. Purdue Univ. (B).

*21. FINNI, GARY R. 1973. The winter stonefly genus *Allocapnia* in Indiana. Proc. Indiana Acad. Sci. 82:229-230. (A).

*22. FRAZEE, JAMES R. 1974. Population dynamics of the green peach aphid, *Myzus persicae* (Sulzer), on the oilseed crop, Crambe. Ph.D. Thesis. Purdue Univ. (B).

23. DERSCH, LOUIS H., JR. 1976. Comparative biology and ecology of *Ephoron album* (Say) and *E. leukon* Williamson cohabiting the Tippecanoe River, Indiana. (Ephemeroptera: Polymitarcidae). M.S. Thesis. Purdue Univ. (B).

*24. GOULD, GEORGE E. 1971. The corn rootworm problem in Indiana. Proc. Indiana Acad. Sci. 80:267-274. (A).

25. HALLMAN, GUY J. 1976. Mexican bean beetle-soybean cultivar relationships in southern Indiana. M.S. Thesis. Purdue Univ. (B).

26. HARRIS, TODD. Purdue Univ. Trichoptera fauna of Indiana. (C).

*27. HART, JOHN W. 1971. New records of Indiana Collembola. Proc. Indiana Acad. Sci. 80:246. (A).

*28. HART, JOHN W. 1973. New Records of Indiana Collembola. Proc. Indiana Acad. Sci. 82:231. (A).

*29. HART, JOHN W. 1974. Preliminary studies of Collembola at the Brookville Ecological Research Center, including new records of Indiana springtails. Proc. Indiana Acad. Sci. 83:224-229. (A).

30. HART, JOHN W. 1975. New records of Indiana Collembola. Proc. Indiana Acad. Sci. 84:283. (A).

31. HEATH, B. L. and W. P. MCCAFFERTY. 1975. Aquatic and semi-aquatic Diptera of Indiana. Purdue Univ. Agr. Exp. Sta. Res. Bull. No. 930:18p. (A).

*32. HINZ, THOMAS R. 1972. The influence of physical factors on alfalfa weevil, *Hypera postica* (Gyll.), oviposition and egg development with an interpretation for determination of adult density and mortality. M.S. Thesis. Purdue Univ. (B).

*33. HOGG, DAVID B. 1974. Overwintering success of a field population of the European corn borer. M.S. Thesis. Purdue Univ. (B).

34. HUFF, BERNARD L., JR. 1975. Biological studies of heptageniid mayflies and their systematic implication. Ph.D. Thesis. Purdue Univ. (B).

*35. JACQUES, RICHARD L. 1972. Taxonomic revision of the genus *Leptinotarsa* (Coleoptera: Chrysomelidae) of North America. Ph.D. Thesis. Purdue Univ. (B).

*36. KNAPP, VIRGIL R. 1973. Preliminary annotated list of Indiana Aphididae. Proc. Indiana Acad. Sci. 82:242-263. (A).

*37. LAWSON, H. RANDOLPH. 1972. The Planipennia (Neuroptera) in Indiana. Proc. Indiana Acad. Sci. 81:173-174. (A).

*38. LAWSON, H. RANDOLPH. 1974. An analysis of ordination as a tool in animal synecology, with especial reference to ant (Hymenoptera: Formicoidea) populations in a woodland ravine. (List of Indiana ants, etc.) Ph.D. Thesis. Purdue Univ. (B).

*39. LEVINE, ELI. 1974. Biology of *Bellura gortynoides* Walker (=*vulnifica* (Grote)), the yellow water-lily borer (Lepidoptera: Noctuidae). Proc. Indiana Acad. Sci. 83:214-215. (A).

*40. LINDSTROM, BRUCE M., and SARAH C. STRAWN. 1971. Nest mortality in two species of mud-daubers in eastern Indiana. Proc. Indiana Acad. Sci. 80:245. (A).

*41. LUBE, BRUCE M. 1972. The winter ecology of stem nesting bees and wasps. (Hymenoptera). M.S. Thesis. Purdue Univ. (B).

42. LUND, REA D. 1975. The field activity and feeding habits of Carabidae associated with Indiana cornfields. M.S. Thesis. Purdue Univ. (B).

*43. MATTESON, LYLE E., JR. 1972. A quantitative study of the vertical distribution of the alfalfa weevil, *Hypera postica* (Gyllenhal) and *Bathyplectes curculionis* (Thomson) on alfalfa. M.S. Thesis. Purdue Univ. (B).

44. MCCAFFERTY, W. P. 1975. Institutional insect collections in Indiana. Proc. Indiana Acad. Sci. 84:294-306. (A).

45. MCCAFFERTY, W. P. 1975. The burrowing mayflies (Ephemeroptera: Ephemeroidea) of the United States. Trans. Amer. Entomol. Soc. 101:447-504. (A).

46. MCCAFFERTY, W. P. 1976. A coordinate indexing system for ecosystematic data. Proc. Indiana Acad. Sci. 85:251-257. (A).

47. MCCAFFERTY, W. P., and J. L. STEIN. 1976. Indiana Ensifera (Orthoptera). Gr. Lakes Entomol. 9:25-56. (A).

*48. MEYER, R. W., and J. V. OSMUND. 1971. Insects and other arthropods of economic importance in Indiana during 1970. Proc. Indiana Acad. Sci. 80:286-298. (A).

*49. MEYER, R. W., and J. V. OSMUND. 1972. Insects and other arthropods of economic importance in Indiana during 1971. Proc. Indiana Acad. Sci. 81:171. (A).

*50. MEYER, ROBERT W. 1974. Insects and other arthropods of economic importance in Indiana during 1973. Proc. Indiana Acad. Sci. 83:230-238. (A).

51. MEYER, ROBERT W. 1975. Insects and other arthropods of economic importance in Indiana during 1974. Proc. Indiana Acad. Sci. 84:313-321. (A).

*52. MIGNOT, EDWARD C. 1970. Taxonomic revision of the tribes Aspicelini and Disonychini (Coleoptera: Chrysomelidae, Alticinae) north of Mexico. (Distribution of Indiana species). Ph.D. Thesis. Purdue Univ. (B).

*53. MONTGOMERY, B. ELWOOD. 1971. Records and observations of Indiana Odonata. Proc. Indiana Acad. Sci. 80:253-263. (A).

*54. MONTGOMERY, B. ELWOOD. 1972. Survival of Odonata naiads through drought and freezing. Proc. Indiana Acad. Sci. 81:171. (A).

*55. MONTGOMERY, B. ELWOOD. 1973. Why snakefeeder: Why dragonfly? Some random observations on etymological entomology. Proc. Indiana Acad. Sci. 82:235-241. (A).

56. MUNSEE, JACK R. Indiana State Univ. *Smithistruma filitalpa*, Brown, an Indiana dacetine ant. (C).

57. OLIVERIA, FORREST L. 1975. Interpretation of regional population data and effects of dynamic climatology on density fluctuations of the Columbian timber beetle, *Corthylus columbianus* Hopkins (Coleoptera: Scolytidae). Ph.D. Thesis. Purdue Univ. (B).

58. SANDERS, DARRYL P., and JOHN L. PETERSON. 1975. The occurrence of the pigeon fly, *Pseudolynchia canariensis* (Macquart) in Indiana. Proc. Indiana Acad. Sci. 84:287-288. (A).

59. SCHOENBOHM, RICHARD B. 1976. The biology of *Meteorus leviventris* (Wesmael) (Hymenoptera: Braconidae) and the effect of parasitism on the feeding activity of its black cutworm host. M.S. Thesis. Purdue Univ. (B).

60. SCHOENBOHM, RICHARD B. Purdue Univ. Parasites of the black cutworm (*Agrotis ipsilon* Hufnagel) in Indiana. (C).

*61. SCHUDER, DONALD L. 1974. A new barberry pest found in Indiana. Proc. Indiana Acad. Sci. 83:216-217. (A).

*62. SCHROYER, DONALD A., and R. W. MEYER. 1974. New distribution records of mosquitoes in Indiana, 1973 (Diptera: Culicidae). Proc. Indiana Acad. Sci. 83:218-219. (A).

*63. SHROYER, DONALD A. 1974. The influence of carbohydrate-feeding and insemination on oviposition of an Indiana strain of *Aedes vexans* (Meigen). M.S. Thesis. Purdue Univ. (B).

*64. SHULL, ERNEST M. 1972. Indiana state records and notes on some rare butterflies and skippers in the state. Proc. Indiana Acad. Sci. 81:175-176. (A).

*65. SILLINGS, JOHN O. 1971. A survey of the parasites of the tarnished plant bug. *Lygus lineolaris* (Palisot de Beauvois) (Hemiptera: Miridae) in Indiana. M.S. Thesis. Purdue Univ. (B).

66. SIVERLY, RUSSELL E. 1975. Blood meal identifications of *Culex pipiens* (northern house mosquito) collected during 1972 and 1973 in Delaware and Henry counties, Indiana. Proc. Indiana Acad. Sci. 84:284. (A).

*67. SMITH, ERIC H. 1970. Taxonomic revision of the genus *Systena* Chev. (Coleoptera: Chrysomelidae, Altincinae) of America north of Mexico. M.S. Thesis. Purdue Univ. (B).

68. SMITH, ERIC H. 1976. *Systena bimarginata* Smith, new name, to replace *Systena plicata* Blake (Coleoptera: Chrysomelidae, Altincinae). Coleopterists' Bull. 30(4):342. (A).

69. STEIN, J. L., and W. P. MCCAFFERTY. 1975. The Ensifera (Orthoptera) of Indiana. Proc. Indiana Acad. Sci. 84:283. (A).

*70. WARD, GERTRUDE L. 1970. The comparative ethology of coexisting mud-dauber species. (Hymenoptera: Sphecidae). Ph.D. Thesis. Purdue Univ. (B).

*71. WARD, GERTRUDE L. 1971. Nest site preference of *Chalybion zimmermanni* Dahlbom (Hymenopteraly: Sphecidae). Proc. Indiana Acad. Sci. 80:264-266. (A).

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* Off-year publication.

NECROLOGY

Fay Kenoyer Daily, Butler University

Edna Banta

Switzerland County, Indiana
July 19, 1889

Near Nashville, Indiana
April 21, 1975

Edna Banta, teacher and naturalist, was born July 19, 1889, near Vevay, Indiana. She grew up near Madison, Indiana, where her interest in nature developed under the influence of the beautiful countryside.

Her undergraduate college training was obtained at Hanover College and graduate work was done at Indiana University where she earned a Master's degree and did work toward a Ph. D. degree.

Miss Banta began teaching in Indiana at Jefferson County grade schools. She taught also at Madison and Spencer high schools. She went to New Castle in 1947 where she stayed until 1952. There she developed an elementary science program and was science consultant to elementary schools. Her effective teaching methods were the subject of an article in *The Indiana Teacher* (V. 92, p. 216, March, 1948). Of considerable value in this program was the collection of about 900 slides of natural objects. Some of her photographs were accepted for exhibition at the International Salon of Nature Photography in Chicago. She also had a "live library" consisting of a squirrel, rabbit and other pets on loan to classes for study. Nature study trips were also conducted by the teachers to cultivate the ability and accuracy of observation. Miss Banta was a valuable consultant for identification of specimens. She also gave slide talks to garden and civic clubs. One of the most famous topics was the Great Smokies, where she visited. She also walked about 120 miles in Yosemite National Park one summer looking for specimens.

In 1948, Miss Banta went to Santiago, Chile, to teach science in a girl's school for a year. She also served as Park Naturalist at Clifty Falls State Park and McCormick's Creek State Park in Indiana. Her gentleness with animals and care of injured birds and beasts produced a number of charming pets, well-remembered by park visitors and friends.

When the Mary Gray Bird Sanctuary was obtained by the Indiana Audubon Society, Miss Banta became the Resident Naturalist there. The Tulip Popular Trail was laid out and developed by Miss Banta and she made many of the permanent plantings.

In 1962, she left the sanctuary and moved to a home near Nashville, Indiana, where she lived until her death, there, April 21, 1975. She was the subject of an article in the *Indianapolis Times* (December 21, 1962) which mentioned the beautiful decorations which she fashioned from natural materials collected from her property. The wreaths and other objects were on consignment at two shops.

Miss Banta joined the Indiana Academy of Science in 1931 and became an emeritus member in 1967. She served on the Junior Academy Committee in 1951. She presented a paper on the plants of Jefferson County, new or rare, at a paper session in 1935. Representative specimens were sent to the Deam Herbarium and her work is cited in Deam's *Flora of Indiana.*

Unforgettable Miss Banta shared her love of nature with others and enriched their lives by it, a legacy which will benefit many.

THOMAS M(ARK) BUSHNELL

Monticello, Indiana
April 5, 1889

Lafayette, Indiana
January 20, 1976

Dr. Thomas M. Bushnell was a retired professor of Agronomy at Purdue University and died at Lafayette, Indiana, January 20, 1976. He was born in Monticello, Indiana, April 5, 1889. He received a B.S. in Agronomy from Purdue in 1912.

His career began as Soil Surveyor, Bureau of Soils, U.S. Department of Agriculture from 1912 to 1918. In 1917 to 1919, while serving in the aviation section of the U.S. Army Signal Corps, he realized that air photography could be applied to soil survey. He returned to be with the agricultural experiment station at Texas Agriculture and Mechanical College from 1919 to 1921, but came back to Indiana in 1921 to be in charge of soil survey at Purdue's Experimental Station until 1953. He became Emeritus Professor of Agronomy in 1959. He used air photos for mapping Jennings County in 1929, the first entire county survey in the U.S. to be made on air photos.

Prof. Bushnell was head of a land classification unit of the Resettlement Administration from 1935 to 1937. He also supervised land classification units in 1946 to 1947 in Japan and was with the Cornell Air Photo team from 1954 to 1956 in Rangoon, Burma. He did soil surveys in the Dominican Republic in 1951.

Purdue's soil exhibit at the Indiana State Fair promoted soil knowledge by innovations provided by Dr. Bushnell. He developed a simple means of sampling soils, easily stored and preserved, and called the resulting products "micromonoliths". He made available in a kit the cutters, preservatives, glues and cards needed for their preparation. He prepared an electronic board where visitors to the fair could find answers to the soil questions by flashing lights or buzzers. The idea was adapted by state park naturalists for identification of wildlife by visitors.

Dr. Bushnell wrote a *Story of Indiana Soils* published in 1944 by the Purdue Experiment Station. It was so popular that the demand, long after it was out of print, prompted Dr. Bushnell to publish it privately in 1958 and market it by his own company, Peda Products, under the title, *A Story of Hoosier Soils.* He also offered the kits for micromonolith sampling. These were used in 4H projects. Several years ago, the remaining books and kits were presented to Purdue's Agronomy Club for distribution.

Dr. Bushnell joined the Indiana Academy of Science in 1922 and was honored as a Fellow in 1935. He became an emeritus member in 1975. He was a frequent contributor to paper sessions and published papers in the *Proceedings Indiana Academy of Science* on soil survey, aerial photography applied to soil survey, taxonomy, outline of classification of Indiana soils, soil maps, a mystery mound in Lake county,

the history of soil science in Indiana 1816 to 1966, etc. He was chairman of the Geology and Geography Division in 1939.

Dr. Bushnell was also a member of the A.A.A.S., Soil Science Society, Soil Survey Association, International Society of Soil Science and Fellow of the Agronomy Society.

Dr. Thomas M. Bushnell died at age 86 after a two-week illness. He had been one of the leaders of thought among an early generation of soil surveyors, and tried to make pedology important and understandable to two generations of Indiana citizens.

ANSEL MILLER GOODING

Seymour, Iowa
July 12, 1924

Richmond, Indiana
March 24, 1976

Dr. Ansel M. Gooding died suddenly at Richmond, Indiana, March 24, 1976. Apparently, he suffered a heart attack after having two earlier attacks. He was 51 years old and was a professor of geology at Earlham College. He was recognized as an authority on the glacial geology of southeastern Indiana and southwestern Ohio. He is credited with 23 publications in an Earlham faculty "Memorial Minute". These include *The Glacial Geology of Southeastern Indiana, Guidebook for Field Conference G, Great Lakes and Ohio River Valley* (1965).

Dr. Gooding was born at Seymour, Iowa, July 12, 1924. His A.B. degree was obtained from Augustana College, Rock Island, Illinois in 1949 where geology was given under the able direction of Dr. Fritioff Fryxell. He served in the U.S. Navy from 1944 to 1946, was summer field assistant on the U.S. Geological Survey in 1948 and geologist with the Missouri Geological Survey in 1950 and 1952. His graduate work was done at Iowa State University where he received an M.S. degree in 1951 under the guidance of Prof. A.C. Trowbridge and a Ph.D. in 1957. When he came to Earlham in 1951 as an assistant professor, much of the work on a doctorate had been completed. It was finished later during a leave of absence.

During work on his dissertation, Dr. Gooding received a grant from the National Science Foundation to help with student assistant expenses. The success of the project led to further N.S.F. grants of hundreds of thousands of dollars for research in geology, soils, chemistry, physics and biology over a period of 20 years benefitting faculty and students in all Science Division Departments.

Dr. Gooding became full professor at Earlham in 1964. He was Chairman of the Geology Department from 1961 to 1973, and clerk of the faculty in 1973. He was an excellent and stimulating teacher and his field trips are recalled by students with pleasure. In 1974, he attended a meeting of the Society of Soil Science in Russia and visited the interesting Alma Ata region in southeastern Russia.

He was also active in community affairs and geological and environmental problems. He was also an active member of the local SPUR group and in 1973 was appointed to the Indiana Senate Committee to investigate environmental quality in Indiana in conjunction with the Indiana State Senate Environment and Ecology Committee.

Dr. Gooding joined the Indiana Academy of Science in 1966. He was a member of the Research Grants Committee from 1973 until death. He was also a member of several other professional societies: Geological Society of America; Fellow, National Association of Geology Teachers; International Association for Quaternary Research; American Quaternary Association; Ohio Academy of Science, Honorary Research Society of Sigma Xi and the informal field excursion group, "Friends

of the Pleistocene". He was organizer for some of the field trips for the latter society.

At Dr. Ansel Miller Gooding's unexpected death, Earlham President Franklin Wallen remembered Dr. Gooding as "a man who gave unstintingly of himself to his students, to the study of geology, to the community and his family. His many accomplishments, his firm commitment and warm friendship will be deeply missed by all of Earlham".

DAVID T(RACY) JONES

Near Mount Auburn, Iowa — Vinton, Iowa
January 9, 1900 — December 15, 1974

Dr. David T. Jones was born on a farm near Mt. Auburn, Iowa, January 9, 1900. It is a farm that has been in his family for 122 years, bought in 1854 from the government. In 1906, his father became County Superintendent of Schools for Benton County and took his family to live in Vinton, Iowa. It was there that David received his early education until his senior year in high school when he attended Iowa State Teacher's College (now Northern Iowa University) because he had already decided to be a teacher. His interest in natural science and teaching developed early. His father allowed him to attend a summer teacher's institute which he held at Vinton High School. There the boy showed talent in geography and especially enjoyed drawing. Dr. Jones received an A.B. degree in 1923 and an M.S. degree in 1925 from Iowa State University and a Ph. D. degree in 1933 from Indiana University.

His professional career was varied. He was a zoology instructor at Utah State University from 1926 to 1927; director of laboratories at Oregon State University from 1927 to 1928; instructor of biology at Marietta College from 1928 to 1931; associate professor at Utah State University from 1933 to 1945; instructor in a summer institute in Kansas the summer of 1945; professor of physical science and department chairman at Huntington College from 1945 to 1946; assistant professor of physiology at Miami University (Ohio) from 1946 to 1948, associate professor from 1949 to 1957; teacher in the Biology Department of Olivet Nazarene College (Kankakee, Illinois) from 1957 to 1963, professor from 1963 to 1969; and then did independent research after that. He was a scholar and a kind and religious man. He helped young people through school after he became a teacher and began tithing for churches at an early age.

Dr. Jones joined the Indiana Academy of Science in 1931 listing his interests as Zoology, Entomology and Cell Biology. He gave a paper at the 1932 fall Academy meeting on anatomical features of the tiger snail *Anguispira alternata*. The snails were collected at Bloomington, Indiana, and the study was made at the Indiana University Zoology Department. He was an emeritus member at death.

Dr. Jones was also a Fellow of the American Association for the Advancement of Science; member of Iowa, Ohio, and Kansas Academies of Science; Fellow, Utah Academy of Science, Arts and Letters; Historical Society of Iowa and the American Malacological Union. He was honored by election to Phi Beta Kappa and Sigma Xi. He contributed articles to various scientific journals and was co-author of *Mollusca of Utah*, 1929; author of *Practical Exercises in Basic Animal Histology*, 1939 and 1944; and also was author of *The Spinal Cord of Amphioxis*, 1944.

Although Dr. Jones taught out of state most of the years after joining the Indiana Academy of Science, he remained loyal to the society and maintained membership for 45 years. He died of hardening of the arteries December 15, 1974, in Vinton, Iowa, at 74 years of age.

WILLIAM P(ITT) MORGAN

Indianapolis, Indiana
November 17, 1893

Indianapolis, Indiana
January 21, 1976

Dr. William P. Morgan was born in Indianapolis, Indiana, November 17, 1893, spent most of his life in this city and died here January 21, 1976. He was Emeritus Professor of Biology from Indiana Central College and was well known for a successful teaching career and research in hybridization of plants.

His education began in Perry Township grade school and secondary school, Manual Training High School of Indianapolis. Material for botany classes was obtained from the Lenia Elder and Brothers Greenhouse on the southside of Indianapolis where a fascination with the variation in gladioli, roses and freezias grown there led Dr. Morgan to his later research in this field.

Dr. Morgan obtained an A.B. degree from Indiana Central College in 1919. He received an M.A. from Indiana University in 1922, was a Fellow there 1925 to 1926 and received a Ph. D. in Zoology in 1926.

His professional career began as Art Supervisor in the Perry Township Schools, Marion County, Indiana, from 1914 to 1919, and he was part-time instructor of art at Indiana Central College. He became Associate Professor of Biology at Indiana Central College from 1919 to 1926 and was a professor from 1926 to 1959, serving as Head of the Biology Department. He became emeritus professor in 1959, but finally retired in 1965. He was also a lecturer at Indiana University, Indianapolis Extension, from 1927 to 1967. He was honored by receiving an L.L.D. degree from Indiana Central College in 1955 for his excellent teaching and he was also an honored alumnus of Indiana University.

Dr. Morgan joined the Indiana Academy of Science in 1920, and was honored as a fellow in 1930. He presented papers at the fall meetings as early as 1922 and for a number of years on insect cytology and on the variation and hybridization of freezias and gladioli. He gave generously of his time in serving the society in many capacities—especially an all time record of 15 years as treasurer from 1935 to 1950. The state of the economy during these years produced financial difficulties for the Indiana Academy of Science which could have meant the end of the society. However, through the successful efforts of Dr. Morgan to obtain funds and manage them wisely, it survived. He became president in 1951 and also served as assistant secretary in 1926 and for several years thereafter. He served on a number of committees: the committee to arrange A.A.A.S. meetings in Indianapolis for 1937; Fifty Year Index Committee 1945 to 1950; Chairman of the Auditing committee 1952 to 1960; Bonding of the Trustee Committee 1954 to 1958; Trustees of the Academy Foundation Chairman 1964 to 1969 and member 1970 to 1972; Invitations Committee 1963 and 1964 and Nominations Committee in 1952. Dr. Morgan also belonged to the Zoological Society of America and Genetics Society of America.

Dr. Morgan's property on the southside of Indianapolis was a showplace in the spring for the great variety of *Narcissus* blooms and other flowers. He had a greenhouse there where much of his hybridization studies were carried on. He perfected several hybrid roses, one of which, "Swingtime" was patented. During his declining years, he suffered several strokes. After having one in 1971, he no longer could work in the greenhouse, but was nursed and aided in finishing some research by his wife, Ada. His sudden death due to a heart attack ended the career of this fine teacher and valued friend.

MARION A. RECTOR

Cass Lake, Minnesota — Chicago, Illinois
December 23, 1907 — November 13, 1974

Mrs. Marion A. Rector was born December 23, 1907, at Cass Lake, Minnesota, but came to Indiana early in life. Her early education was obtained at a grade and high school in Montmorenci, Indiana. She graduated from Ball State University where she also received a Master's degree. She was a science instructor there from 1946 to 1964. She was an efficient and well-liked teacher who particularly enjoyed giving the courses in the local flora. Mrs. Rector joined the Indiana Academy of Science in 1946 and was an emeritus member when she died. She presented a paper at a meeting on the herbaceous plants and shrubs of Christy Woods at Ball State University. Her work is cited in *Natural Areas in Indiana* by Lindsey, Schmelz and Nichols. Mrs. Rector served on the Youth Activities Committee for 1964 and 1966 and was state representative on the committee for the Kappa Kappa Kappa Sorority. She was also a member of the University Club; Sigma Zeta, science honorary; Sewing Club; Alpha Association Chapter of Kappa Kappa Kappa and had been on the board of the Muncie Mission.

After becoming blind and suffering a long illness, Mrs. Rector died at 66 years of age in Chicago, Illinois, November 13, 1974. She had been living there with her daughter.

JACOB RICHARD SCHRAMM

Hancock County, Indiana — Indianapolis, Indiana
February 6, 1885 — January 13, 1976

Dr. Jacob R. Schramm was 90 years old when he died January 13, 1976, at Indianapolis, Indiana. He was former Head of the Botany Department of the University of Pennsylvania and Research Scholar in Plant Sciences at Indiana University. He is probably best known for his excellent teaching and the founding of *Botanical Abstracts* later broadened to become *Biological Abstracts*, also for his research on the ecology of black mining wastes and physiology of the algae which earned for him an international reputation.

Dr. Schramm was born in Hancock County near Cumberland, Indiana, February 6, 1885. His education at home by his German parents was invaluable to him in later years. He was bilingual and his father had imparted a knowledge of the trees and wild flowers of his native county. He was well-disciplined and led to appreciate music, literature and art. He attended Shortridge High School at Indianapolis, Indiana, when David Starr Jordan was on the faculty. Young Schramm worked several years to earn money for his further education and entered Wabash College in 1907. His life was influenced very much by the teaching and personality of his botany professor, Mason B. Thomas, whose example was held in esteem. By taking summer courses and extra course work in regular sessions, he was able to obtain an A.B. degree by 1910. He became a Lackland Fellow at Washington University, St. Louis, from 1910 to 1912 and received a Ph. D. in Botany in 1913.

Dr. Schramm's professional career began as an assistant to George T. Moore, director of the Missouri Botanical Garden from 1912 to 1915. From 1913 to 1915, he was also an Instructor of Botany at the Shaw School of Botany, Washington University. From 1915 to 1925, Dr. Schramm taught Botany at Cornell University. While there, he founded *Botanical Abstracts* and was editor from 1921 to 1926. He also served as Executive Secretary of the Division of Biology and Agriculture of the National Research Council from 1922 to 1924. He left Cornell to become editor when *Botanical Abstracts* expanded to become *Biological Abstracts* and served from 1926 to 1937. He then became Professor of Botany at the University of Pennsylvania 1937 to 1955 when he became emeritus professor. During this time (1939 to 1954), he was also Director of the Morris Arboretum. He was then a research scholar at Indiana University in 1956 until death. While there in 1966, his volume on the ecology of black mining wastes was published by the American Philosophical Society. He wrote many botanical papers.

Dr. Schramm joined the Indiana Academy of Science while at Wabash College in 1908 and was a member until 1911 when he moved to St. Louis. His membership was renewed in 1956 when he returned to Indiana University as a research scholar. A paper on endophytic

algae was read by title at the 1908 meeting. Dr. Schramm collected algae at Woods Hole Marine Biological Laboratory accompanied by Dr. Thomas of Wabash in the summer of 1909. It was there that he met Dr. George T. Moore, a former Wabash student, with whom he later worked at the Missouri Botanical Garden.

Dr. Schramm belonged to and served several other societies: American Association for the Advancement of Science; Botanical Society of America (secretary, 1918 to 1922; vice president, 1923; president, 1925; recipient of Merit Award, 1969); Philosophical Society (secretary, 1947 to 1953; vice president, 1959; recipient of Franklin Medal, 1952). He was also honored by election to Phi Beta Kappa and Sigma Xi, by receiving the G. Miles Conrad Award in 1967 and the Honorary Degree of Doctor of Science at Wabash University in 1959.

Dr. Schramm was married in 1913 and his wife, Mildred, also obtained a Ph. D. degree at Shaw's Garden. She was active in cancer research and helped found the Little Red Door. The lives of the Schramms were exemplary.

R(USSELL) E(MMETT) SIVERLY

Louisa County, Iowa — Muncie, Indiana
December 3, 1913 — February 21, 1976

Dr. Russell E. Siverly was born in Louisa County, Iowa, on December 3, 1913. His undergraduate work was taken at Iowa State Teacher's College where he received a B.A. degree in 1939. He obtained an M.S. degree from the University of Wyoming in 1946 and a Ph. D. degree from Oregon State College in 1956.

His professional career began as a teacher in public schools in Iowa, and he served in the U.S. Army Air Corps from 1942 to 1945. He was an entomologist with the U.S. Public Health Service from 1948 to 1953. He spent summers with the U.S. Public Health Service Technical Development Laboratory at Savannah, Georgia, from 1957 to 1959. He received the rank of Scientist (Reserve) in 1961 and continued as a consultant with the laboratory. He became a member of the Ball State University faculty in 1956 as a professor of health science and was also a member of the Muncie Board of Health for two years. He was honored in 1974 by Ball State University at an awards dinner for the faculty because of his outstanding contributions to the university.

Dr. Siverly's chief research interest was the identification, distribution and control of mosquitos. He had grants from the Indiana State Board of Health, National Science Foundation and Ball State University for his work. He wrote many articles and the books: *Mosquitoes of Indiana* and *Rearing Insects in Schools*. He was working with officials at the Indiana State Board of Health to help prevent an outbreak of encephalitis this last summer. At his death, he was preparing short courses for sanitarians to identify mosquito species, their breeding grounds and methods of control.

Dr. Siverly joined the Indiana Academy of Science in 1956 and was elected fellow in 1961. He was chairman of the Entomology Division for 1961 and was Invitations Committee Chairman for 1962. He presented a study of the life cycle of the mosquito illustrated with color slides at the dinner meeting of the Academy on May 18, 1962. He also presented numerous papers, mostly on mosquito populations, habitat, and as disease vectors at other meetings. He also was a member of the American Association for the Advancement of Science, Entomology Society of America, American Mosquito Control Association; Sigma Zeta and Sigma Xi, science honorary societies; Society of Systematic Zoology and American Public Health Association.

Dr. Siverly was a nationally recognized authority on mosquitoes and control at his death. He died February 21, 1976 in Muncie, Indiana, after a brief illness.

NED M(YRON) SMITH

Indianapolis, Indiana
September 9, 1923

Lafayette, Indiana
January 23, 1976

Dr. Ned M. Smith was a lifelong Hoosier. He was born in Indianapolis, Indiana, September 9, 1923. Following high school, he served during World War II with the U.S. Army Airforce in Europe and Africa from 1942 to 1945. He became a Sergeant and received the Air Medal with Cluster. He retained his interest in aircraft and devotion to country in later years.

His college education was obtained at Indiana University, where he received a B.A. degree in 1949, an M.A. degree in 1955 and a Ph. D. degree in 1962.

He was a geologist with the Industrial Minerals Section of the Indiana Geological Survey from 1950 to 1963. He was visiting faculty member in the Department of Geology, Fresno State College, California, in 1963. He also joined the Purdue faculty that year as an associate geology professor in the School of Civil Engineering. In 1967, he transferred to the new Department of Geosciences, School of Science.

Dr. Smith was essentially a field geologist and was Director of Purdue Summer Geology Field Camp in North Park, Colorado, which he helped locate, organize and operate. His enthusiastic guidance and teaching were appreciated by his students, some of whom suggested establishing the Ned Smith Field Camp Fund which has been done in his memory.

Dr. Smith joined the Academy in 1950 when he was with the Indiana Geological Survey. He reported to the society on a "fossil" cave filling in St. Louis limestone in Putnam County, Indiana. He was a fellow of the Geological Society of America, a member of the American Institute of Professional Geologists, National Association of Geology Teachers, Society of Economic Paleontologists and Mineralogists, American Association of Petroleum Geologists and was a Certified Professional Geologist and Geological Consultant.

He wrote numerous publications and file reports on Indiana geology and many confidential consulting reports for the dimension stone and quarry industry.

Dr. Ned M. Smith, 52 years of age, died from a rapidly progressing cancer. The end came January 23, 1976, in Lafayette, Indiana. He taught classes up until a week before his death, so that his passing came with shock and sorrow to his students and colleagues at Purdue.

ELMER GRIFFITH SULZER

Madison, Indiana
July 29, 1903

Sarasota, Florida
February 14, 1976

Born a stone's throw away from the famous "Madison, Indiana, cut" producing the 5.89 per cent railroad grade there, Mr. Elmer G. Sulzer found a natural interest in railroads at an early age. Later, this was expressed in his numerous books and articles on early railroading and the history of abandoned railroads. He attended Indiana University and DePauw University receiving an A.B. degree from DePauw in journalism and music in 1925. He was in business with the Sulzer Brothers in Madison from 1925 to 1926. He served at the University of Kentucky from 1926 to 1952 as band director, public relations director and head of the Department of Radio and Arts. He had also been director of the Kentucky University marching band. In 1949, he earned an M.A. degree in communication research from the University of Illinois while also serving as production director of station WILL in Champaign-Urbana.

While at Kentucky University, he took education to the mountain country of Kentucky by use of battery operated radios in communities with otherwise poor communication systems. He built the first university FM station in the United States.

In 1952, Mr. Sulzer came to Indiana University to organize a department of radio and television of which he became chairman. While there, he fostered a fine radio-television facility and the training center became one of the finest in the United States. He became a leading broadcast educator. He retired from the chairmanship in 1964 and returned full time to research and teaching and became coordinator of Industrial Relations. He established the first broadcast institute for high school students and was a consultant to Australian broadcasters and educators to implement broadcast education in Australian Universities. He became professor emeritus in 1969. He received numerous awards for his broadcasting. One of them is the very distinguished George Foster Peabody Award for an educational series on venereal disease. He was also a Kentucky Colonel, Sagamore of the Wabash, honorary chief of the Lexington, Kentucky, fire department, and was honorary member of the Brotherhood of Railway Trainmen. He was an honorary citizen of Louisville, Kentucky, and one of a small group, Broadcast Pioneers. His biography is included in *Indiana Lives, Indiana Authors and Their Books 1917 to 1966* (written by Donald E. Thompson), *Ghost Railroads of Indiana* dust jacket and *Indiana Alumni Magazine* articles.

Mr. Sulzer was also vice president and chairman of the board of Electronics Laboratories, Inc. Louisville, Kentucky; and part owner of radio stations in Jeffersonville and Madison, Indiana.

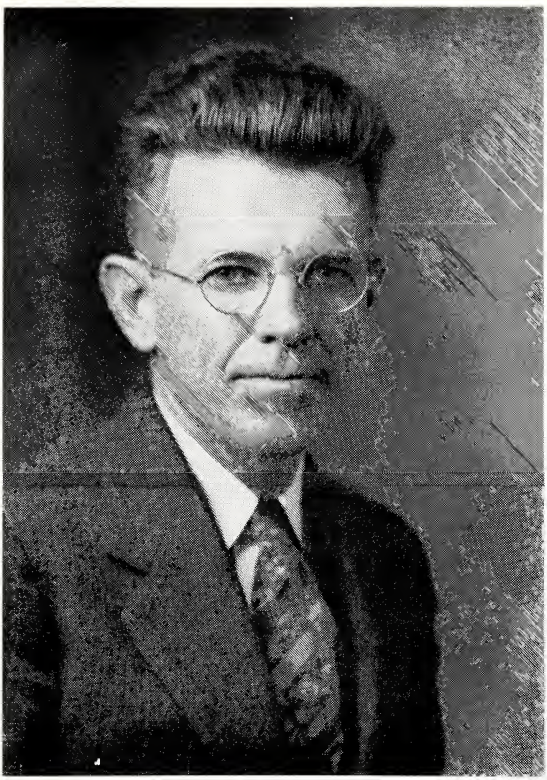
Mr. Sulzer joined the Indiana Academy of Science in 1918 and was an emeritus member when he died. He had presented papers in

the Geology-Geography Section on "erosional freaks" of Saluda limestone, remnant monuments near Madison and a paper on railroad history and abandonment in Indiana. He was also active in the National Association of Educational Broadcasters, American Colleges Public Relations Association, Association of Professional Broadcasting Education, Kentucky and Indiana Broadcaster's Associations and a member of other fraternal and professional societies.

Mr. Sulzer became a world-wide authority on abandoned railroads and the causes. He wrote: *Ghost Railroads of Kentucky, Ghost Railroads of Indiana* and *Ghost Railroads of Tennessee.* Manuscripts and notes are already with the Indianapolis publisher, Vane A. Jones (personal communication), for *Ghost Electric Railroads of Kentucky and Tennessee,* tentatively scheduled for next year. It is also planned to update the books on abandoned railroads in Kentucky and Indiana. Some of his articles appeared in *Trains, The Bulletin of the Railway and Locomotive Historical Society, The Kentucky Engineer* and other journals.

Mr. Sulzer was a jazz enthusiast and played the piano in the Indiana University Dixieland Combo. He also played the calliope on Ohio River excursion boats.

This talented, colorful, versatile man died in Sarasota, Florida, February 14, 1976, where he lived after retirement.



PAUL WEATHERWAX

Worthington, Indiana
April 4, 1888

Bloomington, Indiana
October 18, 1976

Dr. Paul Weatherwax was born near Worthington, Indiana, April 4, 1888, and grew up on a farm. At death, he was a world traveler, the foremost international authority on the botanical and ethnological history of the corn plant, specialist in the grasses, morphologist, anatomist and was an emeritus professor from Indiana University.

His A.B. degree was earned at Indiana University in 1914, an A.M. in 1915 and Ph.D. in Botany in 1918. He was an assistant in Botany there from 1913 to 1915 and an instructor from 1915 to 1919. He was an associate professor at the University of Georgia from 1919 to 1921 but came back to Indiana University in 1921. He became a full professor at Indiana University in 1935 and taught there until 1959 when he became professor emeritus.

Dr. Weatherwax was a quiet man disguising his dynamic personality. His scholarship was rewarded many times by grants and awards. He was a Waterman Fellow at Indiana University from 1925

to 1930 and Guggenheim Traveling Fellow from 1944 to 1945 when he went to South and Central America to do research on corn. He was technical assistant in science education on an Indiana University contract when he went to Bangkok, Thailand, from 1957 to 1959. On that trip, he planned to study corn in the hills of Burma in his spare time. Just as recently as last June, he received a merit award for outstanding botanical contributions from the Botanical Society of America.

He traveled more than 150,000 miles seeking the wild ancestor of Indian domesticated corn. He concluded that the original ancestor was extinct, but primitive characteristics were present in several extant varieties. In order to preserve these varieties, a national committee was formed under the auspices of the National Research Council for supervision of the task. According to a news item in 1952, Dr. Weatherwax belonged to this committee. The purpose of the preservation of various corn characteristics was to be able to develop corn adapted to the specific needs of the future, redevelop a resistant corn if blight developed, or redevelop domestic stock if wiped out in a disaster of any kind.

His adventures in the isolated areas of the Andes Mountains in Peru, Equador and Bolivia took him to native corn fields to search for varieties new to science. He was escorted to jails three times during his trips to Central and South America before he could explain his activities to the natives. He also temporarily lost a precious notebook in New Mexico when it was grabbed while he was watching a Pueblo Indian harvest dance. It took much persuasion to recover it. Many trips were taken to Arizona and New Mexico in his quest. He was the author of a hundred or more papers and *Charles Clemon Deam: Hoosier Botanist in Indiana, Magazine of History* (1971), *Indian Corn in Old America* (MacMillan Press, 1954), *The Story of the Maize Plant* and *Plant Biology,* a textbook which has been widely used. His drawings attracted particular interest and there is a permanent collection displayed at the Hunt Botanical Library, Carnegie-Mellon University, Pittsburgh, Pennsylvania.

He was also well known for his advocacy of conservation before its present popularity. Following the precedent at the campus, he helped in planning the preservation and renewal of Dunn Woods, site of the Indiana University Bloomington Campus during the building program. He named and mapped the trees of the campus in *The Wildwood Campus of Indiana University* first issued in 1963 at the urging of Herman B Wells. Dr. Weatherwax was honored June, 1974, at an Indiana University Arbor Day when a marker was dedicated in his honor on the 100th anniversary of the 1874 Arbor Day at I.U.

After Dr. Weatherwax became professor emeritus at Indiana University in 1959, he continued teaching at Franklin College from 1960 to 1963 and at Hanover College in 1966. He also continued research on grass plants. He had access to a section of the Jordan Hall greenhouse at Indiana University, Bloomington campus, for this purpose.

Dr. Weatherwax was a member of the Indiana Academy of Science 63 years, having joined in 1913. He became a fellow in 1922, was Divisional Chairman of the History of Science Division in 1949 and Botanical Division in 1962, treasurer in 1933 and 1934, editor from 1935 to 1940, president in 1941, parliamentarian from 1965 to 1974 and he was a representative on the Council of the A.A.A.S. in 1949. He served on many committees: membership, program, biological survey, resolutions, nominations, publication of the *Proceedings of the Indiana Academy of Science*, research grants, 50-year index, index, *Indiana Scientists* and the special constitution revision committee. His many papers given at Academy meetings reflected a wide range of interests. His early study of microbiology yielded two papers in 1913, the year he joined the Academy, on a parasite of *Spirogyra dubia* and ecological notes on some White River algae. These were notes gathered while he served as an assistant in a sanitary survey done by the Indiana State Board of Health Water Laboratory. In addition, he gave two papers in 1914 on aerating culture collections and some peculiarities of *Spirogyra dubia*. He was an authority on grasses and gave a number of papers at Academy meetings in this field. Many of his papers were on various aspects of his research on corn: morphology, variation and inheritance, origins and some anthropological observations related to corn study. He gave an after dinner speech at an Academy spring meeting in 1932 on his then recent Central American trip. His presidential address was on the Indian as a corn breeder. He gave the invited paper, *Indiana Botany in Retrospect* as part of the Academy participation in the Indiana Sesquicentennial celebration. He gave papers on botanical teaching techniques and one in 1971 on "liquid" endosperm of grasses.

Dr. Weatherwax was a member of several other societies: American Association for the Advancement of Science, Society of American Naturalists, Botanical Society of America (treasurer, vice president), Genetics Society of America, Indiana Historical Society, Phi Beta Kappa, Sigma Xi, New England Botany Club and Society for the Study of Evolution. Numerous biographical sketches and newspaper articles were written about Dr. Weatherwax. The latest was published a few weeks after his death based on an interview obtained in September. This appeared in the *Indiana Alumni Magazine* (November, 1976). In it, it is mentioned that he and his wife had a son, Charles, employee at R.C.A.; Robert, a bacteriologist; and daughter, Helen, first woman editor of the *Indiana Daily Student*.

Dr. Weatherwax died at 88 years of age in Bloomington, Indiana, October 18, 1976. Death came after a prolonged fight with cancer. His wisdom, friendship, long association and service in the Indiana Academy of Science will be sincerely missed.

NEW MEMBERS INDIANA ACADEMY OF SCIENCE—1976

Dr. T. Scott Abney, Dept. Botany & Plant Pathology, Purdue University, West Lafayette, IN 47907

Mr. William James Adam, Bionucleonics Dept., Purdue University, West Lafayette, IN 47907

Mrs. Mary C. Ailor, Dept. of Entomology, Purdue University, West Lafayette, IN 47907

Mr. Gary A. Apfelstadt, Anthropology Laboratory, Indiana State University, Terre Haute, IN 47809

Mr. John B. Bailey, 328 Potomac, Terre Haute, IN 47803

Mr. John E. Bassett, Dept. Biological Sciences, Purdue University, West Lafayette, IN 47907

Mr. David D. Biesboer, Plant Sciences Dept., Jordan Hall, Indiana University, Bloomington, IN 47401

Dr. Sylvia P. Brehm, Dept. of Life Sciences, Indiana State University, Terre Haute, IN 47809

Mr. Warren A. Bruns, Agronomy Dept., Purdue University, West Lafayette, IN 47905

Mr. William Chang, 611 N. Fess St., Apt. E-1, Bloomington, IN 47401

Ms. Sara A. Clavin, Eli Lilly & Co., Indianapolis, IN 46202

Mr. Kenneth J. Collier, Dept. of Chemistry, Ball State University, Muncie, IN 47306

Ms. Cynthia S. Cordera, Dept. Microbiology, I.U. Medical Center, Indianapolis, IN 46202

Dr. Jerry Mallory Davis, Dept. of Geography, Indiana University, Bloomington, IN 47401

Mr. Robert D. Feldt, 607 State Office Bldg., Indianapolis, IN 46204

Miss Laura S. Fisher, Dept. of Geosciences, Purdue University, West Lafayette, IN 47907

Mr. Steven D. Ford, Jasper Polaski Fish & Wildlife Area, Medaryville, IN 47957

Dr. John E. Foster, Dept. of Entomology, Purdue University, West Lafayette, IN 47907

Mr. Tom French, Dept. of Life Sciences, Indiana State University, Terre Haute, IN 47809

Dr. Dorothy Gabel, School of Education, Indiana University, Bloomington, IN 47401

Mr. John A. Gansfuss, Dept. of Geosciences, Purdue University, West Lafayette, IN 47907

Dr. Garland F. Hicks, Jr., Biology Dept., Valparaiso University, Valparaiso, IN 46383

Dr. David Holtz, Holcomb Research Institute, Butler University, Indianapolis, IN 46208

Mr. Russell R. Hyer, 607 State Office Building, Indianapolis, IN 46204

Dr. & Mrs. Zafar Iqbal, Dept. of Physiology, I.U. Medical Center, Indianapolis, IN 46202

Mr. Steven D. Jansen, Energy Resources Center, University of Illinois, Chicago, IL 60680

Mr. Alfred F. Johnson, 3737 South 7th St., Terre South Vigo H.S., Terre Haute, IN 47802

Dr. Stephen A. Justham, Dept. of Geog. & Geol., Ball State University, Muncie, IN 47306

Dr. Kevin R. Kazacos, Dept. Veterinary Microbiol., Pathology & Pub. Health, Purdue University, West Lafayette, IN 47907

Dr. James H. Kellar, 9th & Fess Sts., Bloomington, IN 47401

Mr. Matthew Kelty, Box 369, Dept. of Biology, Notre Dame, IN 46556

Dr. Duncan T. Kennedy, Center for Medical Education, Ball State University, Muncie, IN 47306

Mr. George A. Kinias, 1440 E. 35th Ave., Indiana Vocational Tech. College, Gary, IN 46409

Mr. Gerald W. Kline, Dept. of Anthropology, University of Tennessee, Knoxville, TN 37916

Dr. N. Gary Lane, Dept. of Geology, Indiana University, Bloomington, IN 47401

Mr. Karl H. Langlois, Jr., P.O. Box 723, Monticello, IN 47960

MR. THOMAS EDWARD LAUER, 1330 W. Michigan, Indiana State Board of Health, Indianapolis, IN 46206

DR. MORRIS LEVY, Dept. of Biological Sciences, Purdue University, West Lafayette, IN 47907

MISS MARY LOU LYONS, 10101 E. 38th St., John Marshall High School, Indianapolis, IN 46236

MR. BRADFORD R. MCCLARNON, I.U. Student Health #344, Bloomington, IN 47401

DR. MACLEAN, Dept. of Biology, Youngstown State University, Youngstown, OH 44555

MR. RALPH A. MATACALE, c/o Lloyd Egler, R.R. 2, Box 156B, Ferdinand, IN 47523

MR. DAVID MAXWELL, 1330 West Michigan St., Indianapolis, IN 46206

MR. C. EDWARD MEADOWS, Dept. of Natural Resources, Ball State University, Muncie, IN 47306

DR. KENNETH G. MIGLIORESE, 3400 Broadway, Indiana University Northwest, Gary, IN 46408

MR. JOHN S. MOORE, Kendalls Apts. #3, Paoli, IN 47454

DR. CHARLES O. MORTENSEN, Dept. Natural Resources, Ball State University, Muncie, IN 47306

MISS LUCINDA MORTON, Science Teaching Center, Indiana State University, Terre Haute, IN 47809

MR. LEONARD E. MUNSTERMANN, Dept. of Biology, University of Notre Dame, Notre Dame, IN 46556

MR. LORAN S. O'BANNON, Fairway Drive, R.R. 1, Greencastle, IN 46135

MR. LARRY W. OILER, Wabash College, Crawfordsville, IN 47933

MR. PAUL F. PEDONE, Soil Conservation Service, 5610 Crawfordsville Rd., Indianapolis, IN 46224

MR. ROBERT R. PRIDDY, Dept. of Natural Resources, Huntington College, Huntington, IN 46750

DR. DAVID K. REED, Fruit & Veg. Insect Res. Lab., USDA-ARS/Box 944, Vincennes, IN 47591

MRS. RUTH M. REICHMANN, R.R. 2, Box 272, Nashville, IN 47448

JOHN L. and INA C. RIDGEWAY, 1315 N. Cecil Ave., Greenfield, IN 46219

MR. DAVID W. RING, P.O. Box 1918, Harrison Hall, West Lafayette, IN 47906

MR. JOHN L. ROTH, JR., Dept. of Plant Science, Indiana University, Bloomington, IN 47401

MR. and MRS. GARRY L. SCHOLZ, Western Materials Co., Box 150, Lafayette, IN 47902

DR. T. C. SCHWAN, Dept. of Chemistry, Valparaiso University, Valparaiso, IN 46383

DR. DONALD H. SCOTT, Dept Botany & Plant Path., Purdue University, West Lafayette, IN 47907

MS. JANET K. SHAW, 6 N. Chauncey, West Lafayette, IN 47906

MRS. GAIL E. SHEW, Dept. of Biology, Ball State University, Muncie, IN 47306

DR. TOUFIQ A. SIDDIQI, 400 E. 7th St., Indiana University, Bloomington, IN 47401

MS. DAIDEE E. SPRINGER, 220 N. Union St., Kokomo Public Library, Kokomo, IN 46901

MR. STEVEN W. STONER, Biology Dept., Ball State University, Muncie, IN 47306

MR. WILLIAM E. TOZER, JR., Biology Dept., Ball State University, Muncie, IN 47306

MRS. LAURA C. TROUT, 202 Education Bldg., Indiana University, Bloomington, IN 47401

DR. GILBERT R. TURPIN, 120 East Walnut, Indianapolis Public Schools, Indianapolis, IN 46204

MR. MARK ALAN VERBLE, David St., Medora, IN 47260

DR. CARL E. WARNES, Biology Dept., Ball State University, Muncie, IN 47306

DR. PETER WASER, Dept. of Biology, Purdue University, West Lafayette, IN 47907

MRS. MARGARET R. WATANABE, Dept. of Microbiology, I.U. Medical Center, Indianapolis, IN 46202

DR. & MRS. JAMES WATSON, JR., Physics Dept., Ball State University, Muncie, IN 47906

MR. JOHN M. WIEHE, Zoology Dept., North Dakota State University, Fargo, ND 58102

MR. JAMES WILLUT, 835 Laport, Valparaiso, IN 46383

MS. SUE WINDER, Dept. of Anthropology, Indiana University, Bloomington, IN 47401

MR. DENNIS WOLKOFF, Rt. 1, Box 115, The Nature Conservancy, Nashville, IN 47448

MR. ROBERT O. YAGER, Heritage High School, Monroeville, IN 46773

DR. ALAN C. YORK, Entomology Hall, Purdue University, West Lafayette, IN 47907

MR. HANSON L. YOUNG, 2929 Engle Road, Kekionga Jr. High School, Fort Wayne, IN 46809

MR. ROSS B. ZIMMERMAN, Dept. of Zoology, Indiana University, Bloomington, IN 47401

SCIENCE CLUB, Bishop Luers High School, Fort Wayne, IN 46798

LEW WALLACE BIOLOGY CLUB, Lew Wallace High School, Gary, IN 46407

MADISON HIGH SCHOOL SCIENCE CLUB, c/o Virgil Imel, Madison Consolidated High School, Madison, IN 47250

MADISON JR. HIGH SCIENCE CLUB, Madison Jr. High School, c/o Dennis J. Paul, Madison, IN 47250

BROWN COUNTY CHAPTER OF THE INDIANA JUNIOR ACADEMY OF SCIENCE, Brown County High School, Nashville, IN 47448

FLOYD CENTRAL HIGH SCHOOL, c/o Ray Weatherholt, R.R. 2, Box 445A, New Albany, IN 47150

NEW ALBANY HIGH SCHOOL SCIENCE CLUB, c/o David J. Hines, New Albany High School, New Albany, IN 47150

SCIENCE CLUB, c/o Larry Holler, Yorktown Middle School, Yorktown, IN 47396

INDIANA ENERGY 1977

A STATUS REPORT WITH SUGGESTIONS FOR POLICY ACTION

Committee on Science and Society, Indiana Academy of Science

PREAMBLE

Among the actions taken by the Executive Committee of the Indiana Academy of Sciences at the fall 1975 meeting was the authorization of the Committee on Science and Society to prepare annually, on behalf of the Academy, a report setting forth the status of some aspect of science with significant current societal ramifications, pointing where appropriate to any areas in need of special awareness or action.

Following a review of a number of scientifically-related problems currently the focus of national attention, including several for which the Committee had already initiated activity, the Committee selected Energy as the central theme of this, its first, Annual Report to the Academy. In particular, it was decided to review the condition of Indiana's indigenous energy resources, the current energy consumption within the State, and current thinking regarding future trends against the background of established and *de facto* State policies. Where appropriate, suggestions were to be made for additions to or modifications of policies that concern energy.

During the summer of 1976 the Committee appointed an *ad hoc* panel to prepare the report. This document is the result of discussions among the panelists, their review of pertinent literature, and their collective scientific judgments.

I—Introduction

In 1969, the Bureau of Natural Gas of the Federal Power Commission (FPC) released a report warning of impending supply difficulties with natural gas in the 1970's. This was followed by a second report in 1972 which projected supply and demand for this fuel through 1990 and predicted that domestic production would peak in the nineteen seventies, an event which actually occurred in 1974. The statistical data for the decline of proven reserves were sufficiently compelling that, in 1970, the FPC initiated a round of meetings with national wholesalers of natural gas that led to a series of agreements to curtail deliveries of interstate gas. The major repercussions of these agreements had impact on the large volume sales of gas in the rate category of interruptible contracts with industry. In succeeding years, the curtailment agreements became more stringent, and in the summer of 1975 the FPC and the interstate gas companies announced curtailments in deliveries for the 1975-76 heating season ranging up to 36 percent of anticipated demand. Varying percentages of curtailments, differing geographic areas with regard to proximity to interstate pipelines, and differing mixes of priority users led to projections of grossly inequitable shortages among the states and within individual states. The projected impacts, while

widely publicized, turned out for a combination of reasons to be significantly overstated.

The overestimates of natural gas shortages for the 1975-76 heating season tended to obscure in the minds of the public the important fact that the shortage which did occur was very close to that predicted by the FPC Staff Study of 1974 which warned of declines in natural gas supplies of about 5% per year through at least 1980. A similar decline in supplies may well be expected for the 1976-77 heating season.

The public was made dramatically aware of the corresponding situation with regard to crude oil with the embargo initiated by Arab-nation members of the Organization of Petroleum Exporting Countries in October 1973 and the subsequent shortages and rapid escalation of prices for refinery products such as gasoline, heating oils, and diesel fuels. The current adequate, indeed surplus, supplies of petroleum products have led to relaxation of public concern for what is in reality a most serious situation. Even in the presence of surpluses, world crude oil prices have not declined markedly as would be expected if petroleum were traded in a free market. In addition, the proportion of U.S. petroleum consumption that is imported at these higher world prices has risen from about 23% in 1970 to approximately 40% currently, a consequence of steadily declining domestic production. Unfortunately, this falling production will be offset only briefly by the arrival of Alaskan oil, expected to begin late in 1977.

The United States and Indiana are well endowed with coal reserves, but the changing availability of petroleum and natural gas has affected this resource, too. Contract sales at $25 per ton have recently been announced, a figure more than double that of just four years ago. Part of the increase is certainly due to environmental constraints on sulfur emissions, with a resultant shift in demand to low-sulfur coals, but the apportionment is complex, as are the future prospects for utilization of the nation's high-sulfur coal reserves. Economic and technological delays in the implementation of new methods for meeting national air quality standards by the electric utilities, by far the largest single users of Indiana coal, contribute to this uncertainty.

Parallel uncertainties also continue to plague the nuclear power component of the electrical industry which has, in addition, its own unique set of issues. Referenda designed to restrict the development of nuclear energy systems in various ways have recently appeared on the ballot in several states reflecting public uneasiness regarding recurring questions associated with weapons proliferation, radioactive wastes, control of nuclear fuel, and the potential for reactor accidents.

Amidst all this there seems to be an urgent need for us to know where we stand and to decide what our positions on these complex matters will be, both as a nation and particularly as a State. To be sure, in some cases national policies are pre-emptive, but in other areas the stance taken by the State of Indiana will be the most important to the welfare of her citizens and could well play a shaping or even determinant role in the formulation of national energy policies.

The State of Indiana has taken a number of positive positions on energy-related matters. Important among these are the legislatively established policies in the areas of surface mine reclamation and property tax reductions for home solar heating installations. In addition, various State agencies and offices have jurisdiction over, or at least give consideration to, single aspects of the energy situation. They include several divisions of the Department of Natural Resources, the Public Service Commission, the State Board of Health and the related Stream Pollution Control Board and Air Pollution Control Board, the Department of Commerce, and others. Indiana has also taken a leading role in the regional analysis of energy matters in the forum of the Midwest Governors' Conference. However, at this writing Indiana lacks a mechanism for considering total energy needs, methods of filling those needs in the face of reduced supplies in some categories, and development of internal energy sources. Nowhere in the State is there any organization or body that considers the various needs and problems as they relate to one another.

Indiana as a State appears to be doing very little to stimulate development of known or suspected alternate energy sources. In contrast, Kentucky, a major importer of Indiana coal, is supporting major coal gasification and liquefaction projects. Illinois has authorized a $75 million bond issue to fund special efforts at the State level to cope with future energy requirements. In Indiana, however, such matters as whether electrical generating capacity will be increased through expansion at existing sites or installation of entirely new facilities and the siting of proposed nuclear generating facilities are determined solely by the utilities. The State of Indiana takes no official position in such matters or in other energy consumption and development issues.

With the intent of addressing these issues, the two chapters that follow present a brief account of the Indiana energy situation, emphasizing the prospects as they presently exist for various energy alternatives and outlining some suggestions for State policies that, in our judgment, deserve prompt attention.

II—Indiana Energy

Rather than restating energy consumption by consuming sector and fuel or reviewing widely publicized data on declining reserves, the thrust of this chapter is to describe the present situation for the major components of Indiana's energy system, noting in particular the status and future prospects of potential alternatives to those fuels now in common usage.* While our time frame is deliberately vague, the situation will be much as we describe through at least 1980 because the lead times necessary to affect major alterations are typically long. Beyond that time the situation as viewed from the present is progressively less clear.

* In this section the panel made considerable use of the report "Indiana Natural Gas: Accommodation to Reality" and acknowledges with appreciation the contributions of the task force members who prepared that document. A listing of the task force membership appears in Appendix D.

Energy Conservation

Energy conservation measures offer immediate possibilities to alleviate near-term shortages of domestic fossil fuels. It is generally recognized that the only other means of offsetting such shortfalls is with imported oil, a strategy with obvious problems in view of the nation's current import rate.

Energy conservation, while it is equivalent to a once-only reduction in consumption, offers the potential for substantial fuel savings, dollar economies, and environmental benefits. Unlike other alternatives, the conservation option offers the opportunity for broad public participation and direct, highly visible action on the part of governmental units at all levels with some benefits accruing directly to consumers. On balance, it must also be noted that certain conservation measures might be implemented via price manipulation, a strategy that would increase energy unit costs for consumers. Among the areas where substantial savings can be realized are transportation (e.g., enforced speed limits, tax incentives for smaller engines), residential and commercial uses (e.g., more efficient appliances, improved insulation), and recycling (particularly energy-intensive and petroleum-based materials).

Electricity: Generation Capability and Nuclear Projections

The electric utilities in Indiana are included within the East Central Area Reliability Coordination Agreement (ECAR), one of nine regional reliability councils encompassing nearly all of the power systems of the U.S. and a large fraction of those in Canada. (See Figure 1.) Interconnections between regions are available, so that the future adequacy of electric power in Indiana is likely to depend strongly on the adequacy of regional and national generating capacity. Nevertheless, Indiana policies relative to the construction of new generating capacity will influence the extent to which Indiana can supply its own share of electricity in the future. For example, pioneering State policy regarding the consumptive use of water will have the effect of restricting most new capacity to the Ohio and lower Wabash Rivers.

On a national basis, and therefore on a State basis as well, there is so much uncertainty regarding generation capacity additions and future loads that there can be no assurance that shortages may not begin to develop in the late '70's and early '80's. Current plans for power plant construction during the next decade are expected to result in an annual capacity increase averaging about 5.3% for the 48 contiguous states of the U.S. and about 4.7% for ECAR. But the current load projections for summer load peaks, including the conservatism resulting from the recession, increase at an average rate of about 6.4%, both for the nation and as a whole and for ECAR. Therefore, if these numbers should turn out to be correct, a gradual reduction in reserve capacity will occur from the current 32.5% to 14.7% by 1985. This reduction would inevitably be accompanied by an increasing lack of system reliability and by electrical energy deficiencies with potentially serious economic and social consequences.

Most of the new electric generating capacity that is planned for the next decade is for coal-fired and nuclear plants. Oil-fired capacity is expected to increase slightly and then level off; natural gas-fired generation, primarily in Texas and neighboring states, is projected to decline. The increase in coal capacity averages about 5.8% per year nationally compared with only about 3.3% for ECAR. Projected increases in nuclear capacity average about 17% per year nationally compared with more than 23% for ECAR.

The planned expansion of both coal-fired and nuclear plants should be regarded as lower limits. It would be prudent to increase both, if possible. An excess of capacity would be far less risky to Indiana residents and much easier to correct. Both nuclear and coal-fired capacity expansions are subject to such constraints that a policy of dropping back on one by increasing the other would in all likelihood increase the threat of brown-outs and serious deficiencies of electric power. Accompanying the capacity expansion, consideration should also be given to the introduction of new energy storage technologies and rate structure changes as means of reducing projected increases in peak capacity requirements.

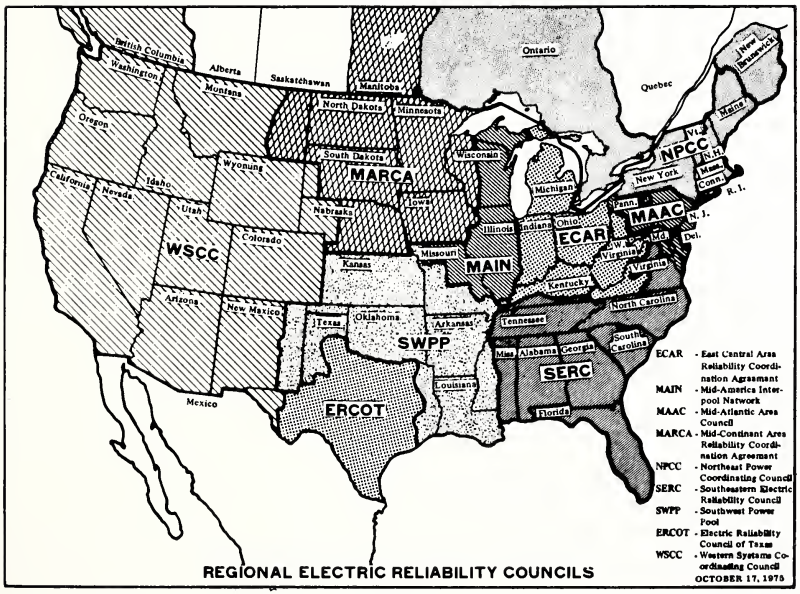


FIGURE 1.

Solar Energy

Indiana's solar flux is sufficiently large to justify continued active development of this resource, especially for use in space heating and air conditioning and in domestic hot water heating. However, the variability of the flux is such that this application will require storage and backup systems. Large scale solar electric power generation will not

be attractive in Indiana without major advances in conversion and storage technologies. Table 1 illustrates the average solar flux in Indiana by month.

TABLE 1. *Average Solar Flux on Collector Surface Which is 50° from the Horizontal (BTU/sq ft/day)*

January	1067	July	1581
February	1224	August	1625
March	1438	September	1823
April	1392	October	1682
May	1439	November	1296
June	1493	December	1084

Solar energy in Indiana may not only replace some nonrenewable fuels but, because of the requirement for storage systems, it also has the potential to help alleviate the peak load situation facing the electric utilities. For example, thermal storage systems can be used to "store" air conditioning during the peak demand periods in the summer. Thus, air conditioners in solar homes could be run at night and operated at reduced levels or even turned off during the day when the heaviest electricity demand usually occurs. A similar procedure could be followed for heating systems in the colder months. The procedure in the latter case would be to keep a high percentage of thermal storage capacity in place during the day, even if the solar system is not fully operational. In this manner the solar energy system's storage unit assists in reducing the electrical system's required peak generating capacity.

Because of the high solar flux and the required emphasis on thermal storage, Indiana and neighboring states have the potential to become leaders in solar heating and air conditioning demonstration projects, technology development, and applications. Among the more important areas in which technological development will be important are low-temperature air conditioner systems, solar space heating and domestic hot water systems suitable for retrofitting existing structures, thermal storage systems, auxiliary systems for solar applications such as controls, insulated ducting and low-cost valves, and lower solar collector costs through simpler design, mass production, and on-site construction.

Natural Gas Production in Indiana

Unless major new reserves of natural gas are discovered in Indiana, the State must continue to rely upon gas brought in by long-distance pipelines from the South and Southwest. Present in-state reserves amount to only about 1 percent of the State's annual consumption. Production from Indiana wells last year would have satisfied the State's consumption for 5 hours.

Access to Natural Gas from Out-of-State Sources

Indiana is favorably situated to receive gas from the principal producing regions in the United States, as trunklines from the south and west cross or pass near the State enroute to major consuming regions

farther north and east. Proposals now under active review to bring Alaskan gas to the lower 48 states may well result in additional service to the Midwest, including Indiana, from that source. The reduced availability of gas that has been experienced in the past three years and which may be expected to become progressively more acute for the foreseeable future results primarily from declining production at the sources rather than from any inadequacy in the interstate distribution system. A complicating factor, however, is federal price control at the wellhead of gas sold in the interstate market. Some effects of price regulation have been to restrict the availability of gas outside the principal producing states, to encourage use of gas in place of other fuels, and to reduce production. A further complicating factor for Indiana is the varying curtailment levels and differing mixes of priority users across the State leading to inequitable distribution resulting in gas surpluses in some areas and shortages in others. The average 5% annual decline in deliveries to Indiana over the next several years may be expected to amplify those inequalities in the absence of mitigating action by the State or federal government.

Underground Storage of Natural Gas

Large volumes of natural gas stored in porous and permeable sandstone and limestone reservoirs were originally developed to serve as a cushion against fluctuating demand and to permit the local warehousing of gas at times when it was available and the price was low. Indiana has more than 30 such storage reservoirs, and they have performed a valuable service both in making gas more available during periods of high use and in reducing the cost to the consumer. They are based, however, on the concept of gas available in large volume and at low cost. This situation no longer exists, and the storage facilities, which have never been filled to their capacity, are no longer utilized as fully as in previous years. Storage is only effective when there is something to store.

Liquefied Petroleum Gases

Propane and butane (mostly the former) recovered in refining operations are shipped and stored under pressure in liquid form. To a considerable extent they are interchangeable as fuels with natural gas, and they have been the standby fuel for many consumers who have interruptible contracts for natural gas. The liquid form makes them readily transportable, and for this reason they are used extensively for mobile installations, seasonal spot uses (e.g., grain drying), and isolated facilities (cabins, rural residences). Their cost per Btu is high relative to natural gas, and in time of other fuel shortages local supplies may be exhausted.

Underground storage in pressurized excavated space exists at four localities in Indiana and provides some cushion against both high seasonal demand and restricted shipment from refining centers. Product pipelines deliver LPG to the underground reservoirs and surface storage, thus improving delivery capacity in some parts of the state.

Crude Oil Production in Indiana

Indiana's crude oil production is only a small proportion of the State's crude oil consumption (in terms of refinery products), although the exact percentage is difficult to assess because Indiana has a large refining industry, and very large volumes of crude oil are shipped into the State to yield refinery products most of which again go out-of-state. Whatever this ratio may be, Indiana's total known crude oil reserves of 22 million barrels can have little impact on the availability of refinery products within the State. Only significant new oil discoveries can alter this balance, and the discovery rate of recent years does not offer great hope for a change.

Indiana's Access to Crude Oil from Out-of-State

High prices and shortages due to restricted imports would appear to be the only limitations on the availability of crude oil to Indiana's refining industry. Oil enters the State principally via cross-country pipelines and a major and increasing part of the oil is from foreign sources. The crude oil supply to Indiana's largest refinery is nearly 40% foreign, closely paralleling the national situation. This supply is, of course, vulnerable to embargo. Much of the State is not dependent upon Indiana refineries for access to refinery products.

Indiana Coal

Indiana has large reserves of coal (17 billion tons) and substantial annual production (about 25 million tons in 1974 and 1975), but nearly twice as much coal is consumed annually as is produced in the State. Table 2 contains information regarding Indiana coal reserves. The State's consumption profile is contained in Appendix A for both 1974 and 1975. Approximately 5 million tons of Indiana coal are shipped out-of-state annually, which means that over half of the coal consumed is imported. The reasons, in addition to the fact that the State's annual consumption exceeds the annual capacity, are that 1) Indiana ranked 2nd nationally in 1975 in steel production and all metallurgical coking coal must be imported, and 2) the sulfur content in much of Indiana's coals currently requires that they be blended with lower sulfur coals for use in electrical generation. Indiana coal production could be increased about 1 million tons annually for a number of years, a rate already planned by producers for the next 3 to 5 years.

Conjectural Sources of Additional Fuels

Gas from shale and from coal, oil from oil shale, and uranium have received some attention as possible future supplements to Indiana's energy supply.

Natural gas has been produced in modest amounts at a few localities in Indiana from the rock unit called the New Albany Shale, which underlies extensive areas. The Indiana Geological Survey is participating in a broad, multi-state investigation of the shale gas possibilities, supported by the Energy Research and Development Administration. Shale gas wells, if favorable conditions for production are found, will have

relatively low individual yield, although the total volume ultimately recovered could be appreciable.

Methane can be removed from bituminous coal in advance of underground mining as a safety measure. The shortage of natural gas combined with increasing prices suggests that demethanization could reach the level of commercial gas production in some regions. The Indiana Geological Survey, in cooperation with the U.S. Bureau of Mines, is testing Indiana coals for methane yield. Early results suggest that the expectable gain in gas supply will be modest even if such development materializes.

TABLE 2. *Recoverable Coal Reserves in Indiana by County, January 1 1974*[1]

County	Strippable	Non-Strippable	TOTAL
Clay	312,770,247	252,366,000	565,136,247
Daviess	137,005,877	119,502,000	256,507,877
Dubois	4,803,000	3,981,000	8,784,000
Fountain } Warren }	32,446,705	3,603,000	36,049,705
Gibson	----------	2,230,905,992	2,230,905,992
Greene	193,619,319	228,181,472	421,800,791
Knox	142,285,000	2,241,335,016	2,383,620,016
Martin	82,771,000	11,000	82,782,000
Owen	49,533,774	----------	49,533,774
Parke	9,526,877	29,402,000	38,928,877
Perry	----------	28,200,000	28,200,000
Pike	215,199,514	370,015,945	585,215,459
Posey	----------	2,870,391,000	2,870,391,000
Spencer	52,140,749	----------	52,140,749
Sullivan	290,478,626	3,482,373,446	3,772,852,072
Vanderburgh	----------	1,083,454,000	1,083,454,000
Vermillion	37,157,280	295,399,205	332,556,485
Vigo	253,918,457	1,448,483,408	1,702,401,865
Warrick	257,942,501	517,134,269	775,076,770
TOTAL	2,071,598,926	15,205,738,753	17,276,337,679

[1] Modified from Table 6, Page 33, Coal Resources of Indiana, Bulletin 42-I, Indiana Geological Survey (thru Jan. 1, 1965) with Annual Reports of Indiana Bureau of Mines and U.S. Bureau of Mines, 1965 through 1973. Based on recovery by current technology.

The same New Albany Shale that is a possible source for additional natural gas is also classified as a low-grade oil shale and, in addition, contains some uranium. The oil yield in gallons per ton is substantially below the level that is now considered commercial, only 8 to 14 gallons per ton from the richest parts of the formation compared with the minimum yield for economic operation for the Coloado Shales of about 25 gallons per ton. The most radioactive part of the New Albany Shale tested to date is about 0.01 percent U_3O_8 equivalent, in comparison with about 0.2 percent for the current minimum commercial grades. Even this disparity does not tell the whole story, however, as much of the "U_3O_8 equivalent" reflects potassium in the clay minerals, rather than uranium or even thorium. Evaluation of both shale oil and nuclear fuel possibilities must consider, however, the enormous tonnages of New Albany shale that underlie Indiana and other parts of the Midwest.

Coal Conversion

Both gaseous and liquid products that would be satisfactory substitutes for natural gas and certain refinery products can be produced from coal of the type that constitutes Indiana's principal reserves. These methods of utilizing coal have the advantage that sulfur removal from the products is more readily accomplished than from the coal itself, making possible more environmentally sound utilization of Indiana's high-sulfur coals. Processing plants of commercial size are very costly, and only pilot or experimental installations are in operation or under construction at this time, none in Indiana. Both processes entail huge water consumption, and acceptable sites in Indiana would be largely restricted to the Ohio River region. Despite the high costs and other handicaps, coal conversion is probably the best means for the United States to attain a satisfactory level of domestic security in liquid and gaseous fuels. Some research on coal conversion, federally supported, is currently underway within the State.

Low-BTU Gas

Gas that has a BTU content considerably lower than that of pipeline gas (300 to 400 BTU per cubic foot as compared with pipeline natural gas at 1,000 to 1,100 BTU per cubic foot) can be manufactured readily from coal and was indeed the gaseous fuel of the Midwest in the years between the depletion of the early natural gas fields and the coming of the long-distance interstate pipelines from the western and southwestern states and the Gulf of Mexico. The technology is known, and suitable coal is available, for production of low-BTU gas in significant volume, although major production capacity is not in place at this time. Such substitute gas is considered less desirable than natural gas and is less suited to pipeline delivery except over short distances. This lower desirability factor may be expected to prevail until the first cold day after the natural gas supplies become inadequate.

III—Suggestions for Policy

No single answer exists to the problems associated with the impending and projected shortages of energy, whether these be the immediate shortfalls in natural gas or those that will certainly occur among some of the other energy resources consumed in our economy. The potential contributions from many alternative sources must be explored with no guarantees of success. Our situation is such that no possible contributor, the small and improbable as well as the large and apparently obvious, can be ignored without peril. It is also critically important to realize that many potentially significant solutions should receive action now in order to have effects on our State's energy supplies beyond 1980. With these points in mind, the panel makes the following suggestions for policy consideration. These suggestions represent a consensus on each point; being different individuals with differing priority concerns, not all members subscribed to all suggestions.

1. Energy Conservation

While it is not certain to what extent energy consumption may be decoupled from gross national product, good energy conservation practices appear to offer an excellent economical immediate method of counteracting projected shortages of natural gas and petroleum without markedly affecting lifestyles. A considerable relaxation of the conservation efforts of 1973-74 has apparently occurred, and indications are that much of the expected near-term energy shortages and economic impacts could be offset by a renewed and continuing program to educate the public regarding the wisdom of saving energy. A very recent analysis by the International Energy Agency (IEA) shows the U.S. energy conservation effort to be among the worst in the IEA countries. Recognizing that implementation of conservation strategies must be monitored carefully to avoid adverse economic impacts, the State of Indiana could be among the nation's leaders in this area by adoption of the following:

(i) Provide authoritative energy conservation information and an active state-wide program for disseminating it.

(ii) Consider a program of tax incentives to encourage conservation including, but not limited to, rebates for retrofitting existing structures with high efficiency insulation, property tax allowance for similar installations in new structures, and reduced assessments for passenger cars with smaller engines.

(iii) Encouragement of energy-conserving new construction, setting an example by moving to maximize the energy efficiency of State-owned buildings and by requiring that new buildings funded entirely or in part by State funds utilize the best available energy-conserving designs and technologies including solar energy supplementation. Introduction of new building codes such as ASHRAE 90-75 is recommended.

(iv) Development of a technology transfer network throughout Indiana to facilitate the transfer of energy conservation knowledge to end users.

(v) Strict enforcement of the 55-mile-per-hour speed limit on Indiana highways.

(vi) Implementation of appropriate incentive programs to encourage recycling of energy-intensive and petroleum-based materials.

(vii) Thorough consideration of the phase-out of one-way beverage containers as an energy conservation action.

(viii) Analysis of alternative electricity rate structures to determine their conservation impacts.

2. Solar Energy

The potential cited earlier for solar energy utilization within Indiana supports the following recommendations:

(i) Indiana's pioneering solar energy property tax reduction law should be widely publicized in the State.

(ii) The State of Indiana should determine and establish a realistic goal for the percentage of new construction to involve solar heating and air conditioning by 1980, with a similarly developed objective set for the percentage of all space heating and cooling that should be provided by solar means by 1985.

(iii) Solar energy information centers should be developed (perhaps a part of the network suggested in 1. (iv) above). These centers would provide architects, builders, savings and loan associations, banks, industrial and residential consumers, trade unions, and others with technical information on solar energy applications.

(iv) The State should play an active role in attracting demonstration funds for solar energy from ERDA and HUD to Indiana.

(v) Indiana should develop further the existing network of solar monitoring stations for data collections.

(vi) An active State-wide program should be implemented to educate the public on solar energy. This program would include the production of authoritative literature whose major purpose would be to inform the consumer on the following: (a) give consumers enough understanding to permit them to recognize accuracy of performance claims of solar equipment manufacturers; (b) give consumers enough background to make personal decisions in regard to their own best use of solar energy; (c) provide technical information that will make it possible for "do it yourself" individuals to go ahead on their own and build solar collecting equipment.

3. Electrical Power

Announced generating capacity expansion plans within ECAR over the next ten years prompts the following suggestions for policy consideration:

(i) A prudent policy for both Indiana and the nation is to recognize the constraints to building additional coal-fired and nuclear capacity, and to make every effort to resolve the many problems involved in order that the utility companies may find it possible to install more capacity than is currently planned, and to do so with minimal environmental impact.

(ii) Utilities should be encouraged to explore the potential for lower facility construction costs through energy storage installations, e.g., pumped storage, underground compressed air, or thermal storage.

4. Coal

Following completion of the large interstate gas pipelines in the 1950's, Indiana consumers along with those in most of the midwestern and northeastern states responded to economic incentives and shifted a significant portion of their energy consumption to natural gas produced in the South and Southwest. As supplies from those areas begin to

decline, it appears that a most important alternative available to the State is its large coal reserves. Gasification to produce both high and low Btu gas from coal offers direct substitution for natural gas. Additional means of utilizing coal efficiently with due recognition of environmental constraints need active study. These points support the following policy recommendations:

(i) The State should make immediate, vigorous efforts to develop gasification projects for both high and low Btu gas at scales sufficient to relieve impending pressures that will surely result as future interstate natural gas curtailments spread more deeply into the Indiana economy.

(ii) The State should carefully consider the advisability of a State tax on all future coal mined. The returns should be applied, under legislative authority, to a trust fund for research, development, and demonstration of gasification, liquefaction, and desulfurization of Indiana coals for use in Indiana homes, businesses, and industries. A one percent tax on Indiana's 1975 coal production of 25,269,000 tons with an average minehead value of $11.25 per ton would raise $2,840,000 for this purpose.

Appendix A

Indiana Coal Consumption—1975
(tons)

In-State Consumer Use of State Coal Production:		
Electric Utilities		17,222,000
Coke & Gas Plants		---
Retail Dealers		416,000
All Others		2,735,000
Sub-total		20,373,000
Coal Shipped Out-of-State to:		
Michigan	132,000	
Ohio	72,000	
Illinois	386,000	
Wisconsin	871,000	
Minnesota	88,000	
Missouri	402,000	
Georgia	482,000	
Kentucky	1,689,000	
Tennessee	509,000	
Alabama	25,000	
Not Revealable	15,000	
	4,671,000	4,671,000
Total State Production		25,044,000

Appendix A—Continued

Coal Shipped Into State From:		
Pennsylvania	2,040,000	
West Virginia	9,819,000	
W. Kentucky	4,267,000	
Illinois	6,273,000	
Ala., Ga., Tenn.	164,000	
Colorado	2,000	
Wyoming	3,019,000	
Utah	131,000	
Montana, Wash.	840,000	
	26,555,000	26,555,000
State Production Used in State		20,373,000
Total Coal Consumption Used		46,928,000
Consumer Use In State (Grand Total)		
Electric Utilities		28,715,000
Coke & Gas Plants		14,072,000
Retail Dealers		596,000
All Others		3,545,000
GRAND TOTAL		46,928,000

SOURCE: Bituminous Coal and Lignite Distribution Calendar Year 1975, Div. of Fossil Fuels, Ap. 12, 1976, U.S. Dept. of The Interior, U.S. Bureau of Mines

Indiana Coal Consumption—1974
(tons)

In-State Consumer Use of State Coal Production:		
Electric Utilities		15,741,000
Coke & Gas Plants		
[1] Retail Dealers		153,000
[2] All Others		3,246,000
Sub-total		19,150,000
Coal Shipped Out-of-State to:		
Ohio	347,000	
Illinois	493,000	
Wisconsin	404,000	
Minnesota	106,000	
Missouri	68,000	
Georgia	1,255,000	
Kentucky	1,656,000	
Tennessee	262,000	
Not Revealable	35,000	4,626,000
Total State Production		23,766,000

[1] "Retail Dealers." Any person (including the retail outlet, branch or department of one who is also a producer, wholesaler, or dock operator), to the extent that he acts in the capacity of a supplier, shipper, or seller of bituminous coal and lignite in any transaction involving a shipment, sale, or sale and delivery to a consumer of broken-bulk bituminous coal and lignite physically handled in a truck, wagon, or other less-than-carload facility, without regard to type of consumer or to the quantity or frequency of delivery. Also, all railroad carload shipments that are delivered to a retail dealer's facilities are to be reported in this category (not including, however, carload shipments that are shipped for his account but not to his plant or facilities.)

[2] "All Others." All consumers of bituminous coal and lignite other than electric utilities, coke and gas plants, retail dealers, railroads, coal mines, and mine employees.

Appendix A—Continued

Coal Shipped Into State From:		
Pennsylvania	1,721,000	
Ohio	31,000	
[3] District 7	3,272,000	
[4] Districts 3-6	160,000	
[5] District 8	6,226,000	
W. Kentucky	3,506,000	
Illinois	6,922,000	
[6] District 13	43,000	
Colorado	13,000	
Wyoming	2,255,000	
Utah	29,000	
[7] Districts 22-23	603,000	24,781,000
State Production Used in State		19,140,000
Total Coal Consumption Used		43,921,000
Consumer Use In State (Grand Total)		
Electric Utilities		25,313,000
Coke & Gas Plants		13,609,000
Retail Dealers		396,000
All Others		4,603,000
GRAND TOTAL		43,921,000

SOURCE: Bituminous Coal and Lignite Distribution Calendar Year 1974, Division of Fossil Fuels, April 18, 1975, U.S. Department of The Interior, U.S. Bureau of Mines

[3] Specified counties in West Virginia and Virginia.
[4] Specified counties in northern West Virginia and the panhandle of W. Va.
[5] Specified counties in West Virginia, Virginia, Kentucky and Tennessee.
[6] All of Alabama and specified counties in Georgia and Tennessee.
[7] Montana, Washington, Oregon and Alaska.

Appendix B

SCIENCE AND SOCIETY COMMITTEE

DR. OTTO K. BEHRENS (Chairman)
4225 Sunrise Road
Indianapolis, IN 46208

DR. STANLEY L. BURDEN
Box 528
Taylor University
Upland, IN 46989

DR. DONALD J. COOK
625 E. Washington Street
Greencastle, IN 46135

DR. HARRY G. DAY
Department of Chemistry
Indiana University
Bloomington, IN 47401

DR. CLARENCE F. DINEEN
Department of Biology
St. Mary's College
Notre Dame, IN 46556

DR. AUSTIN W. FERGUSSON
326 Federal Building
Ft. Wayne, IN 96802

DR. ROBERT E. HENDERSON
Indianapolis Center for Advanced Research
1219 West Michigan Street
Indianapolis, IN 46202

Appendix B—Continued

DR. GERALDINE HUITINK
Department of Chemistry
Indiana University-South Bend
South Bend, IN 46615

DR. WILLIS JOHNSON
Department of Biology
Wabash College
Crawfordsville, IN 46933

DR. RALPH A. LLEWELLYN
Department of Physics
Indiana State University
Terre Haute, IN 47809

DR. ROBERT MENKE
St. Henry Road
Huntingburg, IN 47542

DR. CLYDE R. METZ
Department of Chemistry
I.U.P.U.I.
Indianapolis, IN 46205

PROF. ROBERT D. MILES
Dept. of Civil Engineering
Purdue University
Lafayette, IN 47907

DR. JERRY J. NISBET
Institute for Environmental Studies
Ball State University
Muncie, IN 47306

DR. JOHN B. PATTON
State Geologist
Indiana Geological Survey
611 North Walnut Grove
Bloomington, IN 47901

DR. HOWARD YOUSE
P. O. Box 253
Greencastle, IN 46135

Appendix C

MEMBERS OF THE AD HOC PANEL TO PREPARE THE ANNUAL REPORT

DR. JOHN J. CORRIGAN
Associate Dean
College of Arts and Sciences
Indiana State University
Terre Haute, IN 47809

DR. JOHN PATTON
State Geologist
Geological Survey
Indiana Department of Natural Resources
611 North Walnut Grove
Bloomington, IN 47401

DR. ROBERT HENDERSON
Director
Indianapolis Center for Advanced Research
1219 West Michigan
Indianapolis, IN 46202

DR. PHILLIP POWERS
Director
Energy Engineering Center
Energy Administration
Purdue University
West Lafayette, IN 47907

DR. RALPH A. LLEWELLYN (Chm.)
Chairman
Department of Physics
Indiana State University
Terre Haute, IN 47809

Appendix D

INDIANA NATURAL GAS: ACCOMMODATION TO REALITY

A Report to the Lt. Governor's Science Advisory Committee

TASK FORCE MEMBERS

Mr. Duane Amundson
Vice President
Indiana Gas Corporation

Mr. William Beeman
Executive Vice President
Indiana Coal Association

Dr. William Beranek
Holcomb Institute
Butler University

Mr. Robert Berlin
Indiana Energy Office
State Office Building

Mr. Burt Calkins
Manager
Operations Research Division
Applied Sciences Department
Naval Weapons Support Center

Dr. Donald T. Carr
Geological Survey
Indiana Department of Natural Resources

Dr. James Coughlin
Public Service Indiana

Mr. Robert Cravens
(Executive Secretary)
Linton, Indiana

Mr. David Davis
Executive Secretary
Indiana Petroleum Council

Dr. Robert Henderson
Director
Indianapolis Center for Advanced Research

Mr. Harold Hutchison
Geological Survey
Indiana Department of Natural Resources

Dr. Frank Incropera
School of Mechanical Engineering
Purdue University

Mr. Stanley Keller
Geological Survey
Indiana Department of Natural Resources

Dr. Charles Killpack
Holcomb Institute
Butler University

Dr. James Kohn
Department of Chemical Engineering
Notre Dame University

Dr. Norman Laurendeau
School of Mechanical Engineering
Purdue University

Dr. Donald Levandowski
School of Geoscience
Purdue University

Dr. Ralph Llewellyn (Chm.)
Chairman
Department of Physics
Indiana State University

Mr. Robert Longardner
President
Longardner and Associates

Dr. Kraemer Luks
Department of Chemical Engineering
Notre Dame University

Dr. Stuart McComas
Department of Chemical Engineering
Notre Dame University

Dr. Bruce McKenzie
Department of Agricultural Engineering
Purdue University

Dr. James Patterson
Business Administration
Pennsylvania State University

Appendix D—Continued

DR. JOHN PATTON
State Geologist
Geological Survey
Indiana Department of Natural Resources

DR. ROBERT PEART
Department of Agricultural Engineering
Purdue University

DR. PHIL POWERS, Director
Energy Engineering Center
Energy Administration
Purdue University

MR. WILLIAM ROE
Chief Metallurgist
Bethlehem Steel Corporation

MR. WENDALL TAHLER
Indiana Gas Corporation