

MACTLAC

WESTERN ASSOCIATION OF CHEMISTRY TEACHERS IN LIBERAL ARTS COLLEGES



TO: MACTLAC MEMBERS

3/20/86

FROM: OFFICE OF THE SECRETARY-TREASURER
NORTH CENTRAL COLLEGE
NAPERVILLE, IL 60566

SUBJECT: SUPPLEMENT TO THE ANNUAL REPORT OF FEBRUARY 1986

After the February 1986 Annual Report was mailed the attached material was received. We wanted all of you to have it.

I am looking forward to seeing many of you at the Wheaton Meeting on October 17-18, 1986. They are planning an interesting meeting.

I hope that you have a good SPRING!

Sincerely,

A handwritten signature in cursive script that reads "Anne T. Sherren".

Anne T. Sherren, Secretary-Treasurer of MACTLAC

management in university, government and industry and the 1957 "Sputnik" awakening. These events thrust the USA into the forefront of science. The government currently needs to give education a high priority through scholarship support and student loans to educate and nourish the limited talent among the populace thus insuring the competitiveness, prosperity and survival of the USA.

University, government and industrial constituencies each had a vested interest in the post WWII science expansion. The universities, in the pursuit of pure knowledge, the striving for excellence, expansion; the government in the pursuit of health of the populace, economic prowess, defensive/offensive weapons; and industry, in the pursuit of new products, competitive edge and growth. Until 1975 unparalleled economic growth and prosperity for the USA was evident, however events in the seventies: the formation of OPEC, the massive inroads of foreign products into the USA market and the failure of the nuclear power industry have forced the scientific community to reassess its position. In marketing, both price and quality control have affected the key chemical and pharmaceutical industries. In the USA, unlike France, Canada and Britain, no standardization of design of nuclear power plants was imposed and major design flaws, cost overruns have resulted. Thus, energy sources vital to the chemical industry have failed.

Agriculture, dependent upon chemical technology, has also suffered through loss of markets because of the strong dollar and because former markets such as India have become self-sufficient. Self-sufficiency of other nations in agriculture through biotechnology is imminent. The deteriorating industrial competitive position of the USA in the world is forcing a stronger university/corporate/government interface to optimize the competitive position of the USA. Since 1958 industry has obtained basic scientific results from university scientists essentially "free-of-charge" because these results have been obtained by scientists funded by federal granting agencies. The effect has precluded a necessary industrial/academic interdependence.

In summary, over the past five years industrial/academic ties have strengthened because of: 1.) the decline of U.S. industry relative to foreign competition 2.) the stabilization or relative decline in the face of inflation of federal funds for university research and 3.) increasing costs of university research, largely as a result of essential highly sophisticated and expensive instrumentation.

Recent scientific advances at major research universities have led to entrepreneurship between academia and industry. Industry has infused large grants into academic institutions (\$25MM research agreement between Monsanto and Harvard in the cancer area, \$5MM between Mallinckrodt and Washington University in the area of *in vitro* diagnosis using monoclonal antibodies, \$3MM DuPont to Harvard, \$25MM between Monsanto and Washington University in the area of hormonal peptides etc) frequently on a contractual basis. The support allows the academic investigator to publish and the academic institution to retain patent rights but industry gains a "window" on new technologies and would hope for "product opportunities". Some scientists have formed their own companies (300 biotechnology companies).

USA industry generally has philanthropic programs to support colleges and universities but donations frequently have a bias (e.g. funds to source of most effective academic consultants; graduates who make the most successful employees etc). The level of industrial support to academia today is 5-6% with 94-95% coming from government. It seems unlikely that the level of industrial support will exceed 10%. Industry believes that the primary obligation for funding research and training in colleges and universities must remain that of state, local and federal governments.

The science departments of Liberal Arts Colleges have made major contributions to the national welfare through the training and inspiration of highly qualified and motivated students. Neither industry nor the Federal granting agencies have been properly cognizant of LAC's as a resource and it is only through meetings such as MACTIAC that a case can be made to industry and the Government for support at this academic level.

TO: Anne Sherren, Secretary-Treasurer, MACTIAC

FR: Rhoda Craig, 33rd Annual MACTIAC Meeting Coordinator

RE: 1985-86 Final Report

The 33rd annual MACTIAC Meeting was held on October 11-12, 1985 on the campus of Kalamazoo College with an attendance of 120 members. Although inclement weather prevailed it did not dampen the spirits of the participants who appreciated both the breadth and depth of information disseminated by well-informed, recognized speakers in the academic, legal, industrial and government arena and the diversity of topics pertaining to chemistry.

The meeting, organized by Dr. Rhoda Craig, began on Friday afternoon with brief welcoming statements from the President of Kalamazoo College, Dr. David W. Breneman and Chairman of the Chemistry Department, Dr. Richard J. Cook. Dr. Rhoda Craig introduced the speaker for the session, Dr. William D. Phillips, Senior Vice President for Science and Technology at Mallinckrodt, Inc. St. Louis, MO.

Speaker: Dr. William D. Phillips Reporter: Rhoda E.R. Craig
Title: "Industry/University Interactions: Perceptions and Reality"

Dr. Phillip's lecture detailed the historical development of the university/corporate interface emphasizing the changes over the past five years arising from the nations economic difficulties.

The inception and passage of the Morrill Act of 1862 which established land-grant colleges to train people to promote American industry and agriculture was the seed which allowed the United States to flourish and become the most scientifically advanced country in the world today.

In the 19th century the United States was a developing nation and participated only marginally in scientific advances while the major effort occurred in Germany, France and Great Britain. The advent of World War I made chemicals inaccessible from Germany on the American market and forced the United States to manufacture essential chemicals of synthetic origin. The DuPont Company and other industries rapidly expanded into the synthetic chemicals field and the American Chemical Industry was conceived. Today, it still remains the premier chemical industry of the world.

Between World War I and World War II although many American Scientists (Lewis, Hilliken, Langmuir, Compton, Pauling, Carothers etc) made recognized contributions to science it was not until after World War II that the 'seat' of science moved to the United States.

After World War II, agencies of the Federal Government (e.g. Office of Naval Research) began to support through competitive grants, basic scientific and engineering research in universities. This early (late 1940's-early 1950's) funding of basic research in universities was to be the precursor of the massive funding by the National Science Foundation, the National Institutes of Health and other agencies of the Federal government, that was to play the key role in the creation of the magnificent scientific structure that resides today in our universities and has benefitted the U.S. over the past 25 years. This massive no-strings-attached support of university research by agencies of the federal government has driven a wedge between universities and industry and obscured their basic interdependence. During the past five years events have occurred leading to an essential refocusing and realization of the fundamental interdependences of industry, university and the government.

Postwar World War II events which shaped and impacted science positively were the educational benefits offered WWII veterans, ultimately providing the USA with a generation of highly effective scientists and engineers for research and

Following a refreshment break, the conferees had three options: a 2 1/2 hour microclassroom workshop; a 2 hour grants workshop or two one hour discussion groups covering "Industrial Chemistry" and "Successful Programs within MACTLAC for Student/Faculty Involvement with Industry".

Session: "Industrial Chemistry"

Reporter: Richard J. Cook

Dr. Robert White (Upjohn Company) and Dr. Richard Cook (Kalamazoo College) opened with brief statements about the advantages of industrial-academic cooperation and interchange.

Dr. Wayne Hesolowski presented the results of an industrial survey, used to gain insight into what industry "expects" or wants from our graduates. Although the responses were mixed and wide-ranging, one clear message was that rather than specific chemical subject matter, communication skills and knowing how to "think" were seen as primary requisite abilities.

Dr. John McFarland (DePauw), Dr. Phil Bays (St. Mary's), and Dr. John Yordy (Coahen) each presented accounts of successful academic-industrial cooperation. The general conclusion of the group was that communication between colleges and industry is essential and productive, and that we can positively influence each other.

While industry cannot and should not dictate our curricula, we must recognize that many of our graduates will eventually end up in the chemical industry, and must be prepared in important ways to handle the scientific, technical, ethical, and interpersonal demands of such positions.

Session: "Successful Programs Within MACTLAC for Student/Faculty Involvement with Industry"

Reporter: Laurence E. Wilson

Laurence E. Wilson, Kalamazoo College
Robert Kelly, The Upjohn Company

Kalamazoo College introduced a curricular plan in 1962 that requires that each student complete a "senior individualized project" (SIP). The SIP for the overwhelming majority of chemistry majors is a full-time, one-quarter (winter) research project, with thesis. Some students perform their SIP research on campus, working with members of the faculty. Other students do research with established scientists in laboratories that are independent of the College. The Upjohn Company, with central research laboratories located in Kalamazoo, has provided research experience for several dozen students in the years since 1971. Experiences have spanned areas such as organic synthesis, drug assays and biomedical activity characterization. The Company sees the program as supporting investigations in which its scientists have personal interest; the program is not viewed as support of projects that are of immediate significance to the Company. The College sees the program as providing expansion of the experiences available to students. Students are exposed to an atmosphere where sense of inquiry and professionalism prevails; chemical and biological principles are brought to bear on a wide range of questions; and technical support and instrumentation is exceptionally strong. The students are viewed as guests of the Company, not as employees, though the Company makes an annual grant to the College and this grant enables the College's Financial Aid Office to make variable grants (averaging around \$700) to students for living expenses during the SIP quarter.

Richard Bayer described the formation of a private corporation call Bionomics Corporation, by Carroll College, for the performance of contract research. The corporation is managed by science faculty and takes advantage of faculty artistic knowledge and College facilities and equipment. The corporation makes a number of salaried positions open to qualified students and provides financial support to students and faculty. Participation in corporation projects enhances the educational program and student employability.

Grants Workshop

Reporter: Thomas J. Smith

This session consisted of presentations by representatives of federal and private research funding agencies. The scheduled visitor from Argonne National Laboratory was unable to attend the meeting. Each speaker described the purpose, guidelines, application procedures, and other information concerning their programs.

Richard J. Anderson, Program Associate, Division of Research Improvement and Initiation, National Science Foundation. Emphasis was placed primarily upon the Research in Undergraduate Institutions (RUI) and Research Opportunity Awards (ROA) programs. The RUI awards are designed to support basic research or instrumentation acquisition for investigators at primarily undergraduate (2/4 year) colleges and universities. A specific proposal is required which must address the impact of the proposed research on the research environment of the principal investigator's department and on the ability of that department to prepare students for entry into advanced degree programs and careers in science and engineering. The ROA program involves affiliation with an investigator, usually at a research university, who submits a regular NSF proposal with a request for support for the research activity of a visitor from a primarily undergraduate institution. A brochure describing the RUI program has just been made available and may be obtained from:

Dr. Joseph Danek
RUI Program Coordinator
Division of Research Initiation and Improvement
National Science Foundation
1800 G Street, N.W.
Washington, D.C. 20550
(202) 357-7436

George G. Galasso, Associate Director for Extramural Affairs, Department of Health and Human Service, National Institutes of Health. Academic Research Enhancement Awards (AREA), a new NIH program, were featured in this report. These grants are designed to support new research projects in the health sciences or the expansion of ongoing research proposed by faculty members at institutions which offer baccalaureate degrees in the sciences related to health. In addition to the intrinsic merit of the proposal, evaluation will include the institution's contribution to undergraduate preparation of doctoral-level health professionals. For detailed information write to:

AREA
Office of Grant Inquiries
Division of Research Grants
National Institutes of Health
Westwood Bldg. - Room 449
Bethesda, Maryland 20892

Additional information on NIH programs may be found in the CUR Newsletter, Vol VI, No. 1 (Sept. 1985) pp 8-16.

Speaker: Fred Basolo

Title: "Academic-Industrial Interface: Academic Perspective"

Reporter: Rhoda Craig

Dr. Basolo's talk addressed the following relationships: Liberal Arts Colleges (LAC) - Research Universities (RU); RU-Industry and finally a combination of LAC-RU-Industry.

LAC-RU: LAC's because of their priorities can do an outstanding job in teaching, in advising, and in motivating undergraduates while research oriented universities give top priority to doing scholarly research. This observation is supported by the statistics on the origin of doctoral recipients. At Northwestern University 302/1040 Ph.D. recipients have come from LAC, a statistic which parallels the national average. Hence, RU's are concerned about the welfare of LAC's.

At the RU-Industrial level, the attitudes have undergone a change with time. Originally the attitude of research university faculty was one of superiority over industrial Ph.D. chemists. However now the attitude is one of mutual respect and support between academic and industrial Ph.D. chemists. This industry/academic awareness has developed from professional and scholarly factors. It is now essential to bridge the industry/research university/liberal arts college gap to the mutual benefit of all. Ideally, academia must appreciate, respect and understand the important work in industry while industry must help academia prepare its students for the real world.

In reality, the industry/university interfaces are: 'Past-On-campus industrial recruiting; grants-in-aid; fellowships; faculty consultants to industry; faculty seminar speakers at industry; industrial seminar speakers at universities; Industrial Associates (only CALTECH and MIT); and Chemistry Department Industrial Affiliate (1967-Stanford); endowed professorships. 'Present Add-ons to Industrial University Interactions: Chemistry Department Industrial Associates; Specialty (Catalysis, Polymers) Industrial Associates; Start-up grants to beginning faculty; Council for Chemical Research; Research Proposals to Industry for Grants; Donation of Equipment; Name Lecturers sponsored by Industry; Name Industrial Lecturers; Industry/University NSF Grants. The add-ons are largely focused on research which, for economic reasons, cannot be done in industry but must be done in academia. Industry will support RU chemistry departments doing research in an area of concern to them hastening technological developments.

The most important aspect of academia, either at LAC or RU level, should be their graduates and industry should be primarily concerned with helping departments turn out their best graduates.

Dr. Basolo presented data from a June 1985 report 'An Analysis of Leading Undergraduate Sources of Ph.D.'s, Adjusted for Institutional Size' prepared by Carol H. Fuller for the GICA. Similar data were provided for the Associated Colleges of the Midwest, the Big Ten and the Ivy League. Comparison of GICA versus Ivy League schools and ACM versus the Big Ten indicate that in both cases the LAC colleges have a greater Ph.D. productivity.

The prevailing attitude of industry is to support universities who have graduate programs from which they hire Ph.D.'s. Industry has lost sight of the fact that the livelihood of these graduate programs depends on good undergraduate programs such as are provided by LAC's.

If industry can be encouraged to provide support for LAC's, this support may take various forms. Financial support could be furnished on a rotating basis among many colleges. Alternate kinds of industrial support are: Grant-in-aid; scholarship; seminar speakers from industry; faculty speakers at industry seminars; LAC faculty 'open house' at industry; 'permanent' summer positions for faculty in industry; summer jobs for students in industry; summer jobs for students in LAC lab; high school 'open house' at LAC with displays and speakers from industry; Name lecture or lecture series supported by industry; donation of equipment with tax discount to industry. Many of these activities are in place with research universities but only a limited number with LAC's. LAC's and industry must develop the necessary machinery to move these activities into existence.

-6-

Brian H. Andreen, Regional Director, Research Corporation. Information concerning the Cottrell College Science Grants which sponsor research in the natural sciences at private, predominantly undergraduate colleges was presented. Approximately 50% of the awards have recently gone to chemists. MACTLAC members seeking additional details should contact:

Brian Andreen
Regional Director Grants
Research Corporation
6840 East Broadway Blvd.
Tucson, Arizona 85710-2815
(602) 296-6400

Andrew Colb, Assistant Program Administrator, Petroleum Research Fund. Discussion was focused principally upon Type B PRF grants which are also designed to assist investigators at primarily undergraduate institutions. Type AC grants may also be suitable for support of research although these tend to be awarded principally to researchers at larger universities. For more information contact:

Dr. Joseph E. Rogers, Jr.
Program Administrator
American Chemical Society
Petroleum Research Fund
1155 Sixteenth Street, N.W.
Washington, D.C. 20036
(202) 872-4481

Microglassware Workshop:

Dana W. Mayo, Bowdoin College
Ron Pike, Merrimack College

Reporter: Rhoda Craig

A 'hands-on' workshop using the new Ace Glass microwave kits and microscale Organic Chemistry experiments developed by Mayo and Pike was well received. A lecture demonstration by Mayo and Pike on the synthesis of "tetraphenylcyclopentadienone" via an aldol condensation employing various techniques (recrystallization) was followed by two 'hands-on' laboratory syntheses involving electrophilic aromatic substitution: Halogenation "4-Bromoacetanilide" and nitration "2,5-Dibromonitrobenzene". The microglassware kits were supplied by Ace Glass, Vineland, N.J.; the prepublication laboratory manual "Microscale Organic Laboratory" by Dana W. Mayo, Ronald M. Pike and Samuel S. Butcher was furnished by John Wiley & Sons free to all workshop participants and the Gow Mac Instrument Company modified the detector system in two Kalamazoo College Gow Mac gas chromatography instruments for use with microscale experiments at the MACTLAC conference.

Informal tours of the Olds-Upton science facilities were conducted both Friday afternoon and Saturday morning. Refreshments were served by the Kalamazoo College ACS Student Affiliate. In the evening everyone enjoyed a delicious banquet in Old Welles Dining Room of the Hicks Center. Following the banquet, Dr. Fred Basolo, Northwestern University, gave a speech with humorous asides on "Academic-Industrial Interface: Academic Perspective."

-5-

As previously indicated by Dr. Phillips, the "Big Bucks" for education comes from and will continue to come from government. Conferences such as the CUR-Colgate Conference in July 1985 must continue to gain impetus and impact government to release additional funding at the undergraduate level. Continued efforts to improve the industrial/academic interface are crucial.

Following Dr. Basolo's address MACTIAC members migrated to a Wine and Cheese Mixer where lively informal discussions occurred in a relaxing environment.

On Saturday morning the members gathered for the Annual Business Meeting. Following the business meeting Ric Gass, Adjunct Professor of Law at Marquette University and Lawyer with the firm of Kasdorf, Lewis and Szelcick of Milwaukee gave a presentation entitled "Chemistry, Courtrooms and Common Sense". An excellent discussion period followed this talk concerning liability issues in the laboratory. Because all participants were provided with the 50-page handout for this talk, no summary will be provided in this report.

A refreshment break followed Mr. Gass's talk and the membership again had the option of attending one of three possible presentations: a 2 1/2 hour Microglassware Workshop; a 2 hour Industrial Workshop or two one hour discussion groups on "Reports on the June 9-10, 1985 Oberlin Meeting on 'The Future of Science at Liberal Arts Colleges'" and the Colgate-CUR Conference of July 24-25, 1985 "The Education of Scientists: The Role and Funding of Research at Undergraduate Institutions". Microglassware Workshop: a repeat of the Friday afternoon session written up on page 5.

Session: "Report on the June 9-10, 1985 Oberlin College meeting 'The Future of Science at Liberal Arts Colleges'" Reporter: Ralph H. Deal

The session was chaired by Ralph H. Deal of Kalamazoo College (the scheduled co-chair, Clayton W. Jacobsen of the Upjohn Company was unable to attend).

The session began with a lengthy discussion of the June, 1985 Oberlin conference "The Future of Science at Liberal Arts Colleges", a convening of the presidents of 48 colleges of the liberal arts and sciences to react to and extend an extensive document prepared for them by the office of the provost of Oberlin College from data collected from the same institutions as well as the Independent Colleges Office, the National Center for Education Statistics, and the Great Lakes College Association.

This discussion was led by one of the participants at the conference, David W. Breneman, President of Kalamazoo College. The importance of relatively small colleges with strong traditions in science in the national production of Ph.D.'s in the sciences was heavily documented and stressed. The prepared document is worth study by institutions who did not attend and should be available from the office of the provost, Oberlin College. The document makes 24 specific recommendations: The first emphasizes the importance of science and mathematics education in the public schools; the next five deal with curriculum and programs; improved planning at departmental and divisional levels; enhanced curricular opportunities for student research; inclusion of scientific inquiry in non-science major science courses; improvement of writing and computer skills at all student levels; the legitimacy of computer science as a discipline. The next 13 dealt with funding; need for competitive salaries; "starter grants" for new faculty; research leaves during the probationary period for faculty; faculty development via external grants; enhanced sabbatical and short-term leave programs; improved communication between faculty with similar research interests; better funding for student research; institutional aid in grant application preparation; regular review of faculty productivity with individual career planning; more capital outlay to keep laboratories current and safe; additional maintenance and support personnel; improvement of computer facilities (mainframe and micros) and applications; better library resources. The last four dealt with renewal strategies: Develop recognition by federal agencies of the slower pace but high quality of research at selective small colleges; Better

coordination at the federal level of educational and research programs; increased corporate support of research; New Foundation programs to support innovative and innovative efforts at the research colleges.

The president of Oberlin College, Frederick Starr, had strongly advocated the establishment of an association of research colleges to act together in seeking federal and industrial funding for a variety of programs at their institutions, including research leaves, NSF endowed lectureships. Several MACTIAC members objected to what seemed an attempt to exclude many small institutions with commitment to research by faculty and students from the organization. In addition, there were objections to the label "research colleges" which was seen as marking an imbalance in the so-called colleges, an imbalance inconsistent for a liberal arts institution.

Bill Mungall (Hope College) pointed out that a "research college" is still going to be better known for the students it produces than the research it produces.

Breneman emphasized that the sciences are a legitimate part of the liberal arts and need not be compromised for the sake of balance.

Brian Andreen pointed out the failure of the report to emphasize the role of private foundations such as Research Corporation in supporting research in the small research colleges.

In response to questions about the effect of the conference on himself, Breneman felt that he had been made much more aware of the problems facing the sciences in small colleges and potential for enlarged support. He now knows that the liberal arts colleges are preparing future scientists better than the large universities.

Some participants wanted to know how to get their presidents to such a conference.

There was some discussion of the fall-off of science majors, especially at larger schools. There was also some discussion of the significance of the rise of the percentage of women among undergraduate science majors.

The CUR conference was the second topic of the session. Unfortunately, because of the enthusiastic response to Breneman's presentation, this portion of the session consisted mostly of prepared reports on aspects of the conference. Wilmer Stratton (Earlham College) gave an overview. He emphasized the wealth of contributions at the conference. There was tribute paid to the role of liberal arts colleges in preparing scientists. 41% of chemists who get advanced training come from liberal arts colleges.

It was recommended that administrations put money into research first before seeking much outside funding.

Complete reports of the CUR Conference sessions have now appeared in the CUR Newsletter, Vol VI, No. 1 (Sept. 1985) and Vol. VI, No. 1 (January 1986).

The Session on "Troubleshotting Grant Proposals" was ultimately cancelled because of the extended discussion of the foregoing conference reports.

Industrial Workshop: No formal report was made on this session. A copy of the talk by Miriam Welly is enclosed while the presentations by Vance General (Dupont) and Doug Robertson (Dow Midland) have appeared in recent C&E News Issues.

This session was one of the most diverse and interesting to provide insight into the scope of industrial/academic interaction with specific industries.

The main speeches: Dr. W.D. Phillips, Dr. Fred Basolo and Mr. Gass are taped and are available at \$6 per tape including postage. The speeches have been reproduced and included with this report.

Lunch was served in the President's Dining Room prior to departure by the MACTIAC members from a stimulating conference.