THE NUCLEUS

May 1988 *Of the Northeastern Section of the American Chemical Society* *Vol. LXVI, No. 8*

Monthly Meeting:

Education Awards
Dr. Byron Lichtenberg to Speak on Outer Space

THE CHEMIST TODAY

Conclusion of Article by Mary L. Good

Richards Medal Award Photos

May Meeting

The 709th Meeting of the Northeastern Section of the American Chemical Society.

Thursday, May 12, 1988
Simmons College
300 The Fenway
Boston, Massachusetts

All activities will take place in the Main College Building

5:30 p.m. Social Hour – The Fens Room

6:30 p.m. Dinner

7:30 p.m. PRESENTATION OF AWARDS

Presentation of Avery A. Ashdown Chemistry Examination Contest Awards

Presentation of the Northeastern Section Award for Excellence in Teaching at the Secondary School Level

Induction of New Members into Aula Laudis

Presentation of Undergraduate Research Symposium Certificates

Presentation of James Flack Norris Undergraduate Research Grants

Presentation of Philip L. Levins Memorial Award

Presentation of Fifty Year Membership Certificates

8:30 p.m. LECTURE

"What It's Like To Be In Outer Space" by Dr. Byron Lichtenberg (see Biography on p. 4)

Refreshments will be served after the lecture.

Dinner reservations should be made no later than May 8. Please call the ACS office at 1-800-872-2054 or (617) 456-8227. Reservations not cancelled at least 24 hours in advance will be charged at the appropriate dinner rate: $13.00 for ACS members, $15.00 for non-members, and $5.00 for students. Teachers please note the reduced rate for students and encourage your students to attend. Free parking is available behind the Main College Building; enter from Avenue Louis Pasteur.

The Northeastern Section of The American Chemical Society Inc.
Office: Karen Piper, 19 Mill Road, Harvard, MA 01451, in 617 area 1-800-872-2054; (617) 456-8227
Any ACS Business may always be conducted via the business office above.

Contents

ELECTION OF 1989 OFFICERS, COUNCILORS AND COMMITTEES

The ballot for voting for the 1989 candidates for the various Section positions is enclosed. Also enclosed are the candidate biographies and statements and the special ballot envelope and addressed return envelope.

BE SURE to vote and return your ballot by the June 1, 1988 deadline.

If you are a Section member and failed to receive the election materials, please call the Section office, 1-800-872-2054 or (617) 456-8227.

THE NUCLEUS

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May Meeting Biography

Dr. Byron K. Lichtenberg

In November 1983, Dr. Lichtenberg became the first U.S. payload specialist astronaut as a member of the crew of the Spacelab 1 mission. Some seventy scientific experiments in astronomy, physics, biology, and materials science were performed in the space laboratory which rides in the cargo bay of the space shuttle. In the future, Dr. Lichtenberg will be returning to space as a payload specialist aboard the Atmospheric Laboratory and Applications Mission (ATLAS-1).

Dr. Lichtenberg has combined a distinguished career in aerospace, mechanical and bioengineering with more than 2300 hours of flight experience. After graduating cum laude from Brown University in 1969 with the ScB degree in aerospace engineering, Dr. Lichtenberg spent four years as a USAF fighter pilot, including a Southeast Asia combat tour, and received two Distinguished Flying Crosses and 11 Air Medals. In 1975 he earned the MS degree in mechanical engineering at MIT working on advanced concepts in limb prothesis control. In 1979 he was awarded the ScD degree in engineering, also from MIT. His work included development of prototype equipment for the MIT-Canadian vestibular (inner ear organ of balance) experiments on the Spacelab 1, Spacelab D-1, and Spacelab 4 missions.

In 1978 Dr. Lichtenberg was chosen by the Spacelab 1 principal investigators to become a payload specialist for that mission. He was responsible for a major portion of experiment operations development, contingency procedures, and replanning concepts, as well as participating as a co-investigator on the MIT-Canadian experiments. This also involved training for and performing experiments in five scientific disciplines during 10 days of on-orbit operations.

Continued on page 8.

What is a Chemist Today?

New Directions in Chemistry for U.S. Economic Competitiveness (conclusion)

by Mary L. Good
1987 ACS President

A comparison of annual R&D efforts in advanced ceramics reveals that, in those areas where data is available, Japan spends about the same amount as the U.S. for R&D in advanced ceramics for optical uses, and significantly more for the ceramic heat engine. Our best sources claim that Japan has a 10:1 lead in patents on advanced ceramics for electronic applications and a 20:1 lead in ceramics for structural applications. And this is in a newly emerging technology in which the U.S. is pushing for a concerted effort!

Biotechnology. By the year 2000, the world market in biotechnology could reach $100 billion, according to a study done by the Japanese Technology Evaluation Program's (JTECH) panel. The panel predicts that high value-added specialty products are likely to appear first, followed by production of chemicals and feedstocks, and later, biomass conversion.

In the U.S., the biotechnology development effort is led by small start-up firms that derive early technology from government-sponsored research at the universities. The large firms are hastening to form or acquire biotechnology divisions. For most American companies, the strategic planning time scale is 3–5 years in biotechnology R&D. Although the U.S. currently leads the world in most areas of biotechnology research, that lead has been challenged by West Germany, Britain, Switzerland, Sweden, and France, but most strongly by Japan.

Japanese industry has extensive bioprocess experience, and historically has been strong in fermentation techniques. The brewing industries appear to hold an advantage in this area because of the experience, equipment and the base of financial support they already have in place for this effort. In contrast to the U.S., most Japanese biotechnology development is currently being done by large firms. The National Science Foundation has found that the quality of biotechnology research performed in Japan matches that done in the West. And Japanese firms, with their 10–15 year strategic planning timescale, have made a serious commitment to long-term development.

In Japan, government support for biotechnology commercialization has been swift and wholehearted. Cooperative research associations between government and industry have been developed solely to commercialize biotechnology. For example, MITI formed BIDEC (Bioindustry Development Center), a cooperative research association of more than 130 major chemical and manufacturing companies. Working together, they avoid duplication of effort and share biotech-related R&D.

The JTECH panel predicts that Japan will offer the U.S. stiff competition in biosensors for the medical market. According to the panel, Japan already poses significant competition in cell culture technology; is now fourth in the world and gaining in protein engineering; and is scaling up its lagging effort in recombinant DNA technology.

This has been a brief review of where we stand with some of the emerging technologies that soon may affect our standard of living. But what of the people who must face the challenge of economic competition at the research level and bring these emerging technologies home first?

What is a Chemist Today? I believe that we in American chemistry today have reached a turning point in the evolution of our science and our profession. Chemistry is finally coming into its own as "the molecular science." Recent restructuring within the chemical industry has focused industrial chemical research away from the traditional "chemistry only" groups to stress an integrated, interdisciplinary approach to the solution of major technical problems and the development of new technologies and new products.

Let me illustrate where we stand. Some people were shocked not long ago when Herbert Hauptmann, a mathematician, and Jerome Karle, a chemist, together were awarded the 1985 Nobel Prize in chemistry. In response to the Prize, an article in the *New York Times* crowed, ". . . the practice of what still passes for chemistry seems to have been largely pre-empted by outsiders—physicists, quantum theorists, computer mavens, statisticians, instrument designers, laser experts, genetic engineers, medical researchers, psychiatrists, astronomers, materials specialists."

Of course, the boundaries between sciences have always been blurred. The *New York Times* article is, in a sense, an acknowledgment of the continuum of science, a continuum with chemistry at its center. That there are so many nontraditional practitioners of chemistry demonstrates both the depth and breadth of our science. Many of the practitioners of chemistry on the *New York Times'* list work in the interdisciplinary sciences of biotechnology and materials science. Others are skilled in adapting the capabilities of the microprocessor to scientific problems, impossible until only a few years ago. Recombinant DNA techniques, materials design, and mathematical modeling can all be used to manipulate and understand the nature of substances and their transformations.

One concern is not that other kinds of scientists are addressing chemistry problems but that chemists may miss out because many traditional chemists do not consider their work applicable to a wide range of technical problems. With the new technology comes the necessity of a multidisciplinary approach to research. We are realizing that for excellent work in science, it is necessary to master one discipline before taking on another. Instead of multidisciplinary people, we should strive to develop multidisciplinary research groups composed of people trained in traditional core disciplines. A mathematician and a chemist, working together to create a computer model of a chemical system, can bring to the proj-

ect the depth of understanding and expertise of both disciplines. In the process, of course, they learn from each other. They may even win a Nobel Prize.

Changes in Chemical Industry. Increased economic competition from abroad is spurring the chemical industry to incorporate new technologies and invest more money in long-term R&D. At the same time, many companies are acquiring this new technology externally and, out of necessity, are redefining their priorities through restructuring. Many analysts consider the recent large-scale reductions in force an appropriate response to slow growth in traditional markets.

As it turns out, the drastic measures that industry has had to take are working. Marginal businesses have been shut down or sold off and manufacturing operations generally streamlined. The industry is now leaner and more cost efficient. Productivity for the chemicals and allied products industries increased 5.5% in 1986 compared with 2.5% for all manufacturing. The fact is, industrial growth patterns are no longer the same as they were in the past. The chemical industry did better last year than did U.S. industry as a whole; the trade surplus in chemistry was up 7% in 1986 and is expected to reach 8% in 1987. The industry boasts a 4% rise in exports last year as well. Although sales increased by a narrow 1% last year, earnings were up 54%. And it is important to note that investment in research did not decrease.

Investment in R&D by U.S. companies is expected to continue to grow, approximately 7% in 1986 and another 5% in 1987, although this represents a slower growth rate in company-funded R&D investment from what it was 1975–85. Chemical industry officials told the NSF that they expected 6% growth in chemical R&D spending in both 1986 and 1987. Pharmaceutical companies projected a 12% growth rate for 1986 and 5% for '87; their primary programs involve biotechnology, genetic engineering, and neuropharmacology. In contrast, industrial chemicals firms forecast a 3% spending increase for '86 and '87, but also in new areas: specialty chemicals, biotechnology, plant biology, and animal science.

Non-traditional chemically-based science offers new opportunities for chemical professionals, especially those with some grounding in the new technologies. Some of the old-line chemical companies that restructured and reduced staff are actually hiring new people—non-chemists—to do work that is essentially chemistry. DuPont, fresh from its huge staff reductions, recently recruited new scientists for its cutting-edge programs in molecular biology and plant science R&D. According to an article in *Chemical & Engineering News*, only half of the new hires held degrees in chemistry. The other half held degrees in biochemistry, a field classified as a biological science by the U.S. Department of Education. It would appear that opportunities for chemists in the restructured chemical companies will depend on how well chemists are able to adapt to working on interdisciplinary teams in these new fields and how well industry is able to attract and keep them.

The Role of the Professional Society. The American Chemical Society is now the largest professional scientific organization in the world. With our numbers and resources, we can influence the direction that chemical science takes in the United States. The Society's Congressional charter, fifty years old this year, states ACS's mission to carry the chemical sciences for the nation, promoting:

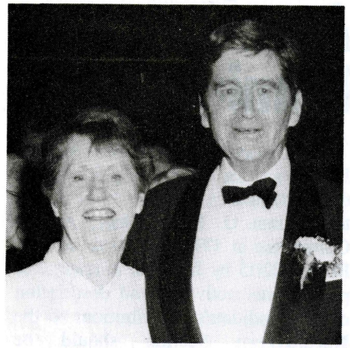
> ". . . scientific interests and inquiry, thereby fostering public welfare and education, aiding the development of our country's industries, and adding to the material prosperity of our people."

Collectively, we have in the ACS the capabilities and resources, and, in terms of our charter, an obligation to make a positive contribution to our nation's economic problems. ACS is taking a leadership position in the new areas that will become so important for the employment of chemists in the future: advanced materials and biotechnology. We already have:

- Presented a Select Conference on Advances in Biotechnology and Materials Science in Washington, D.C., to many of those who make and interpret national science policy.
- Organized a Biotechnology Secretariat. This group's first technical program at the Anaheim meeting was extraordinarily well received.
- Presented a Tutorial on high-temperature superconducting materials at the national meeting in Denver last spring.
- Evaluated the potential for new journals in biotechnology and materials chemistry.
- Developed *CA Selects* in several areas of materials and biotechnology.
- Considered a definition for a new certified B.S. degree with emphasis on biochemistry.
- Developed continuing education courses on materials-related topics.

Summary. Our nation's economy is in flux. We are on the verge of a new economy, one that will depend on newly-emerging, chemically-based technologies. The new technologies will make our products and processes more efficient, improve their quality, and lower their cost; in other words, it will make them more competitive. Japan, a nation that already recognizes the potential of the new technologies, has emerged as our most powerful long-term competitor. Japan's great strengths are the structure of its industry and the national programs it has built around the new technologies, coordinated among the government, industry, and academia. To maintain our standard of living, the U.S. must also exploit these new technologies. Chemistry will play a vital role at the research and development levels, especially in the new fields of advanced materials and biotechnology. In our country, chemical industry already leads research efforts in these newly emerging fields. In these fields, chemists will also find opportunities for professional growth. The ACS can help by drawing chemical professionals into the new technological arenas that offer employment, professional reward, contribution to our nation's economy, and the maintenance of a reasonable standard of living for our children and grandchildren. ◊

1988 T.W. Richards Medal Awarded



Left: Professor and Mrs. Walter H. Stockmayer at the Harvard University Faculty Club on March 10, 1988.

Below: Dr. Thomas Gilbert, Chairman of the Northeastern Section, ACS, presents the T.W. Richards Medal to Professor Stockmayer.

Photos by John Correggio

Holiday Lecture Draws Record Crowd

Valerie A. Wilcox
Public Services Committee
(Dr. Phyllis A. Brauner, Chair)

Dr. Bassam Z. Shakhashiri, Assistant Director for Science and Engineering Education, National Science Foundation, and Professor of Chemistry at the University of Wisconsin, presented the second annual Holiday Lecture at the Museum of Science on Monday, December 28. This Lecture, as well as many of the activities of National Chemistry Day, was made possible by a generous grant from the Polaroid Corporation. The Museum of Science donated the lecture hall, the exhibit halls, and laboratory facilities.

Because last year's Lecture was oversubscribed—more than 200 persons had to be turned away—Dr. Shakhashiri graciously agreed to present two lectures, one in the afternoon and a repeat performance in the evening. A total of 750 persons ranging in age from young children to the retired jammed Cahners Theater to enjoy the many exciting, dramatic and educational demonstrations and Dr. Shakhashiri's inimitable enthusiasm and clarity of presentation. In the true tradition of Michael Faraday's original lectures at the Royal Institution, Dr. Shakhashiri

Continued on page 8.

Calendar

Monday, May 2
Professor Geoffrey Davies (Northeastern University)
"Transmetalation Reactions"
Brandeis University
Gerstenzang Room 122 at 4:00 P.M.
Call (617) 736-2500 for more information

Tuesday, May 3
Professor David Singel (Harvard)
"Nuclear Modulation of Electron Spin Echoes: Field Effects"
Massachusetts Institute of Technology
MIT Room 4-370 at 4:00 P.M.

Wednesday, May 4
Dr. Steve George (Stanford)
Title to be announced
Harvard University
Mallinckrodt Room MB-23 at 4:00 P.M.
Call (617) 495-4070 for more information

Monday, May 9
Professor Mark Wrighton (MIT)
"Molecule-Based Microelectronic Devices: New Opportunities for Chemistry"
Brandeis University
Gerstenzang Room 122 at 4:00 P.M.
Call (617) 736-2500 for more information

Wednesday, May 11
Dr. David King (University of Liverpool)
"Adsorption, Desorption and Reactive Scattering at Metal Surfaces"
Harvard University
Mallinckrodt Room MB-23 at 4:00 P.M.
Call (617) 495-4070 for more information

May Meeting

Continued from page 4.

He has been awarded numerous medals including the NASA Spaceflight medal, the AIAA Haley Spaceflight award, the FAI Komarov Diploma, and the VFW 1984 Space Award and is author or co-author of numerous scientific papers in the field of biomedical engineering and spaceflight.

Dr. Lichtenberg is president of Payload Systems, Inc., a spaceflight consulting firm assisting commercial, university and foreign government research and development efforts in space. ◇

Henry A. Hill Award Nominations

Nominations for the 1988 Henry A. Hill Award for Outstanding Service to the Northeastern Section should be sent to William O. Foye, Chair, Awards Committee at 179 Longwood Avenue, Boston 02115 by June 30. A resumé of professional activities and description of the candidate's contributions to the Northeastern Section should be included. ◇

Holiday Lecture

Continued from page 7.

succeeded in instilling a sense of wonder in his listeners, urging them to observe, to question, and to experiment for themselves.

The Directorate for Science and Engineering Education of the National Science Foundation provided a bag of materials and directions for experiments for each member of the audience. Cider and cookies and a chance to visit the Museum's West Wing followed the lecture. The Holiday Lectures are arranged by the Public Services Committee of the Northeastern Section. Dr. Shakhashiri generously donated his honorarium for the lectures to the Committee for use in providing assistance to chemistry teachers. ◇

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