TUFTS UNIVERSITY CHEMISTRY DEPARTMENT

Chem Notes

SPRING 1992

Chairman's Message

David R. Walt

Despite all we hear about the economy, and the difficulties facing higher education, Tufts continues to buck the trend. Applicants are up at both undergraduate and graduate levels both in numbers and quality. Although some budget restraints were put in place, so far the University has weathered the recession well. Improvements continue in the Chemistry Department. The Pearson and Michael Buildings continue to improve. Offices and common areas have been refurbished. A "History of Chemistry at Tufts" display has been placed in the new display cabinets in the Pearson entryway. Professor Samuel Kounaves collected the information and is now the resident departmental historian. A second display on "Environmental Research in the Chemistry Department" highlights four faculty members' work.

The Departments of Chemistry and Biology have secured a Kresge Foundation award to purchase and endow new instrumentation. Corporate and alumni sponsors were the major benefactors for securing the matching funds needed. Combined funds total 1.4 million dollars! The award will be used to purchase and update some of the instrumentation used in both undergraduate courses and graduate and undergraduate research.

The department has enjoyed significant success virtually across the board in recent years. Chemistry enrollments are up nearly 40% over two years ago.

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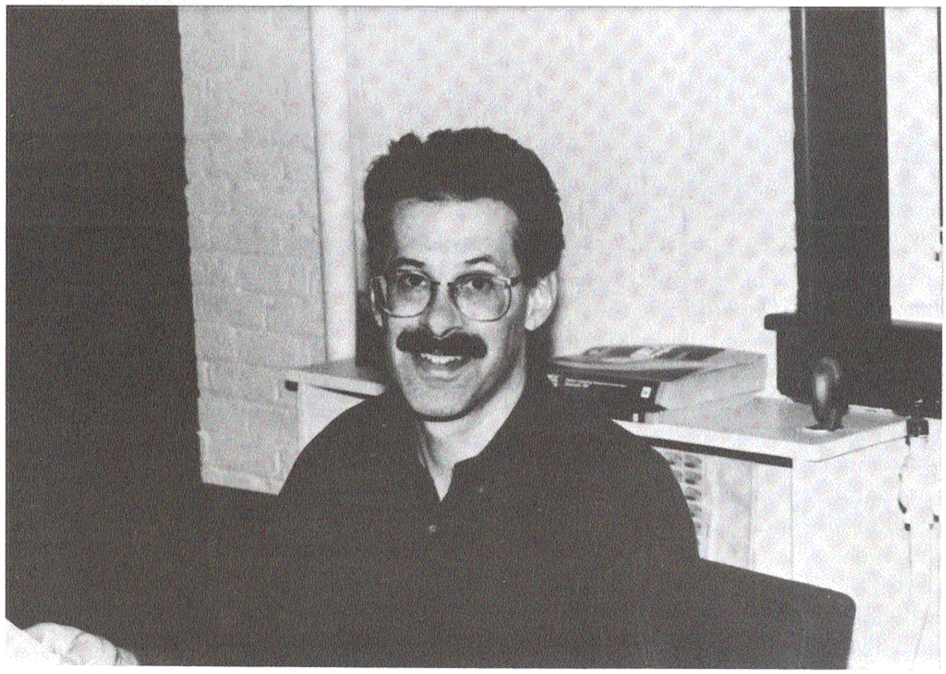

David R. Walt

REPORT ON THE CHEMISTRY GRADUATE PROGRAM

Compiled by Edward J. Brush, Graduate Committee Chair

The Chemistry Graduate Program, which is now one of the top graduate programs in the College of Arts and Sciences, is a key contributor to the teaching efforts and vigorous growth of the research program in the Department of Chemistry. Consider the prospects of effectively teaching the nearly five hundred undergraduate students enrolled in general and organic chemistry this fall without the twenty-two graduate teaching assistants, who carry the brunt of laboratory and recitation assignments, the grading and proctoring of exams, as well as helping to relieve some of the apprehension and anxiety of first and second-year undergraduate science students. Furthermore, the unprecedented growth in the research program would not be possible without the dedicated efforts of our graduate research students. The success of our graduate program has been achieved by the investment of a significant amount of Department resources in the year-round efforts of advertising, identifying and recruiting prospective students, as well as counseling and advising them through 4-5 years of graduate education and research training. The purpose of this article is to update the Chemistry Alumni as to the current status of the chemistry graduate program, and its importance to the Department's future.

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Glazed Ceramics & History

A. Kaczmarczyk

3,500 year old core formed Egyptian glass vessel. Deep blue glass trailed with yellow white and turquois bands. Height 101 mm.

This vessel was produced by winding molten glass rods around cores made of a mixture of clay and dung; the cores were scraped out of the vessel after they had cooled and hardened. An extensive palette of glass colors had been developed and a range of brightly colored polychrome vessels was produced, initially in Mesopotamia and, it is believed, somewhat later in Egypt.

Among the subjects that have fascinated me for years are the origins of the material cultures that sustained the spectacular civilizations of Ancient Egypt and Mesopotamia. Considering the amount of archaeological work and the linguistic endeavor that has been devoted to the Ancient Near East, one might presume that a clear picture would emerge showing which innovations can be credited to Egypt and which to Mesopotamia or some other part of the Ancient East. Unfortunately, the picture is still very hazy and is likely to remain so until many more archaeological remains have been subjected to a rigorous scientific examination. Only then will we be in a better position to distinguish remains made *in situ* from foreign imports and make reasonable inferences as to which manufacturing techniques were native and which borrowed from some other country.

In this age of information explosion few people realize how little information regarding ancient technology can be gleaned from ancient written sources. The type of technical data with which we are inundated today was of little interest to the chroniclers of the Ancient Near East who preferred to speak of heroic deeds and fates of empires. We can read about the Egyptian or Assyrian conquests, we can learn the names of the conquerors and of the vanquished, about the amount and type of loot, the number of persons enslaved, but never about what was learned from the contact with foreigners. Moreover, attempts to determine from literary records what types of materials and individuals travelled or were forcibly moved from one country to another often founder on our inadequate understanding of geographical and technical terms.

For example, the Egyptian royal archives of the 14th c.B.C. known as "Amarna letters" contain a letter from a ruler of Alashia who speaks of copper shipments to Egypt. While most Egyptologists believe that Alashia is the modern Cyprus, an island famous for its copper in Roman times, some archaeologists point out that so far no evidence has been found that Cypriote copper was either mined or smelted at this early date. So did the Egyptians import raw ore or processed metal from Cyprus? If not, where were they importing it from? An answer to this question may soon emerge from current work on the isotopic composition of lead impurities found in most ancient copper-containing objects. The isotopic composition is the result of geological history of the deposit and depends on the relative proportions of uranium and thorium (the radioactive precursors of terrestrial lead) that precipitated with the ore. Thus the isotopic ratios act as fingerprints making it possible to trace the Pb in archaeological objects to a specific mine from which the ore came. So by matching ratios in Egyptian objects of the period to ratios in various Cypriote ores we might find out if Egyptians were or were not acquiring copper from Cyprus.

To illustrate the problems resulting from our poor knowledge of mineral and technical terms I will cite another example from the same royal archive. A letter from a Syrian prince is full of excuses for not sending to Egypt an adequate supply of *mekku* and *ehlipakku*, substances which the Chicago Assyrian Dictionary defines as: "a kind of precious stone", but which the distinguished Assyriologist A. Leo Oppenheim tentatively identified as raw colored glass. Egyptologists were willing to accept the probability that glassmaking was introduced into Egypt by deported Asiatic artisans since no glass vessels antedating the Asiatic conquests have ever been found in Egypt. Now they had to assume that a century after the great conquests the conquerors still had not learned how to make raw glass and had to import glass cullet from Asia to manufacture the beautiful vessels that were being made in Egypt at this time.

FACULTY BIOGRAPHICAL SKETCH

Marc d'Alarcao Assistant Professor

Marc d'Alarcao

Dr. d'Alarcao joined the Chemistry Department faculty in 1986. Although he received his BS in chemistry from Bridgewater State College, his undergraduate research was conducted at the University of Massachusetts Medical School in the laboratory of Prof. M.G. Marinus in the field of microbiology and genetics. In 1978 he moved to the University of Illinois for graduate study in chemistry with Prof. N.J. Leonard where he participated in the chemical synthesis of modified nucleotides and radiolabeled photoaffinity labels for plant auxin receptors. From Illinois he moved to Harvard where he was a postdoctoral fellow with Nobel laureate Prof. E.J. Corey. While at Harvard his interest in bioorganic chemistry blossomed as he engaged in the: 1) chemical synthesis of irreversible inhibitors of lipoxygenase enzymes, 2) identification of physiologically unstable eicosanoids, and 3) elucidation of the biosynthetic pathway of marine prostanoids.

Since coming to Tufts, Dr. d'Alarcao's work has focused on understanding the ways in which hormones, which usually bind to the exterior surface of cells, transmit their information across the cell membrane and ultimately to the biochemical machinery within the cell. As an organic chemist, he is using the technique of chemical synthesis to prepare small molecules carefully designed to test the mechanisms by which these "messages" are delivered to the interior of the cell. This work has significant medical applications since many disease processes such as manic depression, diabetes mellitus, and cancer (to name just three) are believed to result, in part, from cells which have altered signal transduction capabilities. For example, recent research by the d'Alarcao group has resulted in the synthesis of a compound which can partially bypass the normal signal transduction system for the hormone insulin and may find application in the treatment of diabetes mellitus.

Teaching has remained a strong interest for Dr. d'Alarcao and he has been involved in the teaching of chemistry at every level at Tufts from Chemistry 1 to graduate courses in Medicinal Chemistry, Synthesis, and Physical Organic Chemistry. He is currently working with members of the Biology and Chemistry Departments to explore the possibility of establishing an interdisciplinary major between these two merging fields of study.

Dr. d'Alarcao's research group currently occupies a newly renovated laboratory on the third floor of the Michael chemistry building. His research is supported by grants from the National Institutes of Health, the Warner-Lambert Company, and Tufts University.

NEW ENVIRONMENTAL COURSE FOR NONSCIENTISTS

Jonathan E. Kenny

In the past few years, Tufts faculty and staff have developed many new courses on environmental topics, or revised old courses to cover environmental topics. Much of this course development has occurred with the support of the Tufts Environmental Literacy Institute, or TELI, which was recently recognized by President Bush in an awards ceremony in the Rose Garden. Accepting the award for TELI and the Tufts Center for Environmental Management (CEM) were President Mayer and Dean of Environmental Programs Tony Cortese.

It is quite natural that the Department of Chemistry offer coursework in this area; in fact, Professor Illinger developed and offered a course in environmental chemistry in the seventies. Recently, with the growth of interest in environmental issues and careers, we decided to develop a new course aimed

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Report on continued from page 1

Recruiting. Recently, the scientific community has expressed its concern over the decreasing number of U.S. students pursuing graduate education in the natural sciences. A serious shortage in the number of Ph.D.'s by the year 2000 is projected, with academic research, teaching and the chemical industry expected to be the hardest hit. Despite these dire predictions, the Chemistry Department had the most successful recruiting effort in the College of Arts and Sciences in 1991-92 with the matriculation of ten graduate students (nine Ph.D., of which five are women), a substantial increase over the past several years. Recruiting of these students began in the fall of 1990. Students are initially contacted *via* informative mailings made to virtually every college in the northeastern quadrant of the United States. Hundreds of inquiries requesting application forms and more specific information on the graduate program are received, with many of these prospective students invited to attend the Department's Open House, held on the first Saturday of November. Alumni may be interested to know that although the primary purpose of the Open House is to recruit prospective students into the graduate program, this event also presents the Tufts community with an opportunity to become better acquainted with the faculty, graduate students and research activities of the Department. In only three years since its inception, the Open House has become our primary tool for recruiting graduate students. Of the twenty prospective graduate students who attended the November 1990 Open House, seven enrolled at Tufts. Another key recruiting effort are faculty seminars presented at predominantly undergraduate schools in the New England states. These recruiting visits, which have ranged from Colby College in Maine to Hamilton College in central New York, are financed by the Department of Chemistry. Again, the main purpose of these visits is to identify and recruit prospective students into the Tufts graduate program.

Graduate Student Profile. Graduate enrollment in the Department of Chemistry currently numbers forty-four students, of whom forty-one are Ph.D. candidates, and nineteen are women. The typical chemistry graduate student at Tufts received a B.S. degree from a small college in the northeastern United States, and was attracted to Tufts by its excellent academic reputation, the interdisciplinary research in bioorganic, environmental and materials science, and the small size of the department, which allows for more personal student-faculty contact. The Department of Chemistry also offers an attractive financial aid package which includes a tuition scholarship and guaranteed twelve month stipend to cover living expenses through at least five years of graduate education and research. Several of our first-year students were featured in the December 1991 issue of the Tufts Journal. The focus of the article was on this year's eight incoming Ph.D. candidates, a group equally divided by gender (four women, four men) and racially diverse.

All but one of these students were educated in New England. The Department recruits students from a variety of traditional *and* non-traditional backgrounds, and is most interested in students who are enthusiastic about chemistry and are dedicated to working hard toward the completion of their graduate degree.

Prospects for the Future. Since the 1989-90 academic year, the Department has conferred a total of nineteen doctoral (eight women, eleven men) and seventeen masters (seven women , ten men) degrees. The quality of our program is apparent as our graduates have gone on to successful careers in academia (University of California-Santa Barbara, California Institute of Technology, Emory, Rockefeller, Penn State, Ohio State, Purdue University), and industry (Ciba-Geigy, Mobil Corporation, Biotechnica International, Perkin Elmer, EIC Corporation and Raytheon). A summary of our doctoral and masters graduates follows this article. Based on the success of our graduates, the increasing trends in research funding and publications, and our continued success in recruiting quality students, a bright future for the Department and its graduate program seems assured.

From the Curriculum Committee

Mary Jane Shultz

The departmental curriculum continues to see innovation and growth. During the year we have added two new courses, expanded credit, and have initiated a unique method for undergraduate participation in course development.

Revitalization of the introductory laboratory sequence is a subject currently receiving copious national attention. This summer saw implementation of the first phase of a truly novel procedure for this revitalization at Tufts. The basic premise of the program was that students themselves are in the best position to provide input into what "makes an experiment work" from the point of view of awakening the student's curiosity and interest. Four students and one faculty member participated for several weeks and chose three specific subjects for exploration: an environmentally relevant experiment, one designed to illustrate aspects of reactivity, and one on kinetics. Two of these were completed and substantial progress was made on the third. The focus of the environmental experiment is acid rain: how is it formed and what are the effects of it on building materials and plants. This is a very colorful experiment involving redox chemistry and principles of solubility as well as the obvious acid/base chemistry. Since acid rain is a topic that students hear a lot about it is an excellent candidate for the introductory laboratory because students come in with some awareness and curiosity. The challenge, as the student participants outlined it, was to design experiments that exploited the initial interest and enhanced the curiosity. Material was pulled from a variety of sources, the experiments were tested and the write up completed. This was a major job.

The kinetics experiment was one that students have been doing for a while with mixed success: for some groups the experiment ran smoothly while for others there seemed to be tons of

Continued on page 6

Glazed Ceramics continued from page 2

After years of painstaking analyses of over 1,000 specimens of Egyptian glass and faience (glazed sand-core ceramic) I have shown (in a book and an article) such an assumption of Egyptian technological ignorance to be untenable, by demonstrating that the blue cobalt pigment found in glass, faience glazes and blue pottery paint was invariably accompanied by significant levels of unusual impurities seen so far only in Co from the oases of western Egypt. The pigment on objects from most sites in western Asia has a very different type of Co. Thus were it not for the type of analytical work that I am currently doing on Syrian and Mesopotamian glazed ceramics, our appreciation of the level of Egyptian pyrotechnology of the period would hinge on the meaning of a pair of words.

The value of a large analytical data bank, based on the study of well-dated excavated objects was illustrated in other recent articles. Thus after analyzing the collection of Cretan Minoan faience at the Ashmolean Museum in Oxford (a superb collection formed by the museum's former curator—Sir Arthur Evans, the discoverer of Knossos) I discovered that in the 14th c.B.C. the Minoan craftsmen made a radical change in their choice of black pigment. They switched from reduced iron to manganese oxide. Such a switch is not a trivial matter, since it requires a redesign of the kiln to transform a reducing to an oxidizing atmosphere. My extensive study of Egyptian ceramics revealed that by this time in history the Egyptians had been using Mn-based black pigment for over 1,500 years, and that this remained their pigment of choice until the country was conquered by the Greeks at the end of the 4th c.B.C. The Greeks had extensive experience with the use of reduced and oxidized iron as witnessed by the beautiful black and red vases, on which the black design owes its color to reduced and the red to oxidized iron. So, what made the Cretans abandon an old and familiar chemical recipe? Who convinced them that a black pigment based on manganese oxide is more reliable and easier to work with? The analyses provided one possible answer—the pigment and the technology were probably imported from Egypt. The manganese found in the black pigment of the Late Minoan faience contained the type and quantities of impurities seen in contemporary Egyptian black faience. That Cretans of the period traded with Egypt has been known for a long time since Egyptian tomb paintings show individuals dressed in typical Minoan costumes (as seen on the Knossos frescoes) bearing gifts. But what did they get from Egypt in return? We can now suggest that in addition to minerals and gold, for which Egypt was renown in antiquity, glazing technology was also being transferred.

For years archaeologists have been digging up Egyptian-looking objects in regions within a certain distance of Egypt, and a question arose: were these the remains of Egyptian imports or of imitations made by local craftsmen? In a recent publication, using my large and growing analytical data bank, I was able to identify among a large collection of Late Bronze Age faience (15th-12th c.B.C.) from Cyprus and Ras Shamra, Syria, specimens which not only looked Egyptian but were made of Egyptian raw materials. These, more likely than not, were imports.

The choice of analytical techniques is dictated by the nature of the objects being studied. Since the objects I have concentrated on are glazed ceramics, x-ray fluorescence was the method of choice for the visible exterior and atomic absorption for the coarse interior. The former technique allows for a truly non-destructive analysis of the glaze, with no need to scar the surface as no sample has to be removed. Considering the great value and often small size of the objects under examination, the museum curators would be most reluctant to allow sampling which might mar the surface. If cracks or breaks give access to the interior, removal of a small sample for atomic absorption analysis is more acceptable since a hole resulting from the extraction of a 20mg core will remain invisible to the museum visitor.

Professor Kaczmarczyk will retire this year and will move to Paris where he will continue his research at the Louvre.

SEMINARS

Dr. Barry Miller
AT&T Labs
"Fullerene Electrochemistry"

Dr. Michael Carrabba
EIC Laboratories
"State of the Art Applications of Raman Spectroscopy: Techniques and Instrumentation"

Prof. Paul M. Gallop
Harvard Medical School
"Biological Interconversion of Dioxygen and Superoxide by the PQQ Coenzyme"

Prof. Cynthia Zoski
University of Rhode Island
"Steady State Voltammetry at Microelectrodes"

Prof. Peter T. Lansbury
MIT
"Synthesis and Conformational Studies of the Amyloid Protein of Alzheimer's Disease"

Prof. Alan Campion
University of Texas
"Spectroscopic Studies of Chemistry and Photochemistry on Surfaces"

Prof. Larry R. Faulkner
University of Illinois at Urbana
"Electrochemical Processes in Controlled Structures at Interfaces"

Prof. Steven Rokita
SUNY, Stony Brook
"Sequence and Conformation Dependent Reaction of DNA"

Prof. Dennis H. Evans
University of Delaware
"Electron-transfer-induced Reactions: Nitroalkanes to Bucky Balls"

Environmental Course Cont. from page 3

at nonscientists, a clientele the department has not specifically targeted at the introductory level (Professor Kaczmarczyk's course on Chemistry in Art and Archaeology has appealed to a broad audience at the upper undergraduate and graduate levels).

The new course, Chemistry 8, is entitled **Environmental Chemistry**. The course has been offered in the spring semester since 1990. High-school chemistry is the only prerequisite: this saves our having to develop all the basic concepts and vocabulary from scratch and allows us to get to applications a little more quickly.

The course is arranged in units: Water, Energy, Air. At the beginning of the sequence, some time is necessarily spent in developing background: units and scientific notation, models of chemical bonding and stoichiometry. At the end, the interconnection of the various systems is discussed in the context of global climate change.

Because so many concepts are introduced in the Water unit, it tends to be the longest, often taking half the semester. The first homework set requires students to estimate their direct water usage for a week, and to research the chemical composition of various popular "waters": Perrier, Evian, seltzer, distilled, and tap. Problems of contamination and treatment for drinking supplies are discussed.

In the Energy unit, students get an introduction to the laws of thermodynamics as limits on the performance of actual energy conversions. This material is quite striking (and challenging) to them. They learn why a heat pump can be more efficient than a 100% efficient quartz heater, why small temperature increases in the summer cause big overloads and brownouts, what octane rating is, and what some of the byproducts of nuclear generation of electricity are.

The discussion of internal combustion engines provides a nice transition from energy to air pollution. Students learn about the byproducts of combustion and why more efficient engines produce a different set of emissions problems than less efficient ones. They get a glimpse of the complexity of free radical reactions in the production of smog and the destruction of the ozone layer.

The final section on global climate change was quite compressed the first two times the course was offered, as the other topics took longer than anticipated to cover. Dr. William R. Moomaw, Director of Research at CEM and a renowned expert on global warming, has guest lectured in the course.

The students keep journals and watch out for environmental stories in the media; every week, some class time is devoted to the latter. Last year, their interest in chemical warfare during the war in the Persian Gulf led to a guest lecture on the topic by our own Marc d'Alarcao, whose research is on medicinal chemistry, including the effects of chemicals on the brain and nervous system. Professor Jim Noble of the Chemical Engineering department spoke about his specialty, municipal solid waste.
The nonexistence of a suitable text has made organizing the course more challenging: most environmental chemistry texts are for advanced chemistry students, while most chemistry for nonscientists books have few environmental applications. We have used sections of such books, along with numerous handouts from C&E News and other publications, and some internally generated materials. Suggestions for topics, materials, and guest lecturers (including volunteers!) are most welcome.

Curriculum cont. from page 4

problems. The goal was to unearth as many problems as possible, trace the source and work out a smoother procedure. This challenge brought out the best in the student participants who came up with many, truly creative solutions to all sorts of practical problems. The final peg turned out to be a vaseline plug! Congratulations Brendan McCarthy (with help from Tamara Hattwick) for that creative suggestion! This experiment was also written up and has been accepted for publication. Good job team!

In the broader curriculum, after a review of our offerings and extensive examination of the goals of our undergraduate courses in each area, the department arrived at a new set of courses with greater credit granted. Briefly, the core organic and physical courses will each be offered in two sections: a lecture section with one credit and a laboratory section carrying a half-credit. Consistent with this change, the analytical course, chemistry 042, will carry one-and-one-half credits. All of you who have gone through these courses need not be told that this crediting is more in keeping with the effort required in these courses! Just as important, this change provides greater flexibility to attain the goals of these courses. For example, the physical chemists plan to shift the emphasis in the laboratory to an independent exploration rather than the techniques learning/confirmatory emphasis of the past. This places Tufts on the leading edge of the national trend in this direction!
Our two new courses are a Survey of Organic Chemistry and Transition Metals. Both are advanced undergraduate/graduate level courses designed to enhance our offerings at this level. The organic chemistry course includes a survey of advanced topics incorporating synthetic, physical, and bioorganic chemistry. The transition metals course augments the undergraduate and graduate main group courses.

Curriculum innovation and growth are a continuous process: keep an eye on this column to see what we have brewing next year.

Chairman cont. from page 1

External research funding has grown exponentially. Publication rates of faculty are at an all-time high. Curriculum improvements continue. We still have a long way to go however. Chemical Engineering moved out of Pearson to the new Science Center leaving old laboratory space. We are hoping to convert the space into a new Undergraduate Laboratory Wing for the General, Organic, and Physical Chemistry Laboratories as soon as funding is secured.

We are making an effort to reach all our alumni. Please feel free to stop in and visit the department anytime. We would like to meet you and show you all the recent changes.

UPCOMING EVENTS

Alumni Weekend May 13 thru 17

Visit the Department for tours and research presentations.

S E M I N A R S

MARCH 24

Prof. Peter C. Jurs
Penn. State University
"Prediction of Physical and Spectral Properties of Organic Molecules from Molecular Structure"

MARCH 25

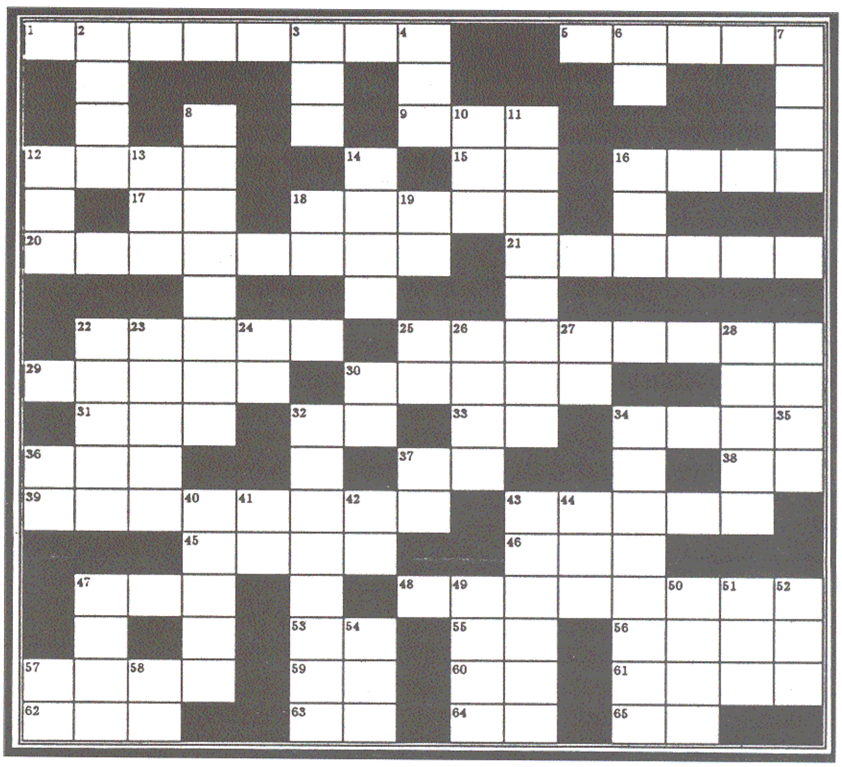
Dr. Herbert Eleuterio
E.I duPont DeNemours
"Discovery in Science"

APRIL 14

Prof. William P. Jencks
Brandeis University
"Reaction Mechanisms: Appearance and Reality"

APRIL 21

Prof. C. Michael Elliott
Colorado State University
"Electrochemically Active Polymer Films"



Across

1 Members of periodic table
5 Rutherford's projectile
9 Short for biology
12 Ortho, ...
15 101 Roman style
16 Acid + base
17 Light bulb filler
18 Kind of mushroom
20 Element, oxide which is effective sunscreen
21 Compounds constitute 14% of sebum, natural oil secreted by skin's sebaceous glands
22 Put off (as in studying)
25 Element, in finely-powdered form called kohl, used as eye shadow by Egyptian women
29 Ferriporphyrin chloride
30 ______ copper ore, eye shadow of prehistoric times
31 Vein comb. form
32 Discovered by M. Currie
33 Either
35 3-amino-5-nitro-*O*-toluamide
36 Spectral region adjacent to visible, for short
37 Off
38 Main ingredient of sand
39 Common humectant used in cosmetics
43 Computer accessory
45 ene-3beta,17beta-diol
46 Limb
47 Colonial hymenopterous insect
48 Polyvinylalcohol used in some toothpastes
53 Element number 58
55 Lead
56 Fluorine's atomic number
57 Comet feature
59 First of the rare earths
60 Element whose oxide is amphoteric
61 Carbonyldiamide
62 Massachusetts cape
63 Holmium's neighbor
64 The (Fr.)
65 Myself

Down

2 Fluid rock
3 Former of acid rain
4 Below
6 Trivalent rare earth
7 Vinegar (comb. form)
8 Class of emollient used in cosmetics
10 $H_2O(s)$
11 Kind of emulsion used in vanishing creams
12 Flatten or smooth
13 Large rodent
14 60 minutes
16 Jazz instrument
18 Third tone of diatonic scale
19 Room
22 Evil being
23 Fine-grained corundum used in grinding and polishing
24 Made of
25 Mp -189.33; bp -185.6
26 Noble gas
27 Opp. of out
28 Hangman's trademark
30 Leave
32 In cosmetic emulsion, the finer the ______ size, the more stable the emulsion and the higher the viscosity
34 Salt of this element are used in antiperspirants and styptic
35 Rutile: ______ dioxide
36 Useless
37 Signifies organic alcohol
40 ______ alcohol, common ingredient of cold cream
41 Radioactive element produced artificially
42 Either ___________
43 Form of calcium carbonate
44 Short form of orbit
47 _______ Lloyd Hodgkin, Nobelist in physiology or medicine
49 SiO_2nH_2O
50 Fatigue
51 Uni
52 Grassland pasture
54 Hear with
57 Acid resisting, metallic member of the vanadium family
58 Out __________

CLASS NOTES

Roy Desrochers (A 1983) of Arthur D. Little gave a presentation "Sensory Directed Chemical Analysis" at the International Symposium on Off Flavors of the Aquatic Environment.

Ellen Fox Davis (J 1986) graduated from Northeastern University Law School in June and is doing primarily environment law.

Michael Carrabba (Kenny, Ph.D. 1985) came back to give an exceptional seminar in the department in the fall entitled "State of the Art Applications of Raman Spectroscopy: Techniques and Instrumentation". It was great to have him back.

Smita Patel (Walt, Ph.D. 1988) became an Assistant Professor of Biochemistry at Ohio State University last fall.

William Koster (Georgian, Ph.D. 1972) has been promoted to Vice President of Cardiovascular Diseases/Drug Discovery at Bristol-Myers Squibb. Congratulations!

Herbert S. Eleuterio (A 1949) received the Dupont Technical Excellence Award.

Dr. Frank S. Parker (A 1942, G1944) retired in June, 1991 as Professor Emeritus in the Dept. of Biochemistry and Molecular Biology of New York Medical College in Valhalla. Dr. Parker credits Prof. Crosby Baker, who was chairman of Tufts Chemistry Dept. in 1942, with starting him on a teaching and research career.

PLEASE SEND IN ANY RECENT NEWS AND/OR ACCOMPLISHMENTS FOR THE NEXT ISSUE.

NEW GRADUATE STUDENTS

Pericles Calias, Marianne McAllister, Amy Esslinger, Robert Simpson, Lygia Snow, Martin Dunne, Yurii Gankin. Not Shown: Peter Andrulis, Lisa McFarland and Ellen Veenstra.

1991 GRADUATES & CAREER OPTIONS

Peter Andrulis, BS
Grad student, Tufts

Steven Barnard, PhD
Ciba-Geigy

Anthony Bevilacqua, PhD
Mobil Corporation

Chris Caputo, BS
Grad student, Harvard

Komgrit Chukiert, BS
Med school

Sean Collins, BS
Research position

Jung-Yie Kao, PhD
Postdoc, Wesleyan Univ.

Shufang Luo, PhD
Postdoc, Pittsburgh

Dieu Ly, BS
Dental school

Tianmei Ouyang, PhD
Postdoc, University of California Berkeley

Richard Popovic, BS
Med school

Rich Wing, BS
Grad student, Harvard

Dong Yu, PhD
Postdoc, UMASS

Philip Yu, PhD
PPG

Ping Yuan, PhD
Postdoc, Amherst

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