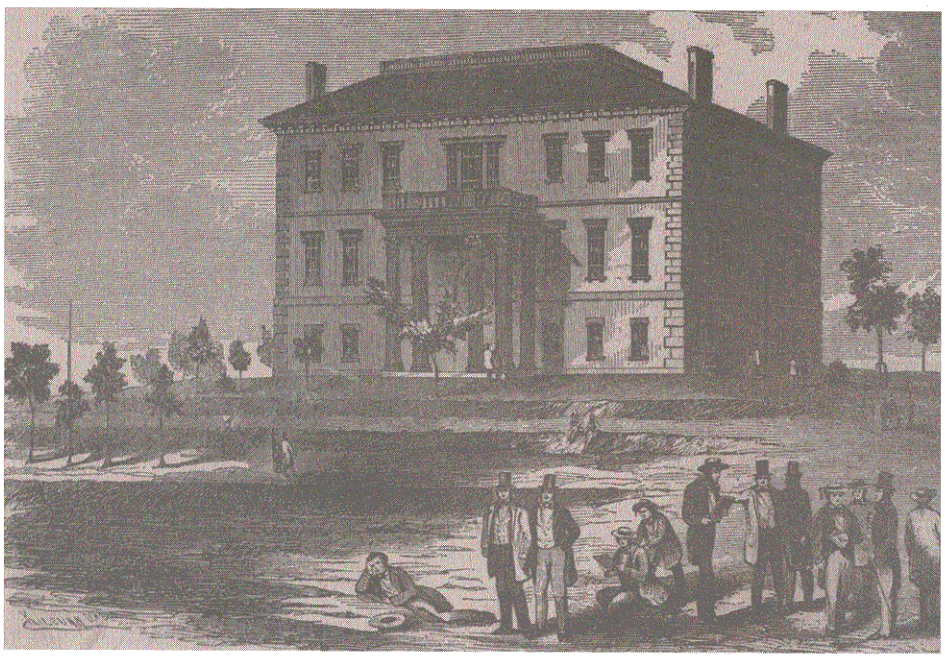
TUFTS UNIVERSITY CHEMISTRY DEPARTMENT

ChemNotes

SPRING–SUMMER 1997

A Brief History of the Chemistry Department – Part I

(excerpts from the Michael Building Rededication Address by Professor David Walt)



The Chemistry Department was housed in Ballou Hall from 1865 to 1894.

The official record of Tufts College for the year 1855 shows that John Marshall, a graduate of Yale, was appointed professor of Mathematics and Physics by the college trustees. John Marshall was the first professor at the University and was also professor of Chemistry. The records also show that he was professor of Mathematics and Physics until 1865 when he was relieved of responsibilities in these two college departments and acquired three others: Mineralogy, Geology, and Chemistry. He held the professorship of Geology and Mineralogy until 1898. From 1892-98 he was dean of the Art School and in 1876 at his own request, the college trustees relieved him of his professorship in Chemistry. The following year Steven Pittman was appointed as professor. Professor Pittman held this position until 1882, when he resigned to enter the insurance field. It was not until 1882 when trustees of the college appointed Arthur Michael professor of Chemistry that the present Chemistry Department, (originally called the Chemical Department) really had its beginnings. The Chemical Department was then located on the first floor of Ballou.

Arthur Lamb, a renowned Harvard professor, wrote in the Journal of the American Chemical Society: "Indeed, chemistry has had a notable history at Tufts. Professor Michael, the most brilliant organic chemist that America has produced, came to Tufts in the 1880's

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Chair's Corner

Marc d'Alarcao

In September 1996, Prof. David Walt stepped down as chairman of the Chemistry Department and began a well-deserved sabbatical leave. Much exciting research has been coming from the Walt research laboratory and he used this sabbatical year to concentrate on his research efforts. Since September, I have been serving as interim chairman.

The Chemistry Department has undergone many positive and significant changes under Prof. Walt's seven year stewardship. We have recognized the areas of environmental, biomedical, and materials chemistry as among our areas of strength and have made strategic faculty hires in these areas. Teams of faculty, graduate and undergraduate students, and postdoctoral fellows are producing ever more exciting and important research in these and other areas. The department's curriculum is beginning to reflect our strategic focus as general courses such as Chemical Fundamentals (Chem 1) and Chemical Principles (Chem 2) incorporate more and more examples drawn from environmental, materials and biomedical chemistry. These real world examples help to draw connections for the student between the rarefied principles of basic chemistry and those issues which touch our lives on a daily basis. New courses in these focal areas at various experience levels have been introduced to further strengthen our curriculum. Courses with titles like Environmental Chemistry (for non-science majors), Chemistry of Materials (for beginning majors and non-majors, alike) and Medicinal Chemistry (for advanced science students) have been developed to provide a richer menu of relevant and interesting courses from which students may select.

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A brief history, *continued from page 1*

and for thirty-odd years published from the laboratory those researches which made Tufts College known in every civilized country. Michael not only carried through to success many important experimental investigations, he also evolved a broad theory of chemical reactions, a genuine philosophy of chemistry, which sought to express the chemical properties and reactions of substances on the basis of the energy contained in constituent atoms. It is not merely the relative positions of the atoms with respect to one another, but also their endowment of energy of various kinds which determine their behavior. And Michael has shown methods of evaluating at least approximately the amount and nature of these energies. Michael made but a single excursion so far as I know into the field of inorganic chemistry, but he brought back a rich booty. On the basis of his theoretical ideas he reasoned that under certain circumstances it should be possible to form a compound of two atoms of Chlorine with seven atoms of Oxygen. He realized these conditions experimentally and presto! the predicted new oxide of Chlorine was formed. This discovery alone would afford fame enough for ordinary laboratories."

In an interview with Arthur Michael's older brother, Edward, in September 1942, Edward said, "Arthur was a small, curly-headed boy who, during his early years, was interested in games, sports, and out-of-door things like most boys. He was very fond of baseball. He was, however, rather sickly as a boy. At twelve to thirteen years old, he lost interest in sports and play, gave up many of his boyhood acquaintances and became absorbed in chemistry and studies." Edward spoke of how Arthur attended Briggs classical school and prepared himself for Harvard. He attended Clark University for a brief time but got into a dispute with the president of that university and came to Tufts. Also alluded to in the interview was the occasion of Abraham Lincoln's address in 1861 to a military procession in Buffalo at which Arthur was present.

It was in the laboratory at Tufts, on the first floor of Ballou, that young Michael published a reaction that now bears his name. It was published in the Journal for Praktishe Chemie in Germany, which was at that time the seat of Chemistry.

A second paper was published contemporaneously with the German paper in the *American Chemical Society Journal*. These events occurred when Tufts was called Tufts College, and located in College Hill, Massachusetts, predating when Tufts was part of Medford.

Professor Arthur Michael

In Ballou, the student laboratory was in the southwest corner of the building, and included most of the space now occupied by the offices of the deans and the registrar. In 1889 Dr. Frank Durkee, who was one of Professor Michael's first students, was appointed instructor of Chemistry, Gymnasium, and Natural History. In 1895, he was promoted to professor of Chemistry, where he remained until his retirement in 1939. The 76 papers published between 1882 and 1890 in the leading chemical journals of Germany and America demonstrate how busy and occupied these laboratories were. On the other hand, the courses of study were very meager, consisting even up to the college year of 1890-91 of about five subjects: General Inorganic Chemistry, two courses in Qualitative Analysis, each a half-year, one course in Quantitative Analysis of one year, and Organic Chemistry, one half-year. It is interesting to note that in the year 1890-91 there were 26 students in General Chemistry, 22 in the first half of Qualitative Analysis, nine in the second half, and no students taking Quantitative Analysis or Organic Chemistry. The faculty consisted of one professor and one instructor.

This situation inspired Mr. Newton Talbot, (of Talbot Avenue fame), able Boston businessman and treasurer of the college, to house the Chemical Department in a wooden building. Professor Michael was absent at the time and the design of the building fell upon the instructor in residence. A workman of the college farm, who was not a stonemason, laid the foundation. The superintendent of Grounds and Buildings, a carpenter, arranged the construction work. Every man from the college farm who could drive a nail joined the working crew. The laboratory started in July 1895 and was finished and occupied the first of October in the same year. It was located under the Hill by the railroad track, was 100 feet long, 50 feet wide and sheltered one floor and a basement. The cost in round numbers was $1,700. Perhaps it was a record-breaking achievement in low-cost construction of college laboratories. With the addition of plumbing and gas heat, the cost was a few dollars more than $7,000. In the college year 1895-96, the course leading to the B.S. degree in Chemistry was offered, and the course leading to the B.S. degree in Chemical Engineering in the college year 1898-99. From 1895 to 1910, 75 important papers were published, mostly in Germany, making Tufts College Chemical Department better known among German-speaking than among English-speaking countries.

In the meantime, some of the largest industrial concerns of the U.S., Canada, Mexico, and Brazil used the Chemical Department for consulting and research purposes. By 1915, 25 percent of all the students enrolled in Arts, Engineering, and Divinity Schools together with students in Jackson College were working for the B.S. degree in Chemistry or the B.S. in Chemical Engineering. The Chemical Graduates had no difficulty in securing desirable positions, a situation which further stimulated student enrollment, until the Chemical Department, of necessity, overflowed into the attic of Bromfield-Pearson, the basement of Curtis Hall, and the space at that time occupied by the cafeteria. These events made it clear to the trustees and the administration and also to friends of the college that a new and more commodious chemical laboratory must be provided. A committee was appointed to raise funds but met with little success. This was during the first World War, and because times were tight, only $10,000 was pledged. It was not until Dr. Cousens became president of the college, that the necessary funds were secured to build Pearson Hall.

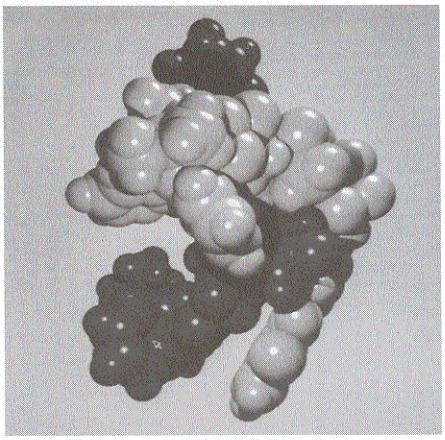
Next: Pearson Hall and the department's expansion.

Instrumentation

The elucidation of the three dimensional structure of molecules remains one of the great challenges in chemistry. For many years, X-ray crystallography has been the only technique providing high resolution structures of complex molecules. Over the last fifteen years, two-dimensional nuclear magnetic resonance (NMR) spectroscopy and molecular dynamics calculations have been developed as a viable alternative to this traditional technique. With NMR-based techniques, molecules can be studied in solution, eliminating the need for crystallization that often complicates X-ray studies on biomolecules.

One-dimensional NMR spectroscopy has a strong tradition at Tufts. The first 60 MHz spectrometer was commissioned in 1963 and the first publication to include NMR data appeared soon after that date.[1] More detailed studies on NMR phenomena followed.[2]

Since biomedical chemistry is one of the developing foci in the department, recent studies have used two-dimensional NMR experiments and molecular dynamics. One of the first solution structures under investigation with this approach is shown above.[3] This structure of a dimethylene sulfone-linked ribonucleotide is unusual in its hydrogen bonding pattern. Nucleobase to backbone hydrogen bonds that are not found in any of the known structures of natural RNA are observed. This observation helps to explain the unusual recognition properties of RNA bearing the $CH_2SO_2CH_2$ backbone substitution.[4] The results also suggest roles for phosphodiesters in natural RNA and DNA beyond their function in retaining genetic material within cell membranes[5]. To solve the three-dimensional structure, special protocols for symmetrical complexes had to be used.[6]



Space filling model of the solution structure of a dimethylene sulfone-linked RNA dimer.

As recent advances in NMR and computational technology enable this kind of analysis of large, biologically-significant molecules, the Tufts Chemistry Department must keep moving to meet the challenge and opportunity that these advances offer. We are planning significant NMR instrument improvements and acquisitions to allow high-level structure determinations.

Clemens Richert

1. Stolow, R.D.; Sadchev, K. *Tetrahedron* **1965**, *21*, 1889-1895.
2. (a) Fung, B.M.; Stolow, R.D. *Chem. Comm.* **1967**, 257-258. (b) Stolow, R.D.; Giants, T.W. *Chem. Comm.* **1971**, 528.
3. Steinbeck, C., Richert, C., manuscript in preparation.
4. Richert, C.; Roughton, A.L.; Benner, S.A. *J. Am. Chem. Soc.* **1996**, *118*, 4518-4531.
5. Westheimer, F.H., *Nature*, **1978**, *235*, 1173-1178.
6. Nilges, M. Proteins *Struc. Func., Gen.* **1993**, *17*, 297-309.

Chair's Corner, *continued from p. 1*

With the generous support of alumni and friends we have begun a major renovation of the physical environment which houses the Chemistry Department. The Michael Research Building has been fully refurbished providing an outstanding research facility including the W. M. Keck Foundation Materials Chemistry Laboratory and the John A. Krol Environmental Laboratories. The west wing of the Pearson Building has also received major renovation including a new laboratory for the physical chemistry classes and a new eighty-seat lecture hall soon to be fully equipped with state-of-the-art electronic teaching equipment.

As we look toward the future, we are not complacent. We must continue the progress made during the Walt years. We must complete the renovation of the remaining physical structure, including the organic and analytical chemistry teaching laboratories. We must further strengthen the teaching and research of our focus areas of environmental, biomedical and materials chemistry by further refining the curriculum and by attracting the best young talent in these areas to our faculty. With our faculty, students, staff, alumni, and friends working together, we can achieve our vision of Tufts Chemistry as a place where the great opportunities of a research university and the special character of a small teaching college meet.

Seminars

Seminars in the Chemistry Department at Tufts have become increasingly attractive. At the beginning of the Fall 1996 Series, the newly renovated lecture hall, Pearson 106, became available for the presentations. Speakers and audience enjoy a very elegant and modern setting. Soon, state-of the-art audio-visual equipment will be installed, making our seminar room not only one of the most inviting but also one of the best equipped lecture halls on campus.

This distinct improvement in the facility, brought about by completion of renovation phase 1B, is fully matched by a number of exciting presentations. Speakers from all fields of modern chemistry coming from well known national and international research institutions presented their research this year. Several of the speakers are leaders in their field. The names of internationally famous researchers can be found side by side with those of young promising scientists.

In the fall of 1995, the Chemistry Department began a tradition of inviting an exceptionally promising young scientist from the area to give the opening lecture. This somewhat unorthodox initiative has been a great success. After two talks by chemists from Harvard (B. Peterson and L. Isaacs, fall 1995 and spring 1996), Professor Morgan Conn reported last fall on his work performed at the M.I.T., U.C./Berkeley, and Amherst College. Peter Belshaw, who did his doctoral work with Professor Stuart Schreiber, gave the Spring 1997 opening seminar titled "Controlling cellular events with chemical inducers of dimerization."

The Spring 1997 Series included presentations by Professor JoAnne Stubbe (M.I.T.) on February 25, by Professor John Wright, who gave the Eddy Lecture on March 11, and by Professor Reza Ghadiri (Scripps) on May 13, 1997.

The Chemistry Department is looking forward to welcoming additional listeners from outside the department. The seminars are an opportunity for alumni who happen to be in the area to spend an informative and pleasant hour sitting next to Tufts' youngest generation of chemists. The seminars are held at 4:30 p.m. in Pearson 106 unless otherwise noted. Refreshments are served 30 minutes prior to the seminars in Pearson 102.

Fall 1996 Seminar Series

September 10 Prof. Morgan Conn
UC Berkeley – Amherst College
Molecular Recognition and Catalysis: Design and Selection

September 17 Prof. James Dittami
Worcester Polytechnic Institute
Photoinitiated Intramolecular Ylide-Alkene Addition Reactions

September 24 Prof. Nick Serpone
Concordia University, Montreal
Photochemistry and Photophysics of Semiconductors: Understanding the Role of Titania, TiO^2, in Heterogeneous Photocatalysis

October 1 Prof. Charles Lieber
Harvard University
Pushing and Pulling Molecules and Molecular Assemblies: Probing Intermolecular Forces, Friction and Mech-anics by Probe Microscopy

October 8 Prof. Roger Tobin
Tufts University
Chemistry on Stepped Metal Surfaces

October 22 Prof. Martin Egli
Northwestern University
Structure-Function Investigations on Chemically Modified Nucleic Acids and Catalytic RNA

October 29 Prof. James Williamson
M.I.T.
Molecular Recognition in RNA-Protein Complexes

November 5 Prof. Paul Davidovits
Boston College
How do gas molecules enter liquids and what do they do there?
Applications to atmospheric chemistry

November 12 Prof. Vassili Karanassios,
University of Waterloo
Elemental Micro-Analysis by ICP Spectrometry

December 10 Prof. Adam Heller
University of Texas at Austin
Electrical "Wiring" of Enzyme Reaction Centers to Electrodes through Electron Conducting Hydrogels

Spring 1997 Seminar Series

January 14 Dr. Peter Belshaw
Harvard University
Controlling Cellular Events with Chemical Inducers of Dimerization

January 21 Prof. Amy Mullin
Boston University
Collisional Quenching of Highly Excited Molecules: Toward a State-Resolved Picture of Energy Dependence

January 28 Dr. Alex Margolin
Altus Biologics
Cross-linked Protein Crystals as New Catalysts and Materials

February 4 Prof. Michael Haley
University of Oregon Eugene
Dehydrobenzoannulenes Revisited: A New Look for a Classic Molecular System

February 25 Prof. JoAnne Stubbe
M.I.T.
Bleomycins: Structure and Function

March 4 Prof. Vincent Rotello
University of Massachusetts Amherst
Modulation of Cofactor Redox Potentials through Specific Interactions: Synthetic Models of the Flavoenzymes.

March 11 Prof. John Wright
University of Wisconsin Madison

Eddy Lecture

Is there Credible Evidence that Active Learning Works?

March 12 Prof. John Wright
University of Wisconsin Madison
Research Opportunities at High Laser Intensities – New Optical Materials Based on Fullerenes and New Spectroscopies Based on Multiresonant Vibrational Transitions

March 25 Prof. David Kaplan
Tufts University
Spider Silk – A New Paradigm for Materials Science

April 1 Dr. Katharine Gibson
DuPont
Mechanism of Dethiobiotin Synthetase

April 8 Prof. Dennis Jacobs
University of Notre Dame
Reactive Scattering of State-Selected Molecular Ions on Surfaces

May 13 Prof. Reza Ghadiri
The Scripps Research Institute
Molecular Replication

A second interesting and popular series of presentations is held on Thursday afternoons at 4:30 p.m. in Pearson 106. Second year graduate students present their public study topics. This past fall and spring, the following young scientists gave their talks:

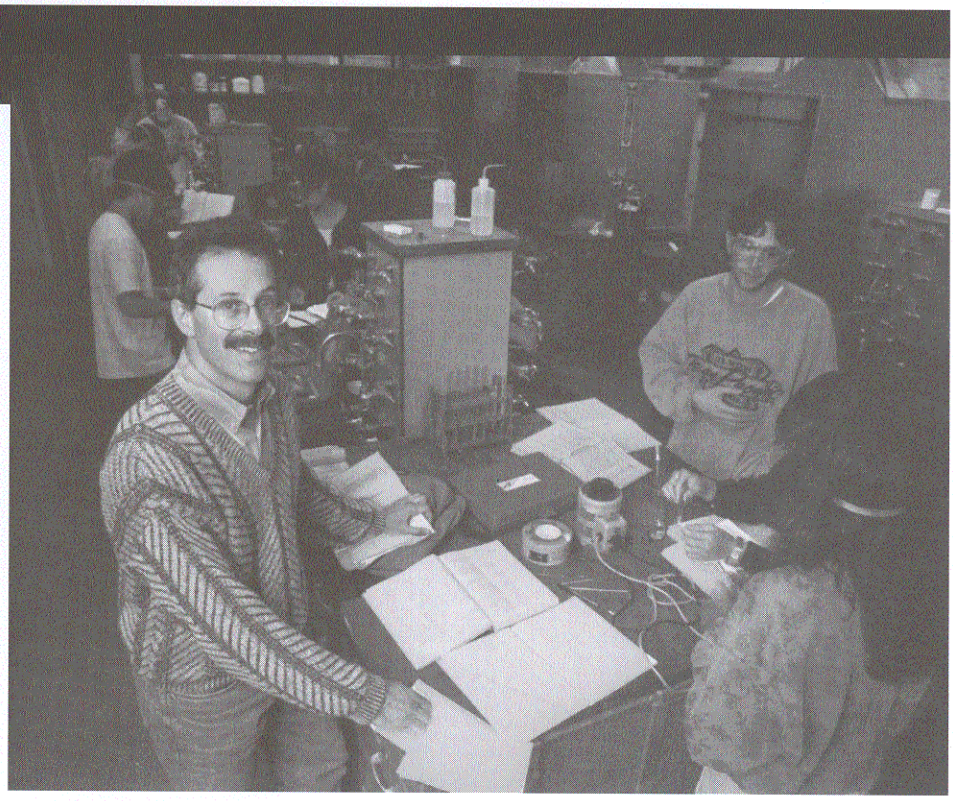
September 12	David Turner
September 19	Rosemary Feeney
October 3	Jane Pepper
October 10	Danielle Simonelli
October 24	Colleen Bleczinski
October 31	Laura Taylor
November 14	Jane Ferguson
November 21	Vladislav Tarasov
December 5	Charles Tetzlaff
January 23	Ludo Juurlink
February 13	John Birtles
April 24	Christa Bock

You can find information on the departmental seminar series and many other departmental activities on the Tufts Chemistry page on the World Wide Web:(http://www.tufts.edu/departments/chemistry/seminars.html).

For the most current information, please contact the Chemistry Department Office, Tel. (617) 627-3441, FAX (617) 627 3443. Janice Silva and her team will be happy to place your name on the mailing list for the seminar announcements. All seminars are public and guests are always welcome.

Faculty Profile:

David R. Walt



Professor David R. Walt in his laboratory.

Professor David Walt joined the Chemistry Department at Tufts University in 1981. He held the chairmanship from 1989 to 1996 and is currently completing a one year sabbatical leave. After receiving a Bachelor of Science degree from the University of Michigan in 1974, he completed graduate studies in Organic Chemistry and Pharmacology at SUNY at Stony Brook in 1979 and did postdoctoral work at M.I.T.

During his tenure as chairman, Dr. Walt has made significant contributions to the Chemistry Department and to the overall standing of Tufts University as a highly regarded educational institution. Under his direction, facilities have been dramatically improved. As a result, teaching laboratories in several courses are now an enhancement to the learning environment and contain state-of-the-art equipment.

Under his leadership, recruitment efforts to hire new faculty have resulted in the addition of new faculty members with exceptional teaching abilities. The momentum gained by these efforts will continue to drive the department toward teaching excellence well into the future.

The research facilities have also been upgraded and renovated. Dr. Walt has been committed to building a strong research atmosphere. Funding, in general, has increased significantly and all faculty are now receiving funding from external sources such as the National Institutes of Health, the National Science Foundation, the Departments of Energy and Defense, and the Environmental Protection Agency.

Curriculum in the Chemistry Department has been expanded in response to the changing needs of the students. Chem 50, a one semester survey course of Organic Chemistry developed by Dr. Walt, was directed toward students majoring in Biology, Chemical Engineering, and Environmental Studies. An additional course, Chem 156, Biochemistry, was developed in a collaborative effort to provide students with a chemical perspective on Biochemistry. The standard approach had been to teach the course with a metabolic pathway orientation.

Dr. Walt and his research group have several areas of interest. As an organic chemist the focus of all his research is on polymer, materials, surface, and dye chemistry. For the past ten years he has been working on the development of fiber-optic chemical sensors with an overall goal of developing new sensing schemes for clinical, environmental, and process control applications. Sensors which measure continuously the concentration changes in various components of biological and environmental samples have been successfully designed. Some examples include organic vapor sensors for groundwater monitoring and pH sensors for blood monitoring.

His group is currently engaged in a collaborative effort with Dr. John Kauer of the Neuroscience Department at Tufts University School of Medicine to examine how the mammalian olfactory system (sense of smell) functions and to apply the principles of a biological system in order to design a broad-based chemical sensing system. This project has generated international interest.

A recent area of interest is micro- and nano-fabrication which involves the design of very small structures on both the micro and nano scale for possible applications in microscopy, high density information storage and lithography.

There is no doubt that Dr. Walt's accomplishments have helped to thrust the Chemistry Department into a highly visible position in the scientific community.

Let us put YOU on the Tufts Chemistry WEB!

The Department of Chemistry's web site continues to grow! During the past semester we have added several new pages of information, but we would like to add even more. Especially for our alumni, we are creating an "Alumni Page" where we would like to list as many of you as possible. We would like to include not only names and e-mail addresses but items of interest and WWW links to alumni pages and your areas of current employment or involvement. So please write or e-mail one of us listed below if you would like to be included. Let us know where you are and what you are doing!

For those of you who are new to the Internet, the World Wide Web (WWW or web) is a combination of the worldwide network (known as the Internet) and various software systems, some of which can be accessed at the PC level using a "Web Browser." There are many types of browsers — Net-scape Navigator, Microsoft Explorer, and Mosaic are a few examples. Currently, Netscape works best with our web site, but all text information can be viewed with any browser.

The Tufts Chemistry homepage provides information such as course listings, degree requirements, faculty/staff/student info, the graduate program, special events, links to other chemistry resources, and group research information. The hope is that this resource will not only provide information for prospective graduate students and alumni, but will eventually contain within it links to many valuable chemistry resources within the department and throughout the world. To access the page from a Web browser, use the URL (Uniform Resource Locator):

http://www.tufts.edu/departments/chemistry/index.html

The page is currently maintained by Professor Sam Kounaves (skounave@emerald.tufts.edu)

FACULTY AND STAFF N E W S

Arlene Chaplin joined the staff in August 1996 as the Chemistry Department Manager. Arlene completed her undergraduate work at Northeastern University in Medical Laboratory Science and received a Master's degree from Boston University in 1995. Prior to joining the Tufts community, she was employed at the Deaconess Hospital in Boston in the Pathology Department. She brings to the department her experience in financial management, laboratory safety, and coordination of renovation projects.

The Annual Summer Picnic to welcome new graduate students was held last August. Achievement Awards were presented by Professor Marc d'Alarcao for outstanding performance during the Spring 1996 Semester:

STAFF: **Janice Silva,** *Office Manager*
FACULTY: **Professor Arthur Utz**
GRADUATE STUDENT: **Laura Taylor**

Professor David Walt has been interviewed on National Public Radio, CNN, BBC, and elsewhere to explain his collaborative research on the application of principles of a biological system (the mammalian olfactory system) to design a broad-based chemical sensing system.

Professor Albert Robbat, Jr. has developed PC-based software which has generated a great deal of interest among environmentalists. The technology, Ion Fingerprint Detection®, can detect complex mixtures (environmental, drug and explosives) in minutes rather than days where multiple chemical compounds are present. The rapid detection capability saves fifty to seventy percent of soil analysis costs.

The Annual Holiday Party in December at Alumnae Lounge was a festive occasion. Both faculty and graduate students demonstrated their theatrical skills by presenting comedic views of the department to colleagues, family, and friends in attendance. A highlight of the party was the presentation of the Fall 1996 Semester Awards for outstanding achievement. The presentations were made by **Professor d'Alarcao** to the following:

STAFF: **Dr. Sarah Iacobucci,** *Laboratory Manager*
FACULTY: **Professor Robert Dewald**
GRADUATE STUDENT: **Robert Simpson**

CLASS NOTES

1950 Stanley R. Mackay (BS 1950) is retired and living in Marblehead, MA.

1953 Harry Linde (BS 1950) retired in 1991 as professor and associate dean at Northwestern University. He is enjoying his leisure time cruising his motor yacht down the intracoastal waterway to Florida.

1955 John Downey (BS 1955) died on January 11, 1996. He retired from Polaroid as a senior research group leader in 1993. His work there led to patents in polymer applications and silane coatings.

1962 Henry Ferry (BS 1962) is teaching Biology and Chemistry at Mount St. Charles Academy in Woonsocket, Rhode Island.

1970 Elwood G. Trask (PhD 1970) is a technical director at Gates Formed-Fibre Products in Auburn, Maine. The company is a major supplier of molded trim components to the auto industry as well as a producer of polyester fiber made from recycled soda bottles. He is holder or co-holder of eight patents.

1984 Dr. Carol (DiGiusto) Burd (BS 1984) is a practicing internist at Harvard Pilgrim Health in Wellesley, MA.

1985 Glen Bouchard (BS 1995) completed his residency in Emergency Medicine at University of Massachusetts Medical Center in 1994 and is currently practicing medicine as a member of the Wachusett Emergency Physicians' Group in Leominster MA.

1991 Komgrit Chukiert (BS 1991 – MS 1995) is currently at the Medical Center Hospital at University of Vermont in the residency program.

1995 Martin Morrison (BS 1995) is employed by Osteotech, an orthopedic implant firm in Shrewsbury, N.J., where demineralized bone powders, gels, and flexible bone sheets are produced.

1995 Glen Pearlstein (BS 1993 – MS 1995) is currently a research fellow with the NIAID Institute of the National Institute of Health (NIH).

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Michael Lee
Daniel Minior
Hien Nguyen
Yelena Sinelnikova
Mary Tsikitis
Nilesh Vyas

Doctoral Degrees Awarded 1995-96

Frances R. Blanco *(Harlan)* "Isolation, Characterization, and Reactivity of a High-Valent Manganese Imido PorphyrinComplex"

Pericles Calias *(d'Alarcao)* "Synthesis and Biological Evaluation of Water Soluble Flavonoid Analogues: Inositol 2-phosphate-quercetin Conjugates and Partial Synthesis of Phosphatidylinositol Glycans in the Study of Insulin Signal Transduction"

Brian G. Healey *(Walt)* "Design and Fabrication of Polymer Arrays on Optical Imaging Fibers and Their Use as Chemical Sensors"

Siqun Huang *(Kenny)* "Internal Rotation of the Isopropyl Group of Guaiazulene and a Method to Evaluate the Sachs Formula"

Stella Papasavva *(Kenny)* "Reducing the Risk of Global Warming from CFC Alternatives: A Scientific Basis for Policy Options"