STANFORD CHEMISTRY DEPARTMENT

1977-2000

OLD MAIN CHEMISTRY, 1999

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Professor of Chemistry, Emeritus

CONTENTS

PREFACE

In 1999 my husband began writing a history of the Chemistry Department at Stanford for the years 1977-2000. He felt that the excellent history of the Department that Professor Eric Hutchinson had written covering the earlier years (1891-1976) should be continued. Unfortunately, he was not quite able to complete the work before he became ill. After his death in March 2001, I undertook to complete the lists of degrees granted and to edit, in a minor way, the text that he had written. I trust that the readers, especially his colleagues, will therefore understand and excuse any errors that they may detect.

Carol W. Mosher
October 2001

As the first Harry S. Mosher Professor, I have had the privilege and honor of helping Carol Mosher assemble this document for publication on our departmental web site. We have prepared the document as Harry finished it, with Carol's completions. I am deeply indebted our Head Librarian, Grace Baysinger, for her skillful assistance in checking and correcting facts, and to the Chemistry Administrative Services Group for scanning photographs.

W. E. Moerner
January 2006

FOREWORD

I am deeply indebted to Prof. Eric Hutchinson who compiled the chronicle of the Stanford Chemistry Department from 1891-1976, preserving the records of the early days of the Department, beginning with the founding by the first executive head, Prof. John Stillman. Twenty-four years have passed since this earlier account was written. Collective memories are short and are notoriously poor at preserving records. It seemed to me appropriate, and even urgent, that these chronicles be continued. The pace of developments in the science of Chemistry and its teaching during the last twenty-five years has resulted in changes in the faculty, buildings, curricula and students almost equaling the changes during the first eighty-five years in the life of the department. Accordingly I have undertaken the present project bringing the chronicle up to the twentyfirst century.

In the Foreword to his chronicles, Prof. Hutchinson made the point that he had not written a *History* of the Chemistry Department. He stated that a history should deal with people, their actions, decisions, contributions and consequences. He felt that it would be impossible for him to give a balanced, objective evaluation of the colleagues with whom he had worked over the years. He wrote: "It seems to me to be palpably obvious that to attempt a history of living individuals is, on the one hand, presumptuous, in that no sound

perspective can be gained of living persons; and hazardous, on the other hand, in that, with the best will in the world and with the most dispassionately objective view, the writer is all too likely to give offense---if not to the individual, then at least to the members of his family." I fully agree with these sentiments and have followed this same self-imposed injunction in the present account.

Soon after the founding of the University, President David Starr Jordan in a lecture about Stanford was quoted as saying "It is not buildings that make a university but professors and students." I have used his statement to organize this chronicle of Stanford's Chemistry Department, 1977-2000, into four major subjects---Faculty, Undergraduate Curricula, Buildings and Students. These are all interrelated, but it seems more logical to treat them separately than to try to weave them together in strictly chronological order.

It is easy to see how, in the beginning days of Stanford University, the observer would be preoccupied with the growing physical structures and not consider the real nature of the astounding transformation happening on Stanford's farm. This is still true; it is much easier to think of the development of Stanford's Chemistry Department in terms of the buildings added over the years than the happenings with the faculty and students. However, since the growth of the facilities was designed to keep pace with the development of the curricula and with the growth of the faculty and number of students, these categories are obviously part of the same whole.

We begin with a consideration of the faculty members, but it is not our intention to undertake a full biographical account of the individual accomplishments of each. The precedent set by Professor Eric Hutchinson will be followed. For those who would like more detailed accounts of the faculty, some accounts do exist. For our three Nobel Laureates, Professors Flory, Pauling and Taube, there are biographies in the book, Nobel Laureates in Chemistry, 1901-1992 published by the American Chemical Society. Professor J. Murray Luck has written an autobiography Reminiscences published by Annual Reviews, Inc. 1999. Autobiographies of Professors Carl Djerassi and W. S. Johnson were published by the American Chemical Society in the series Profiles, Pathways, and Dreams edited by Jeffrey T. Seeman. For anyone interested in the detailed research interests of a particular professor or his students, we recommend the ACS

Directory of Graduate Research, published every two years since 1953 by the American Chemical Society, which gives a list of all the research publications by each professor for the preceding two year period. A copy of every faculty publication in the Chemistry Department is available in the Swain Library for 1927-1963, and for 1976 onward. An abbreviated biographical outline, in the format used in the American Men and Women of Science, is included here for each of the professors, arranged in the order of their joining the department. Photographs of tenured professors were taken by Albert Dadian.
/Harry S. Mosher

I. FACULTY

Chairmen

The chairmen of the Chemistry Department from 1969-2000 are listed below. These faculty members with the responsibility of guiding the Department's development over these specific years certainly are key figures in this chronicle.

Paul Flory	1969-1972
Eugene VanTamelen	1972-1978
Henry Taube	1978-1979
John Brauman	1979-1983
John Ross	1983-1989
Harden McConnell	1989-1992
Robert Pecora	1992-1995
John Brauman	1995-1996
Barry Trost	1996-

It is significant that Prof. Johnson's official title was "Executive Head of Chemistry" (1960-1969), while the subsequent appointees were "Department Chairmen". A quote from Johnson's autobiography explains this: "During the 1960s the affairs of the department were being handled in an increasingly democratic fashion. When I resigned the headship in 1969, (Provost) Terman recommended that the department was ready to run itself: that is, in a democratic fashion with a three-year term chairman. Once a department reaches a certain level of excellence it is self-perpetuating." With Prof. Flory (1969-1972) as his successor this was a safe move. Johnson was on firm ground when he pointed out the level of excellence of the department that he had developed in his nine years as executive head. In 1959, when he became Executive Head, there were neither any Nobel awardees nor any National Academy of Science members on the Chemistry faculty. In 1969 when he stepped down, there were three Nobel Laureates, seven members of the National Academy of Science and two National Medal of Science awardees. The Stanford Chemistry Department had undergone a transformation, entering the upper echelons of academic science departments in the United States.

The following excerpt, taken from a letter sent to Prof. Johnson by Provost Fred Terman on the occasion of Johnson's retirement in July 1970, is quite revealing about the

relationship between the two men: "The transformation that you have achieved in chemistry at Stanford is probably without parallel in the history of education in chemistry since it was done with a modest injection of new funds and without producing a swollen oversized chemistry department. You certainly exploited the basic principle understood by so few that the quality of an educational program depends more on the person on whom one spends his money than on how much money is spent, or the gross number of appointments made." The following passage also taken from Prof. Johnson's autobiography reveals his philosophy in this crucial aspect of building up the chemistry department. "During our efforts to bring distinguished scholars to Stanford I learned that in the 1960s when granting agencies were inclined to be generous in supporting established scholars, financial support was not the most important factor. The candidate must feel that he is moving to a place that has, or will have, a better reputation and can attract better students than the place he or she would be leaving. Preferably the candidate would be leaving a place he or she had lived in for at least 10 years and a change is appealing. In other words a push as well as a pull is generally needed." He discusses this philosophy in making the appointments of Professors Flory and Taube.

Quite clearly, he considered the most important job of the Executive Head was the recruiting of faculty. There is of course a vast difference in making an appointment at the tenured level as done in the case of Professors Flory and Taube versus that made at the assistant professor level. It is almost impossible to extricate gracefully from a "mistake" made at the tenured level, but the assistant professor appointment is quite a different situation. The latter is made without any guarantee of tenure and with the understanding that the candidate has six years to prove herself/himself in research and teaching. Not achieving tenure need not be a disaster for the assistant professor appointee since he/she will have gained valuable experience in teaching and directing research of graduate students at a major university, which presumably will help to obtain an academic position at another university. Between 1964 and 1990 nine assistant professors were appointed in physical chemistry; six of these obtained tenure at Stanford. In organic chemistry, two out of eight assistant professors were tenured during the same time period. Of those organic chemists that did not reach tenure at Stanford, four obtained appointments at other universities (Case Western Reserve, Purdue, Duke, Univ. of Florida), one started his own

chemical business and another took a research position at a major oil company. Of the tenured professors at Stanford during this period, three left for other University positions- Prof. Holm to Harvard, Prof. Sharpless to MIT (and then to Scripps Institute in La Jolla) and Prof. Lewis to his Alma Mater, Cal Tech.

Of the forty-five members of the tenured faculty at Stanford during the years 1975-2000, ten obtained their Ph.D. training at Harvard, eight at Cal Tech, seven at MIT and seven at U.C. Berkeley. Thus 70% of our faculty came from these four institutions. These numbers indicate a certain amount of academic inbreeding in the Stanford faculty and presumably the situation at many other universities is not much different. Of the remaining 30% of our faculty, there were two each from Cambridge (England), Univ of Illinois, Stanford, Yale and Columbia with one each from Cornell, Northwestern, Penn State and Texas A&M.

Faculty Numbers

Over the last thirty-five years, the number of Chemistry faculty has not changed as much as one might expect, considering the increase in undergraduate enrollment, in the number of undergraduate chemistry courses offered and in the number of graduate students. During the 1960s the number of tenured and non-tenured chemistry faculty was 18-20 while the graduate student enrollment was 75-90. In 1995-1999 the number of faculty members was 20-24. In 1995 there were 197 graduate students, more than twice the number enrolled thirty years earlier. The enrollment in the beginning undergraduate chemistry courses had multiplied almost four times from about 150 to over 600. The number of faculty is determined by the number of slots allocated in the office of the Dean of Humanities and Sciences. One way that it has been possible to handle the increased number of students without a corresponding increase in the number of faculty, is through the greater use of graduate teaching assistants. This provides increased financial support for graduate students and teaching becomes an integral part of their education.

Because of the high caliber of our graduate students and the use of small recitation and laboratory sections, undergraduates receive excellent attention from the dedicated graduate students who are only a few years older than the undergraduates they are teaching. The undergraduates often enjoy closer rapport with teaching assistants than with the faculty lecturers. The graduate assistants are given careful instructions with

respect to their duties and in laboratory safety practices; each receives credit for a unit of teaching. Some of those who so choose and have proven to be excellent as instructors in recitation sections may supplement their incomes with extra teaching duties in their third and fourth years at Stanford. There is a small number of Asian and other foreign graduate students who are not assigned teaching duties in their first year if their English communication abilities are inadequate. Support for some of these students comes from "technical teaching assistantships," the requirements for which are connected more with maintaining instruments such as the NMR machines than with direct interaction with undergraduates, until their command of English has improved.

Research Trends

A major trend in academic chemical research is towards borderline areas of chemistry, sometimes in collaboration with colleagues in other departments. Stanford has a very favorable environment for interactions with other departments including Biological Sciences, Biochemistry, Physiology and Pharmacology in the Medical School or with SLAC (Stanford Linear Accelerator Center for experiments requiring high energy radiation sources), or with Chemical Engineering, Materials Science, Physics, Applied Physics, or Geology. Paramount among such trends is the greatly increased research in the chemical aspects of biological and medical problems. This does not mean that biochemistry will be taught in the Chemistry Department; this is clearly in the purview of the Medical School Biochemistry Department and many of our graduate students will take their courses. This trend indicates that our faculty members realize that the most interesting and challenging areas for chemical research are at the interface of their areas of expertise with biological or medical problems. The following selected examples are taken from the 1998-1999 Chemistry at Stanford brochure which is distributed to all prospective graduate students so they will have an idea of the research areas available and the research interests of the professors. These subjects document the trend in faculty research interests.

Prof. Chaitan Khosla, one of our recently appointed faculty members, is conducting research on "development of a strategy for the controlled expression of natural or engineered polyketide biosynthetic pathways in 'genetics-friendly host organisms'..... development of a new strategy for interfacing synthesis and biosynthesis through the

incorporation of cell permeable synthetic building blocks into appropriately engineered biosynthetic pathways."

Profs. McConnell, Huestis and Boxer are investigating techniques needed to understand the "molecular structure of biological membranes and mechanisms whereby cells control shapes, mobility, deformability and the structural integrity of their membranes." Prof. Hodgson is involved in molecular structural studies of metal ions as active sites of biomolecules "utilizing techniques such as X-ray absorption spectroscopy (XAS) to study the electronic and molecular details of given ions in solution."

Some of Prof. Collman's students are studying "multi-electron redox reactions in certain biological systems through the agency of multi-metallic enzymes (cytochrome c oxidase, laccase and nitrogenases)."

Profs. Trost, DuBois and Wender are deeply involved in the synthesis of biologically active naturally occurring organic compounds and the development of the synthetic tools, i.e. reactions and reagents, to achieve their goals.

Prof. Stack is working in the area of "synthetic inorganic coordination chemistry which is focused on the development of small synthetic metal complexes that capture the essence of metalloenzymes by mimicking their spectroscopic structure and reactivity features." Prof. Wandless is primarily interested in the "synthesis of molecules with defined (biological) functions. In many cases these molecules serve as probes of biological processes, particularly related to signal transduction and the role that the cytoskeleton plays in cellular signaling. Our investigations go beyond synthetic organic chemistry and require expertise in enzymology and molecular biology."

The professors not mentioned here may indeed be doing research in frontier areas bordering on other disciplines; but this was not mentioned in the brochure sent out to prospective graduate students.

A recent W. S. Johnson Symposium in 1999 (the 14th) for the first time exclusively featured lectures by Stanford Faculty members. Seven of these ten lectures contained a major theme of either bioinorganic, biophysical or biochemical nature. The subjects of these seven lectures would scarcely have been dreamed of 10 to 20 years ago, indicating the way chemistry is changing and the corresponding shift in academic research.

As mentioned above, an injunction was invoked against trying to write biographical accounts of my colleagues; however an account of our Chemistry Department without some mention of our preeminent faculty members leaves an obvious and unpardonable void. Therefore accounts of these faculty members will be included, but limited to brief factual summaries of their major scientific contributions, generally as described in their award citations.

So that I am not the one to judge who are the preeminent members of our faculty, I am citing only those who have won the highest United States Congressional Scientific recognition; namely, the National Medal of Science; the list is given at the end of this section. This is an arbitrary and hardly unbiased classification.

Prof. Johnson's role as Executive Head in rebuilding the Department has already been recounted. In addition, over his years at Stanford, with his graduate students and postdoctoral associates, he relentlessly pursued the problem of cyclizations of polyenes to polycyclic compounds possessing the terpene and steroid basic carbon skeleton. These studies were elegantly detailed in his autobiography, A Fifty Year Love Affair with Organic Chemistry, published in the American Chemical Society series, Profiles, Pathways and Dreams.

Prof. Carl Djerassi had achieved chemical fame before he came to Stanford as Prof. Johnson's first appointee. With Dr. Huttrer, he was the co-discoverer of pyribenzamine, the first successful antihistamine drug, produced at Ciba Pharmaceutical Co., patented in 1946. Then in 1951 he synthesized and developed the first oral contraceptive while at Syntex Co. in Mexico City. When he was invited by Prof. Johnson to come to Stanford as a professor of chemistry, he was able to continue his connection with Syntex which had moved to the Stanford Industrial Park. He was careful to keep his Stanford academic research separate from research at Syntex.

He was in the forefront of the instrumental revolution in organic chemical analysis, almost single handedly introducing the use of mass spectrometry in the general study of organic compounds other than hydrocarbons where it had been used previously. He analyzed fragmentation patterns, introduced rules for interpretation of the data and wrote the universally used book on mass spectrometry for organic compounds. He also at the same time continued his work on the use of optical rotary dispersion (ORD), started at

Wayne State University, for the elucidation of absolute configuration of organic compounds. Djerassi published the standard monograph Optical Rotary Dispersion, McGraw-Hill Book Company, 1960 and developed with W. Moffitt, R.B. Woodward, A. Moscowitz and W. Klyne the widely used octant rule for the deduction of the configuration of chiral carbonyl compounds based on their ORD spectra. As in the field of mass spectrometry of organic compounds, Prof. Djerassi was a central figure in developing ORD in its formative period which has now matured into a well established tool for structure elucidation used routinely in almost every organic chemical laboratory. He investigated the field of steroids of marine origin and isolated and characterized over 200 new steroidal compounds, many of which had novel structures with no terrestial counterparts. He retired from academic scientific research in 1991 to undertake other interests including writing poetry, plays and science-in-fiction novels and teaching in Stanford's Human Biology program. He has participated in many world affairs conferences. In the book Organic Chemistry in the United States 1875-1955, Tarbell and Tarbell summarize a discussion of some of Djerassi's contributions by writing "His energy, versatility, imagination and concern about the social aspects of science make him a unique figure in American chemistry."

Prof. Paul Flory was persuaded to leave his position as Director of Research at the Mellon Institute in Pittsburgh to join the Stanford faculty by Prof. Johnson in 1961. He was chosen as Chairman of the Department upon Prof. Johnson's retirement from the position of Executive Head of Chemistry. Prof. Flory was a pioneer in the field of polymer chemistry. When he took a position at the du Pont Co. after completing his graduate studies, he was assigned work in a small group under Wallace Crothers, the inventor of nylon and neoprene. With this association he began to investigate the fundamentals of polymerization and the structure of polymers. During the war years (at the University of Cincinnati, Goodyear Rubber Co. and Esso Laboratories) he expanded his work on the fundamentals of polymer science and was invited to give the Baker Lectures at Cornell University. This led to his writing the classical textbook Principles of Polymer Chemistry that established his position of eminence in this field and his appointment as a professor at Cornell and subsequently as the Director of Research at Mellon Institute.

At Stanford, his students continued his investigations into understanding the fundamental principles underlying the science of polymerization and properties of polymers, which are the foundation of the modern polymer materials industry. These contributions include the theory explaining the viscosity of polymer solutions and the relationship of polymer structure to viscosity, elasticity and crystallinity. One of Flory's major interests was the calculation of the configuration of polymer chains from the potential energies of the chain units. His second book Statistical Properties of Chain Molecules summarized the results of those studies. These life-long contributions culminated in his receiving the Nobel Prize in 1974. Paul Flory was outspoken in supporting the human rights struggles of foreign scientists. He was the founder and primary spokesman for the group working to obtain freedom for the Russian scientists Sakharov, Orlov and Scharansky.

Prof. Henry Taube was enticed away from the University of Chicago by Prof. Johnson in 1962, one year after Paul Flory came to Stanford. These appointments in addition to that of Prof. Djerassi produced a powerful and prestigious foundation for the building of the major Department envisioned by Provost Terman and entrusted to Prof. Johnson to realize. Prof. Taube continued his elucidation of the fundamentals of inorganic solution oxidation-reduction reactions on an electronic level, defining the role of "outer sphere" electron transfer and "inner sphere" electron transfer. His work changed the way that chemists think about the entire field of inorganic chemical solution reactions. In recognition of these contributions, he was awarded the Nobel Prize in 1983 and the Priestley Medal, the highest scientific award of the American Chemical Society, in 1985.

When Prof. Harden McConnell came to Stanford from his position as Professor of Physical Chemistry at the California Institute of Technology in 1964, his major research interests were in the area of the theory of electronic spin resonance (ESR) and nuclear magnetic resonance (NMR) spectroscopies and the use of these phenomena to predict (using the McConnell equation) the electronic structure of molecules. This was in a sense a logical move for both McConnell and Stanford, the latter being the institution where the co-discoverer of NMR, Prof. Felix Bloch, was a member of the Physics Department. These basic findings were used by McConnell and others throughout the scientific community to measure the precise electronic structure of metal-containing organic

complexes including compounds containing lanthanide elements used as shift reagents. McConnell invented the use of free radicals as electron spin tracer reagents which have been used extensively, both by his own students and in numerous other laboratories, to label and follow complex biochemical reactions, processes involving conformational changes and migrations of molecules in membranes. He has always tackled experimentally difficult and basically very important problems on the most fundamental level. These have often required the ingenious development of new experimental methods. His studies in the late 1990s have become more biophysical and have centered on the studies of lipid monolayers in the region of membrane-membrane interactions. Understanding such interactions is basic to the science of immunology.

Prof. John Ross came to Stanford in 1980 after serving on the faculty of Brown University (1953-1966) and Massachusetts Institute of Technology (1966-1980). At MIT he had been Chairman of the Chemistry Department (1966-1971) and also of the University Faculty (1975-1977). After three years at Stanford he became Chairman of the Chemistry Department, guiding the Department in occupying the newly constructed Keck Science Building. Ross is a preeminent physical chemist and a leader in the area of understanding the nature and interaction of multiple reactions such as those occurring in complex biological systems where the reactions are taking place far from chemical equilibrium and involving many simultaneous chemical reactions with numerous species. He has made crucial contributions to the Department both academically and scientifically and has been a valuable component of the collegiality of our faculty.

Prof. Richard Zare came to Stanford from Columbia University in 1977. He obtained his Ph.D. degree at Harvard in Chemical Physics, as a student of Prof. Dudley Herschbach, who had been a Stanford undergraduate. Zare has shown a prodigious capacity for managing a large research organization as well as conducting his regular professorial duties, while serving as Chair of the National Science Board and as a member of the Council of the National Academy of Science. He was Chair of the Board of Directors of Annual Reviews in addition to working on the editorial boards of a number of chemistry and physics journals. His graduate research program was described in one of his award citations as follows: “Prof. Zare is renowned for his research in the area of laser chemistry resulting in a greater understanding of chemical reactions at the molecular

level. By these experiments and theoretical studies he has made seminal contributions to our knowledge of molecular collision processes and contributed substantially to solving a variety of problems in chemical analysis. His development of laser induced fluorescence as a method of studying reaction dynamics has been widely adapted in other laboratories. In 1988, after the Keck building was completed, the chemistry faculty members found themselves in offices in four buildings with the library in a fifth. The only common un-planned crossing of paths occurred at the mailboxes in the main office in the S.G. Mudd building. Casual faculty interactions were obviously negatively affected by this dispersal of offices. Perhaps the academic work pace had become too pressing to leave time for the leisurely coffee break when Stanford gained the reputation of a major research institution. Albert Dadian, the mailroom manager, always had a pot of coffee in the mailroom that many faculty and staff took advantage of; but it was not a place conducive to gatherings and extensive conversations. He also maintained a coffee cart in the S.G. Mudd lobby, with a coffee can for a 10-cent donation, which was widely used. Albert is only one of many devoted staff members who have volunteered loyal service far beyond the usual requirements of their jobs, and who was sorely missed after his retirement in 2002.

Although she is not a member of the faculty, Lois Durham merits recognition as the longtime manager of the Nuclear Magnetic Resonance Laboratory. After receiving her Ph.D. in organic chemistry at Stanford and spending a few years at SRI International, she accepted the position of managing the NMR lab. For 39 years she has trained undergraduate and graduate students in the operation of the instruments, helped students and faculty in interpreting spectral data and maintained the instruments, which now number five. She is an invaluable member of the Chemistry Department.

The emeriti constitute another faculty group. A list of current Stanford chemistry emeriti professors (in this year 2000) is given at the end of this section. Until 1980, retirement was mandatory at age 65; after this date, however, discrimination based on age was prohibited by federal law. A professor could remain on active duty as long as it was mutually agreeable to the department and the individual. Although it is not a university policy, in chemistry an emeritus professor has always been supplied with an office, and if available, laboratory space. As long as he has funds, he can continue research with postdoctoral students, but not with graduate students, unless in a joint project with an

active faculty member. Although an emeritus member can be recalled to active duty at the request of the department, it is seldom done for teaching duties but more often to allow the professor to continue his research activities after official retirement.

Faculty Portraits

In 1986, the Department hired Albert Dadian as manager of the mail room/copy room in the new S.G. Mudd Building. Albert's hobby is portrait photography. It was suggested that Albert take portraits of all members of the faculty; the result has been a portrait gallery, a major attraction in the foyer of the S.G. Mudd Chemistry Building. These 8" x 10" color portraits now fill the wall opposite the black and white portraits (obtained from the University archives) of the earlier faculty members starting with John Stillman (1896). These portraits include all the tenured faculty over the years and also the current assistant professors. Albert's work is acknowledged by a framed copy of an article featuring him and this volunteer project in the Stanford Campus Report. Portraits included at the end of this volume are copies of the ones taken by Albert.

Members of the National Academy of Sciences

Although the numerous awards of the faculty are not listed in their short biographical sketches, members who have been elected to the National Academy of Sciences deserve special note because of the significance given to this honor by Provost Terman. In W.S. Johnson's autobiography, it is mentioned that Terman used as a measure of the reputation of a Department in Sciences or Engineering, the number of its faculty who were members of the National Academy. When Johnson became Executive Head of Chemistry in 1960, Stanford Chemistry was without such members; now, by 2000, twelve have been elected.

Hans Andersen	Carl Djerassi	Henry Taube
John Brauman	Richard Holm	Barry Trost
Michel Boudart	Harden McConnell	Eugene Van Tamelen
James Collman	John Ross	Richard Zare

National Medal of Science Awardees

Seven faculty members have received the highest United States Science award, established by Congress and presented by the President:

Carl Djerassi	1973	William S. Johnson	1987
Paul Flory	1974	Harden McConnell	1989
Henry Taube	1977	John Ross	1999
Richard Zare	1985		

Chemistry Department Endowed Chairs (as of year 2000)

J.C. Jackson-C.J. Wood
Held by Paul Flory 1965-1975
W.S. Johnson 1975-1980
John Brauman 1980-
Marguerite Blake Wilbur
Held by Henry Taube 1976-1985
Richard Zare 1986- Robert Eckles Swain
Held by Harden McConnell 1979-2000
Robert Waymouth 2000-
George A. and Hilda Daubert
Held by James Collman 1980-
Monroe Spaight
Held by Edward Solomon 1982-
Francis W. Bergstrom
Held by Paul Wender 1983-
Job and Gertrud Tamaki
Held by Barry Trost 1990-
Camille and Henry Dreyfus
Held by John Ross 1985-2000
Steven Boxer 2000-
David Mulvane Ehrsam and Edward Curtis Franklin
Held by Hans Andersen 2000-
Michael Fayer 2000-

Emeritus Professors

J. Murray Luck, emeritus 1965, d. 1993
Paul Flory, emeritus 1975, d. 1985
Douglas A. Skoog, emeritus 1976
Eric Hutchinson, emeritus 1978
William S Johnson emeritus 1978, d. 1995
Harry S. Mosher, emeritus 1980 (d. 2001)
William A. Bonner, emeritus 1983
Richard H. Eastman, emeritus 1983, d. 2000
David M Mason, emeritus 1987, d. 1988
Henry Taube, emeritus 1988
Harden McConnell, emeritus 2000

II. UNDERGRADUATE CURRICULA

The 1970s brought three major changes in the undergraduate core curriculum, probably the greatest changes in Stanford's chemistry curriculum in the 20th century. They are considered as follows:

First--Revised core sequence of courses--the introduction of organic chemistry in the freshman year after one quarter of a chemical principles course.

Second--The introduction of qualitative organic analysis laboratory course for **all** chemistry students, not just chemistry majors.

Third--Dropping instrumental analysis course and incorporating the material in this course into the qualitative organic analysis and the physical chemistry laboratory courses.

We became aware in the early 1970s from conversations with students in the organic chemistry course that the biology students were studying structure and reactions of complex organic molecules, i.e. biochemistry, in their biology courses before the basis for these subjects had been taken up in the core chemical curriculum. This seemed to be a poor pedagogical arrangement. The biology department would not consider delaying study of biochemical material until the spring quarter of the sophomore year when the chemistry courses would have arrived at the relevant treatment of the organic chemistry pertaining to proteins, carbohydrates, heterocyclic compounds etc.

The only solution from chemistry's standpoint was the introduction of organic chemistry earlier, in the freshman year, which was a novel concept. Traditionally the freshman year course dealt with principles of chemistry, which covered the study of atomic and molecular structure, bonding, molecular spectra, thermochemistry, chemical equilibria and kinetics, acidity-basicity, pH, and molecular orbital theory. The new plan was to present in the first quarter of the freshman year an introductory basic course on the principles of chemistry, using **inorganic chemical** examples. This would then be followed by the winter and spring courses in **organic chemistry** based on the principles of structure and bonding, molecular spectra, equilibria, etc. In our discussions it was suggested that the teaching of organic chemistry could be started in the winter quarter of the freshman year and that we could introduce many of the same principles using organic

rather than inorganic examples. This change, started in 1973 and phased in over a threeyear period, was firmly established by 1976. The result was that one quarter of general chemistry (Chemical Principles 31) was taught in the autumn quarter of the freshman year, followed by Chemistry 33 (Structure and Reactivity which was the organic chemistry of functional groups) in the winter quarter and Chemistry 35 (Monofunctional organic compounds) in the spring quarter. It was recommended that only students with a good background in high school chemistry start this sequence in their freshman year. In the autumn quarter of the second year, polyfunctional compounds of biochemical interest (amino acids and proteins, carbohydrates and other natural products including nucleic acids) were treated before the biochemical aspects of these compounds were taken up in the biology sequence.

The scheduling of organic chemistry into the freshman year turned out to be successful and probably enhanced the students' interest in chemistry because of the greater relevance of organic chemistry *versus* inorganic chemistry to the basic biological curricula.

Qualitative Organic Analysis Laboratory for All Chemistry Students About the same time that the changes in the organic chemistry lecture courses were taking place, the students in the organic chemistry laboratory course, Chem 35, told us that the experiments they were doing had little or no relation to their projected careers in biology and medicine. They were bored and felt that they were spending time learning irrelevant techniques, such as the nitration of benzene to give nitrobenzene that was reduced to aniline that in turn was acetylated. Stanford is supposed to challenge students, not bore them. What organic laboratory chemistry experience should a biomedical student have? We certainly could not give them biochemical experiments that would not be in our purview or our expertise. It was suggested that what might be most valuable would be the ability to identify an unknown substance. For instance, confronted with a white powder that might be sugar, or salt or aspirin or cocaine, how could a doctor, or medical researcher, tell which it was? This is the subject of qualitative organic chemical analysis. A medical doctor might never be required to do such an identification, but should be familiar with the process used and have the basic understanding to evaluate the results.

As in biology, chemistry had undergone major changes. By the early 1970s the developments of automatic instruments for determining the infrared (IR) and nuclear magnetic resonance (NMR) spectra had brought about a revolution in the procedures, greatly simplifying the identification of organic compounds. These instruments were being used routinely in research laboratories and some of the basic theory was being taught in our organic chemistry lecture courses. Most of our organic graduate students were familiar with these techniques from their own Ph.D. research projects. If we could utilize these methods in a course for all the organic laboratory students, it might be possible to teach the course to the large number of students involved in the time allotted. It would certainly challenge our students with the chemical laboratory science as it was practiced in the real world.

To teach such a course to a large number of students who were not chemistry majors, was a revolutionary suggestion at that time. Almost every chemistry major will tell you that qualitative organic analysis was the course where he or she really learned what organic chemistry was all about. He or she will also, in the same breath, tell you it was one of the most difficult lab courses taken. The prospects of teaching such a course to 300-400 students were so staggering, that the suggestion seemed impractical. Since we were already teaching a similar course to the chemistry majors in a class of about 15 students, we well knew the logistical problems involved and the difficulties our chemistry majors had with this kind of course. Could we give such a course to the large number of non-chemistry majors without initiating a rebellion? Extrapolating from a class of 15 students to 20 sections with 20 students in each, indicated an undertaking of major proportions. In our Qualitative Organic Lab for chemistry majors, each student received three unknown samples to identify--two samples of one pure compound and a third sample which was a mixture of three compounds, (the components of which had to be separated before they could be identified). If we were to base the large course for all the organic chemistry students on the same number of unknowns, we would need to pass out approximately 1200 vials, properly coded and arranged in groups of appropriately diverse compound types. Since we had only about 200-300 suitable pure organic compounds in our stockroom, there would be duplication in unknowns given to students, necessitating a complicated coding system. We could certainly anticipate that students in living groups

would accumulate files with code numbers and correct answers over the years. The physical arrangements required of such an enterprise were daunting. If there were a major foul-up, the resulting chaos would haunt the Department for many years. Finally we agreed that, even considering all the problems, this proposed course would be best for the students' education and we should institute the change. It was not impossible, only difficult.

There was no obvious way to phase in such a course gradually. It was first given in the autumn of 1975 in the large second-floor laboratory in the old Main Chemistry Building. Although the stock room for all the laboratory classes was on the first floor, the room for solutions and unknown samples was in the basement. Since there was no elevator, the mechanics for operating the laboratory were awkward. In recognizing these problems, we did gain experience which was valuable in planning laboratories and support facilities for the new S.G. Mudd Chemistry Building to accommodate the many requirements of this course, including 1) an office for a director or manager of the undergraduate teaching laboratories, 2) facilities for the washing of lab glassware by staff using commercial dish-washing equipment, 3) separate room(s) near the laboratory for infrared spectrograph and gas chromatograph, 4) secure separate room for storage of organic chemicals used as unknowns, 5) room to serve as office, storage and laboratory preparation room for an individual in charge of stocking undergraduate labs. It was planned that all of these, with about eight, 20-student laboratories would occupy the second floor of the new S.G. Mudd Building.

The course as given that first year certainly had some rough spots. With only two laboratory sessions a week, most students did not have enough time to identify all their unknowns, although they were supplied with the nuclear magnetic resonance spectra (after taking the IR spectra and correctly classifying each of their unknowns). We had underestimated the difficulty of the course. It was also apparent that the cadre of ten or more graduate teaching assistants needed additional special instruction in guiding the students in interpreting their data. Certainly the students were not bored! The use of the Chemistry Library rose dramatically in the quarters when this course was given; this was gratifying, as was a student’s sense of accomplishment when he or she was successful in identifying an unknown.

It should be added here that the technique involved in taking an infrared spectrum was easily mastered by the students. The Perkin-Elmer instrument in l976 cost about $6,000 and several were available in the department. By 1989 in the S.G. Mudd Building, the students were using several Varian FT-IR (Fourier Transform Infrared) instruments, which cost about $12,000 each and were much faster than the older Perkin-Elmer instruments. In the small class for the Qualitative Organic Analysis course for the chemistry majors the students could be taught to take their own NMR spectra; however, the techniques were too specialized, varied and time consuming and the cost of the instrument (about $200,000) such that this was impractical for the large number of students. Therefore it was necessary for us to supply the NMR spectrum to each student in this large class.

Lectures were given on the interpretation of IR and NMR spectra in connection with this laboratory course instead of in the regular organic chemistry lecture course; this saved time in the latter, which was appreciated. An extra unit of credit was assigned to the laboratory course. The students were motivated to learn the theory and rules for interpreting the spectra of their unknowns, which was a great improvement over memorizing rules as a sterile paper exercise.

An innovation that was initiated when we moved from the old Main Chemistry to the S.G. Mudd Building was the washing of dirty glassware for the students. In the standard old system, each student was assigned a desk equipped with the glassware and hardware required in the course. Thus most of the time of the first class was consumed in "checking in" and the last class session in "checking out", a waste of about 10% of laboratory time on a totally non-educational exercise. After all, students didn't come to Stanford to learn how to wash dirty laboratory glassware. In the laboratories in the new building, the students were assigned desks but the required clean glassware was available in open bins along one side of the room, for them to pick up as needed. At the end of each period, dirty glassware was placed in trays and then washed in commercial dishwashers in the staff-run facility. The concern that breakage would be much higher was unfounded and two laboratory periods for productive work had been added to the quarter.

These course changes were not without problems and they did create a controversy amongst some of the students as shown by the following article that appeared in the

Stanford Daily, Jan. 25, 1977: **"Pre-meds Air Gripes about Chem. Series**...a reexamination of the Organic Chemistry series is being called for in petition (250 signatures) which was being circulated through chemistry and biology classes last week." This petition called for "constructive changes that need to be made in the Organic Chemistry series.....the laboratories were singled out as the weakest link in the organic chain....The Chem.132 lab is under a very tight time schedule; if something goes wrong you are out of luck.....The Physics and Biology Departments used to be as bad as Chemistry but they have improved. The Bio labs are now Pass/Fail, very low key and very good as a result." The main petitioner took exception to the Daily article and wrote a rebuttal "To the Editors" that was published in a subsequent issue clarifying his position. A few quotes from this later communication characterized the first article as "wellintentioned but an inept attempt to delineate the position of those students seeking reforming of the chemistry series....We are not asking that the organic chemistry courses be made easier. Organic chemistry is a difficult and tedious subject.... We are simply saying that it is capable of being taught more effectively.....The major complaint is that students are completing the organic chemistry series without learning chemistry.....The primary difficulty lies in the Chemistry Department's conception of the organic chem series as little more than an early selection process for medical students.....laboratory courses are poorly taught, poorly examined and unnecessarily high pressured." These discussions in the Stanford Daily did get the attention of the Chemistry faculty involved in the organic sequence. In the first years of the Qualitative Organic Analysis course we underestimated the time that the course would require and the ability of non-majors to tackle successfully the basic problem-solving nature of the course. When we moved from the old Main Chemistry into the new S G. Mudd Building, it had been decided that one faculty member alone could not be expected to handle this course and that we needed an additional staff member who would be the full-time Director of Undergraduate Laboratories, in charge of scheduling the many different laboratory classes, the scheduling and supervision of the teaching assistants, ordering of laboratory supplies and overseeing services such as glassware cleaning etc. One of the applicants for this new position was Dr. James LuValle, who had been Director of the Research Laboratories of Smith-Corona

Merchant located in the Stanford Industrial Park. Because SCM was moving its laboratories to Chicago, and because he had bought a home in Palo Alto, he was not interested in moving. We were pleased when he accepted the position as Director of Undergraduate Laboratories although he certainly was over-qualified. Dr. LuValle earned his B.S. (1936) and M.S. (1938) degrees from UCLA and his Ph. D. degree from Cal. Tech. in Chemistry and Mathematics (1941) with Prof. Linus Pauling as his major professor. When Dr. LuValle retired as the first Director of the Undergraduate Laboratories in 1982, he was succeeded by Dr. Kirk Roberts (1982-92) and then by Dr. Sharon Brauman (1992-).

As a result of our experiences in the first few years, some course details were changed. It was changed from a three- to a four-unit course to compensate for the large amount of library work required outside of the laboratory and lectures. The course has been greatly refined but remains with essentially the same format. The unknown compounds have been sorted by actual student tests; we know that they can be solved in reasonable times by the majority of students.

This course has been a source of satisfaction for most of the students who feel that they have developed a first-hand understanding of organic chemistry and the properties of organic compounds. Few students have complained that they weren't learning anything useful or were wasting their time. During the period 1975-80, major changes in the teaching of chemistry were made, Stanford responding in the educational forefront.

Quantitative and Instrumental Analyses

With analysis at the heart of most experimental branches of chemistry, the situation with respect to teaching analytical chemistry has also evolved drastically with time. For example, when the Main Chemistry building was constructed in 1900, a separate one-story sandstone building with a basement was built directly behind the Chemistry building. Originally it was referred to as the Assay laboratory but was known as the Chemical Engineering building by about 1950. The importance of assaying ores in the early days of California's gold rush explains the construction of a separate building for the teaching of this branch of quantitative analytical chemistry; many mineral assay methods required heating crucibles to very high temperatures, best done in a building set apart because of heightened fire danger. The U.S. government operated an official assay

office in San Francisco on Gold St (between Jackson and Pacific Avenues), now marked by a brass plaque. The Courses and Degrees Stanford catalog carried announcements of a course in mineral assays from 1900 to 1912 ("4 afternoons a week for students who wanted to become assayers"). The old assay laboratory was demolished in 1962 when Stauffer III was built to house Chemical Engineering. Santa Clara County code would not permit the two buildings to be so close, which explains the broad lawn area that currently exists between the old Main Chemistry and the Stauffer buildings.

In a totally different way, the teaching of analytical chemistry was undergoing major changes in the mid 1970s, triggered by the emergence of new instruments and methods of analysis which were replacing the classical wet chemical methods. As an example, one of the initiation rites for a chemistry major in the 1930-40s was learning the meticulous techniques required for precisely weighing a sample on a classical double pan balance. With the new electrobalances, the sample is placed on a single pan and a digital read-out gives the weight with a precision commensurate with the qualities of the balance being used, a procedure that requires no special talents or learning. A single old, elegantly encased, double pan balance is now relegated to an antique showcase in the S.G. Mudd Lobby.

Most of these new analytical methods use an instrument based on advanced spectroscopic measurements or other physical properties and the signal is processed electronically. The data appear as a number on a dial or as a generated graph or an LCD (liquid crystal display). The theory behind the instrumental methods involves sophisticated principles and mathematical analysis of signals which call for more advanced treatment than was envisioned even a few years earlier. Where should such a course fit in the regular chemistry curricula?

At Stanford it was decided to no longer offer a separate course in instrumental analysis. Instead, the subject was to be treated throughout several courses as it came up in terms of practical applications. Some basic principles of quantitative analysis are taught in Chem 134, Theory and Practice of Quantitative Chemistry; the use of IR and NMR instruments and the interpretation of these spectra are covered in Chem 132, Qualitative Organic Analysis. In the Physical Chemistry Laboratory (Chem 174) many more instruments are routinely being used in analytical measurements. The theory and practice

of these instruments are considered as they are introduced in the physical chemistry measurements laboratory.

A complicating aspect of the teaching of analytical chemistry was that Prof. Skoog, who had been the Associate Head of Chemistry, decided to retire early in 1976. He was the only designated analytical chemist on our faculty at that time. He had written, with Prof. D. West of San Jose State University, two widely used, successful texts for courses in quantitative analysis--one, a short course for premedical students and the second, a complete text for chemistry majors. He wanted to spend time writing a text on The Principles of Instrumental Analysis, which he did; it became the premier text in this field, a position it has retained with several revisions, into the twenty-first century.

The American Chemical Society has a program for certifying chemistry graduates who complete an approved program from a college or university that is on the ACS list of approved schools. This program is monitored by their Committee on Professional Training (CPT). A department that wants to be on the list first goes through an approval process and then sends in annual reports to maintain an approved status with a major review every five years. It was not long before CPT noticed that Stanford no longer had a bona fide analytical chemist on the faculty. They also interpreted our placement of the undergraduate organic chemistry sequence in the freshman year as an indication that we were over-emphasizing organic chemistry at the expense of analytical and inorganic chemistry. At a CPT meeting in Atlanta (April 1981) Prof. Mosher discussed the Stanford program and explained in more detail how the subject of instrumental analysis was being treated in the qualitative organic analysis and the physical chemistry laboratory courses and defended the emphasis on organic chemistry by the student composition of the course---more than 80% were biologically oriented students receiving instruction in biochemical subjects at the same time they were taking their organic chemistry course. Objections were made by the committee that this still probably was not adequate. There was a feeling that the major universities, including Stanford, were arrogant in presuming to know more than CPT about how to educate the undergraduate chemistry majors. Furthermore, if a Stanford, Harvard, or MIT could deviate so drastically from the CPT approved and recommended criteria, how could CPT maintain the stated minimum standards? Further explanation and correspondence led to additional consideration by the

CPT and in the spring of 1983, Profs. Brauman and Ross again met with CPT; as a result they received a very encouraging letter indicating "approval of your program". This led Prof. Brauman to send a memo to the Dean of Humanities and Sciences (April 15, 1983)---- "As you can see by the enclosed we have done well in persuading the American Chemical Society that we should lead and not follow.....you should be aware, however, that there is a strong feeling there, as well as at Stanford, that our laboratory programs need to be enhanced.....these improvements will probably require an increase in teaching assistants and laboratory".

This optimism was premature. On behalf of the ACS's Committee on Professional Training, Prof Harry Pardue, an analytical chemist from Purdue University, visited Stanford for an on-site inspection and conferences with faculty concerned with undergraduate teaching. After CPT met again to discuss Stanford's compliance with the CPT guidelines, a letter was sent to President Donald Kennedy with copies to the Chemistry Department that said in part: "If your department does not change its program, the ACS must put you on probation; if you wish to remain on the ACS approved list, the Committee would like to discuss with you possible solutions to the problems that it sees in your program." The letter was accompanied by fully detailed reports by CPT and by Prof. Harry Pardue.

As a result, the Department's curriculum committee with Prof. Wray Huestis as chairperson held many meetings; in 1985, an extensive proposed revamping of the undergraduate curriculum was developed. The proposed changes included reinstituting a course in instrumental analysis (Chem 172, 3 units of laboratory) and installing a new course in advanced inorganic chemistry (Chem 152, 3 units of laboratory). With these changes the curriculum would meet the ACS recommendation for more laboratory hours and more inorganic chemistry. When submitted to CPT, they responded ---"(We) are pleased to inform you that the Committee concluded that your program continues to meet the guidelines that have been established for ACS approved schools. The Committee would like to commend you for your efforts in upgrading your program with respect to analytical and inorganic chemistry." The story of Stanford's being on the probation list of the ACS's CPT was thus over with no further adverse reaction concerning our program.

The Courses and Degrees Catalog for 1987-88 listed Instrumental Analysis (Chem 172), however it disappeared from the catalog in 1990.

A new appointment to the faculty vacancy in analytical chemistry was never made. In recruiting new faculty it seemed that the best and brightest young chemists were not attracted to this special branch of chemistry. As a result, without a designated analytical chemist on our faculty, the assignment of teaching the quantitative analysis course for chemistry majors (Chem 134, Theory and Practice of Quantitative Analysis) fell to the lot of the newer assistant professors in physical chemistry in the period 1976-1998. Both Profs. Harden McConnell and Richard Zare are renowned physical chemists who have made major research contributions of new methods and techniques to the frontiers of analytical chemistry, but neither is considered a classical analytical chemist. Professor Zare won the ACS Award in Analytical Chemistry in 1998. He took over the teaching of Chem 134 in 1999.

Special Non-required Chemistry Courses

In 1996-97, the University inaugurated a new series of optional 2- to 3-unit freshman courses under the general title of "Introductory Seminars". The basic idea was "to give freshmen an opportunity to experience lectures by Stanford professors, on topics of special and current interests that were not part of the regular core curricula but would give an insight into the frontiers of thought and research going on in the world today." Professors were invited to submit proposals for such a course that they would be prepared to give. Following is a list of such chemistry-sponsored courses, "Stanford Introductory Seminars", for the period 1996-2000 which were accepted into this program.

Chem 21N. "Tactics and Strategies of Science", Prof. Ross

Chem 22N. "The Frontiers of Science", Prof. Collman

Chem 23N. "Chemistry and Biology", Prof. Khosla

Chem 24N. "Nutrition and History", Prof. Huestis

Chem 25N. "Science in Fiction is Not Science Fiction", Prof. Djerassi

Chem 26N. "Macromolecules--Is Bigger Better?", Prof. Waymouth

It has so evolved that freshmen, mostly Biology or Human Biology majors (pre-medical students), entering Stanford who want to take chemistry courses, have the choice of two beginning courses, in addition to the "Introductory Seminars" described above.

1. In 1992, Profs. Collman and Zare perceived that there were many talented first year students taking Chem 31who were not challenged by the course because their high school honors chemistry training had covered the same subjects. Accordingly they introduced a new course, Chem 32 “Frontiers of Chemical Science”, to accommodate these students which would also fulfill the requirement for Chem 31. In spite of its advanced and challenging nature, in 1999-2000 there were about 90 freshman students enrolled in Chem 32.

2. Prof. Djerassi taught a course, generally in alternate years in the Human Biology sequence, Bio 130 “Biological Aspects of Birth Control”. It was an advanced course, also listed under chemistry courses, which involved student participation in an international study with students' first hand reports from summer assignments in various countries. This course was first given in 1972, but was discontinued in 1999.

III. BUILDINGS AND FACILITIES

Eric Hutchinson's chronicle clearly delineates the process that took place to enlarge the chemistry facilities from the original Main Chemistry Building through the expansion of the chemistry complex to include 1) the Organic Building and 2) the three Stauffer Buildings. It also included some of the preliminary planning for what became the S.G. Mudd Building. The expanding chemistry complex in 1975-76 was described in Hutchinson's account as follows: "During the 1960s the du Pont company generously provided funds which permitted the Department of Chemistry to employ Edward Leys, an architect in the University planning office, to work with a faculty subcommittee to consider the problems of a new building which would serve the needs of undergraduate teaching and provide some additional research space. That subcommittee performed its work diligently but for some years it appeared unlikely that funds would become available to translate the group's concepts into physical reality".

One option not mentioned in the Hutchinson account was the seriously considered possibility of remodeling and enlarging the old Main Chemistry Building to accommodate the increased requirements being imposed on the chemistry facilities. Many of the original buildings on the quad had been gutted and reinforced concrete walls installed behind the sandstone facades, thus successfully converting them to suitable modern academic facilities. Why not do the same with old Main Chemistry? The Planning Office had hired the architectural firm of Spencer and Busse to work with Chemistry to develop just such plans. Some first floor load-bearing studies were made on the structure with the conclusion that it was sound. Prof. Skoog recalled that there was a study made earlier by Prof. Bert Wells in Civil Engineering that confirmed this conclusion. In due time William Busse made a formal presentation of his firm's studies at a meeting to a group including Provost Terman, University Business Manager Alf Brandon, Chemistry Department Planning Committee Profs. Skoog, Eastman, Mosher and architects Busse and Spencer. An interesting aspect of the plan included a large lecture hall that was to occupy the space between the north and south wings of the building where the rear courtyard is now located. This major hall would be without pillars and the ceiling would be suspended from steel girders that would be supported by new reinforced concrete walls on

either side. This was a feature that had been used in the reconstruction of the old Physics corner of the outer Quad. Busse's presentation with suitable diagrams continued until it was interrupted by Provost Terman with the question "What is the estimated cost of the project?" After hesitating, Busse said it was hard to estimate in this early planning stage. Terman insisted on an answer until Busse admitted that a good guess would be in the order of 2 million dollars. Terman then replied: "You are wasting our time; I told you that it had to be under one million. Meeting adjourned!" The end of the meeting really was that abrupt. Terman had not been educated as to how much it was going to cost to replace the old Main Chemistry Building if he were to realize his plans for developing the Chemistry Department. This ended the consideration of renovating old Main Chemistry at that time; however, the question "What will happen to the old Main Chemistry Building?" remains unanswered even at this time.

A basic major problem, other than funding, which was not addressed with remodeling old Main Chemistry was: "How would we be able to teach the laboratory courses while any remodeling was being done?" We could probably solve the lecture and recitation space problem, but laboratories presented a much more difficult problem. The renovation of Main Chemistry was not the answer. But something had to be done. There was no more space for office and laboratories for any new appointments in the Stauffer Buildings; the space in Main Chemistry down to the areas under the lecture hall and the stairways was of such antiquated quality that its occupants really needed new modern laboratory facilities. In addition, there was the added concern about safety during earthquakes. In spite of any consideration of the historical value of the building, from a scientific laboratory viewpoint it was a dinosaur from an earlier era. The inescapable conclusion was that a new building to replace the functions conducted in old Main Chemistry had to be built. To continue with the Hutchinson account: ---"a very sharp (and apparently lasting) increase in the number of undergraduate students reading chemistry (as a substantial part of premedical education) convinced the University administration that a new building must be given a high priority. In spite of a tightening financial situation, the Board of Trustees approved the proposal for a building somewhat reduced in scale as compared with the subcommittee's estimates. Birge Clarke was appointed architect----".

Seeley G. Mudd Building

The Seeley Mudd Foundation, whose funds came from the Seeley G. Mudd family who owned oil fields in southern California, had supported academic projects in many California universities. Their Foundation now came forward with a generous gift to Stanford that allowed the new Seeley G. Mudd Chemistry building project to proceed. This was a key project in the Terman plan that brought Prof. W.S. Johnson to Stanford as Head of Chemistry in 1960 with the mandate of raising the level of the Stanford department to that of other major chemistry departments in the United States, such as Harvard, MIT, Columbia, Cal Tech and Univ. of Cal Berkeley.

SEELEY G. MUDD BUILDING, dedicated 1977

This was the kind of challenge Prof. Johnson thrived on and with Terman's strong support he was able to bring it about in a relatively few years. As Prof Hutchinson said in his chronicle of this period "the changes---were fascinating to participants and spectators alike". Prof. Johnson detailed the philosophy behind the rebuilding of the Department in his autobiography A Fifty Year Love Affair with Organic Chemistry, elaborated in the section on Faculty.

Birge Clark was retained to develop plans for this new chemistry building that was initially planned to occupy the space where the "temporary" Organic Chemistry Building

was located. The first idea was to convert the area directly behind the Main building into a mini-quad which would have the three Stauffer buildings with their joining arcade on one side, the new S.G. Mudd building on the museum side (replacing the Organic Chemistry Building), and Biology on the side towards the Main Quad. However, this was not to be since there was no solution to the problem of providing laboratory space for the current occupants of the Organic Chemistry Building (four professors with their 30 or more research students) if the Organic Chemistry Building were to be demolished and the new building constructed in its place. The plans that were finally approved by the Trustees placed the construction of the S.G. Mudd Building in its present location between the Organic Building and Campus Drive, to the north of the Stauffer buildings. This new building would contain the main lecture halls, the undergraduate laboratories, department offices, offices for about eight professors and laboratories for their graduate students. It would <u>not</u> be big enough to house the chemistry library or stock rooms. These would have to be located in some temporary place, as yet unidentified. The planning of S.G. Mudd Building with Birge Clark as the architect was coordinated by a faculty committee chaired by Prof. Skoog who was at the time (1974-75) not only Professor of Analytical Chemistry but also Associate Administrative Head of the Chemistry Department with Prof. Johnson as Executive Head. This was a perfect arrangement since Prof. Skoog was ideally situated to know the physical requirements of the undergraduate courses, as well as the administrative aspects of such a major construction undertaking. Birge Clark, a Stanford graduate of 1914, was very familiar with the Stanford Planning Office and Chemistry, having been the architect for the recently completed Stauffer buildings. As it turned out, this was a propitious time to be designing a new building; the undergraduate laboratory curriculum was undergoing a significant change with innovations that would greatly impact the laboratory design. The move from the old to the new chemistry building would coincide with major changes in the nature of the laboratory course and the design in the new facilities could be made to accommodate these changes. As pointed out in the section on curricula, these changes involved a totally new arrangement for handling student glassware which would be washed, not by each student, but by commercial dishwashing machines operated by chemistry staff personnel. Furthermore, instead of the students occupying one large

laboratory, they would be grouped in small sections of 15-20 in separate rooms. Special instruments (infrared and gas chromatography) would be required, preferably located in separate, but adjoining rooms. Other special requirements included an office for a laboratory administrator etc. This new building would feature two lecture rooms, situated side-by-side, one with 100 seats and the second with 300 seats. They would share a lobby that would open onto a courtyard area, affording ample and pleasant space for students to congregate before and after classes or for special seminars such as the many Industrial Affiliate Symposia held by the department. A special gift from the Braun Foundation made these lecture halls possible, the smaller one named the Braun Lecture Hall and the larger, the Braun Auditorium.

In the design of the S.G. Mudd Building, Birge Clark made a special effort to ensure that it would meet the highest earthquake standards. In addition to the regular reinforced concrete construction, there was a central rectangular reinforced concrete core down the middle of the structure that contained the stairwells on both ends as well as enclosed sections carrying air ducts and other utilities and service rooms. This core served as an integral structural unit that anchored the building firmly as one unit. In the 1989 Loma Prieta earthquake, there were some hairline cracks along a few of the joints but no structural damage and no cost for repairs.

The second floor of the S. G. Mudd Building has a wide, outside reinforced concrete balcony around the building with four stairways leading it to the outside ground level. Each second-floor laboratory has a door opening to this balcony that serves as a fire escape as well as an outside access. The second-floor hallways also open onto this balcony. Stairs connect the third-floor hallways to the second floor and thus the thirdfloor rooms are also readily accessible to this balcony as a fire escape. This balcony also serves as an overhang to give sun and rain protection to the outside ground floor area, especially on the west side onto which the lecture rooms and the lobby open. Twenty years after its construction, there was some major remodeling of the ventilation system to comply with changing air quality standards imposed by stricter Santa Clara County regulations. In the summer of 1999, after 23 years of occupancy, a major overhaul of the seating, lighting and projection facilities in the 300-seat Braun Auditorium took place. This Seeley G. Mudd Building has proven to be a well-planned, durable and completely satisfactory

replacement of the old Main Building, except for the lack of space for the library, the stockroom and some offices for professors. As we will see, however, only some 20 years later it did not satisfy the Santa Clara County's more stringent building codes for laboratory facilities handling toxic chemicals. Insufficient funds were available from the original Mudd Foundation grant to equip and furnish the third floor and some of the first-floor research laboratories. Thus this building was not completely occupied when opened in 1976. However the lecture halls, undergraduate laboratories, department offices and several faculty offices and conference rooms were fully functional. Later, a special gift by the Syntex Corporation allowed completion of the first-floor research laboratories which were then occupied by Profs. John Brauman, Nathan Lewis and Richard Holm. The third-floor laboratories were completed by gifts from the Arthur Varig Daner, the Gates and the Green Foundations and from Mr. and Mrs. Paul Cook. This added space made possible the new appointments of
Prof. Paul Wender from Harvard University in 1981 and Prof. Barry Trost from the University of Wisconsin in 1987.

The S.G. Mudd Building did not solve all of the space problems. Several faculty members with their research students still occupied the old Main Building (Frank Weinhold, John Ross, Michael Fayer, Wray Huestis and Eric Hutchinson). Furthermore the stockroom, machine shop and glassblowing shop remained in the basement while the chemistry library occupied the first and second floors of the north wing.

William M. Keck Science "Surge" Building

Chemistry was not the only department suffering from the pressure of limited space for expansion. Biology especially was overcrowded and Chemical Engineering had outgrown its quarters in Stauffer III. At that time, in the early 1980s, the University was initiating a study of a major development to be known as the Science and Engineering Quad (Western campus addition, SEQ). Again, a basic problem was where to quarter the faculty and research students while new buildings were being constructed. These ambitious plans, at a total estimated cost of $125 million, required removing some existing buildings. A solution that the Stanford Planning Office developed was a "surge" building--a building that would be so constructed with easily repositioned walls and flexible arrangements for utilities that it could accommodate multipurpose laboratories

and could be readily modified to adapt to changing needs. This was the Keck Building, initially planned for occupancy by the Chemistry, Chemical Engineering and Biology departments for their expanding research programs. It was planned that the Biology research activities would move in and stay until their new research facility, now known as the Gilbert Bioscience Building, for which they already had funds, could be constructed. When the Gilbert Building was completed, after about three years, the Biology research groups moved out and Chemical Engineering "surged" into the vacated space; thus the Keck Building now is occupied half by Chemistry and half by Chemical Engineering.

WILLIAM M. KECK SCIENCE BUILDING, dedicated 1988

William M. Keck willed to the University, in trust, $5.6 million in Superior Oil Company stock in 1964. The trust was dissolved in 1984 at which time the value of the original gift had increased to $35 million. Stanford Trustees in 1984 approved use of a portion of this for the Keck Science Building. The design emphasized flexibility, but in reality broad designation for the use of the space was made very early. The location was in the parking lot adjacent to the Organic Building along Roth Way between Main Chemistry and the Rodin Sculpture Gardens of the Museum.

The Keck Building is designed with two separate, mirror-image halves that are three-story units connected in the middle by a full three-story high spacious atrium. On the second and third floors a balcony hallway surrounds this atrium; each of these floors

has two conference rooms, one on the east and the other on the west side of this open atrium. Hallways lead from this central section to the offices and laboratories. The elevator and stairways are located off this atrium that is the main entrance to the building. The architect/builders were McLellary and Copenhagen. Prof. John Ross, department Chairman at that time, described the first meeting of representatives of the occupying departments with Steve Copenhagen. Ross and the others were prepared for a general discussion of the plans and requests for needed space. Instead, Steve Copenhagen said that they planned to start construction in one month and were ordering the steel for the building in the next week. The external size of the structure of the building was set and the detailed planning of the interior would proceed while the steel structure was being erected. He said this was not a radical concept in building construction, but was not commonly employed. It was used in the construction of some buildings currently being built in the Stanford Industrial Park. He reported that the idea had not been used more often because it was thought to be more costly, but in this case, was necessary because of the time schedule for the finished structure. So construction of the Keck Building started months before discussions and details for the interior laboratories and offices were complete. The major feature to accommodate the flexibility in use of the building by different groups was an extra "interstitial" floor above each of the three main floors. The building actually had six floors, three of which were about eight foot "attics" and contained all the facilities--gas, water, steam, ventilation ducts, vacuum line system, electrical conduits etc.---that were fed from above to the laboratories on the floor below. At the end of each floor, farthest from the atrium, was a section that was the full height of combined regular floor and interstitial space. It was used for the heating and ventilation machinery for that floor in that half of the building. The interior walls could be easily taken out and the configuration of the laboratories expanded and changed to fit the requirements of a new occupant.

A most interesting feature of the Keck Building is the material used for the external facing. It has the appearance of solid sandstone but is actually blocks of polystyrene, up to twelve feet long, about one foot deep and two feet high. A person could easily lift one such piece and put it in place. The surface of these blocks was

colored and textured to achieve a fair simulation of real sandstone. These were installed after the entire steel and window framework was in place. The seams were closed and the blocks held in place with a silicone sealant. This facade is obviously an excellent thermal insulator and was installed with great ease and rapidity in comparison with real sandstone. It seems to have weathered very well, but perhaps the 1989 Loma Prieta earthquake opened some of the seams so that water leaked in around the windows during heavy rains. In the summer of 1999 it was necessary to recaulk many of the seams and spray the surface with a waterproofing sealant. This type of outer surface does not appear to have been used on any other new building in the Campus West Addition. The building was completed in record time with the first occupants moving in in January 1986. It was formally dedicated on April 2, 1986 with members of the Keck family and Keck Foundation being present in the impressive atrium of the building.

In the summer of 1999, when the earthquake retrofitting and renovation of Stanford Museum was being completed, a modern sculpture that had been located outside the main entrance to the Museum was moved into the center of the atrium of the Keck Building. It is a striking addition in an appropriate location. This art piece is a bronze cube, about five feet on each side, balanced on one corner. The piece was "Given in memory of Pamela Djerassi, 1971, by her parents 1977-78." The artist is Amaldo Pomodoro, Italy, 1926 and titled "Cubic 1966-67, Bronze 1/2".

Chemistry and Chemical Engineering Library / Organic Chemistry Building

When the Keck building was complete, the occupants of the "temporary" cement block Organic Chemistry Building moved into Keck and their vacated quarters were gutted of all non weight-bearing walls and the building remodeled for the Chemistry and Chemical Engineering Library. Originally this building was constructed in 1949 with University funds when Prof. Leighton was Department Head. It was occupied in 1950 by Profs. Noller, Eastman, Bonner and Mosher with their graduate and undergraduate research students. It served its purpose well for 36 years, but by 1986 it fell far short of modern laboratory standards with its wooden hoods and table tops, its open outdoor sumps for laboratory waste water and lack of proper heating system. Now as the new library building, it could look ahead for a second life. And it proved to be an excellent solution to the library problem. One feature was a section of compact shelving for the

older, lesser-used, bound journals. Massive rows of shelves are stacked against each other, but in rows with a handle at the end of each row of shelves. Thus with very little force, the whole row of shelves can be made to move apart and give an entry space. This manual system has worked without complications since its installation while an electrically controlled system in the Medical School's Lane Library was frequently not working and was recently replaced by a manual system.

This is the Swain library that has now been in use for fourteen years in this location. Its storage capacity for the increasing number of volumes has become inadequate; it seems that the need for additional space never ceases. Before 1962 the Chemistry Library was located in two rooms on the second floor of old Main Chemistry. The room resembled a scene from an old English novel. Two walls were filled with bound journals from the floor to the 12 ft. high ceiling. A ladder along each wall ran on a rail at the top, which permitted access to the highest shelves. Miss Mildred Hall (Chemistry major, class of '23, M.A. '24) who was the lecture demonstrations person also served as librarian. The library was open during daytime hours and users checked out books on the honor system. The graduate students and faculty had keys to this room for after-hours use, a tradition that has carried over for the present library. This turn-of-thecentury space and location became totally inadequate for a modern chemistry department and in 1962 the walls of a lecture room and offices in the northeast corner of the first floor of Main Chemistry were reinforced from the foundations to the second floor to be earthquake safe and the room converted to a modern and spacious library, enlarged to include the Chemical Engineering collection. Mrs. Florence Furst was appointed as full time librarian. It was dedicated as the Swain Library of Chemistry and Chemical Engineering in April 1962, in honor of Prof. Robert Eckles Swain, a former Department Head. His portrait and a brass plaque, which reads as follows, were installed on that occasion:

"Swain Library of Chemistry and Chemical Engineering
Dedicated April 1962 in Memory of
Robert Eckles Swain 1875-1961
Member of Stanford Faculty 1898-1940

Executive Head, Dept of Chemistry 1917-1940
Acting President of Stanford University 1929-1933"

When the library was moved to its new quarters in the remodeled Organic Chemistry Building, this portrait and plaque were installed in the new location.

Chemistry Stockroom

Even with the completion of the Keck Building and the renovated Organic Chemistry Building, the chemistry stockroom remained in the basement of Main Chemistry. This problem was solved in about 1988 by moving it into a triple modular, mobile home type structure, which was installed between the Organic Chemistry Building and the S.G. Mudd Building. The stockroom takes up less room now than in the past because fewer organic chemicals are stored for checking out. It is now quite convenient to order chemicals by computer directly from the supplier. Delivery by air from Sigma Aldrich Company requires only one or two days, unless the substance ordered has been banned from shipping by air. In addition, since most of the research experiments are carried out on a much smaller scale than previously, starting materials are ordered in considerably smaller amounts. Sylvia Barton, who has been with our stock room for many years, took over its management from Chuck Murden who retired about 1990.

Soon after the stockroom was moved out of the basement of Old Main Chemistry Building, which was then totally unoccupied, the University Planning Office declared the building closed and unsafe for occupancy because of possible earthquake hazard.

"Wake" for Old Main Chemistry

Some of the chemistry faculty members, thinking that the old Main Chemistry Building should not be decommissioned without some kind of a celebration of its 80 years of service, suggested to the University Development Office that a "wake" be held for the building with all Chemistry alumni invited to attend. The message came back that the last thing they were interested in was "something as negative as a wake". We concluded that there were no Irishmen involved in that decision.

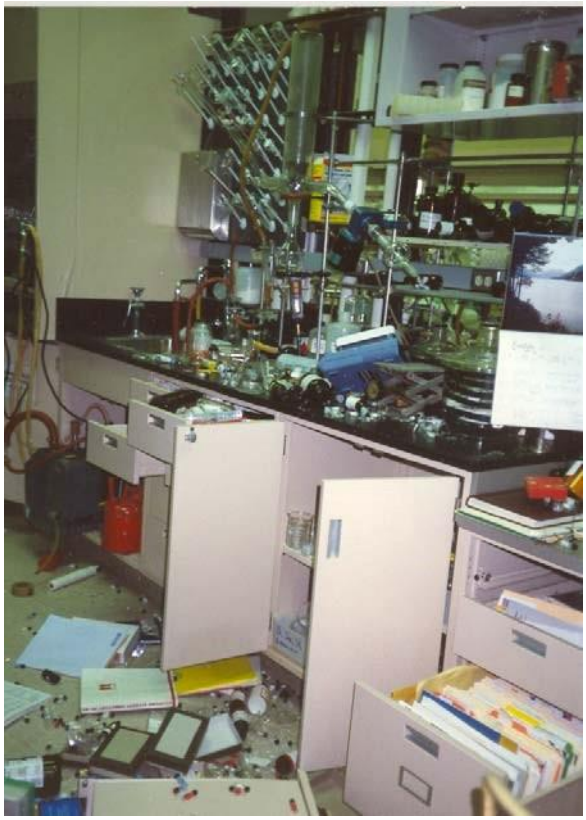
Nevertheless, we went ahead with plans for such a celebration in collaboration with the Stanford Historical Society. We received reluctant permission from the Planning Office, making an exception, for a few hours, of the condemnation of the building as

earthquake unsafe. Invitations were sent to Stanford Historical Society members and all Chemistry alumni in the Bay Area and environs to join in a celebration on Jan. 24, 1988. The affair included guided tours through the old Main Chemistry Building, followed by a reception in the atrium of the Keck Building and a lecture "History of the Old Chemistry Building and the Early Days of the Stanford Chemistry Department" by Prof. Eric Hutchinson in the Braun Lecture Hall of the S.G. Mudd Building. The event was a big success with about 300 in attendance. We received letters from individuals in more distant locations regretting that they had not been notified. The oldest alumnus present was Duncan Stewart from San Jose who had graduated 66 years earlier, in the class of 1922. Since this occasion the old Main Chemistry Building has been officially closed, surrounded by a chain-linked fence.

1989 Loma Prieta Earthquake

On October 17, 1989 at 5:04 PM, the Loma Prieta earthqake occurred. The Keck Building was built to the earthquake standards that by then were well developed. The steel I-beam frame was strong, well braced and slightly flexible. There was no apparent structural damage to the building; only a few hairline cracks showing on the paint on interior non-structural walls. Perhaps the earthquake also opened cracks between the styrofoam blocks, causing leaks in the rainy season.

However, there was considerable clean-up work to be done in all the laboratories, as shown in the pictures to the right. Although all shelves in the Keck Building had been equipped with a one-inch high front lip to prevent bottles from sliding off, bottles on the shelves facing north jumped over the lip and littered the desks and floors. On the opposite wall the bottles were jarred to the back of the shelf. Refrigerators on installation had been secured to the walls, but the doors of those refrigerators and cupboards facing north flew open and the contents tumbled to the floor; creating a huge jumble of broken glass, bottles and their contents. Compressed gas cylinders had been securely fastened to walls or desks by strong chains. However, many were jiggled loose and slipped out from under moorings. In spite of these and many special situations, there were no fires, no serious injuries or accidents involving falling objects. There were many scared laboratory workers, especially several foreign postdoctoral students who had not been indoctrinated in the California attitude toward earthquakes.



Dislodged chimney stones from old Main Chemistry Building made direct hit on car in the courtyard

Old Main Chemistry did show some hairline cracks between sandstone blocks; the one remaining main central chimney, which had survived the 1906 earthquake, was shaken down; a large sandstone block from the chimney landing squarely on a car parked (illegally) behind the building in the loading zone of the courtyard. The large block carried down a certain amount of red tile debris from the roof as it fell. The picture of this damaged car was widely used in news reports. The earthquake set off the automatic sprinkler system causing wet plaster to fall from the ceilings. Thus the timing on condemning the old building had been fortuitous.

The question concerning what will happen to this old historic Main Chemistry Building arises repeatedly. In 1989 there were rumors that the facade would be saved and perhaps the building converted to a joint chemistry-biology library. Now in 2000, it has become a real issue because of the pressure for more building space and because the square footage maximum area imposed by Santa Clara County based on some previous agreements has almost been reached. A major article written by Karen Bartholomew appeared in the spring 1999 issue of the Stanford Historical Society's publication Sandstone and Tile. It detailed the history of the old Main Chemistry building, including the role that Jane Stanford played in its planning and construction as well as how it

survived the 1906 earthquake with only minor damage (the center front of the building fell out and all of the many chimneys which were used to ventilate the laboratories and lecture halls tumbled down and were never replaced). The article made the point that this building was of great historical significance to the University and should be saved. On the other hand, the experience of the University in remodeling old buildings to meet modern building standards indicates it is much more expensive to remodel than to build new. This is especially so for laboratory type buildings. Accordingly if any part of the old Main Chemistry Building is saved, it probably will be for offices or for library usage; no recent official comment has been made.

Planned Lokey Chemistry-Biology Research Building

In June of 2000 the University announced that a new $50 million research laboratory building, made possible by a gift of $20 million from Lorry Lokey (class of 1949, Communications major) was being planned for completion by Sept 2002. About 2/3 of the building would house Chemistry research and 1/3 would house Biology. The remaining $30 million will be funded by institutional debt served by general funds. The necessity for this building for Chemistry arose because the laboratories in Seeley G. Mudd Building for synthesis research no longer meet the Santa Clara County strict building codes. This will be a three-story, 85,000 sq. ft. structure located along Roth Way where the S.G. Mudd Building parking lot is currently situated. The construction of this new space will require the demolition of the temporary modular stockroom and the Organic Building (now the Chemistry-Chemical Engineering Library). These facilities, in some way, will be incorporated into the renovated space vacated by the synthesis laboratories in the S.G. Mudd Building.

The lack of sufficient space has hindered the ability of the Biological Sciences Department to make important new faculty appointments; this new Lokey building will allow Biology to proceed with its plans for the future.

IV. STUDENTS

Undergraduate Students

There are three categories of students to be considered--the undergraduates, the graduates and the postdoctorates. The curricula that were discussed above were confined

to the undergraduate student courses, covering their evolution during the last twenty-five years of the twentieth century.

The number of undergraduate chemistry majors as measured by the number of B.S. degrees granted to chemistry graduates over these years has not varied greatly. It has been at an average of about 21 chemistry graduates per year, with of low of 10 and a high of 39. There was a low between 1986 and 1990 of 10 to 14 per year; with this exception there seems to be no general trend in these numbers over the 25-year period; there is no obvious explanation for these few low years.

When undergraduates apply for admission to Stanford, they do not declare an intention of their majors; their admission is determined by their overall ratings that presumably do not include any consideration of their areas of study. There are no quotas for specific areas, for instance for Engineering, for Music, for Physics, for Premedical studies etc. As stated under the discussion of curricula, however it seems that up to 50% or more of the entering freshmen in recent years have been taking chemistry courses, largely as a requirement for majoring in Biology with an ultimate goal of applying to medical school for a career in medicine. There is no specifically designated premedical major at Stanford. Of the large number of students enrolling in the beginning chemistry courses (530 in 1999), only a few (about 21, on average in the 1990s) became chemistry majors. Since Stanford in the recent years has admitted only one of about 8 to 10 applicants to the freshman class, we surely should be getting the academically best of a large applicant pool that is already highly self-selected by the applicants themselves. An interesting trend in the make-up of the Stanford undergraduate population is the increasingly large number of non-Caucasian students, who accounted for almost 50% of the entering freshman class in 1999. They may be either United States- or foreignborn. In 1975, of 30 chemistry B.S. degree graduates, 5 (17%) had Asian surnames, so this aspect is not completely new. Even in 1902 and 1903, one of the 12-14 B.S. chemists graduating had a Japanese surname.

Although not required of a chemistry major, undergraduate research (Chem 110, Directed Instruction) is undertaken by most majors. The student usually is assigned a research problem, integrated in a professor's graduate research group and treated almost as a beginning graduate student.

Graduate Students

In contrast to the situation with undergraduate admissions, chemistry has almost complete control of the make-up of the entering graduate class each year. There is keen competition between the major institutions for the best and brightest chemistry B.S. graduates each year. In 1989, when Prof. John Ross was chairman and Profs. Wender and Trost had joined the faculty, the importance of attracting more graduate students became apparent. The Department published for the first time a brochure, Chemistry at Stanford, which was sent to every student who requested information on admission to Stanford Graduate School in Chemistry. This brochure detailed graduate studies in Chemistry at Stanford and contained attractive colored pictures of the campus, of graduate students working in the laboratories and write-ups by each professor on the principal research interests and the types of thesis problems his or her students were undertaking.

An Office of Student Services was created within the Chemistry Department in 1995 under the management of Sharon Minton, later by Roger Kuhn. This office was responsible for putting out the brochure annually as well as a special Handbook for Chemistry Department Graduate Students and administering the graduate admission processes and many related activities such as the campus visits by prospective graduate students. At about the same time (1999) the chemistry graduate students elected a Student Affairs Committee with four student members, one staff representative (Sharon Brauman) and one faculty representative (Prof. Chris Chidsey). The graduate students now put out a monthly publication of four to six pages, named The Free Radical, which carries news and articles of special interest to their group.

A communication problem, over which we have little control, is a result of the physical distribution of our graduate and postdoctoral students. Thus in the spring of 2000 we had a total of a little more than 300 graduate and postdoctoral students in residence, located in five chemistry buildings and in the buildings of four other Departments (usually working for one of the Chemistry Professors by Courtesy).

CHEMISTRY		OTHER DEPTS.	
S.G. Mudd Building	140	Biology	6
Keck Building	65	Medical School	5
Stauffer I	33	SLAC	1

Stauffer II	43
Organic Building	7

The efforts at recruiting more and better graduate students have been increased by formalizing the visits to the campus by prospective students. When students inquire about graduate work, they are sent a copy of the brochure and invited to visit the campus on specific days in the late winter or early spring quarter. They are asked to select professors they would like to talk with and interviews are arranged. They are hosted at lunch and taken on tours of the laboratories and campus by current graduate students. These visits are coordinated with visits by the same students to the Chemistry Department at the Univ. of California, Berkeley.

There has been a significant increase in the number of Stanford Chemistry graduate students in the 1990s; from 1980 to 1985 the number of chemistry Ph.D. graduates averaged about 18 per year, with a low of 15 and a high of 20, compared with an average of 33 per year from 1990 to 1999 with a low of 24 and a high of 37. Since the average time required for the Ph.D. degree is between 4 and 5 years, this means that on the average in this latter period, the number of Ph.D. graduate students in residence in any one year was about 150 compared to about 95 for the years in the earlier period (1980-85). An important trend is the significant increase in the number of women in the Ph. D. program. In the years 1975-79 there were 91 Ph.D. chemistry graduates, 9 (10%) of which were women; in 1995-98, there were 111 Ph. D. degrees granted, 24 (22%) to women.

V. CORPORATE INDUSTRIAL AFFILIATES PROGRAM

In 1969 the Departments of Chemistry and Chemical Engineering initiated a joint Industrial Affiliates Program, which was reorganized in 2000 under the title Corporate Program of the Departments of Chemistry and Chemical Engineering. This has been a very successful program, bringing together our departments and various industrial corporations in mutually advantageous ways. This has not involved large numbers of companies, typically about fifteen. A specific faculty member is responsible for communicating with each corporation. The departments arrange symposia, special workshops and intensive advanced courses that are open to the corporate members and

our own students. Our students attend these meetings and develop a realistic idea of industrial chemical activities as well as valuable contacts with industrial representatives and their viewpoints, which are not emphasized in the regular graduate programs. The corporate representatives enjoy an unrestricted relationship with the departments and have opportunities to obtain added insights into the academic view of the latest chemical research developments. In return, the companies give an annual donation to the departments.

Below are current (year 2000) lists of our corporate members, the faculty liaison persons and the programs that have been arranged over the last twenty-five years. Of course this is an ever-changing list and topics covered will evolve in the coming years with the growing importance of chemistry in the bordering frontiers. This program encompasses the annual W.S. Johnson Symposium in Organic Chemistry, the annual Paul Flory Conference on Physical and Macromolecular Chemistry and the annual David Mason Lectures in Chemical Engineering. The subjects and speakers for these meetings have not been listed here but they have included most of the world authorities in the various timely subjects covered. These meetings cannot be mentioned without acknowledging the invaluable contribution of Lindi Bauman Press who has flawlessly arranged the mechanics of almost all the meetings. A faculty committee plans each meeting and invites the speakers; although this committee changes in composition, the core planning has usually involved Profs. Michel Boudart (Chemical Engineering) and Carl Djerassi (Chemistry).

Full Members (Date of joining)	Faculty Liaison
E.I. du Pont de Nemours & Co., Inc. (1969)	Brauman, Zare
Eastman Kodak Co. (1969)	Collman
Exxon Research & Engineering Co. (1969)	Brauman, Collman
Chevron Research and Technology Co. (1969)	Collman, Frank
Roche Bioscience (1995)	Huestis

Overseas Members

Mitsubishi Chemical Corp. (1986)	
BASF AG (1993)	Waymouth
Saudi Aramco (1994)	Shaqfeh

Limited Plus Member

Canon Research Center America, Inc. (1997)

Limited Members

ABB Lummus Global, Inc. (1996)
Catalytica Advanced Technologies (1998)
Symyx Technologies, Inc. (1999)

Honorary Member

Research Institute of King Fahd University
of Petroleum and Minerals

Program of Symposia, Workshops and Intensive Courses, 1976-2000

15th SYMPOSIUM, June 14 and 15, 1976
"Synchrotron Radiation—A Unique New Resource in Chemical Research"
DIVESTITURE CONFERENCE, September 20 and 21, 1976
"Oil Industry Divestiture: Effect on Research and Development in Energy"
[Sponsored by Stanford's Institute for Energy Studies]
16th SYMPOSIUM, December 9 and 10, l976
"Highlights of Applied and Basic Research on Electrochemical Processes"
17th SYMPOSIUM, March 10 and 11, 1977
"Minicomputers and Microprocessors—Developments and Applications"
18th SYMPOSIUM, June 27 and 28, 1977
"Problems and Challenges for Chemical Research in Multinational Corporations"
19th SYMPOSIUM, January 18-20, 1978
"Chemical Reactivity in Catalysis"
20th SYMPOSIUM, October 8-10, 1978
"How Do Chemical Reactions Occur?"
TENTH ANNIVERSARY SYMPOSIUM, June 19-22, 1979 (21st SYMPOSIUM)
"Exotic Materials"
22nd SYMPOSIUM, December 3-5, 1979
"Recent Progress in Clinical Diagnostic Chemistry"
23rd SYMPOSIUM, June 17-19, 1980
"Metal-Catalyzed Selective Oxidations of Hydrocarbons"
24th SYMPOSIUM, October 20 and 21, 1980
"The Analysis and Characterization of Surfaces and Interfaces"
25th SYMPOSIUM, February 2-4, 1981
"Government Regulation of Research and Development: How Can Its Impact on Innovation be Minimized?"
26th SYMPOSIUM, July 13 and 14, 1981
"Asymmetric Reactions and Processes"
27th SYMPOSIUM, February 25 and 26, 1982
"Instabilities in Physical and Chemical Systems"

FIRST INTENSIVE COURSE, June 21-29 1982
"Organometallic Chemistry"
28th SYMPOSIUM, June 30-July 1, 1982
"New Developments in Homogeneous Catalysis"
SECOND INTENSIVE COURSE, August 14-27, 1983
"Kinetics and Mechanisms of Heterogeneous Catalytic Reactions"
29th SYMPOSIUM, December 5 and 6, 1983
"Radiation-Induced Modifications of Thin Films"
30th SYMPOSIUM, March 28-30, 1984
"Active Sites in Catalysis"
THIRD INTENSIVE COURSE, June 25-July 3, 1984
"Chemistry, Physics and Engineering of Macromolecules"
FOURTH INTENSIVE COURSE, August 26-30, 1984
"Fixed-Bed Catalytic Reactor Analysis and Design"
31st SYMPOSIUM, March 17-19, `1985
"Symposium in Economics and Technology" [Co-sponsored by the National Academy of Engineering and Center for Economic Policy Research at Stanford]
32nd SYMPOSIUM, September 4-6, 1985
"Photochemistry: Theory, Experiment and Technology"
33rd SYMPOSIUM, November 1 and 2, 1985
"The State of Chemistry and Chemical Technology" [Held to honor Dr. Ralph Landau, 1985 National Medal of Technology recipient and Prof. Richard N. Zare, 1985 National Medal of Science recipient]
34th SYMPOSIUM, June 26 and 27, 1986
"New Developments in Electrochemistry"
FIFTH INTENSIVE COURSE, July 27-August 2, 1986
"Molecular Thermodynamics of Fluid Phase Equilibria with Application to Chemical Process Design"
35th SYMPOSIUM, October 17 and 18, 1986
"The First Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]
36th SYMPOSIUM, December 3 and 4, 1986
"High Performance Polymers"
SIXTH INTENSIVE COURSE, July 12-17, 1987
"Calculation and Estimation of Rate Constants for Kinetic Modeling of Chemical Processes"
37th SYMPOSIUM, September 21 and 22, 1987
"Disordered Materials, Fractals and Chaos"
38th SYMPOSIUM, October 16 and 17, 1987
"The Second Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]
39th SYMPOSIUM, May 2 and 3, 1988

"Strategies and Opportunities at the Interface between Chemistry, Chemical Engineering and the Life Sciences"

40th SYMPOSIUM, June 26-29, 1988

"Lasers in Analytical Chemistry" [The 41st ACS Summer Symposium on Analytical Chemistry]

41st SYMPOSIUM, September 18-21, 1988

"Scientific Trends and Policy Formation in Human Toxic Risk Assessment" [Cosponsored by the Chemical Industry Institute of Toxicology in Cooperation with the Stanford Center for Risk Analysis]

42nd SYMPOSIUM, October 14 and 15, 1988

"The Third Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]

SEVENTH INTENSIVE COURSE, July 16-21, 1989

"Colloid and Interface Science"

43rd SYMPOSIUM, August 27-31, 1989

"Interdisciplinary Laser Science V (ILS-V)" [Co-sponsored by the American Physical Society]

44th SYMPOSIUM, October 13 and 14, 1989

"The Fourth Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]

45th SYMPOSIUM, October 20 and 21, 1989

"Communication in Science: Challenges for the Nineties" [Held to honor Chemistry Professor J. Murray Luck on his 90th birthday; co-sponsored by Annual Reviews, Inc.]

EIGHTH INTENSIVE COURSE, September 17-21, 1990

"Applications of Synchrotron Radiation to Catalytic Materials"

46th SYMPOSIUM, October 5 and 6, 1990

"The Fifth Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]

47th SYMPOSIUM, May 28-30, 1991

"Catalysis Looks to the Future"

48th SYMPOSIUM, October 11 and 12, 1991

"The Sixth Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]

49th SYMPOSIUM, April 4, 1992

"Organometallic Chemistry and Materials Science"

GRADUATE LEVEL COURSE: Chemical Engineering 235, Spring Quarter 1992
"Catalysis: Science and Technology" [produced on VHS for Affiliates]

50th SYMPOSIUM, October 9 and 10, 1992

"The Seventh Annual William S. Johnson Symposium in Organic Chemistry" [Co-sponsored by the Department of Chemistry]

51st SYMPOSIUM, December 7 and 8, 1992

"Chemistry in Electronics and Photonics"

52nd SYMPOSIUM, May 19-21, 1993
"Molecular Assemblies"
53rd SYMPOSIUM, October 8 and 9, 1993
"The Eighth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
NINTH INTENSIVE COURSE, February 24-26, 1994
"Model Membranes: From Biophysics to Materials Science"
68th ACS COLLOID AND SURFACE SCIENCE SYMPOSIUM, June 19-22, 1994
[Sponsored by the ACS Division of Colloid and Surface Science; Administrative support from the Industrial Affiliates Program]
54th SYMPOSIUM, October 7 and 8, 1994
"The Ninth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
55th SYMPOSIUM, March 30 and 31, 1995
"Taube Insights: From Electron Transfer Reactions to Modern Inorganic Chemistry" [Henry Taube Symposium]
56th SYMPOSIUM, October 6 and 7, 1995
"The Tenth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
IAP WORKSHOP, January 15-17, 1996
"Materials Chemistry: Challenges and Opportunities in Industry and Academe"
[Prof. Robert Waymouth, organizer, Asilomar Conference Center, Pacific Grove, CA]
57th SYMPOSIUM, October 18 and 19, 1996
"The Eleventh Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
58th SYMPOSIUM (IAP WORKSHOP), September 6, 1997
"Conversations on Heterogeneous Catalysis", organized by Prof. Michel Boudart
[Las Vegas, NV just prior to ACS Fall meeting]
59th SYMPOSIUM, October 10 and 11, 1997
"The Twelfth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
60th SYMPOSIUM, January 23 and 24, 1998
"The First Paul Flory Conference in Polymer and Physical Chemistry"
[Profs. Michel Boudart, Alice Gast, George Springer and Robert Waymouth, organizers]
61st SYMPOSIUM, October 16 and 17, 1998
"The Thirteenth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]
62nd SYMPOSIUM, February 13 and 14, 1999
"The Second Paul Flory Conference in Polymer and Physical Chemistry"
24th Annual David M. Mason Lecture in Chemical Engineering, May 19-21, 1999
[Incorporating the 1999 NIH Biotechnology Symposium]

63rd SYMPOSIUM, October 22 and 23, 1999

"The Fourteenth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]

64th SYMPOSIUM, February 11 and 12, 2000

"The Third Paul Flory Conference in Physical and Macromolecular Chemistry"

25th Annual David M. Mason Lecture in Chemical Engineering, May 23-25, 2000

65th SYMPOSIUM, October 6 and 7, 2000

"The Fifteenth Annual William S. Johnson Symposium in Organic Chemistry"
[Co-sponsored by the Department of Chemistry]

VI. PROFESSORS, BRIEF BIOGRAPHICAL SUMMARIES 1976-2000

These brief biographical summaries, listed in the order of their appointments to the faculty, are not intended to be complete and will of course become out of date after the year 2000. The reader is referred to contemporary volumes of American Men and Women of Science for more information and to the ACS Directory of Graduate Research for publication lists.

JAMES MURRAY LUCK. Biochem. B.S. Toronto, Ph.D. Cambridge, England, 1925. Student of J.B.S. Haldane and Sir Gowland Hopkins. Demonstrator Toronto, 1925-26; Asst. Prof. to Prof., Stanford 1926-34, Prof. 1934-65; Emeritus 1965. "1856 Exhibitor Research Scholarship". Founding editor of Annual Reviews of Biochemistry and the many subsequent Annual Reviews Series in other fields. Fellow AAAS, Fellow Calif. Acad. Sci. Born Paris, Ontario, Canada 1898. Died Stanford 8/26/1993.

WILLIAM ANDREW BONNER. Org. Chem. A.B. Harvard, Ph.D. Northwestern, 1944. Student of C.D. Hurd. Instr. to Prof., Stanford 1946-59, Prof. 1959-83, Emeritus 1983. Guggenheim Fellow ETH, Zurich, Switzerland 1953. Born Chicago 1919.

RICHARD HALLENBECK EASTMAN. Org. Chem. A.B. Princeton, Ph.D. Harvard, 1944. Student of R.B. Woodward. Asst. Harvard 1944-46; Instr. to Prof., Stanford 1946-59; Prof. 1959-83, Emeritus 1983. NSF Fellow, U. Marburg 1958-59. Born Erie, PA 1918. Died Stanford 6/18/2000.

HARRY STONE MOSHER. Org. Chem. A.B. Willamette U., M.S. Ore. State Coll., Ph.D. Penn. State Coll. 1942. Student of F.C. Whitmore. Asst. Prof. Willamette 1939-40; Penn. State Coll.1942-47; Asst. Prof to Prof., Stanford 1947-55, Prof. 1955-80, Emeritus 1980. Hon. D.Sc. Willamette 1980. NSF Fellow Chester Beatty Res. Inst., U. of London 1959-60; NSF Fellow ETH, Zurich, Switzerland 1967-68. Visiting Prof. Vrije U. Amsterdam, 1974, U. of Sci. and Tech. of China, Hefei, PRC, 1988; Fellow AAAS, Fellow Calif. Acad. Sci.; Phi Beta Kappa. Born Salem, Ore 1915. Died Stanford 3/2/2001.

DOUGLAS ARVID SKOOG. Anal. Chem. B.S. Ore. State Coll., Ph.D. Illinois 1943. Student of D.T. Englis. Standard Oil of Cal. 1943-47. Asst. Prof. to Prof., Stanford 1947-62, Prof. 1962-76. Assoc. Exec. Head of Chem. Dept. 1961-76, Emeritus 1976. Author of texts in Anal. Chem. and Instrumental Analysis. Division of Chem. Educ. Award of the ACS 1996, Anal. Chem. Division Award of the ACS 1999. Born Wilmar, Minn. 1918.

ERIC HUTCHINSON. Phys. Chem. (Colloid Chem.) B.A., M.A., Ph.D. Cambridge, England. Student of Sir Eric Rideal. Instr. Sheffield U., England 1945-46; Post-Doc. Fellow, Stanford 1946-48, Asst. Prof. Fordham U. 1948-49, Asst. Prof. to Prof., Stanford 1949-59, Prof. 1959-78. Emeritus 1978. University Academic Secretary 1974-78. Visiting Prof. Yokohama National U. 1967-68, U. of Sussex. Born Morton, England, 1920.

DAVID MALCOLM MASON. Chem. Eng. B.S., M.S., Ph.D. Cal. Inst. of Tech. Student of

Bruce Sage. Instr. Cal. Tech., 1949-51, Jet Propulsion Lab. of Cal. Tech. 1952-55, Assoc. Prof. to Prof., Stanford 1955-58, Prof. Chem. Eng. and Chem. 1958-86, Chair Dept. of Chem. Eng. 1955-72, Assoc. Dean of Undergraduate Studies 1972-76, Assoc. Dean Eng. 1972-76, Emeritus 1987. NSF Fellow Imper. Col., U. London 1978-79. Found. Award, Am. Inst. Chem. Eng. 1984. David M. Mason Lectures 1975--. Born Los Angeles 1921. Died Stanford 8/10/88.

CARL DJERASSI. Org. Chem. A.B. Kenyon Coll., Ph.D. U. of Wisc. 1945. Student of A.L. Wilds. Research Chemist Ciba Pharmaceutical Co. 1942-43, 1945-49; Assoc. Dir. Res. Syntex, Mexico City 1949-52; Prof. Wayne State U. 1952-59, Prof. Stanford 1959--. Hon. D. Sc. National U. Mexico, Kenyon Coll., Wayne State U., Worcester Polytechnic Inst., Columbia U., Uppsala U., Coe Coll., U. Geneva, U. Ghent, Adelphi U., U. So. Carolina, U. Wisc., ETH Zurich. Natl. Medal of Science, Natl. Medal of Technology, ACS Award in Pure Chem., Baekland Medalist, Perkin Medal, Priestley Medal, Gibbs Medal, Fritzsche Medal, Natl. Inventors Hall of Fame for Patents (birth control pill), Wolf Prize in Chem., Roussel Prize., Appl. Sci Award. Mem. Nat. Acad. Sci.; Mem. Inst. Med.-Nat. Acad. Sci. Born Vienna, Austria 1923.

WILLIAM SUMNER JOHNSON. Org. Chem. A.B. Amherst, A.M., Ph.D. Harvard 1940. Student of L.F. Fieser. Instr. Amherst 1936-37; Instr. to Prof. Wisc. 1940-60; Prof. Stanford 1960-88; Exec. Head of Chem. Dept. Stanford 1960-69. Emeritus 1988. Honorary D. Sc. Amherst Coll., Long Island U. Syn. Org. Chem. Mfg. Award in Creative Research, ACS Award in Creative Syn. Org. Chem., Nichols Medal, Roussel Prize, Natl. Medal of Science, Mem. Natl. Acad. Sci. Born New Rochelle, N.Y. 1913. Died Stanford 8/19/95.

PAUL JOHN FLORY. Phys. Chem. (Polymer Chem.) A.B. Manchester Coll., M.S., Ph.D. Ohio State 1934. Student of H.L. Johnson. Prof. Cornell U. 1948-57, Exec. Dir. Res. Mellon Inst. 1956-61, Prof. Stanford 1961-75, Chair 1969-72. Emeritus 1975. Hon. D.Sc. Manchester Coll., Indiana U., Manchester U. England, Ohio State U. Prof. Flory was the 1985 Nobel Laureate in Chem.; has been awarded numerous prestigious American chemical awards including Natl. Medal of Sci. (*cf*. Am. Men and Women of Sci., contemporary volume.) Born Sterling, Ill. 1910. Died Big Sur, Cal. 9/8/85.

EUGENE E. VAN TAMELEN. Org. Chem. A.B. Hope Coll., Ph.D. Harvard 1950. Student of Gilbert Stork. Instr. to Prof. Wisc. 1950-62; Prof. Stanford 1962-78; Chair 1974-78. Emeritus 1978. Hon. D.Sc. Hope Coll., Bucknell U. ACS Award in Pure Chem., Baekland Award, ACS Award for Creative Work in Org. Chem. Mem. Natl Acad. Sci, Am. Acad. of Arts and Sci. Born Zeeland, Mich. 1925.

HENRY TAUBE. Inorg. Chem. B.S., M.S. U. Saskatchewan, Ph.D. U. Cal. Berkeley 1940. Student of W.C. Bray. Instr. U.C. Berkeley 1940-41; Asst. Prof. Cornell 1941-46; Assoc. Prof. to Prof. Chicago 1946-52; Prof. 1952-62; Prof. Stanford 1962-88; Chair 1972-74 and 78-79. Emeritus 1988. Hon. L.L.D. U. Sask.; D.Sc. U. Chicago, Polytech. Inst. of N.Y., U. Guelph, Seaton Hall U., Layos Kossuth U. Hungary, Northwestern U., U. of Athens. Prof. Taube was the Nobel Laureate in Chem. in 1983; has been awarded many prestigious American chemical awards, including Natl. Medal of Sci., Chem. Sci. Award of the Natl. Acad. of Sci. (*cf* Am. Men and Women of Sci., contemporary volume). Born Neudorf, Saskatchewan 1915.

JOHN I. BRAUMAN. Org. Chem. B.S. Mass. Inst. Tech., Ph.D. U. Cal. Berkeley 1963. Student of A. Streitwieser, Jr. Asst. Prof to Prof. Stanford 1963-72, Prof. 1972--. Chair 1979-83, 199596; Assoc. Dean School of Humanities and Sci. Awards: ACS Pure Chem., Harrison Howe, James Flack Norris in Phys.-Org. Chem., Arthur Cope Scholar. NSF Fellow, Guggenheim Fellow, Christensen Fellow Oxford U.; Mem. Natl. Acad. Sci, Am. Acad. Arts and Sci. Born Pittsburgh, Pa., 1937.

HARDEN MARSDEN McCONNELL. Phys. Chem. B.S. George Wash. U., Ph.D. Cal. Inst. Tech. 1951. Student of Norman Davidson. Natl. Res. Fellow U. Chicago 1950-52, Res. Chem. Shell Develop. Co. 1952-56. Asst. Prof. to Prof. Cal. Tech. 1956-59, Prof. 1959-63, Prof. Stanford 1964-2000. Chair 1989-92. Emeritus 2000. Founder and Dir. Molecular Devices Corp., Palo Alto, Cal. 1983--. Hon D.Sci. U. Chicago, George Wash. U. Awards: ACS Pure Chem., Harrison Howe, Remsen, Peter Debye, Irving Langmuir. Natl. Medal of Sci., Pauling Medal, Wheland Medal, Wolf Prize in Chem., Mem. Natl. Acad. Sci., Fellow Am. Phys. Soc., Am. Acad. Arts and Sci., AAAS. Born 1927.

ROBERT PECORA. Phys. Chem. B.S., M.S., Ph.D. Columbia U. 1962. Student of R. Bersohn. Asst. Prof. to Prof. Stanford 1964-77, Prof. 1977--, Chair 1992-95. Humbolt Sr. Sci. Award, Natl Res. Coun. Fellow, Brussels, Belg., 1963. Visiting Prof. U. Manchester, England. Born 1938.

JAMES PADDOCK COLLMAN. Org.-Inorg. Chem. B.S., M.S., U. Nebr., Ph.D. U. Ill. 1958. Student of R.C. Fuson. Instr. to Prof. U. No. Carolina 1958-66, Prof. 1966-67. Prof. Stanford 1967--. Hon. D.Sci. U. Nebr. 1988. Awards: Calif. Section ACS, Pauling, ACS Inorganic Chem., Alfred Bader Bioinorg. Biorg.; Sloan Fellow, Guggenheim Fellow, Erskine Fellow U. Canterbury N.Z.; Mem. Natl. Acad. Sci. Born 1932.

HANS CHRISTIAN ANDERSEN. Phys. Chem. B.S., Ph.D. Mass. Inst. Tech. 1966. Student of I. Oppenheim. Jr. Fellow, Soc. Fells. Harvard 1965-68. Asst. Prof. to Prof. Stanford 1968-80, Prof. 1980--, Assoc. Dean of Nat. Sci., School Humanities and Sci. 1996-99. ACS Joel H. Hildebrand Award, Mem. Natl. Acad. Sci., Phi Beta Kappa. Born Brooklyn, N.Y. 1941.

LINUS C. PAULING. Phys., Bioinorg. Chem. B.S. Ore. State Coll., Ph.D. Cal. Inst. Tech. 1925. Student of R.G. Dickinson. Natl. Res. Council Fellow 1925-26; Guggenheim Fellow U. Zurich, Munich and Copenhagen 1926-27. Asst. Prof. to Prof. Cal Tech. 1927-31, Prof. 1931-63. Head Div. of Chem. and Chem. Eng. 1937-58. Prof. Stanford 1969-74. Emeritus 1974. Fellow Linus Pauling Inst. Sci. and Med. 1973-94. Prof. Pauling was the recipient of the Nobel Prize in Chem. 1954 and the Nobel Peace Prize in 1963. He received 30 Honorary degrees from American and foreign Universities and numerous prestigious chemical awards in America and abroad. Born Portland, Ore. 1901. Died Big Sur, Cal. 8/9/94.

FRANK ALBERT WEINHOLD. Phys. Chem. B.S. U. Colo., A.M. and Ph.D. Harvard 1968. Student of E. B. Wilson. Asst. Prof. Stanford 1969-76. U. Wisc. until retirement. Born Scottsbluff, Nebr. 1941.

BRUCE SAMUEL HUDSON. Phys. Chem. B.S., M.S. Calif. Inst. Tech., Ph.D. Harvard 1972.

Student of B. Kohler and R.G. Gordon. Asst. Prof. Stanford 1972-78. Currently at U. Ore. Born Peekskill, N.Y. 1945.

KEITH OWEN HODGSON. Bio-Inorg. (Structural) Chem. B.S. U. Va., Ph.D. U. Cal. Berkeley 1972. NATO Fellow Swiss Fed. Inst. Tech. 1972-73. Asst. Prof. to Prof. Stanford 1973-79, Prof. 1979--. Sloan Fellow 1976-78; Sidhu Award for Contribution to X-ray Diffraction 1978. Born 1947.

WRAY HUGHES HUESTIS. Biophys. Chem. B.S. Macalester Coll., Ph.D. Calif. Inst. Tech. 1972. Student of M.A. Raftery. Sloan Found. Postdoc Fellow Cal. Tech. 1972-73; NIH Postdoc. Fellow Stanford 1973-74. Asst. Prof. to Prof. Stanford 1974-80, Prof. 1980--. Sloan Fellow 1977-79. Born Lander, Wyo. 1945.

MICHAEL DAVID FAYER. Chem. Phys. B.S., Ph.D. U. Cal. Berkeley 1974. Student of Charles Harris. Asst. Prof. to Prof. Stanford 1974-81, Prof. 1981--, Dreyfus Teaching Award 1977; Sloan Found. Fellow, 1987; Guggenheim Found. Fellow 1993-94. Born Los Angeles 1947.

RICHARD H. HOLM. Inorg. Chem. B.S. U. Mass., Ph.D. Mass. Inst. Tech. 1959. Student of F.A. Cotton. Asst. Prof. Harvard 1962-65; Assoc. Prof. Wisc. 1965-67; Prof. MIT 1967-75; Prof. Stanford 1975-80. Prof. Harvard 1980--, Hon. D.Sc. U. Mass., U. Chicago. Awards: Bailar Medal. Inorg. Chem. Award of ACS, Alfred Bader, Harrison Howe, Centenary Medal of Royal Chem. Soc., Dwyer Medal of Australian Chem. Soc., Linus Pauling Medal, Chem. Sci. Award Natl. Acad. Sci., Theodore Richards Medal. Mem. Natl. Acad. Sci., Am. Acad. Arts and Sci. Born Boston 1933.

STEVEN GEORGE BOXER. Phys. Biophys. Chem. B.S. Tufts U., Ph.D. U. Chicago 1976. Student of Gerhart Closs. Asst. Prof. to Prof. Stanford 1976-82, Prof. 1982--. Awards: Sloan Fellow 1980, Dreyfus Teaching Scholar Fellow 1981, Presidential Young Investigator 1984, NIH Merit 1994, Cope Scholar 1995. Mem. Am. Acad. Arts and Sci. Born New York City 1947.

ROBERT H. WOLLENBERG. Org. Chem. B.S., Ph.D. Harvard 1975. Student of E.J. Corey. Asst. Prof. Stanford 1976-83. Moved to Chevron Research Corp. Born 1950.

K. BARRY SHARPLESS. Org. Chem. (Homogeneous Catalysis-Asym. Transformation). B.A. Dartmouth, Ph.D. Stanford 1968. Student of E. Van Tamelen and J. Collman. NIH Fellow Stanford 1968-69, Harvard 69-70. Asst. Prof. to Prof. MIT 1970-77, Prof. 1977; Prof. Stanford 1977-80; Prof. MIT 1981-1990; Prof. Scripps Res. Inst. 1990--. Mem. Natl. Acad. Sci., Fellow Am. Acad. Arts and Sci., Fellow AAAS. Recd. numerous awards in Organic Chem. Born Philadelphia, Pa. 1941.

RICHARD ZARE. Chem. Physics, Anal. Chem. B.A., Ph.D. Harvard 1964. Student of Dudley Herschbach. Postdoc. Fellow Harvard 1964-65; Res. Assoc. and Fellow Inst. Astrophys, U. Colo. 1966-67, Asst. Prof. to Assoc. Prof. Physics and Chem. U. Colo. 1967-69; Prof. Chem. Columbia 1969-77 ;Prof. Stanford 1977--. Awards: Michael Polyani Medal, Fresenius, Am. Phys. Soc., Earle Plyler Prize, Natl. Medal Sci., ACS Gibbs Medal, Debye Award, E. Bright Wilson Award in Spectroscopy, Cal. Scientist of Year Award 1997, ACS Award in Anal.

Chem., Sloan Res. Fellow, Mem. Natl. Acad. Sci., Chair 1996, Fellow Am. Acad. Arts and Sci. Born Cleveland, Ohio 1939.

JOHN ROSS. Phys. Chem. B.S. Queens Coll. N.Y., Ph.D. Mass. Inst. Tech. 1951, Res. Fellow Yale 1952-53, Asst. Prof. to Prof. Brown U. 1953-66. Prof. MIT 1966-80, Chair Chem. Dept.1966-71, Chair of Fac. 1975-77. Prof. Stanford 1980--. Chair 1983-89. Hon. D.Sc.: Weizmann Inst. Sci., Israel, Queens Coll., SUNY, U. Bordeaux, France. ACS Irving Langmuir Award, Natl. Medal of Science, NSF Fellow, Guggenheim Fellow, Sloan Fellow Visiting Van der Waals Prof. U. Amsterdam. Mem. Natl. Acad. Sci, Fellow Am. Acad. Arts and Sci., Fellow Am. Phys. Sci., AAAS. Born Vienna, Austria 1926.

MICHAEL CRAIG PIRRUNG. Bio-org. Chem. B.S., B.A. U. Texas, Austin, Ph.D. U. Cal. Berkeley 1980. Student of Clayton Heathcock. NSF Fellow Columbia U. 1980-81. Asst. Prof. Stanford 1981-89. Prof. Duke U. 1990--. Born Cincinnati, Ohio 1955.

PAUL ANTHONY WENDER. Org. Chem. B.S. Wilkes Coll., Ph.D. Yale 1973. Student of Frederick Ziegler. Asst. Prof. to Assoc. Prof. Harvard 1974-81. Sloan Found. Fellow 1979, Prof. Stanford 1981--. Dreyfus Teaching Scholar 1980. Awards: Ernest Guenther, ICI Pharmaceutical Group's Stuart Award for Excellence in Chem., Cope Scholar, Pfizer Research in Synth. Org. Chem., ACS for Creative Work in Synth. Org. Chem., NIH Merit, Pfizer Res., Alexander von Humbolt. Fellow Am. Acad. Arts and Sci. Born 1947.

NATHAN SAUL LEWIS. Electrochem. B.S., M.S. Cal. Inst. Tech., Ph.D. Mass. Inst. Tech. 1981. Student of Mark Wrighton. Asst. Prof. to Assoc. Prof. Stanford 1981-88. Assoc. Prof. to Prof. Cal Tech. 1988-90, Prof. 1990--. ACS Award in Pure Chem. 1990, Fresenius Award 1990. Born Los Angeles 1955.

EDWARD I. SOLOMON. Phys. Inorg. Chem. B.S. Rensselaer Polytech. Inst., M.A., Ph.D. Princeton 1972. NIH Fellow Cal Tech. 1974-75. Asst. Prof. to Prof. M.I.T. 1975-81, Prof. Stanford 1982--. Fell: Sloan Found. 1976-79, Guggenheim, Christensen, NSF U.C.L.A., Oxford U., AAAS, Am. Acad. Arts and Sci. DuPont, G.E. Young Faculty Awards 1979-80, Remsen Award, Arthur Cope Scholar. Visiting Prof.: Xiamen U. PRC, U. Paris Orsay, U. LaPlata, Arg., Tokyo Inst. Tech. Japan. Born New York City 1946.

JOHN WESLEY FROST. Bio-org. Chem. B.S. Purdue, Ph.D. Mass. Inst. Tech. 1981. Student of George Whitesides. Postdoc. Fellow Harvard 1981-83. Asst. Prof. Stanford 1984-91. Currently at Purdue U. Born 1955.

LISA McELWEE-WHITE. Org. Chem. B.S. U. Kansas, Ph.D. Cal. Inst. Tech. 1983. Student of Dennis Dougherty. Postdoc Res. Affill. Stanford 1983-85. Asst. Prof. Stanford 1985-92. U. of Florida, Gainesville 1992--. Born 1958.

STEVE McCLELLAN GEORGE. Phys. Chem. B.S. Yale, Ph.D. U. Cal. Berkeley 1983. Student of Charles Harris. Postdoc. Res. Fellow Cal. Tech. 1983-84, Sloan Fellow 1988, NSF Pres. Young Investigator Award. Asst. Prof. Stanford 1988-95. Currently U. Colo. Boulder. Born 1955.

DALE GENE DRUECKHAMMER. Bio-org. Chem. B.S. Tarleton State U., Ph.D. Texas A and M 1987. Student of Chi-Huey Wong. NIH Fellow Harvard Med. School 1987-89. Asst. Prof. Stanford 1988-89. Currently at Duke U. Born 1961.

WESLEY ALLEN. Phys. Chem. B.A. Vanderbilt, Ph.D. Chem. Physics U. Cal. Berkeley 1987. Student of H.F. Schaeffer. Asst. Prof. Stanford 1988-94. Born 1961.

ROBERT M. WAYMOUTH. Inorg-Organometallic (Polymer) Chem. B.S., B.A. Washington and Lee U., Ph.D. Cal. Inst. Tech. 1987. Student of Robert Grubbs. Res. Fellow Inst. Polymer Sci., ETH Zurich, Switzerland 1987-88. Asst. Prof. to Prof. Stanford 1988-94, Prof. 1994--. Awards: NSF Young Investigator, Cope Scholar, Sloan Fellow, Union Carbide Innovation, Fresenius, Alan T. Waterman, Undergraduate Teaching Award, Bing Teaching Award. Phi Beta Kappa. Born Warner Robbins, Ga. 1960.

JOHN H. GRIFFIN. Bio-org. Chem. B.S. Hope Coll., Ph.D. Cal. Inst. Tech. 1989. Student of Peter Dervan. Postdoc. Harvard Med. Sch. Asst. Prof. Stanford 1990-96. Currently U. Colo., Boulder. Born 1961.

BARRY M. TROST. Org. Chem. B.A. U. Penn., Ph.D. Mass. Inst. Tech. 1965. Student of Herbert House. Asst. Prof. to Prof. Wisc.-Madison 1965-76. Helfear Prof. 1976-90, Chair 198082. Prof. Stanford 1990--. Chair 1996--. Hon. D.Sc. U. Claude Bernard, Technion Haifa, Israel. Awards: ACS Awards for Creative Org. Chem. 1977, 81, 89, 90; Cope Scholar, Ernest Guenther, Roger Adams, Baekland Medal, NIH Merit, Janssen Prize, Pfizer, Sloan Fellow, AmSwiss Found. Fellow, Dreyfus Fellow, AAAS Teacher-Scholar Grant 1970-75. Mem. Natl. Acad. Sci., Am. Acad. Arts and Sci. Born Philadelphia, Pa. 1941.

T. DANIEL P. STACK. Bio-Inorg. Chem. B.A. Reed Coll., Ph.D. Harvard 1988. Student of Richard Holm. NSF Postdoc. Fellow U. Cal. Berkeley 1988-91. Asst. Prof. to Prof. Stanford 1991-99, Prof. 1999---. Shell Found. New Faculty Award 1993-95; Bing Teaching Award 199598, Hoefer Teaching Award 1997. Born 1959.

CHRISTOPHER E. D. CHIDSEY. Phys. Chem. (Interface Chem.) B.S. Dartmouth, Ph.D. Stanford 1983. Student of Steven Boxer. Dreyfus Teaching Scholar 1983. Res. Assoc. U. No. Carolina 1983-84. AT and T Bell Labs 1984-92. Prof. Stanford 1992--. Born 1957.

THOMAS J. WANDLESS. Bio-Org. Chem. B.S. Trinity U., Ph.D. Harvard 1993. Student of S.L. Schreiber. NSF Postdoc. Fellow Harvard Med. School 1993-95. Asst. Prof. Stanford 1996-. Camille and Henry Dreyfus New Faculty Award. Beckman Found. Investigator. Phi Beta Kappa Teaching Award. Born 1966.

CHAITAN KHOSLA. Chem. Eng. (Biosynth.). B. S. Tech. Indian Institute of Tech., Ph.D. Cal. Inst. Tech. 1990 Asst. Prof. to Assoc. Prof. Chem. Eng., Stanford 1992-97. Joint Assoc. Prof. of Chem. and Chem. Eng. 1997--. Winner of Alan T. Waterman NSF Award 1999; Camille and Henry Dreyfus New Investigator Award; Natl Sci. Found. Young Invest. Award 1994; Alan P. Colburn Award, Am. Inst. Chem. Eng. 1997, ACS Lilly Award in Biolog. Chem., ACS Award in Pure Chem. 1999. Born 1974.

HONGJIE DAI. Phys Org. Chem. B.S. Physics, Tsing Hua U. Beijing PRC, M.S. Applied Sci. Columbia, Ph.D. Chem.-Applied Physics Harvard 1994. Student of Charles M. Lieber. Postdoc. Fellow Harvard 1995-97. Asst. Prof. Stanford 1997--. Camille and Henry Dreyfus New Faculty Award. Born Shaoyang PRC 1966.

WILLIAM E. (W.E.) MOERNER. Phys. Chem. B.S., A.B. Washington U.; M.S., Ph.D. (Physics) Cornell 1982, IBM Res. Staff 1981-95, Manager to Project Leader 1988-95. Prof. U. Cal San Diego 1995-98; Prof. Stanford 1999--. Fellow Am. Phys. Soc., Fellow Optical Soc. Am. Roger I. Wilkinson Natl. Outstanding Young Elect. Eng.; IBM Outstanding Tech. Achievement Award. Visiting Prof. ETH Zurich, Switz.; Woodward Visiting Prof. Harvard. Born Pleasanton, Cal. 1953.

VIJAY S. PANDE. Phys. Chem. (Biosci.) B.A. Physics Princeton, Ph.D. Physics Mass. Inst. Tech. 1995. Student of A. Yu. Grosberg and T. Tanaka. Postdoc. Assoc. M.I.T. 1995-96. Center for Materials Sci and Eng. 1995-96. Fellow Miller Inst. for Basic Research in Sci. 1996-98. Postdoc. Res. Lawrence Natl. Labs Berkeley; Asst. Prof. Stanford 1999--. Born Port of Spain, Trinidad and Tobago 1970.

JUSTIN DU BOIS. Org.-Bioinorg. Chem. B.S. U. Cal. Berkeley, Ph.D. Cal. Inst. Tech. 1997. Student of Stephen J. Lippard. Postdoc. Fellow M.I.T. 1977-99. Asst. Prof. Stanford 1999--. ACS Nobel Laureate Signature Award for Graduate Edu. in Chem.; NIH Gen. Med. Sci. Postdoc. Fellow. Born 1969.

ERIC T. KOOL. Biophys.-Biochem. B.S. Miami U. Ohio; M.A., Ph.D. Columbia 1988. Student of Ronald Breslow. Postdoc. Fellow Cal. Inst. Tech. 1988-90. Asst. Prof. to Prof. U. Rochester, 1990-99; Prof. Stanford 1999--. Awards: ACS Pfizer, Cope Scholar, Sloan, Camille and Henry Dreyfus Teacher Scholar, Arnold and Mabel Beckman Found., Young Investigator, Office Naval Res. Young Investigator, NIH Postdoc. Fellow. Born 1960.

Department of Chemistry Courtesy Appointments

MICHEL JEAN BOUDART. Chem. Eng. B.S., M.S. Louvain, Belg., Ph.D. Princeton 1950. Student of H.S. Taylor. Asst. Prof. Princeton 1954-58; Assoc. Prof. to Prof. of Chem. Eng. U. Cal. Berkeley 1961-64; Prof. Chem. Eng. Stanford 1964-98. W.M. Keck Prof. of Eng. Emeritus 1998. Cofounder and Dir. Catalytica Assoc., Inc., 1974. Awards: Curtis McGraw Res., Am. Soc. Eng. Educ., R.H. Wilhelm, Am. Inst. Chem Eng., Kendal, Murphee, Chem. Pioneer Award of the Am. Inst. of Chemists. Visiting Prof. U. Louvain, Rio de Janeiro, Tokyo, Paris. Mem. Natl Acad. Sci, Natl. Acad. Eng., Belgium Royal Acad. Born Brussels, Belg. 1924.

ROBERT J. MADIX. Prof. Chem. Eng. Ph.D. U. Cal. Berkeley 1964.

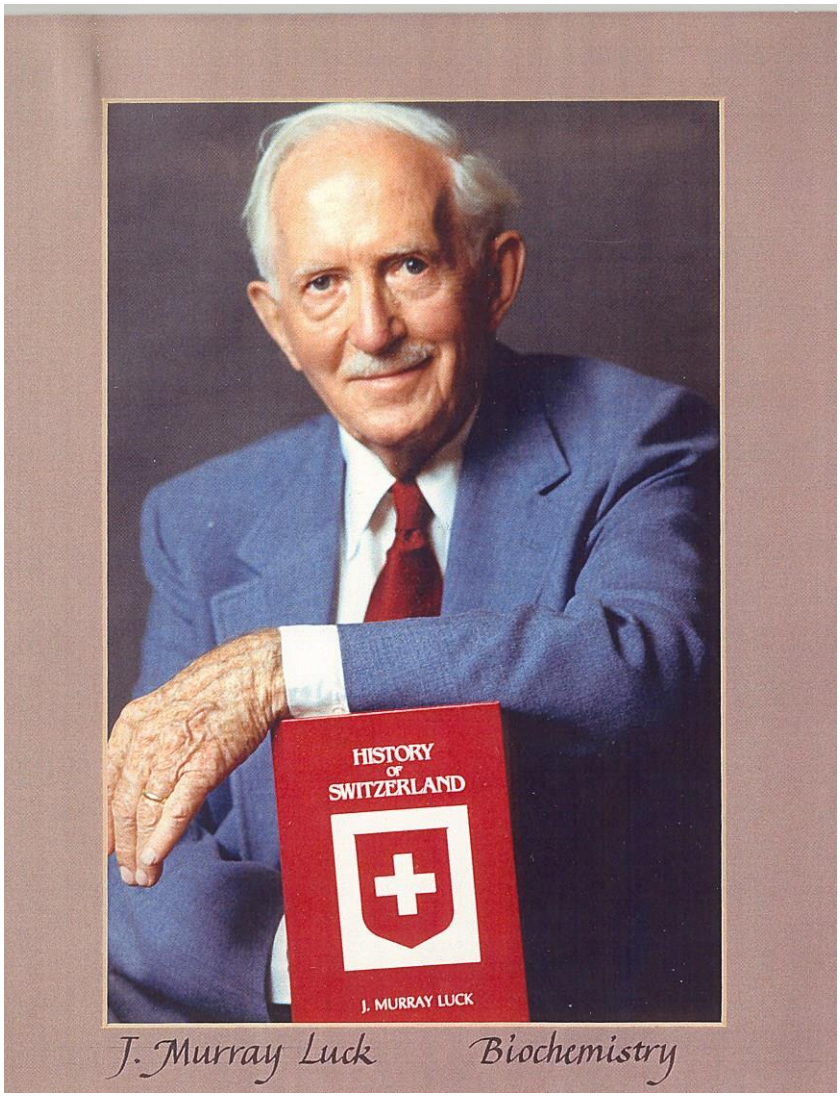
CURTIS W. FRANK. Prof. Chem. Eng. and Material Sci. and Eng. Ph.D. U. Ill. 1972.

ALICE P. GAST. Prof. Chem. Eng. and of SSRL. Ph.D. Princeton 1984.

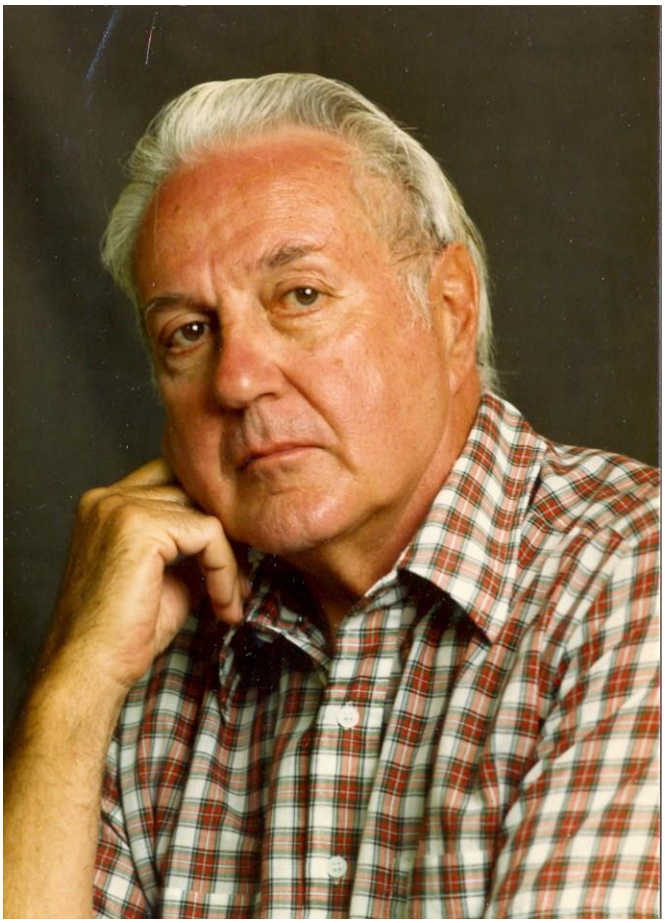
DANIEL HERSCHLAG. Assoc. Prof. Biochemistry. Ph. D. Brandeis 1988.

STACEY F. BENT. Asst. Prof. Chem. Eng. and Elect. Eng. Ph.D. Stanford 1992.

KARLENE CIMPRICH. Asst. Prof. Pharmacology. Ph. D. Harvard 1994.

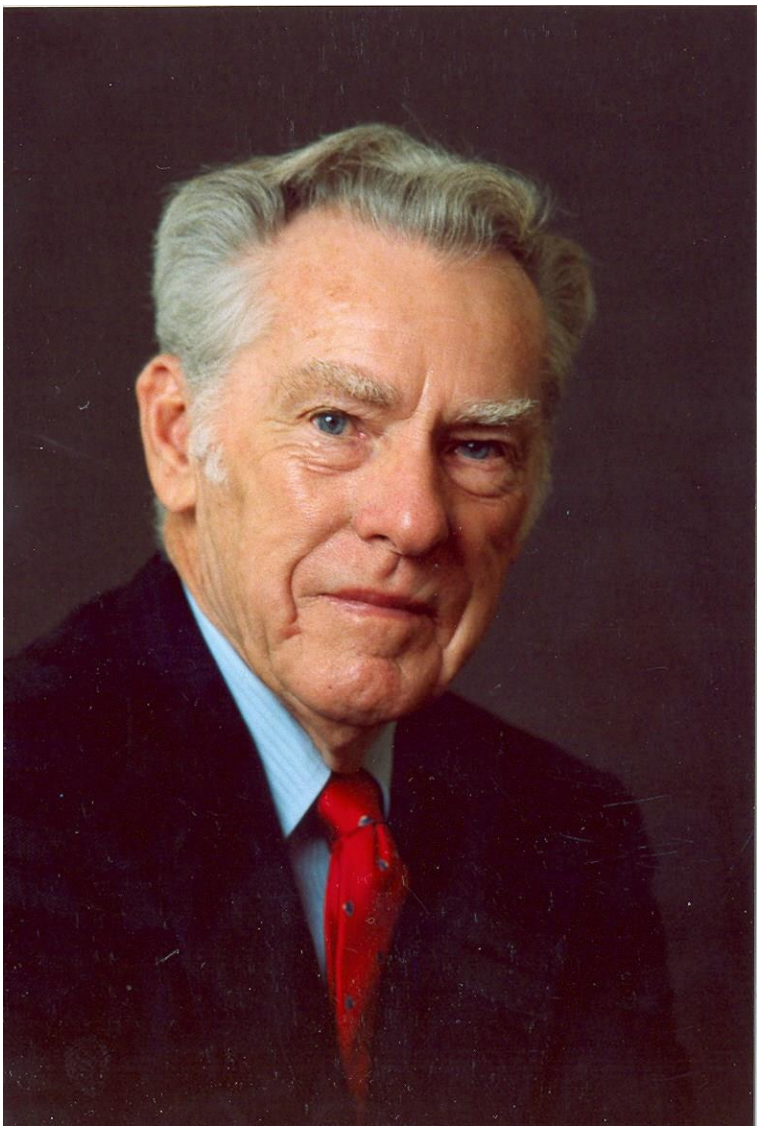


J. MURRAY LUCK
Member of the Faculty 1926-1965

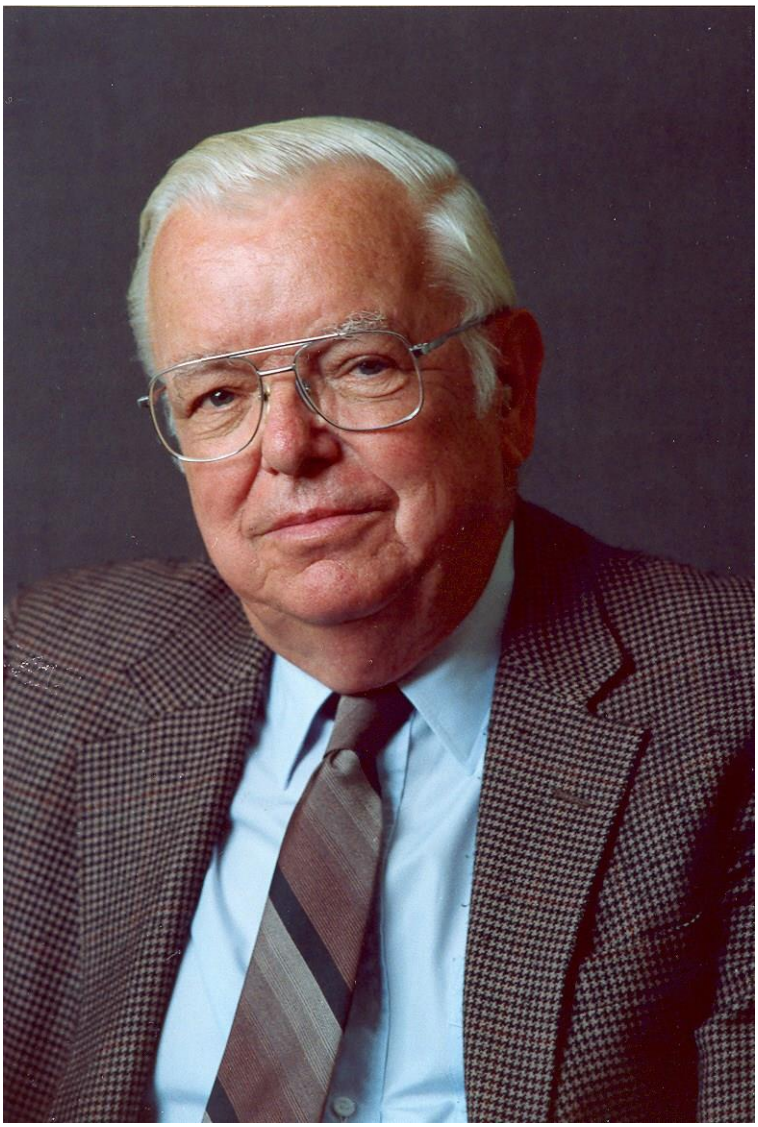


WILLIAM A. BONNER
Member of the Faculty 1946-1983

RICHARD H. EASTMAN
Member of the Faculty 1946-1983

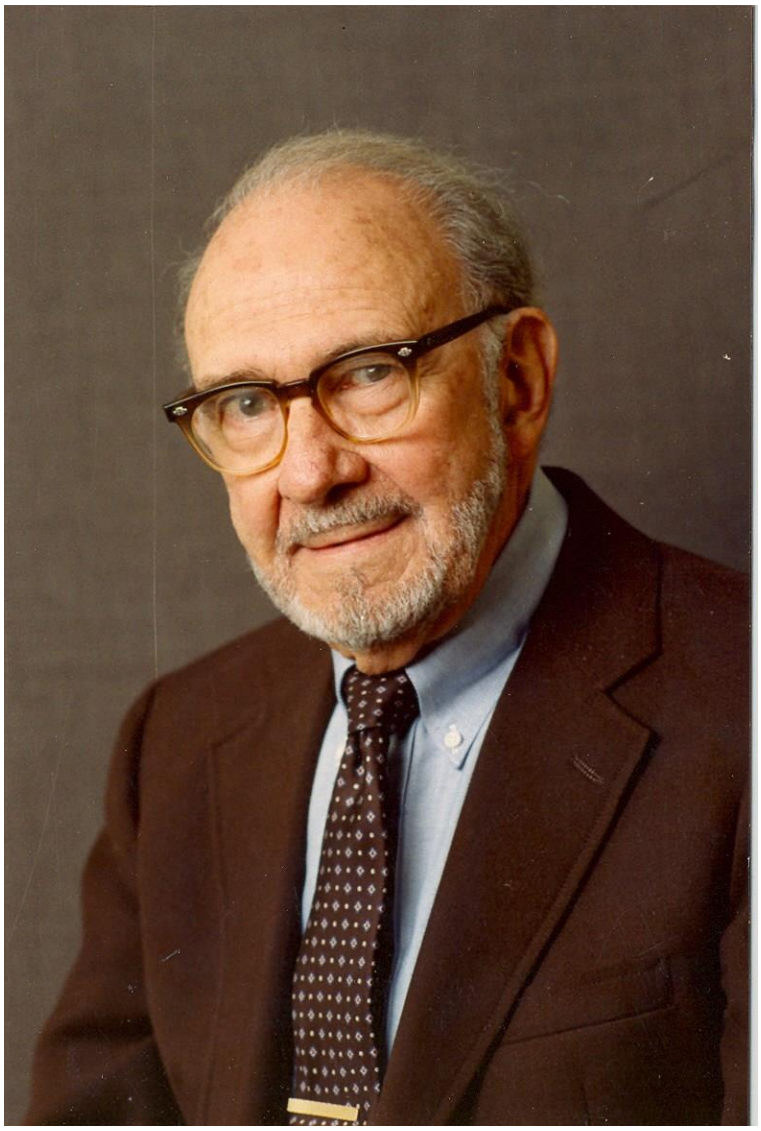


HARRY S. MOSHER
Member of the Faculty 1947-1980



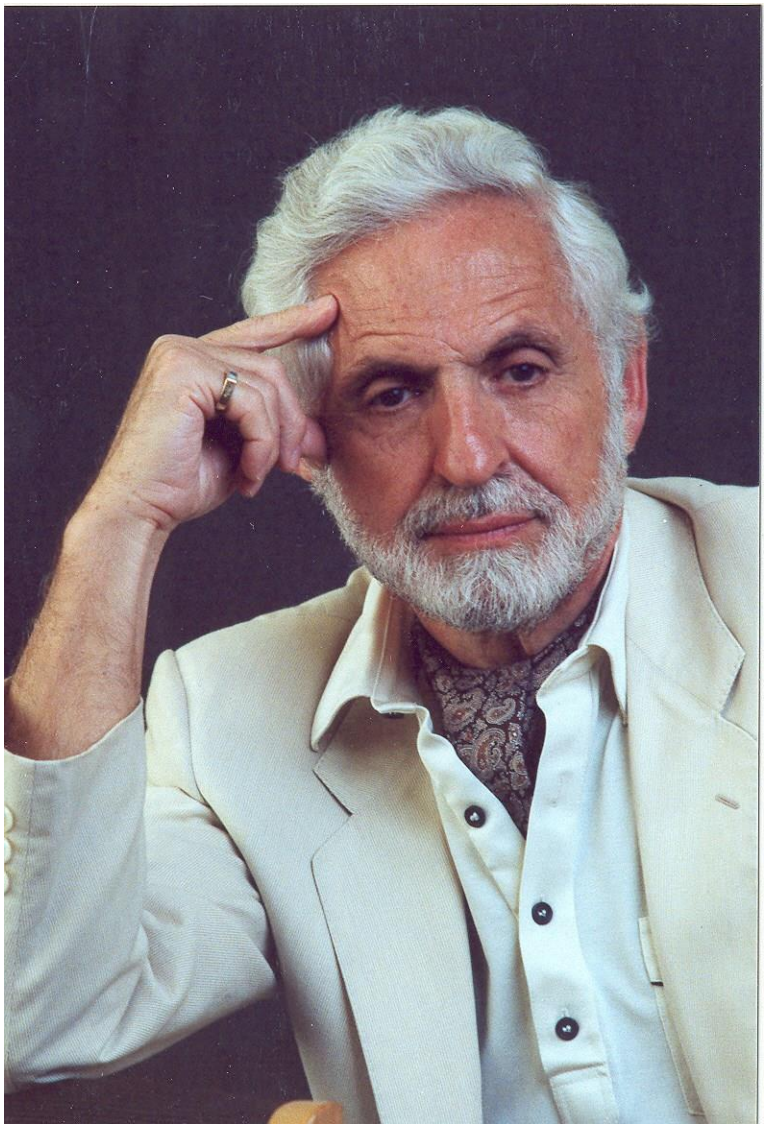
DOUGLAS A. SKOOG
Member of the Faculty 1947-1976

ERIC HUTCHINSON
Member of the Faculty 1949-1978

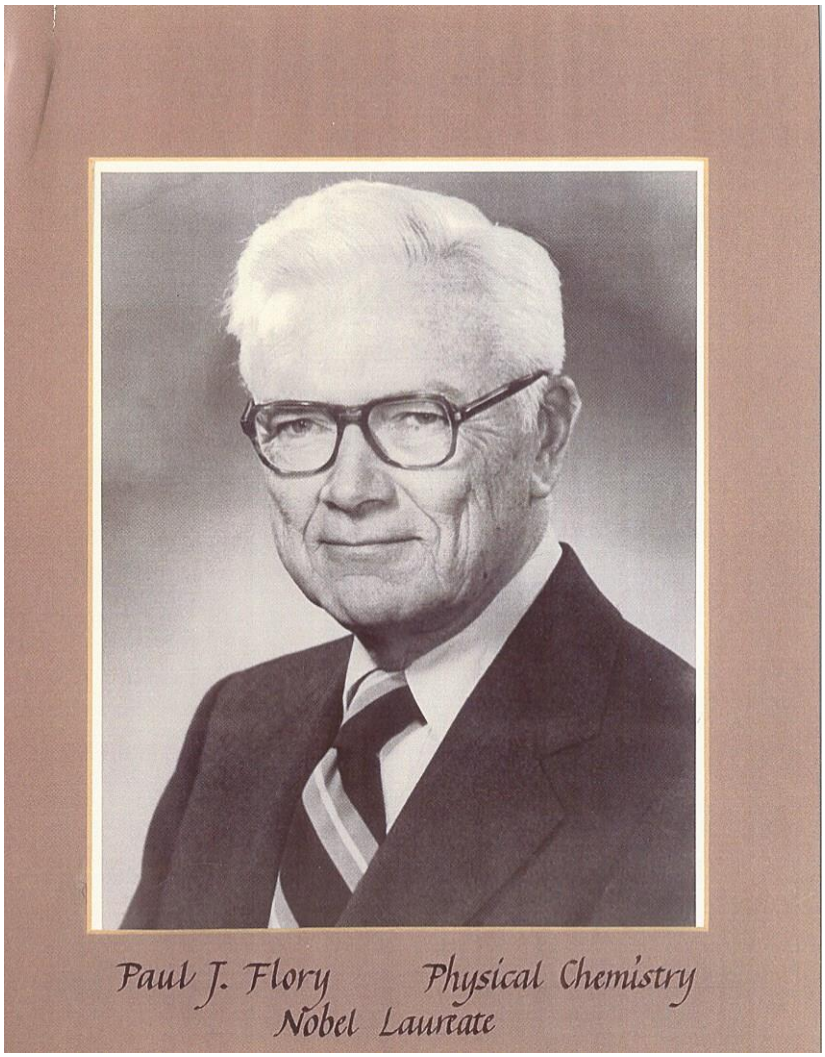


WILLIAM S. JOHNSON
Member of the Faculty 1960-1988
Executive Head 1960-1969
J.C. Jackson and C.J. Wood Professor 1975-1980

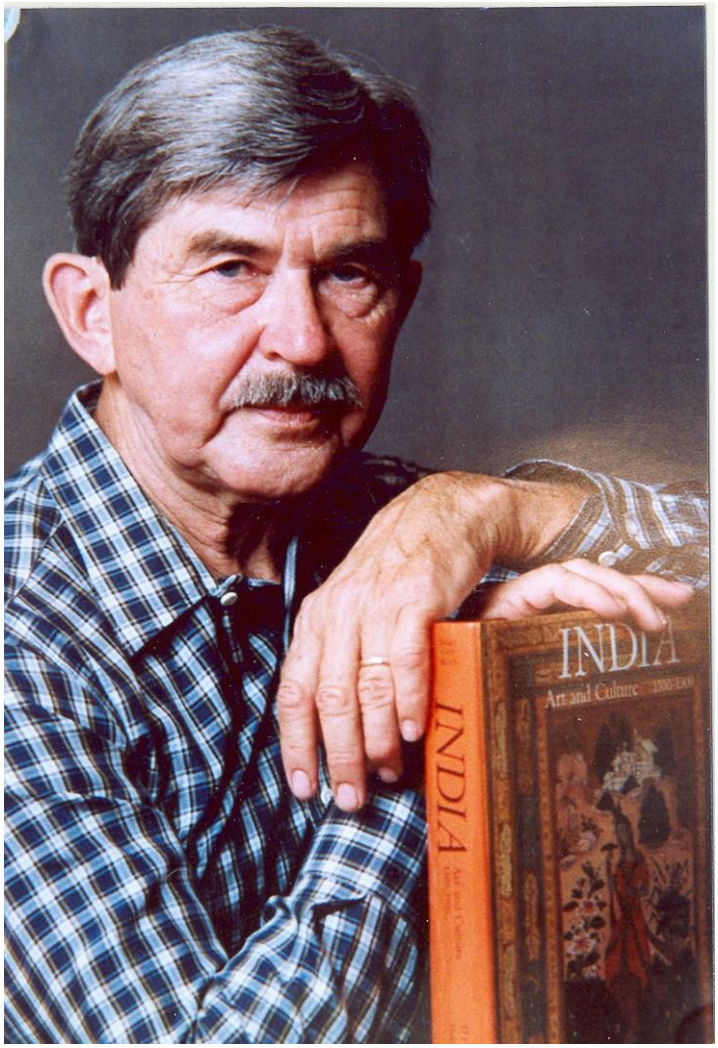
DAVID M. MASON
Member of the Faculty 1955-1987



CARL DJERASSI
Member of the Faculty 1959---



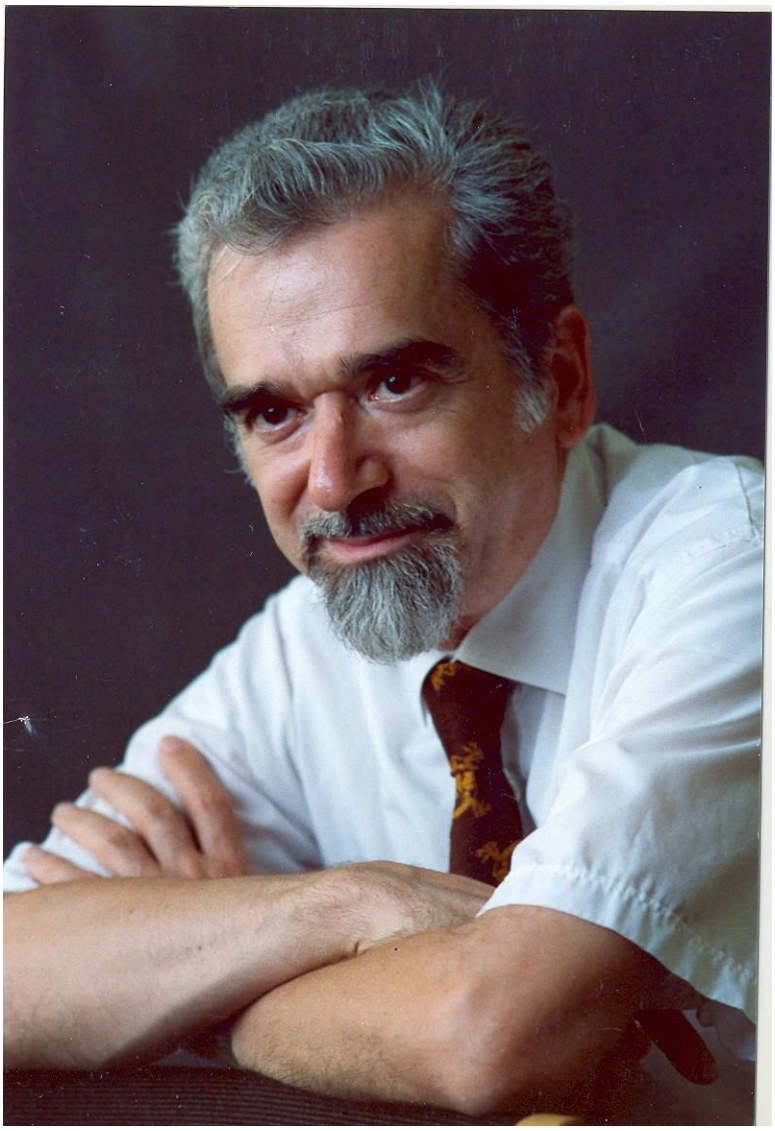
PAUL FLORY
Member of the Faculty 1961-1975
Chairman 1969-1972
J.C. Jackson and C.J. Wood Professor 1965-1975



HENRY TAUBE
Member of the Faculty 1962-1988
Chairman 1972-1974; 1978-1985
Marguerite Blake Wilbur Professor 1976-1985

JOHN BRAUMAN
Member of the Faculty 1963---
Chairman 1979-1983; 1995-1996
J.C. Jackson and C.J. Wood Professor 1980---

HARDEN M. McCONNELL
Member of the Faculty 1964-2000
Chairman 1989-1992
Robert Eckles Swain Professor 1979-2000

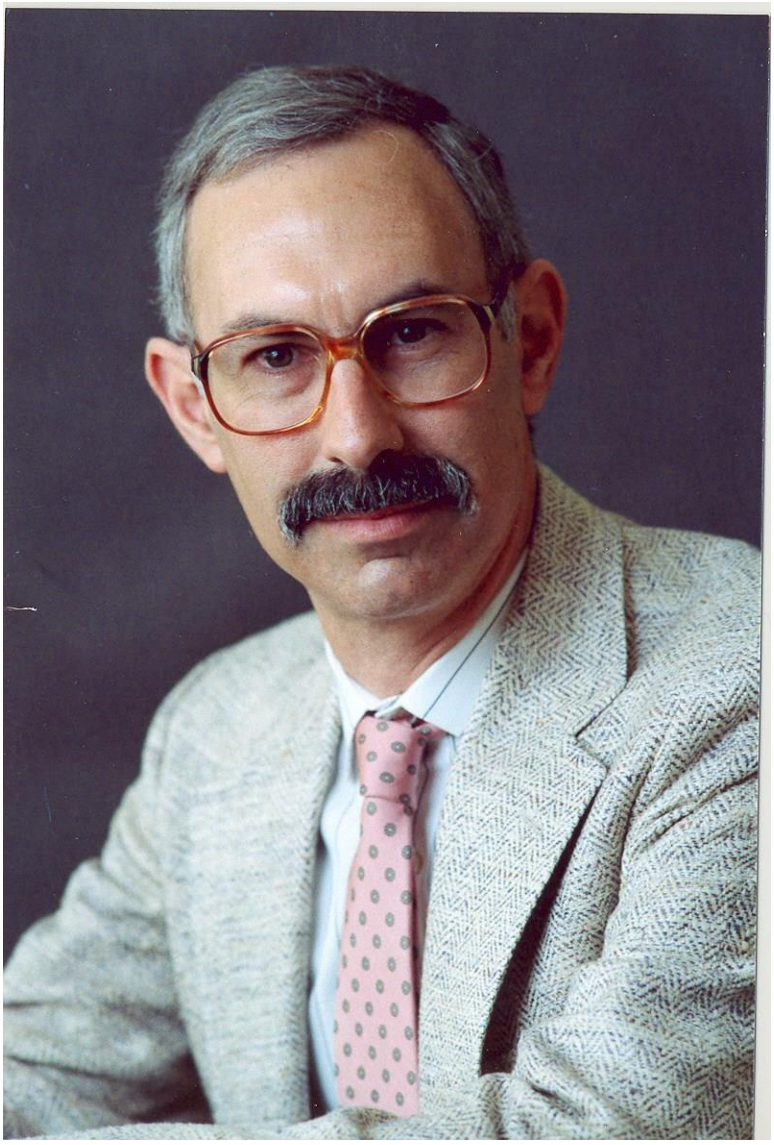


ROBERT PECORA
Member of the Faculty 1964---
Chairman 1992-1995

JAMES P. COLLMAN
Member of the Faculty 1967---
George A. and Hilda M. Daubert Professor 1980---

HANS C. ANDERSEN
Member of the Faculty 1968---
David Mulvane Ehrsam and Edward Curtis Franklin Professor 2000---

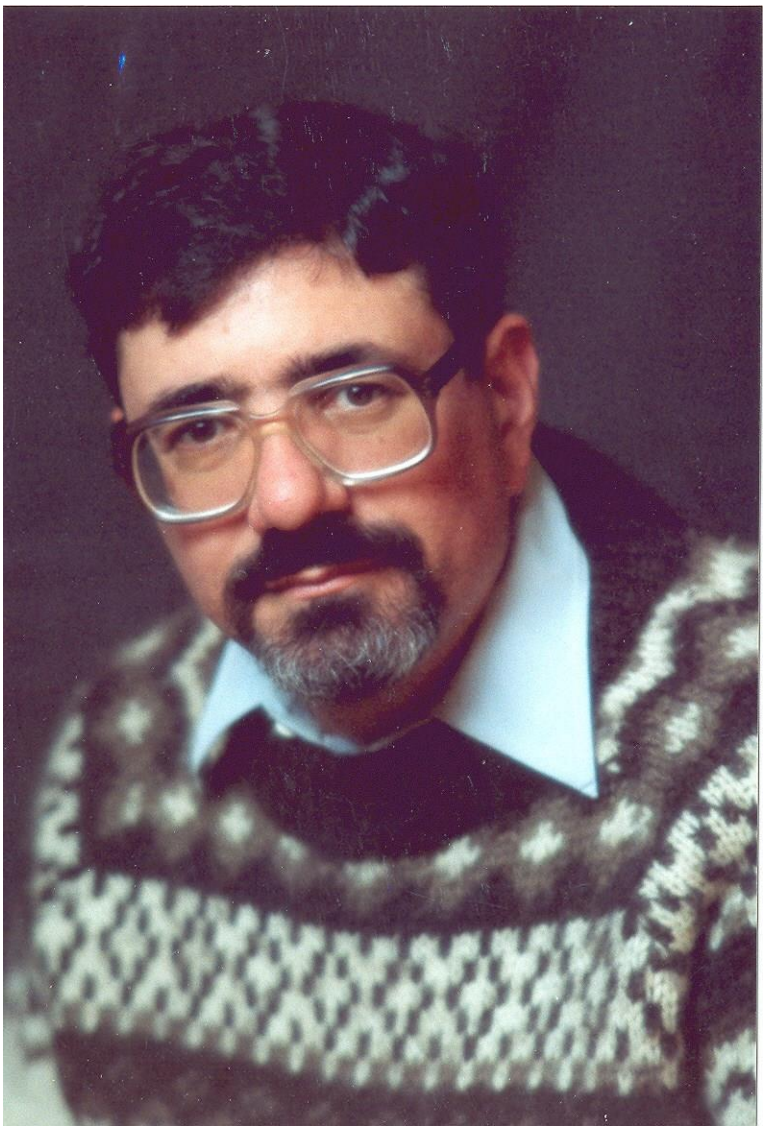
KEITH HODGSON
Member of the Faculty 1973---



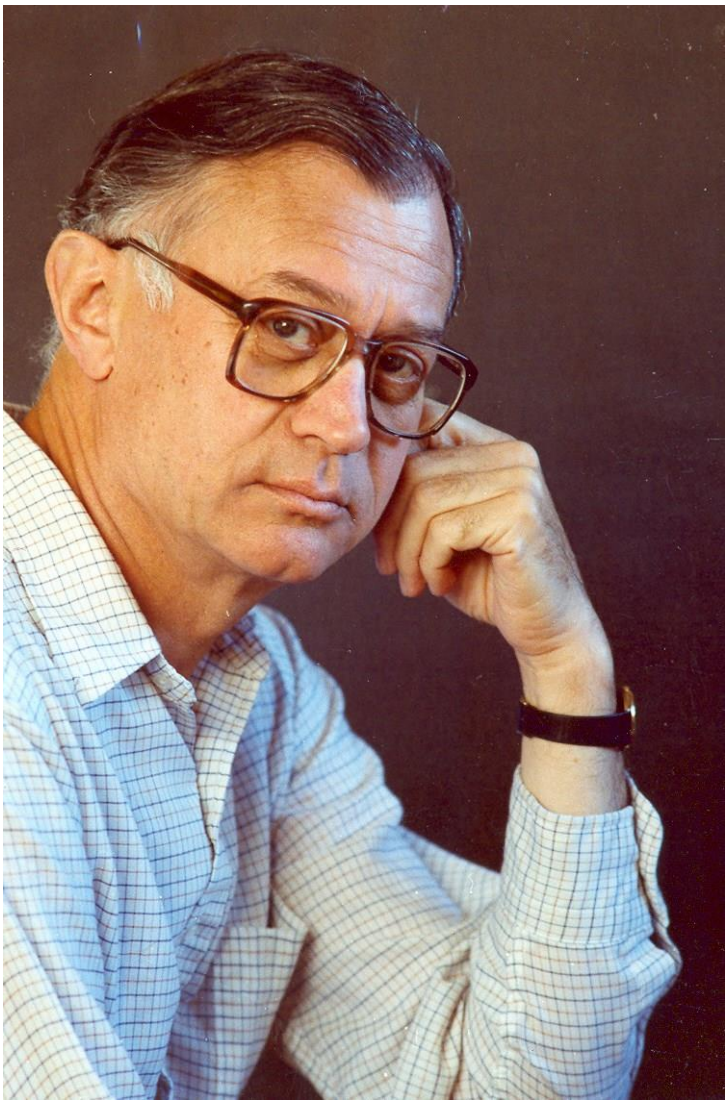
MICHAEL D. FAYER
Member of the Faculty 1974---
David Mulvane Ehrsam and Edward Curtis Franklin Professor 2000---

WRAY H. HUESTIS
Member of the Faculty 1974---

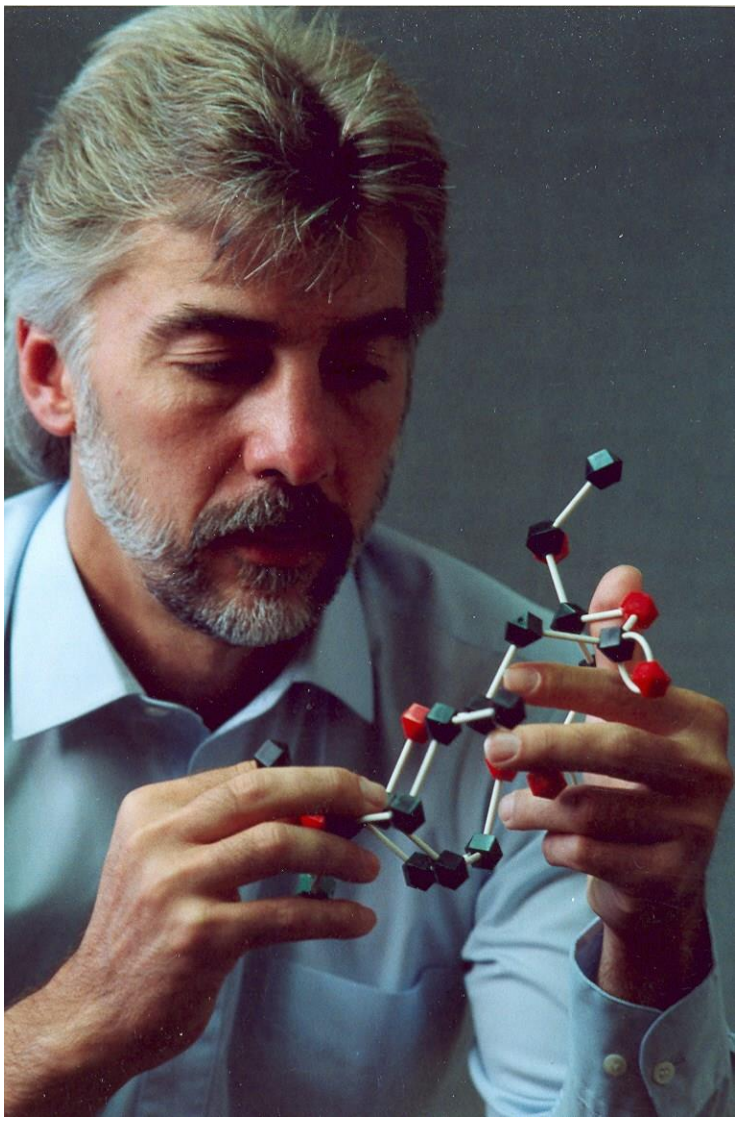
STEVEN G. BOXER
Member of the Faculty 1976---
Camille and Henry Dreyfus Professor 2000---



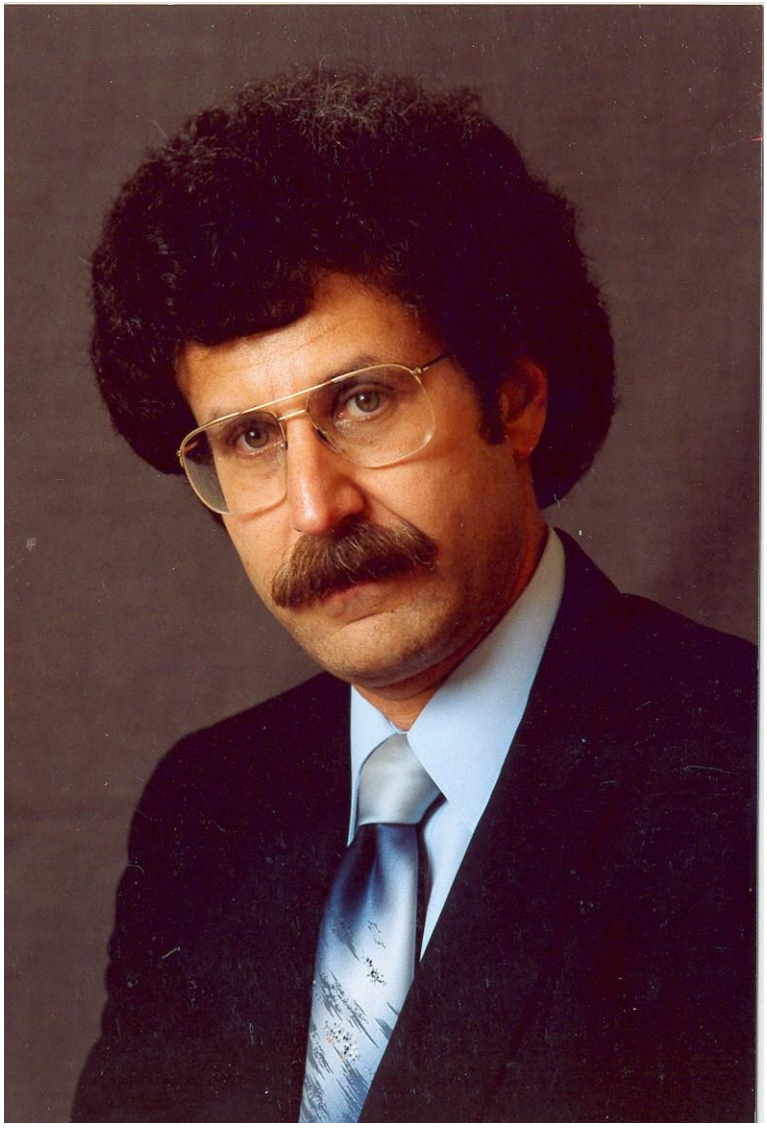
RICHARD ZARE
Member of the Faculty 1977--- Marguerite Blake Wilbur Professor 1986---



JOHN ROSS
Member of the Faculty 1980--- Camille and
Henry Dreyfus Professor 1985-2000



PAUL A. WENDER
Member of the Faculty 1981--- Francis W. Bergstrom Professor 1983---



EDWARD I. SOLOMON
Member of the Faculty 1982--- Monroe Spaight Professor 1982---

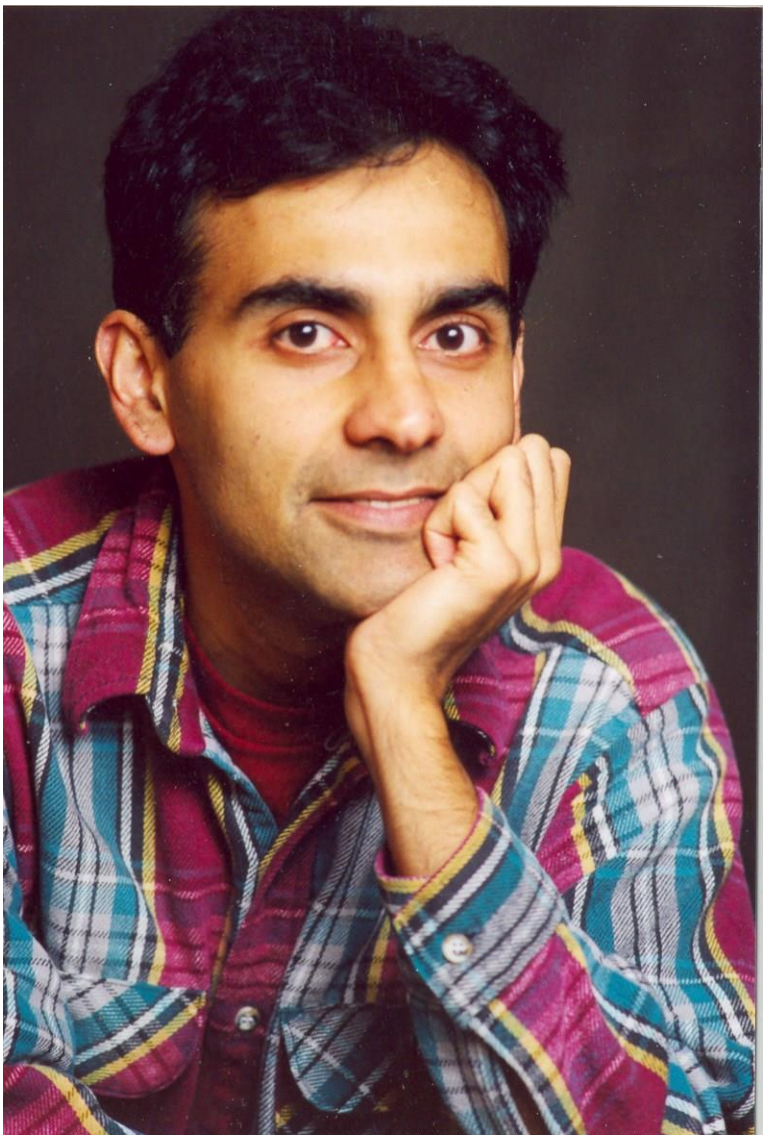
BARRY TROST
Member of the Faculty 1990--- Job
and Gertrud Tamaki Professor 1990---

ROBERT M. WAYMOUTH
Member of the Faculty 1988--- Robert Eckles Swain Professor 2000---

CHRISTOPHER E. D. CHIDSEY
Member of the Faculty 1992---

T. DANIEL STACK
Member of the Faculty 1991---

THOMAS J. WANDLESS
Member of the Faculty 1996---

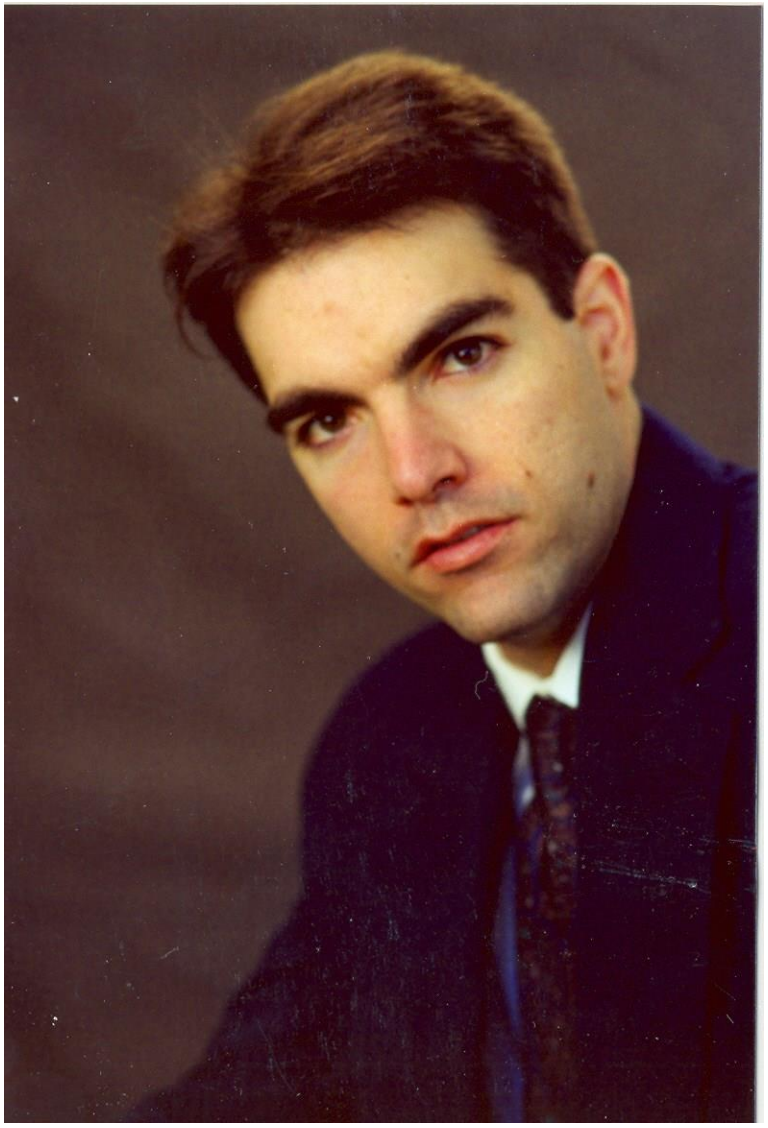


CHAITAN S. KHOSLA
Member of the Faculty 1997---

HONGJIE DAI
Member of the Faculty 1997---

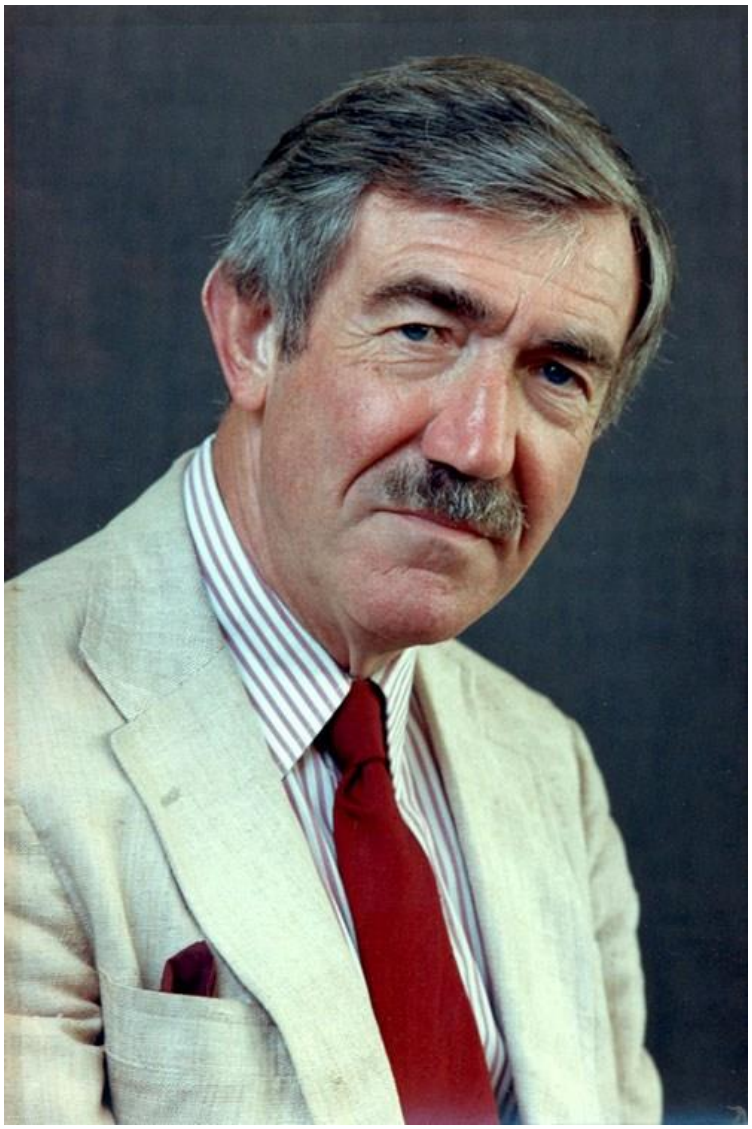
W. E. MOERNER
Member of the Faculty 1999---

VIJAY S. PANDE
Member of the Faculty 1999---



JUSTIN DU BOIS
Member of the Faculty 1999---

ERIC T. KOOL
Member of the Faculty 1999---



MICHEL J. BOUDART
Member of the Faculty (by courtesy) 1964---

DEGREES GRANTED

1977

B.S.

Backer, Mark Phillip
Basich, Anthony Michael
Chang, Akemi Chu-Shih
Cook, Stephen Lloyd
Corden, Barry B.
Diffley, David Michael
Doxsee, Kenneth Martin
Eckert, William Allen
Elgee, Susan Karlson
Finkler, Jack Allan
Fong, Rodney Sun On
Fraimow, Henry Shalom
Frambach, Bruce H.
Funk, Janet Lorraine
Killeen, Thomas Edward
Larson, Eric Robert
Mcquaid, Loretta Ames
Moser, John Rogers
Neubarth, Jeffrey Lee
Neubarth, Jesse Lee
Pitts, William Charles
Robinson, Gene Lee
Runge, Val Murray
Schwartz, Joseph Hersh
Wataha, John Charles
Winkler, Jay Richmond
Yokobata, Kathy Emi
Yuen, Yu-Fahn

1978

B.S.

Abdul-Rahim, Aziz Samir
Anderson, Warren Harry
Bates, David Westfall
Bierbaum, Tucker James
Bowers, Thomas Anderson
Bowles, Alfred Perry
Burgess, Donald Raymond
Chandler, Lois Ann
Daleke, David Leo
Ferrin, Lance Joseph
Friedman, Daniel Paul
Holmes, Susan Marie
Kim, Gloria S.
Kimelman, David
Lee, Tommy Chung
Levine, Marc Joseph
Moore, Eric Jan
Moormeier, Jill Alison
Randall, Brian Charles
Rapoport, Catherine G.
Schwimmer, Judy Lynn
Sutherland, Mark J.
Takimoto, Chris Hidemi
Tao, Helen Peggy
Trullinger, Daniel P.
Yamashita, Tsutomu
Zeitlin, Scott Olof

M.S.

Doxsee, Kenneth Martin
Hayes, Keefe
Sutton, Patrick Mark

1979

B.S.

Berg, Jeremy Mark
Brewer, Wheaton H.
Brose, William George
Chow, George
Cook, Arthur Gilbert
Pearlman, David Ari
Peterson, Mark Steven
Pfaff, Jon Martin
Pithayachariyakul, P.
Poulsen, Michael Thomas

Dean, Jeffrey Francis
Erdoes, Luke Stephan
Freeman, Irene Joyce
Friedman, Theodore H.
Hagberg. Robert Carl
Hayes, Kim F.
Hlavin, Patricia S.
Kellis, James T., Jr.
Reddy, Michele
Rubenstein, Stewart D.
Smith, Carol Lee
Spira, Darlene Joy
Stewart, Brian Auber
Strahan, Susan Elaine
Wang, Angela Chia-Chen

B.S. (cont.)

Leon, John Andrew
Li, Chiu-Kuen
McCallum, John Stuart
Olivero, Alan Gene
Pear, Mark Stephen

M.S.

Berg, Jeremy Mark
Heaney, John Milton
Moore, Eric Jan
Moore, Patrick Stephen
Scheffel, Doris Judith

1980

B.S.

Adamson, Gregory John
Adicoff, Samuel David
Bauman, David Scott
Cruise, Barbara Ann
Deas, Bruce David
Dirbas, Frederick Mark
Fisher, Lawrence E.
Friesen, Valorie Lyn
Gilden, Daniel Joseph
Hedges, James Kenneth
Kaiser, Brian Allen
Kersh, Robert Allen
Lopatin, Gerald Glen
Matlack, Kent Evan S.
Matsumoto, Alan Ken
Matyas, Bela Tamas
Morse, Eric Donald
Nader, Leslie
Nemcek, Paul Anthony
Olah, Ronald Peter
Rebagliati, Michael R,
Sipe, David Michael
Stewart, Bertrand F.
Weidmann, Heidi Ann

M.S.

Bannick, Mark Alan
Zebrowski, Beth Elena

1981

B.S.

Browne, Barry Jay
Carter, Donald Phillip
Cawley, Mary Virginia
Cher, Michael Louis
Clarke, Andrew Leonard
Crosby, Sharon Laurene
Dewhurst, Timothy A.
Miller, Bryan David
Miller, Kenneth Burke
Moran, Kelly Doreen
Muckle, Robert Peter
Obregon, Richard G.
Okamoto, Kelvin Tsugio
Peacey, James Randolph

Dominguez, Raul, Jr.
Dubin, Mark Edward
El-Saden, Suzie May
Eng, Bett Jean
Felix, Brian Ross
Fung, Carl Pui
Greeven, Brett Howard
Groen, Charles Gardner
Hall, Hilary Leigh
Hsieh, Abraham G.
Iverson, Brent Lee
Jardetzky, Theodore S.
Lamb, Richard Compton
Mathews, Lawrence S.
Schumacher, Mary Lynn
Scott, Leland James
Shneider, Benjamin L.
Sosnoff, Connie Susan
Sterman, Wesley David
Tim, Richard Walter
Truitt, Kenneth Edwin
Trusheim, Mark Robert

M.S.

Cooper, Christopher B.
Everhart, Edwin Thomas
Foley, Mary Ellen
Haley, Michael James
Miller, Bryan David

1982

B.S.

Anderson, Paul Kendrick
Bosley, David Lee
Brown, Thomas William
Camras, Louis Edward
Cortes, Andres Enrique
Curtiss, Thomas Jay
Foster, John Curtis
Garrett, Thomas Monroe
Harman, Walter Dean
Jameson, Nancy Anne
Johnson, Kevin Everett
Lee, Joselyn Carmel
Levine, David Howard
Li, Jennifer
Luttropp, Michael E., Jr.
Olsen, Jerry George
Powell, Stephen Forbes
Presnell, Scott Ronald
Rausch, Henry John
Silveira, Scott Goodwin
Smith, Stacia Ann

M.S.

Srikanthan, Suchetha

1983

B.S.

Bottini, John Joseph
Bowen, Jose Antonio
Brodrecht, Louisa M.
Dea, Stanley Kwan
Duxbury, Andrew Saunder
Eng, Soo Jean
Fisher, Joseph Martin
Galbraith, David Allen
Green, Peter Gordon
Kiser, Julie Diane
Maguire, Cary McIlwaine
Mittelstadt, Paul R.
Moore, Brian Scott
Murphy, Shari Kathleen
Negrete, George Raymond
Palmer, Anne Catherine
Perkins, Roberts Kincaid
Pylman, Michael Lester

Guion, Tamara Lynn
Hamilton, Christopher, D.
Hinaga, Scott Thomas
Hirsh, Donald Jerome
Hoskins, Renata Lea
Hsue, Ku-Yuen
Kang, Laura Chanju
Kennefick, Christine Ma
Keys, Christopher Joseph
Romer, Blair Lynn
Salessiotis, Anastasi
Slovic, Steven Brent
Wilson, Byron Eric

M.S.

Fisher, Joseph Martin
Liang, Yi
Peacey, James Randolph
Schaffer, Lauge J.

1984

B.S.

Albritton, Daniel M.
Amsterdam, Peter B.
Basich, Frank Mark
Blue, Linden Prause
Chin, Don Howard
Flowers, Charles Wesley
Focia, Pamela Jean
Govert, Joseph Alan
Green, Ava Joan
Halaska, Christopher R.
Haynes, Philip Anthony
Helm, Scott Whitney
Henzie, Gregory Mark
Kohler, Bern Earl
Kwong, Donna
Lee, Eric Jame
Mahaffey, Kenneth W.
Markowitz, Daniel R.
Oh, Dennis Hyun
Paige, Keith Thomas
Pless, Misha Luis
Sada, Mark Jeffrey
Sainten, Jeanette C.
Sather, Scott Douglas
Tracy, Adam Patrick
Wu, Victor Huateh

M.S.

Dunlap, Steven Eugene
Otonari, Yoshiko Alice
Scholl, David James

1985

B.S.

Adolphs, Ralph
Austin, Benjamin G.
Blair, Neil Frederick
Challener, Cynthia Anne
Chen, Fred Shinglih
Christy, Valerie Sue
Conn, Marcy Beth
Daly, Sharon Marie
Dekock, Bruce Wayne
Dubitsky, Robin
Frank, Steven William
Goulding, Evan Hayward
Leedy, Daniel Allan
Levounis, Petros
Li, David Hop
Lum, Esther Haimin
Nelson, Ronald Andrew
Ogas, Joseph Paul
Thornburg, Scott Camero

M.S.

Flamberg, Pearl E.L.
Furutani, Tracy Takashi

1986

B.S.

Brenner, Jerrell Don
Chou, Ripen
Fowle, Stephen Anthony
Handy, Jonathan Hall
Jay, Patrick Yin Kan
Keller, Jeffrey Francis
Knobel, Jennifer Ann
Koo, Carolyn Weimei
Mercer, Suzanne
Pham, Phuongchi Thi
Robinson, Timothy Oren
Swetland, John Frederic
Topham, Matthew Kent
Ungar, Lowell Warren

M.S.

Peiperl, Laurence
Tang, Wing Tsang
Terzakis, Christina Maria

1987

B.S.

Bishop, Janice Lynn
Bronzan, Rachel Neatby
Chen, Edward Po-Chung
Chen, Stephen Tai
Cohen, Stephen Andrew
Colvin, Vicki Leigh
Jackson, Paul Southgate
Luckey, John Andrew
Ruiz, Pedro Gustavo
Simon, Steven Richard
VanSlate-Teves, Marlo Michelle
Vassilovski, Edna

M.S.

Chang, Virginia Kim
Leep, Carolyn Jane
Lunt, Sharon Ruth
Rolston, Alice E.
Slater, Leo Barney

1988

B.S.

Foster, John Frederick
Keiler, Kenneth Charles
Lee, Shu Yin
McMahon, Michele Ann
Milan, David Joseph
Murata, Yoshihiko
Phillips, Joseph Perry
Quiton, Raimi Lia
Tran, Michael Qui Khoa
Whetzel, Rodney Jon

M.S.

Colbert, Heather Ann
Horowitz, Daniel Mark
Loh, Rhonda K.
Marquart, Angela Lynn
Mercer, Suzanne
Ruby, Michael Vernon

1989

B.S.

Bracker, Allan Stephen
Brewster, Abenaa Marcia
Carter, Lawrence Eugene
Pavlopoulos,Tricia Valerie
Skillman, Allan Geoffrey, Jr.
Su, Jack M.

B.S. (cont.)

Chang, Andrew Kenneth
Ekstrand, Bradley Cameron

M.S.

Bovino, Scott Charles
Bucenell, James Robert

Gibson, Douglas Allen
La Pointe, Anne Marie
Lucier, George Michael
Moriarity, John LeRoy
Crescimanno, Stephen Andrew
Foroughi, Joseph
Helwig, Kathleen Rebecca

1990

B.S.

Bowen, Richard Earl
Chew, Clifford Fay
Cho, Bryan Kenneth
Han, Michael Young
Holmes, G. Frank,III
Kang, Tammy Inyoung
Kantola, Angeline Rae
Lu, Patricia Ann
McMasters, Daniel Robert
Miyamoto, Leigh Hisako
Rosenberg, Bonnie Lisa
Sevilla, Brett John
Thompson, Andrew David

M.S.

Mazzola, Laura T.
Schreier, Cindy Gail
Stein, Kevin Michael
Tokmakoff, Andrei
Wong, Kelvin Ding-Kung

1991

B.S.

Arlas, Angela A.
Barron, Lorena
Brown, Samuel David
Chang, Grace C.
Giles, Todd Walker
Hamadeh, Samer Sabri
Harville, Michael Lee
Johnson, Christopher Sean
Kuo, Eric Ee-Tsaw
Kwan, Gina Pao
Lee, James Hon-Wei
Park, Hyoung Yoon
Randerson, James Tremper
Rezai, Nina
Schaaf, David Thomas
Shaw, Kristin-Ann Reid
Svoboda, Suzette Michelle
Wang, David

M.S.

Cunningham, Paula Lynn
Doede, Tina Mode
Friedman, Benson Kedar
Garcia, Jose Luis
Klepeis, Neil Edward

1992

B.S.

Aung, Thomas Lee
Azure Esquiro, Heather Lynn
Chapa, Eric Florentino
Choo, Bryan Keith
Goloboy, Jennifer Lee
Goodell, Maia Beth
Huang, Joy Yee-jia
Jacobson, Matthew Paul
Smith, Christopher Bradford
Taha, Sharif Alan
Tan, Kenneth Chi-Ming
Teng, Edmond Hua-Tung
Trauger, John Wesley
Wong, Kelvin Ding-Kung

M.S.

Bernstein, Robert Lawrence

Lum, Melissa A.
Mazzalupo, Stacy Marie
Sarti, Marc
McSwain, Hugh
Nelson, Catherine Henriette
Yanai, Makoto

1993

B.S.

Case, Suzanne Elizabeth
Choi, Clara Yong H.
Cohen, Seth Mason
Ramulu, Pradeep Yammanuru
Shogren, Traci Lynn
Struyk, Zachary John

B.S. (cont.)

Craig, Errol Andrew
Hoehn, Silvia Tammy
Knaak, Michael Aaron
Lundberg, Scott Ryan
Miller, Stephen Albert
Min, Caroline Lee
Mix, Gregory Paul
Parsons, Bradford Owen
Sweeney, Zachary Kevin
Tseng, Henry C.
Zaidi, Shahid Abbas

M.S.

Jiang, Naixiong
May, Jennifer Ann
Miller, Stephen Albert
Tebbe, Anne Louise

1994

B.S.

Baird, Geoffrey Stuart
Banthia, Vishal
Beck, Zachary Quinn
Bogle, Melissa Anne
Chabra, Inderjit Singh
Chen, Yu-Harn
Chyorny, Alexander
Elia, Andrew Eugene Hermann
Ganguly, Karunesh
Hammerstrom, Johan James
Hollander, David Avi
Jones, Michael Peter
Leonard, William G.
Lev-On, Topaz
Majewska, Anna Katarzyna
Mansour, Baubak
Maurer, Gregory Martin
Miller, Aubry Kern
O'Connor, Michael Marcel
Previde, Paul Michael
Quintana, Carlos
Satia, Priya
Seto, Anita Gaaryl
Sharpe, Bradley Allen
Sun, Johnny Wei-Ting
Tam. Derek Shieh
Unni, Vivek Kongot
Weissman, Kira Juliet
Widlansky, Michael Eric
Wu, Jie Julie
Yoon, Kenneth S.
Yukl, Steven Alex

M.S.

Bufford, Heather Lynn
Burton, Jonathan Michael
Chen, Amy Fang-Ya
Choo, Bryan Keith
Ellison, Erica Lawson
Gatev, Geo Geov
Patek, Anthony Jude

1995

B.S.

Chanda, Arnab Kumar
Chen, Erik S.
Chu, Penelope Wancie
Juul-Dam, Naya Nicole
Lee, Roger Chi-Che
Lin, Peter T.
Looger, Loren Lee
Miller, Weston Peter, IV
Minion, Daniel John
Odom, Teri Wang
Olhava, Edward James
Robinson, Donald Richard, II
Sauer, Alexis Fay
Schoettler, James David
Shah, Pradshant Chandrakant
Springer, Michael
Taghinia, Amir Hosein
Wu, Priscilla
Yang, Edward

M.S.

Abedin, Sakena
Argent, David B.
Claire, Karen Lynn
Eschelbacher, David Joseph
Evans, Julie Elizabeth
Fan, Andrew Tsao-Wen
Hammels, Debbi Elise
Lev-On, Topaz
Tracy, John Kilmer

1996

B.S.

Chao, Samuel Tay
Coachman, Kyle Bernard
de Blank, Peter Kennedy
Eubanks, Michael Andrew
Fergus, Kalimah
Fu, Kai-Ming Gregory
Galanter, Joshua Mark
Gudiksen, Mark Stout
Herndon, Kelley Barbara
Holmes, George Petersen
Hyde, Geoffrey David
Koh, Michelle Yee Ping
Lau, Nancy Che-Lui
Li, Howard Yeong-rung
Lin, Ken-Yu
Manning, Paul
Mears, Rachel Brooke
Nguyen, Huy Viet
Saketkhoo, Daniel David
Warren, Johanna Beth
Williams, Shara Carol

M.S.

Bublitz, Gerold Ulrich
Harris, Tracy Diane
Kane-Maguire, Kimberlee Ann
Lee, Sarah Marie
Limburg, William Henry
Mosley, David Wayne
Pfaltzgraff, Timothy David
Sauer, Alexis Fay
Schoettler, James David
Zhou, Huilin

1997

B.S.

Agoston, Agoston, Jr.
Baily, Melissa JIll
Baker, Juliet Barbara
MacDonald, Tyson Matthew
Norman, Derek Paul Geoffrey
Pini, Tunghi

Bickford, Lincoln Charles
Bowden, Shauna Lynn
Chang, Jaime Ilka
Chen, Judy Ling
Christensen, Dylan Grant
Chu, Kevin Taylor
Cutler, Serena Tracy
Frederiksen, John Karl
Gergely, Joshua Paul
Jolley, Matthew August
Krauss, Isaac Jonathan
Kwan, Alex Tan
Lin, Tony Kung-Ying
Rajagopalan, Harith
Roeder, Jason T.
Stark, Lucy Muriel
Wong, Jerry Thwin
Yu, Jessen

M.S.

Brown, Geoffrey Harris
Chin, Elbert
Gangwani, Deepa L.
Goldberg, Ellen Rachel
Gregory, T. Kalee
Krishnamurthy, Subhashini

1998

B.S.

Bacher, Claire
Buxbaum, James Leonard
Chinnavaso, Patrick Piya
Chiu, Anna
Chong, Kenneth Voon-Ling
Elghobashi, Nadia
Fielding, Krista Terese
Gaggar, Anuj
Ginsburg, Daniel S.
Greenman, Kevin Lloyd
Hidas, Laura Jean
Jung, Michael Chul
Perez, Steven Daniel
Potts, Jamaica Dawn
Sammis, Glenn Martin
Sengupta, Debleena
Sista, Akhilesh K.
Vassilakis, Athina
Vura-Weis, Joshua Alan
Whitson, Jared Myers
Yang, Eric Song-See

M.S.

Belyea, Brinn David
Cole, Adam Parker

B.S. (cont.)

Keatinge-Clay, Adrian Tristan
Mongan, John Thomas
Osterhout, Robin Elizabeth

M.S. (cont.)

Johnson, Amanda Jean
Wong, Jerry Thwin

1999 B.S.

Alexander, Jes
Appleman, Beth Helene
Chan, Emory Ming-Yue
Greenland, John Richard
Kulharni, Rajan Pramod
Kwan, Brian Joseph
Love, Jennifer Ann
Matross, Daniel Michael
Mukherjee, Kaushik
Peros, James Nicholas
Purewal, Ron Thomas
Speyer, Joseph Lee
Yazzie, Derrick Todd
Hackerman, Clayton David
Kucer, Brian Thomas

M.S.

Ballard, Scott David
Eleftheriou, Antigoni
Laine, Florence
Li, Beitao

Doctoral Degrees Granted

1976

Ph.D.	Adviser	Ph.D.	Adviser
Anderson, Michael Ted	Weinhold	Morrill, Kent Allen	Djerassi
Boettner, Wayne Alan	Flory	Olmstead, William N.	Brauman
Daub, Guido William	VanTamelen	Partridge, Leslie Gregg	Djerassi
Dixon, James Scott	Djerassi	Ross, Alonzo Harvey	McConnell
Finke, Richard Gerald	Collman	Shenvi, Ashokkumar	Johnson
Halbert, Thomas Risher	Collman	Sorrell, Thomas Nelson	Collman
Hetherington, William M.	Hudson	Taylor, Evelyn Jean	Djerassi
Jacobs, Russell Edward	Andersen	Ward, Carl Edward	Johnson
Luna, Elizabeth Jean	McConnell	Williamson, Michael	Taube
Matlock, Paul Lumpkin	Collman	Zimmerman, Albert H.	Brauman

1977

Andrews, John Richard	Hudson	Finn, Robert Gerard	Collman
Asubiojo, Olabode Idowu	Brauman	Fisher, Carolyn Huetter	Mosher
Beechan, Curtis Michael	Djerassi	Glover, Rodger Murray	Weinhold
Bingham, Alpheus, Jr.	Mosher	Kadehjian, Leo	VanTamelen
Bruya, James Edward	Johnson	Lam, Yiu-Lau	Boudart
Buhr, John Douglas	Taube	McPeters, Hamlin Lee	Brauman
Christian, Paul Albert	Collman	Rothrock, Richard Kent	Collman
Cramer, Stephen Paul	Hodgson	Sen, Judith Papish	Taube
Diamond, James Joseph	Hudson	Speth, David R.	Stephenson
Eccles, Thomas Keith	Hodgson	Stein, Cy Aaron	Taube
Elsenbaumer, Ronald Lee	Mosher	Suslick, Kenneth S.	Collman

1978

Carlson, James Gordon	VanTamelen	Neuberg, Mallory Kim	Collman
Carlson, Janet Lynn	Johnson	Schmittou, Eric Richard	Collman
Cornelius, Craig W.	Pecora	Schwartz, Martin A.	Drueckhammer
Denisevich, Peter, Jr.	Collman	Sheats, James Ray	McConnell
Dlott, Dana Donald	Fayer	Small, Vernon Royce, Jr.	Johnson
Dubas, Lawrence Francis	Johnson	Tullius, Thomas David	Hodgson
Gooden, Robert	Brauman	Van Antwerp, Craig L.	Djerassi
Hobbs, Frank Worden, Jr.	Johnson	Wieting, Robert Dean	Fayer
Hopla, Richard Earl	VanTamelen	Wong, Geoffrey, Basil	Holm
McClure, Natalie Lewis	Mosher	Zawacky, Susan K.S.	Taube

1979

Bjarnason, Jon Orn	Andersen	Kiang, Teddy Tian	Zare

Blair, Neal Edward	Brauman	Konopelski, Joseph P.	Djerassi
Bouma, Stanley Robert	Huestis	Loughhead, David G.	VanTamelen
Brown, Frederick J.	Djerassi	Lubman, David Mitchell	Zare
Cooper, Donald Edward	Fayer	Marrocco, Matthew Louis	Collman
Copeland, Bruce Raymond	McConnell	Nelson, Mark James	Huestis
Demers, James Paul	VanTamelen	Rosenfeld, Robert Neil	Brauman
Frank, Patrick	Hodgson	Schlotter, Nicholas E.	Hudson
Groh, Susan Eileen	Collman	Sutton, James Edward	Wender
Gupta, Arunava	George	Walker, Darrel Douglas	Taube
Hentges, Steven George	Sharpless	Wolber, Paul Kenneth	Hudson
Janousek, Bruce Kenneth	Brauman	Wolff, Thomas E	Holm

1980

Gouchanour, Craig Robert	Fayer	Nimitz, Jonathan S.	Mosher
Goldstein, Joel Ersin	Wollenberg	Pavelka, Lee Alfred	Mosher
Jackson, Robert Lloyd	Brauman	Reynolds, John Gordon	Holm
Jasinski, Joseph Martin	Brauman	Richardson, David E.	Taube
Kutzler, Frank William,	Hodgson	Stolzenberg, Alan M.	Holm
Madonik, Alex Michael	Collman	Taylor, Eric Deguyon	VanTamelen
Miller, Charles Milton	Zare	Webber, Bruce David	VanTamelen
Nachman, Ronald James	Mosher		

1981

Balakrishnan, K.	McConnell	Pellerite, Mark James	Brauman
Barnes, Craig Eliot	Collman	Roelofs, Mark Gerrit	Boxer
Belmont, James Alan	Collman	Rossiter, Bryant Edwin	Sharpless
Bencosme, C. Susana	Collman	Sessler, Jonathan I.	Collman
Bucks, Rodney Ray	Boxer	Shortt, Alexandra Baran	Mosher
Garver, Lee Charles	VanTamelen	Stanton, Susan Gail	Hudson
Geselowitz, Daniel A.	Taube	Walkup, Robert Douglas	Djerassi
Howard, Frank Davis, IV	McConnell	Woodard. Scott Santford	Sharpless
Hwu, Jih-Ru	VanTamelen	Zawacky, Steven R.	VanTamelen
Keegan, Joseph Daly	Djerassi	Zero, Karl Michael	Pecora
Nelson, Keith Adam	Fayer		

1982

Armstrong, William H.	Holm	McCord, Elizabeth F.	Boxer
Co, Man Sung	Hodgson	Miller, Robert John D.	Fayer
Crandell, Christopher W.	Djerassi	Oliver, Nelson Henry	Pecora
Drzaic, Paul Stephen	Brauman	Olson, Radley Wahl	Fayer
Johnson, Mark Albert	Zare	Wann, Grady Spurgeon	Collman
Kosydar, Karen Maria	Collman		

1983

Altkorn, Robert Ira	Zare	Guest, Joyce Anne	Zare
Bott, Steven Eric	Pecora	Loring, Roger Frederic	Fayer
Brucat, Philip John	Zare	Moog, Richard Samuel	Boxer
Chidsey, Christopher E.	Boxer	Moylan, Christopher R.	Brauman
Conradson, Steven D.	Hodgson	Penner-Hahn, James E.	Hodgson
Desiderio, Russell A.	Hudson	Prisant, Michael Gary	Zare
Ediger, Mark Donovan	Fayer	Weis, Robert Mark	McConnell
Feldman, Kenneth Scott	VanTamelen	Woo, Lee Keith	Collman
Ferrell, James E., Jr.	Huestis	Wood, Peggy Marie	Ross
Flamberg, Alan	Pecora	Zimmermann, Edwin C.	Brauman

1984

Brothers, Penelope Jane	Collman	Kuki, Atsuo	Boxer
Durant, Joseph Leo, Jr.	Zare	Lee, Howard Wing Hoon	Fayer
Faler, Dennis Leroy	VanTamelen	Raybuck, Scott Alan	Collman
Gorthey, Lee Ann	Djerassi	Smith, Teresa Anne	Hodgson
Kodadek, Thomas James	Collman	Tumas, William	Brauman
Kubiak, Glenn D.	Zare	Wishart, James Fred	Taube

1985

Allendorf, Mark Donald	Solomon	Outka, Duane Alan	Madix
Barfknecht, Andrew T.	Brauman	Park, Jung Ki	Pecora
Chuang, Mei-Chen	Zare	Patterson, Frank Godwin	Fayer
Daleke, David Leo	Huestis	Pugh, Spencer Ian	Ross
Keenan, Richard M, Jr.	Wender	Ryoo, Ryong	Boudart
Keep, Gerald Timothy	Huestis	Salomon, Karen Elena	Brauman
Kuo, John Emerson	Zare	Shu, Yee Leung Arthur	Djerassi
Lieber, Charles Michael	Lewis	Ware, David Charles	Taube
Maier, Karyl Robbers	Pecora	Weber, Robert Sheldon	Boudart
Maiquist, William K.	Mason	Webster, Nicholas J.	Pirrung
Marks, Jeffrey	Brauman	Zebrowski, Beth Elena	Fuller
McGeehan, Gerald M.	Pirrung	Zhang, Guang	Boudart
Newton, Alexandra C.	Huestis		

1986

Birnbaum, Eric Stephen	Boudart	Hendricks, Neil Hyer	Collman
Cho, Jin-Ho	Djerassi	Honeycutt, John Dana	Andersen
Conaway, William Eugene	Zare	Johnson, Arden Phillip	Taube
Correia, Carlos Duarte	Djerassi	Kim, Kimoon	Collman
Dasgupta, Amitava	Djerassi	Levan, Mel Edward	Ross
Deaton, Joseph Charles	Solomon	McDevitt, John Thomas	Collman
Ding, Kejian	Andersen	Pate, James Edmund	Solomon

Domingue, Raymond P.	Fayer	Reem, Richard Carroll	Solomon
Ferry, Laura L.	Lewis	Rose, Todd Steven	Fayer
Fitzgerald, Jeffrey P.	Collman	Subramaniam, Sriram	McConnell
Gewirth, Andrew A.	Solomon	Walsh, Cecilia Ann	Fayer
Han, Chau-Chung	Brauman	Werner, John Arnold	Pirrung
Harman, Walter Dean	Taube		

1987

Bender, Thomas Michael	Pecora	Moy, Vincent Thomas	McConnell
Blake, Richard Stanley	Zare	Noda, Chifuru	Zare
Casagrande, Louis G.	Lewis	Olivera, Alan Gene	Wender
Cooper, Christopher B.	Wender	Pompliano, David Leo	Trost
Cordone, Rossella Maria	Taube	Rakestraw, David Jerry	Zare
Deamicis, Carl Vincent	Pirrung	Rosenblum, Mark Douglas	Lewis
Didziulis, Stephen V.	Solomon	Segall, Jeffrey	Zare
Frey, Thomas Edwin	McConnell	Singh, Sunil Kumar	Wender
Huang, Xiaohua	Zare	Sitz, Greg Orman	Zare
Ihle, Nathan Charles	Wender	Takiff, Larry Conrad	Boxer
Jacobs, Dennis C.	Zare	Thomson, Stephen Andrew	Pirrung
Kau, Lung-Shan	Hodgson	Varadarajan, Raghavan	Boxer
King, Steven Anthony	Trost	Wetzel, Donna Marlene	Brauman
Kummel, Andrew Clyde	Zare	Williamson, James R.	Fayer
Lee, Hee-Yoon	Wender	Wilson, William Larry	Fayer
Mak, Chi Ho	George	Woolworth, Vicki S.	Huestis
McKillop, John Slaton	Zare		

1988

Allendorf, Sarah Williams	Solomon	Lazar, James Gilbert	Ross
Bolding, Barry Charles	Andersen	Newell, Vincent John	Fayer
Brand, John Lawrence	George	Peries, Rohan	Wollenberg
Burke, Martin Luther	Madix	Petersen, Kristen Ann	Fayer
Butcher, Kristine Dianne	Solomon	Reimer, Leah Maria	Frost
Cordeiro, Lucinda Maria	Djerassi	Scanlan, Thomas Sterling	Trost
Deckert, Alice Ann	George	Schmidt, Michael Hans	Lewis
Garner, James Michael	Collman	Sorlie, Susan S.	Pecora
Hahn, Jong Hoon	Zare	Tanoury, Gerald Joseph	Trost
Hampton, Philip David	Collman	Waldeck, Janet Rossel	Zare
Harding, Robert Hibbard	Ross		

1989

Arumainayagam, C. Ravindran	Madix	Ross, Paul Kevin	Solomon
Baer, Susan	Brauman	Santangelo, Patrick G.	Lewis

Koehler, Birgit Gundula	George	Tro, Nivaldo Jose	George
Kosbar, Laura Louise	Frank	Vance, William Neal	Ross
Levine, Barry Haskell	Wender	Venburg, Gregory Dean	Collman
Lockhart, David Jay	Boxer	Yee, Gordon Trent	Collman
Loo, Seng Hai	Frost	Zenobi, Renato F.	Zare
McDonald, Frank Edward, Jr.	Wender	Zhang, Rong	Zare
Meth, Jeffrey Scott	Fayer		

1990

Arena, Mark Vincent	George	Matelich, Michael C.	Trost
Avila, Luis Zulueta	Frost	Matsuoka, Richard Tadao	Trost
Berger, Susan	Brauman	McCormick, James Malcolm	Solomon
Cantor, Adam Scott	Pecora	Middendorf, Thomas R.	Boxer
Cribbs, Cynthia M.	Wender	Mihalich, Jennifer E.	Brauman
Draths, Karen Margaret	Frost	Narasimhan, L. Ravi	Fayer
Gebhard, Matthew S.	Solomon	Nielsen, John Bryant	Trost
Giner, Jose-Luis Pedro	Djerassi	Rabvinowitz, Michael H.	Djerassi
Gottfried, David Scott	Boxer	Rice, Peter Anthony	McConnell
Grese, Timothy A.	Trost	Silva, Christopher J.	Djerassi
Gupta, Prasenjit	Zare	Sleiman, Hanadi Farouk	McElwee-White
Gutow, Jonathan Howard	Zare	Snapper, Marc Leslie	Wender
Hjelmfelt, Allen T.	Ross	Valenca, Gustavo Paim	Boudart
Holcomb, Matthew James	Collman	Wagenknecht, Paul S.	Collman
Hutchinson, James Evan	Collman	Wakatsuki, Soichi	Hodgson
Kliner, Dahv Adam V.	Zare	Zhoa , Daqing	Zare
Lin, Jian-yi	Solomon	Zisk, Matthew Bruce	Collman
Littau, Karl Anthony	Fayer		

1991

Arthur, David Alan	George	Leahy, David John	Zare
Ayre, Caroline Rodney	Madix	Lee, Virgil James	Collman
Baldwin, Michael J.	Solomon	Marrs. Christopher M.	Trost
Boering, Kristie Ann	Brauman	Marshall, Christopher D.	Fayer
Bronikowski, Michael J.	Zare	Maxey, Claudia Tata	McElwee-White
Buntine, Mark Anthony	Zare	Meixner, Donald L.	George
Campbell, James Henry	Zare	Mori, Eugenia	Ross
Carter, John David	McElwee-White	Nunn, David Scott	Pirrung
Chang, Virginia Kim	Frost	Osterheld, Thomas H.	Brauman
Chevalier, Timothy S.	Ross	Piehler, Lars Tynegate	Frost
Coon, Peter Alan	George	Rejto, Paul Abraham	Andersen
DeLong, Mitchell A.	Wender	Samples, Marjorie Sue	Ross
Doede, Tina Mode	Brauman	Shane, Stacy Francine	Zare
Dorfman, Robert	Fayer	Shi, Yian	Trost
Fourkas, John Theodore	Fayer	Simes, Barbara E.	McConnell

Frazen, Stefan H.	Boxer	Stein, Alan Daniel	Waymouth
Frost, Amy Elizabeth	Fayer	Theriault, Thomas P.	McConnell
Guion, Todd Allen	Fayer	Tracy, Mark Alfred	Pecora
Ha, Yunkyoung	Collman	Tsekouras, Athanassios	Zare
Haynes, David Robert	George	Tsujimoto, Kim Kiyoko	Ross
Hines, Melissa Ann	Zare	Van Vranken, David Lee	Trost
Hipskind, Philip A.	Trost	Xie, Jinchun	Zare
Kolasinski, Kurt W.	Zare	Zhang, Xumu	Collman
Lambright, David Glenn	Collman	Zhang, Yan	Solomon

1992

Adelman, David Ellis	Zare	Michelsen, Hope Andrea	Zare
Arndtsen, Bruce Alan	McElwee-White	Mucciaro, Thomas Paul	Wender
Balasubramanian, Sriram	Boxer	Phan, Ly Tam	Trost
Brinkman, Elizabeth Ann	Brauman	Rice, Kenneth Duane	Wender
Caley, Catherine E.	Collman	Schiffer, Sharon Hammes	
DeWitt, Jane Gail		Stankus, John Joseph	Fayer
Dillon, Anne Catherine	George	Stevenson, Michael John	Huestis
Greenfield, Scott R.	Fayer	Strocker, Jonathan Walter	Boxer
Jeong, Jin-Hyun	Trost	Tan, Grace Oon-Bee	Hodgson
Kesti, Michael R.	Waymouth	Waters, Susan Ivy	Huestis
Kingsbury, Kevin Bruce	McElwee-White	Westre, Eric Douglas	Pirrung
Kocks, Peter Friedricks	Ross	Wilbur, James Lawrence	Brauman
Li, Zai-Wei	Taube	Wladkowski, Brian Douglas	Brauman
Gedde, Margaret Maulucci	Huestis	Wolff, Anita Natalie	Ross

1993

Arnold, Hilary Joan	Collman	Miller, Benjamin Locke	Wender
Banovetz, John Patrick	Waymouth	Mogstad, Anne-Lise	Waymouth
Brown, Carl Alexander	Solomon	Moxness, Michael Stuart	Huestis
Coates, Geoffrey William	Waymouth	Parquette, Jonathan Robert	Trost
East, Allan Leonard Leslie	Allen	Robinson, Mary Beth	George
Hung, Yu-Fen	Ross	Shadle, Susan Emery	Solomon
Kellen-Yuen, Cynthia Jean	Collman	Stemwedel, Janet Douglas	Ross
Knight, Kyle Sterling	Waymouth	Tebbe, Mark Joseph	Wender
Lin, Sansan	Huestis	Williams, Skip	Zare
Malik, Pratap	McConnell	Wise, Michael Lester	George
9Martin, David Patrick	Drueckhammer	Yamout, Maria A.	McConnell
Middlebrook, Ann Marie	George	Yang, Eungyeong	Huestis

1994

Beckham, Syzanne	Wender	Jones, Glenn Clark, Jr.	Zare
Brown, David Earl	George	Maechling, Claude Ricketts	Zare
Brown, James William	Huestis	Marcus, Andrew Hadley	Fayer
Chng, Leng Leng	Collman	Massey, Scott Taylor	McElwee-White
Dadoo, Rajeev	Zare	Merrill, Philip Bradley	Madix
Darrow, James William	Drueckhammer	Offord, David Alan	Griffin
Decatur, Sean Michael	Boxer	Pavlosky, Mark Alan	Solomon
Duncan, Rachel	Drueckhammer	Pulver, Sabine	Solomon

Ennis, Matthew Shields	Collman	Remy, Eric David	Andersen
Fang, Liling	Zare	Sannes, Kristin Ann	Brauman
Fish, H.T.	Collman	Schoch, Thomas Kettering	McElwee-White
Fishman, Harvey Abraham	Zare	Shear, Jason Ben	Zare
Guckert, Jeffrey Allen	Solomon	Shi, Zeng	Griffin
Guettler, Robert David	Zare	Simpson, William Robert	Zare
Hansen, Nancy Fisher	Andersen	Steffen, Martin Andrew	Boxer
Higuchi, Robert Iyeo	Trost	Steffens, Kristen Lisa	Brauman
Hsiao, Yu-Ling	Waymouth	Tokmakoff, Andrei	George
Jesudason, Cynthia D.	Wender	Tyvoll, David Alvin	Collman

1995

Bagchi, Kunal Saurov	Andersen	Linford, Matthew Richard	Chidsey
Bunt, Richard Christopher	Trost	Liu, Hongbin Isaac	Hodgson
Buntel, Christopher John	Griffin	Liu, Hui	Pecora
Chen, Deborah Weng Chun	Trost	Nielse, Ida Beck	Allen
Chen, Lingling	Hodgson	Park, Hongkun	Zare
Fleitz, Fred Joseph	Trost	Perry, Catherine Leigh	Collman
Gerusz, Vincent Joseph	Trost	Rawlins, David Brent	Wender
Glass, Timothy Edwards	Wender	Salafsky, Joshua S.	Boxer
Gravert, Dennis James	Griffin	Sengupta, Abhijit	Fayer
Hagen, John Peter	McConnell	Smith, Thomas Everett	Wender
Hall, Michael Patrick	Huestis	Spagnol, Michael Daniel	Trost
Hauri, David Courard	Ross	Stein, Kevin Michael	Waymouth
Herrmann, Paul Clifford	Collman	Swallen, Stephen Fischer	Fayer
Kalogerakis, Konstantinos	Zare	Westre, Tami Ellen	Hodgson
Li, Yong	Trost	Zimdars. David Alan	Fayer

1996

Brewer, Timothy Robert	Fayer	Huang, Xiaohua	Boxer
Bruce, Michael David	Waymouth	Kendall, Jonathan Lee	Collman
Chan, John B.	Trost	Krische, Michael Joseph	Trost
Chen, James Y.	Huestis	LaCroix, Louis Ben	Solomon
Chen, Shixiong	Fayer	Liang, Michael Nien	McConnell
Clement, Simon John	Zare	Ma, Yeming	Zare
Craig, Stephen Lawrence	Brauman	Sutton, James C.	Wender
Dris, Hariklia	Waymouth	Terry, Jeffrey Harve	Pianetta
Floreancig, Paul Edward	Wender	Vogel, Kurt William	Drueckhammer
Fu, Lei	Collman	Vos, Beverly Ann	Trost
Galanter, Joshua Mark	Brauman	Weidemaier, Kristin	Fayer
Gatev, Geo Geov	Brauman	Yeung, Constance	Griffin
Goldsmith, Joshua O.	Bauer	Zhong, Meili	Brauman
Green, Richard James	Zare		

1997

Bubliz, Gerold Ulrich	Boxer	Loeb, Kelly Elise	Solomon
Burson, Kim Katrina	Khosla	Luo, Huihong	Chidsey
Chiu, Daniel Teyun	Zare	McKnight, Andrew Lelans	Waymouth
Chupak, Louis S.	Trost	Moore, Laura Jane	Boxer
Dake, Gregory Richard	Trost	Narlikar, Beeta Jayant	Hershlag
Diachun, Nathan Alden	Fayer	Reitz, John Bradford	Solomon
Dore, Timothy Michael	Wender	Richardson, Maia Therese	Khosla
Dudash, Joseph, Jr.	Trost	Rickert, Paula Karen	Huestis
Ellison, Mark David	Zare	Schnaderbeck, Matthew J.	Trost
Gamelin, Daniel Robert	Solomon	Shaughnessy, Kevin Harold	Waymouth
Grimes, Michael Turner	Drueckhammer	Sundaram, Uma Maheswari	Solomon
Hanson, Edward Thomas	Pecora	Touami, Sofia Meriem	Wender
Harford, Steven Thomas	Collman	Um, Pil-Je	Drueckhammer
Hemming, Brooke L.	Brauman	Wade, Christopher Paul	Chidsey
Houze, Jonathan Brice	Wender	Xu, Hao	Zare
Jonas, Robert Thomas	Stack	Zhang, Hua	Hodgson
Kravchenko, Raisa L.	Waymouth	Zhou, Huilin	Boxer
Lee, Daesung	Wender		

1998

Chanbinyc, Michael L.	Brauman	Kang, Jie	Chidsey
Chao, Cecilia E.	Andersen	Koehler, Michael E.	Wender
Corte, James Richard	Trost	Lee, Chul Bom	Trost
Doherty, George Andrew	Trost	Mazzola, Laura T.	Boxer
Enemark, Eric John	Stack	Meng, Wei	Wender
Everest, Michael Alton	Zare	Millett, Ian Sinclair	Ross
Gilman, Alexander	Ross	Petoff, Jennifer Lynn	Waymouth
Hu, Yirong	Brauman	Rose, Kendra Sue	Solomon
Janaway, Gordon Andrew	Brauman	Wang, Yadong	Stack
Kallander, Lara Schwartz	Zare	Zombrano, Jorge Luis	Trost
Kandel, S. Alexander	Zare		

1999

Bibart, Richard Todd	Drueckhammer	Livingston, Robert Charles	Trost
Burson, Kim Katrina	Huestis	Matthews, Carl Martin	Zare
Dubois, Jennifer Lynn	Hodgson	Millward, Dan Bergen	Waymouth
Fernandez-Alonso, Felix	Zare	Mukherjee, Pulakesh	Stack
Francis, Rick Stanley	Fayer	Pitts, Steven Jerome	Andersen
Gillette, John Sebastian	Zare	Ray, Gregory Thomas	Wandless
Harford, Steven Thomas	Collman	Rector, Kirk D.	Fayer
Hemming, Brooke	Brauman	Rodriguez, Nestor	Zare
Hu, Robert Baonian	Boxer	Sundermann, Michael	Trost
Jonas, Robert Thomas	Stack	Trigiante, Giuseppe	Gast
Koehler, Michael	Wender	Yang, Yi-Shan	Solomon
Lippa, Blaise Scott	Wender	Zhao, Hui	Zare

Luo, Huihong	Chidsey