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