

CHEMISTRY AT THE UNIVERSITY OF SOUTH FLORIDA (USF), 1960–2004

DEAN F. MARTIN

Department of Chemistry, University of South Florida,
4202 East Fowler Avenue, Tampa, FL 33620-5205

ABSTRACT: Chemistry at USF is about 45 years old, and a number of changes have occurred in that time. The faculty has grown from four to over 30. Department status was obtained 40 years ago. The total amount available for research has grown from a few thousand dollars to over three million. The Department is now part of a research I university. The attitude toward research has obviously changed with the development of first a masters, then a doctoral program in chemistry. The tendency toward interdisciplinary research has been strong for many years. The balance between undergraduate and graduate is good. We can look with pride on the accomplishments of the faculty, staff, and alumni of 45 years.

Key Words: anniversary, development, faculty, growth, program, research

AUTUMN 2004 was the 40th anniversary of department status for the Department of Chemistry at the University of South Florida (USF). (Prior to the autumn of 1964, it was a Program in Chemistry.) Now, USF has campuses in Tampa (central administration, home of the Medical Center, the H. Lee Moffitt Cancer Center and Research Institute, and the bulk of academic programs), St. Petersburg (home of the College of Marine Science), Sarasota-Manatee, and Lakeland. The Autumn-2004 head count was over 42,000 students, and there were about 100 baccalaureate, 80 masters programs, and over 35 doctoral programs. By the 68th commencement in December 2003, more than 175,000 students had been graduated, and there were more than 300,000 alumni.

The Department has grown as well. As of the fall, 2004 semester, the Department of Chemistry had 26 tenure-track faculty members, ten adjunct faculty members, 12 staff members, and 125 graduate students, and, recently, it had ranked as high as seventh in the nation in the number of chemistry majors produced. Over 65 tenure track faculty have served in the USF Department of Chemistry (Appendix 1).

Early days—When it was founded by the Florida legislature in 1956, USF had no name, no campus, no students, and no chemists. Land for the campus was donated in December 6, 1956: 1734 acres of scrub pasture covered mostly with a fine-grained quartz sand of low mineral content, representing what was described as “the second-worst soil” in Florida, about eight airline miles northeast of downtown Tampa (Cooper and Fisher, 1982).

Much was accomplished in 1957. Dr. John S. Allen, Vice President of the University of Florida was named the first President (January 27) (Cooper and Fisher,

1982; Anon, 2002a), the future university was named (October 22), Mr. Elliott Hardaway was lured away from the comfort of University of Florida to be the first librarian and the first professional-level person hired by Dr. Allen (Anon., 2002a). The decision to make all buildings air-conditioned was mandated (September 29), which made it possible for students to attend classes year round.

In time faculty were hired. The first faculty member, Dr. James D. Ray, Jr., a biologist (later Dean of the College of Natural Sciences) reported August 1, 1959 (Gristi, 1981). On September 1, 1960 some 134 charter faculty members reported, including four chemists (Appendix 1): Dr. Theodore Askounes Ashford from St. Louis University (Professor and Division of Natural Sciences Director), Dr. Laurence Monley from East Tennessee State (Associate Professor), Dr. Jack E. Fernandez from Tennessee Eastman Company (Assistant Professor), and Dr. T. W. Graham Solomons from a post-doctoral position with Professor Boekelheide at the University of Rochester (Instructor). The university officially opened on September 26 with 1,993 students in the charter class when Gov. LeRoy Collins spoke to an assembled group of about 6,000 (Cooper and Fisher, 1982.) When the ceremonies were over, the students went to their classes and everything was reportedly ready and on time, except that no faculty member could find chalk for the chalkboards, and chemists had to borrow test tubes from a nearby high school (Cooper and Fisher, 1982).

There were a limited number of buildings, three at the start—Administration, the University Center (UC), and Chemistry; two more—the Library and Fine Arts—were available by the end of the academic year. The women's dorm was the top floor of the UC. Because of a severe frost in 1959, state revenue was reduced, and the planned-for Library opened a year late. In 2003, USF had about 250 buildings (Anon., 2003). Chemistry was the original classroom building (78,000 gross square feet), three stories, with two auditoria (180, 200 seats respectively), laboratories (both teaching and research), classrooms, and offices (Anon, 2003). Why chemistry first? Dr. Allen told me in 1964 that it was because you could teach biology in a chemistry building, but you couldn't teach chemistry in a biology building.

Unique features—There were a number of unique features in the new university. Proximity was one; disciplines were close to each other. A colleague said you could get a broad education just walking down the hallway that connected the offices (Rothman, 2003). When I joined the faculty in 1964, I valued the exposure to faculty in education and geology, and would later collaborate with faculty in both. The proximity of other disciplines led to interdisciplinary research, less common at the time than now when it is highly encouraged.

Procedural adjustments had to be made because of the newness; procedures had to be developed, and adjustments made. For example, the Department of Audio-Visual Aids had responsibility for visual aids, which included more than one might expect. They would deliver a slide projector to your classroom when requested in advance. Geography faculty quickly learned that A-V also had the maps and expected to have them returned each night. Chemists had to teach A-V personnel that the periodic charts were expected to be left on the classroom walls (Solomons, 1964).

Academic challenges—Though 1,993 students were in the Charter Class in September 1960, only about 1,000 remained by the end of the academic year. The Chemistry Program had some good students, who would later go on to first-rate graduate schools and/or win awards for their achievements. Two chemistry majors (Carole Bennett and Jeanne Dyer) who were graduated in December 1963 became honored teachers of high school chemistry and won local, state, and national recognition. Joanna Fowler (B.A. '64) worked closely with Dr. Fernandez from the time that she was in general chemistry, and the work led to a publication (Fernandez et al., 1965). Dr. Fowler was elected to membership in the National Academy of Sciences in May, 2003.

Faculty members were encouraged to develop creative courses and programs. One such course was a general chemistry laboratory that covered the gas laws using vacuum lines, one for each pair of students. There were 12 units per room in the double laboratory that accommodated 48 students. Dr. Cal Maybury initiated the project in 1963, inspired by a program at his alma mater, The Johns Hopkins University. The system initially required some attention on his part because of the absence of a glass blower, but things improved in 1964 with the hiring of a glassblower (who helped Dr. Jesse Binford develop a physical chemistry lab project in which students fabricated their own glass electrodes for pH and other measurements). The system was creative and appropriately challenged students. The vacuum lines were finally dismantled when the general chemistry and other teaching laboratories were renovated in Dr. Owen's term as Chairman (1974–78).

A reported first-semester teaching load (Fall semester, 1960) included two sections of general chemistry, a two-hour laboratory section, and two sections of physical chemistry for a total of 14 contact hours (Rothman, 2002). A charter faculty member commented, "The emphasis was on teaching not research. The feeling was that if you had time for research maybe you're not teaching enough" (Rothman, 2002).

By comparison, H. C. Brown noted that the typical teaching load at Wayne State University when he went there in 1943 was 18 hours a week, but he was promised 12 hours a week to be able to do some research (and the investment surely paid off) (Hargittai, 2000).

Books—Faculty were encouraged to write, though perhaps not in the early years, but certainly more so than might be expected for a department in an older, more established university. A number of monographs and textbooks were published (Appendix 2). The most successful, surely, is Solomons' *Organic Chemistry*, which is now in the eighth edition.

Expansion—The 44 years of existence have been years of growth and expansion. President Allen described the campus as the "place where the concrete never sets." Since the first groundbreaking in 1958, there has never been a day when something wasn't in some stage of construction on campus.

Expansion also occurred in the Chemistry Program (Appendix 1), as an effort was made to add two faculty members per year. 1962 was an exception and because of budget constraints, the Chemistry Program was able to add only one faculty member.

Research activities—The USF motto of the time was “Accent on Learning.” And it applied to chemists in a significant way (Rothman, 2002). The official mindset did not favor research until about the third year of operation (Rothman, 2002). **But** the chemists persevered; they worked closely with their students, taught them well in the classroom, and worked with them in the small research labs. It could not have been an easy task, given the teaching loads, budget constraints, and limitations on equipment. Because of its young age, the Program lacked equipment that older institutions had.

Research programs need money. And research proposals were written early on. In May 1961, T. W. Graham Solomons, a Charter Faculty member (Appendix 1) was awarded USF’s first research grant—\$2,750 to study the synthesis and properties of a select group of organic molecules—and in November (1961), Jesse Binford was awarded a grant for \$2,400 from the American Chemical Society (USF Research Office, 1995). In time, the program of working with undergraduate students in laboratories would be supported by NSF Undergraduate Research Participation Grants, with Jack E. Fernandez as the Principal Investigator. The Chemistry program progressed well, despite comparatively limited budgets and resources. Dedicated faculty were added (See Appendix 1). And they were willing to make sacrifices to achieve worthy goals. One was an A-60 NMR instrument, which ate up two years of budget (prior to 1964–65), but was regarded as a good investment. In recent years, the investment in NMR and X-ray equipment exceeded \$1.5 million, and there was a considerable investment in equipment that would be useful to those interested in biochemistry and natural products.

The tendency to support research in a manner typical of a university increased over the years. The first two postdoctoral research associates, Edward J. Olszewski and K. Ramaiah arrived in the fall of 1964 and remained for a year. Significant senior faculty members were added at the full professor level (Appendix 1), and the development of the graduate programs made a significant difference. By 2004, the external grant/contract funding for the department was over \$3 million and over 1000 papers had been published by USF chemistry faculty in scholarly publications (1969–1998; Martin, 2003).

Adding faculty who were interested in developing a major, well-funded research program came at a price called “start-up funds”, which could vary at established universities from \$500,000–\$1 million, depending on the area of research and the extent to which the person depended on specialized instrumentation. Not surprisingly, college and central administrations question the magnitude of costs versus the payoff for proposed faculty members in chemistry.

In November 2003, Dr. Mike Zaworotko (Professor and Chairman), described a study of the impact of start-up funds given to department faculty members in recent years. The study (Zaworotko, 2004), looked at the costs associated with new faculty beginning with Dr. Kyung Jung (who came in 1996 and is now a tenured Associate Professor and Coordinator of the Division of Organic Chemistry) and included ten other faculty members who joined subsequently through Mohamed Eddaoudi (2002). The total start-up cost, provided entirely by the University, was \$3.2 million. By comparison, Dr. Zaworotko found that the total value of grants and contracts raised

by these faculty members had in 2003 already totaled \$7.9 million, and the amount of overhead that they generated was \$1.95 million.

Currently, department research seems to be focused on four interdisciplinary areas: drug design, material science, environmental chemistry, and chemical education. In 1965, faculty was organized into traditional divisions (analytical, inorganic, organic, physical, and later biochemistry), with some divisions a bit thin on faculty. Interdisciplinary collaborations were started before it was popular to do so in chemistry nationally possibly because of the assignment of chemists to buildings housing other disciplines. There has never been a building exclusively occupied by chemists, in contrast with the situation in more traditional departments. This was initially out of necessity, perhaps one that still continues on that basis. In autumn 1964, the first chemists moved out of the Chemistry Building (into the Physics Building), then in 1968, more chemists moved to the Science Center, then into the Bioscience Facility. We anticipate renovation of the Chemistry Building and completion of NES (Natural and Environmental Sciences) in 2005 that will lead to return of chemists to a renovated Chemistry Building and expansion into NES (which will be shared with Environmental Science & Policy and with Geography).

Start of the Graduate Programs, 1965—Between 1960 and 1973, the federal investment in higher education increased notably (\$732 million to \$5.8 billion), and this had implications on the organization and development of universities, including USF (Cooper and Fisher, 1982). Graduate programs were initiated in 1965 by the State Board of Control that supervised all state-supported universities in Florida.

Chemistry's preparations started in the 1964–65 academic year. The M.S. program was initiated in the Fall of 1965, and the Ph.D. program was initiated in the Fall of 1968. Various student applicants were screened and those selected appeared in the Fall of 1965. They included Robert F. Benson (deceased), Rosemary Oelrich Bettcher, Mike Holloway (deceased), Brad Johnson, Robert Peale, Jr., and Roger Walton. The selection process must have been good; all would receive master's degrees in what Conard Fernelius described as one of the tougher masters programs in the nation.

The justification for a doctoral program was that it would provide an opportunity for students working in industry to earn a degree when various commitments prevented them from going to the University of Florida or the Florida State University. In fact, most of the doctoral students were full-time students and this was a fairly persistent pattern through the years. Ours was one of the first doctoral programs; the very first in the natural sciences was one in Marine Biology.

There was a significant concern for quality of the Ph.D. program university-wide and for external credibility. Accordingly, from the outset, the final defense of the candidate's dissertation in addition to being a public defense was frequently a well-attended event, in contrast to the traditional absence of an audience at defenses at more established chemistry departments. In one instance, a chemistry dissertation defense was held in the Physics Building auditorium.

Another quality-control technique was use of an external examiner. The chairman of the defense committee is not the candidate's advisor, but a qualified

person external to the department. Professor Bert Vallee (Harvard) served as external examiner for our first doctoral candidate (Anthony Girgenti, an advisee of Dr. Joseph Cory). Dr. Willard Libby, Nobel Laureate, served as an early Chair of the defense committee (1973) as did William P. Jenks, M.D. (for Dr. Young) and Dr. Esmond E. Snell (for Dr. Lopatin, the latter two students were advisees of Dr. Terence Owen).

The major products of an educational institution are creation of knowledge and its graduates. The sharing of knowledge through publications and books (Appendix 2) is important, as is the development of well-trained students. The "tracking project" is an effort to follow the careers of our graduate alumni and we have hopes of undertaking the same project with our undergraduate alumni as well (<http://www.cas.usf.edu/chemistry/new>). In looking at this list, we can recognize a millionaire entrepreneur, successful faculty members, successful industrial chemists, and other persons successful in other professions in whom we can take pride.

Ahead—Obviously, one would expect considerable change in a 40-year period, but the changes described here seem exceptional in number and extent. A significant number of faculty were lost to retirement in recent years (four in 2002–2003), but they have been slowly replaced. USF became a Research I university in the late 1990s, and this has had a significant impact on the expectation of all chemistry faculty, but especially newer ones. The demand for appropriate funding of research programs leads to a considerable emphasis on writing proposals and papers over books. Some younger faculty claim they spend 70% of their time on one aspect of proposals or another—either writing them or managing them. In addition, there is a considerable effort to balance the need for teaching large numbers of students to generate Student Credit Hours (SCH), and this may well be achieved by the device of bipartite faculty, one group of research-oriented professors who teach a limited number of students and a teaching-oriented faculty, whose efforts are exclusively focused on teaching. To this end, the department hopes to add five new faculty members by summer, 2005. At the same time, USF central administration is encouraging a greater involvement of undergraduate students in research projects with faculty members. The worthiness of this new mandate is manifest; the ultimate outcome and balance with a graduate program is less evident.

ACKNOWLEDGMENTS—I am grateful for helpful comments and suggestions made by Drs. Jeff C. Davis Jr., P. Calvin Maybury, and M. J. Zaworotko. I thank Ms. Pat Smail, USF Human Resources, who helped find some dates of faculty service. Barbara B. Martin served as Editor for this manuscript.

LITERATURE CITED

- ANON. 2002a. Timeline of historic USF events. University Relations Office, USF. <http://isis.hotmail.usf.edu/history/timeline.html> (noted October 2004).
- ANON. 2002b. The Allen legacy. University Relations Office, USF. http://isis.hotmail.usf.edu/allen_legacy.html (noted October 2004).
- ANON. 2003. Information provided by staff members of the USF Physical Plant Division, University of South Florida, Tampa, FL.

- COOPER, R. M. AND M. B. FISHER. 1982. *The Vision of a Contemporary University*. University Presses of Florida, Tampa, Florida.
- SPEAR, F. 1981. To remember when, USF's Silver Anniversary, USF, October 1981 p.5
- GRIST, P. 1981. Natural sciences over the threshold, USF's silver anniversary. USF, October 1981, p.6-7.
- FERNANDEZ, J. E., J. S. FOWLER, AND S. J. GLAROS. 1965. Kinetics of the reaction of nitroalkanes with methylenebis(piperidine). A study of the Mannich reaction. *J. Org. Chem.* 30:2787-2791.
- HARGITTAL, I. 2000. H. C. BROWN. Pp 250-269. *In: Candid Science: Conversations with Famous Chemists*, Imperial College Press, London.
- MARTIN, D. F. 2003. Departmental history (Chapter 4) <http://www.cas.usf/chemistry> [Accessed November, 2005]
- ROTHMAN, L. 2002. First professor recalls USF in the '50s and the '60s. <http://isis.hotmail.usf.edu/history/prof.html> (noted October 2004)
- SOLOMONS, T. W. G. 1964. Department of Chemistry, University of South Florida, Tampa, Pers. Comm.
- USF OFFICE OF RESEARCH. 1995. Building a Research University: a USF Retrospective. Annual Report 1995-95. University of South Florida, Tampa, FL.
- ZAWOROTKO, M. J. 2004. Report of a study of start-up costs and benefits. Department of Chemistry, University of South Florida, Tampa, Pers. Comm.

Florida *Scient.* 68(3): 144-153. 2005

Accepted: December 10, 2004

APPENDIX 1. Faculty Members of the USF Chemistry Department.

Name	Dates
Theo. Askounes Ashford	1960-81
Jack E. Fernandez	1960-95
Laurence E. Monley	1960-71 (85)
T. W. Graham Solomons	1960-90
Jesse S. Binford, Jr.	1961-03
P. Calvin Maybury	1961-87
Robert D. Whitaker	1962-92
Michael Barfield	1963-65
George Wenzinger	1963-99
Terence C. Owen	1964-98
Dean F. Martin	1964-
Eugene D. Olsen	1964-94
Jefferson C. Davis, Jr.	1965-98
George R. Jurch, Jr.	1966-98
Joseph G. Cory	1966-71
Robert S. Braman	1967-03
Brian Stevens	1967-99
Jay H. Worrell	1967-02
Winslow S. Caughey	1967-70
Ronald L. Birke	1969-74
W. Conard Fernelius	1970-75
Daniel L. Akins	1970-77
Larry G. Howell	1970-76
Douglas J. Raber	1970-91
Kin-Ping Wong	1970-75
Frank M. Dudley	1971-81
Stewart W. Schneller	1971-94

APPENDIX I. Continued.

Name	Dates
William Swartz	1972-86
Janice O. Tsokos	1972-85
David L. Wilkinson	1972-76
Joseph A. Stanko	1973-03
Jon E. Wenzierl	1973-
Milton D. Johnston, Jr.	1973-
Paul D. Whitson	1975-79
David O. Lambeth	1973-77
Rebecca M. O'Malley	1977-
Sandor L. Vador	1977-83
Gerald M. Carlson	1978-83
Jay Palmer	1978-80; 82-02
Steven H. Grossman	1981-
Raymond N. Castle	1981-94
Susan Jahoda	1981-84
Eric Wickstrom	1982-92
Leon Mandell	1984-00
Robert L. Potter	1984-
Towner B. Scheffler	1985-92
George R. Newkome	1986-01
Alfred T. D'Agostino	1987-94
Gerhard Meisels	1988-
Li-June Ming	1991-
Jan M. Robert	1992-99
Louis Carlacci	1993-00
Julie P. Harmon	1993-
Abdul Malik	1994-
Kyung Woon Jung	1996-
Edward Turos	1996-
Kirpal Bisht	1998-
Michael J. Zaworotko	1999-
David Merkler	1999-
Brian Space	2000-
Bill J. Baker	2001-
Jennifer Lewis	2001-
Randy Larsen	2002-
Mohamed Eddaoudi	2002-
Mark McLaughlin	2002-
Ellen Verdell	2003-
M. Acevedo-Duncan	2003-
Alfredo Cardenas	2003-
Rosa Walsh	2003-
Edwin Rivera	2004-

APPENDIX 2. Chemists who Served as Administrators.

Name	Position	Date
Laurence Monley	Program Chair	1960-63
P. Calvin Maybury	Chairman	1963-74
Terence C. Owen	Chairman	1974-78
Jefferson C. Davis, Jr.	Chairman	1978-82 1995-98
William Swartz	Chairman	1982-86
Stewart W. Schneller	Chairman	1986-94
Jack E. Fernandez	Chairman	1994-95
Robert L. Potter	Interim Chair	1998-99
Michael J. Zaworotko	Chair	1999-
Other Administrators		
Theo A. Ashford	Division Director, Dean	1960-81
Leon Mandell	Dean	1984-90
George R. Newkome	V-P Research	1986-01
Gerald R. Meisels	Provost	1988-94
	Director, Coalition for Scientific Literacy	1994-

APPENDIX 3. Books Written By USF Department of Chemistry Faculty Members.

Theodore Askounes Ashford

Ashford, T. A. 1960. *From Atoms to Stars: An Introduction to the Physical Sciences*. Holt, Rinehart and Winston, Inc. New York, NY.

Bill J. Baker

McClintock, J. B. and B. J. Baker. (eds). 2001. *Marine Chemical Ecology*. CRC Press. Boca Raton, FL

Jesse S. Binford, Jr.

Binford, J. S. Jr. 1977. *Foundations of Chemistry*. Macmillan New York (Reprinted version, 1985)

Jefferson C. Davis, Jr.

Davis, J. C. Jr. 1965. *Advanced Physical Chemistry; Molecules, Structure, and Spectra*. Ronald Press, New York, NY

——— G. R. Jurch, Jr., and R. D. Whitaker. 1969. *A Laboratory Manual for General Chemistry*, Wm. Brown. Dubuque, IA

——— G. R. Jurch, Jr., and R. D. Whitaker. 1973. *A Laboratory Manual for General Chemistry* (2nd ed.), Kendall-Hunt. Dubuque, IA

——— 1974. *A Study Guide for General Chemistry*, Kendall-Hunt, Dubuque, IA

——— 1976. *A Study Guide for General Chemistry*, Burgess, Minneapolis, MN.

Jack E. Fernandez

Fernandez, J. E. 1971. *Modern Chemical Science*. Macmillan, New York, NY

——— and R. D. Whitaker. 1975. *An Introduction to Chemical Principles*. Macmillan. New York.

Solomons, T. W. G. and J. E. Fernandez 1976. *Solutions Manual for Organic Chemistry*. Wiley, New York, NY

Whitaker, R. D., J. E. Fernandez, and J. O. Tsokos. 1981. *Concepts of General, Organic, and Biological Chemistry*. Houghton Mifflin Co., Boston, MA

Fernandez, J. E. 1982. *Organic Chemistry: An Introduction*. Prentice-Hall, Englewood Cliffs, NJ.

Solomons, T. W. G. and J. E. Fernandez 1986. *Study Guide to Accompany Organic Chemistry 2nd ed*. Wiley. New York

George R. Jurch, Jr.

Davis, J. C. Jr., G. R. Jurch, Jr., and R. D. Whitaker. 1969. *A Laboratory Manual for General Chemistry*, Wm. Brown. Dubuque, IA

APPENDIX 3. Continued.

Dean F. Martin

Martin, D. F. and B. B. Martin. 1964. *Coordination Compounds*, McGraw-Hill Book Company, New York.

Moeller, T. and D. F. Martin. 1965. *Laboratory Chemistry*, D. C. Heath, Boston, MA.

Martin, D. F. and B. B. Martin. 1968. *Coordination Compounds*, (Japanese Language Edition—Translated by K. Morinaga) *Coordination Compounds*. Kogakusha, Tokyo, 1968.

Martin, D. F. 1968. *Marine Chemistry*, Vol 1, Analytical Methods. Marcel Dekker, Inc., New York, First Edition, 1968, 280 pp.

Martin, D. F. 1970. *Marine Chemistry*, Vol. 2, Theory and Applications. Marcel Dekker, Inc., New York.

Martin, D. F. and G. M. Padilla (eds.), 1973. *Marine Pharmacognosy: Action of Marine Biotoxins at the Cellular Level*. Academic Press, New York.

Martin, D. F. 1974. *Marine Chemistry*, Vol 1, Analytical Methods. (Russian Language Edition—Translated by Michael A. Rozengurt) *Gedrometroy*, Leningrad.

George R. Newkome

Newkome, G. R., C. N. Moorefield, F. Vögtle. 1996. *Dentritic Molecules: Concepts, Syntheses, Perspectives*. VCH. Weinheim, New York.

Newkome, G. R. (ed), 1999. *Advances in Dendritic Macromolecules*. JAI. Stamford, CT

Newkome, G. R., C. N. Moorefield, F. Vögtle. 2001. *Dendrimers and Dentrons: Concepts, Syntheses, Applications*. Wiley-VCH. Weinheim, New York

Terence C. Owen

Owen, T. C. 1969. *Characterization of Organic Compounds by Chemical Methods*. Dekker, New York

Douglas J. Raber

Raber, D. J. and N. K. Raber. 1988. *Organic Chemistry*. West Publishing Co.. Minneapolis, MN.

T. W. Graham Solomons

Solomons, T. W. G. 1976. *Organic Chemistry*. Wiley. New York And several additional editions

Solomons, T. W. G. and J. E. Fernandez 1976. *Solutions Manual for Organic Chemistry*. Wiley, New York, NY

Solomons, T. W. G. and J. E. Fernandez 1986. *Study Guide to Accompany Organic Chemistry* (2nd ed.) Wiley. New York

Solomons, T. W. G. and C. B. Fryhle 2000. *Organic Chemistry*. 7th ed. Wiley. New York.

Solomons, T. W. G. and C. B. Fryhle. 2004. *Organic Chemistry*. 8th ed. Wiley. New York.

Janice Tsokos

Whitaker, R. D., J. E. Fernandez, and J. O. Tsokos. 1981. *Concepts of General, Organic, and Biological Chemistry*. Houghton Mifflin Co., Boston, MA

Robert D. Whitaker

Davis, J. C., Jr., G. R. Jurch, Jr., and R. D. Whitaker. 1969. *A Laboratory Manual for General Chemistry*, Wm. Brown. Dubuque, IA

Fernandez, J. E. and R. D. Whitaker. 1975. *An Introduction to Chemical Principles*. Macmillan. New York, NY

Whitaker, R. D., J. E. Fernandez, and J. O. Tsokos. 1981. *Concepts of General, Organic, and Biological Chemistry*. Houghton Mifflin Co., Boston, MA

Jay H. Worrell

Worrell, J. H. 1990. *Labtek: Experiments for General Chemistry*. Contemporary Pub. Co. Raleigh, NC.

Worrell, J. H. 1994. *Labtek: Experiments for General Chemistry*. Contemporary Pub. Co. Raleigh, NC. (And later versions)

Michael J. Zaworotko

Seddon, K. R. and M. J. Zaworotko (eds.) 1999. *Crystal Engineering: The Design and Application of Functional Solids*. NATO ASI Series. Kluwer. Boston