The Society of Toxicology: The First Fifty Years

Celebrating 50 Years of Service in Science
The graphics images of the Mountain Ash that are shown throughout the book were selected because this species is symbolic of mastership and power. The Ash grows throughout the world and lives for hundreds of years. The brightly colored berries that adorn the tree have medicinal qualities and essential oils derived from ash are said to enhance a sense of strength and flexibility. Like the Mountain Ash, the Society has longevity and strength in its membership. The complex, multi-layered ash tree represents the strength of our membership as we combine our efforts to be one entity nourishing many species with our knowledge.

We are proud to print this publication entirely on Forest Stewardship Council certified paper. FSC certification ensures that the paper in this publication contains fiber from well-managed and responsibly harvested forests that meet strict environmental and socioeconomic standards.
This book is dedicated to Gabriel Plaa, an American-Canadian toxicologist who contributed greatly to the field of toxicology through his research involving chemical-induced liver injury. He was extraordinarily charitable with his time for the advancement of science nationally and internationally. He also played a significant role in the education of graduate and postgraduate students in toxicology and made significant contributions to the scientific community through the publication of 233 peer-reviewed manuscripts, and the authorship of 48 chapters and literature reviews. Dr. Plaa also served as a member of the 50th Year Anniversary Task Force Subcommittee charged with publishing this book. As with all areas of his work, his dedication and hard work here are greatly appreciated. His memory and contributions to the science of toxicology are lasting.
ACKNOWLEDGMENTS

The Society of Toxicology is indebted to members of the FAST Publication Subcommittee, who dedicated countless hours in preparing and reviewing the numerous articles that appear in this publication. In particular, we would like to give special thanks to William Hays, Dennis Devlin, Dennis Paustenbach, and Ron Tjalkens for their tireless work in making this publication a reality. We would also like to pay special tribute to John Doull for his extraordinary efforts to create, inspire, and garner the necessary support from the toxicology community to produce this publication. Dr. Doull has generously given his time, expertise, and knowledge to make the book a treasured slice of toxicology history. We would also like to pay tribute to the members of the 50th Year Anniversary SOT Task Force:

Martin A. Philbert, Chair

Linda Birnbaum
James S. Bus
Gary P. Carlson
Jack H. Dean
Dennis Devlin
John Doull
David L. Eaton
William C. Hays
Ernest Hodgson

Michael P. Holsapple
Meryl H. Karol
Lisa A. Opanashuk
Dennis J. Paustenbach
Gabriel Plaa
Robert A. Scala
Ronald B. Tjalkens
Hanspeter Witschi

We would also like to thank the many authors whose contributions to this publication are very much appreciated and who are listed at the top of their respective article(s) and listed in the author index beginning on page 243.

We have come a long way in the past 50 years and we look forward to many more accomplishments for the next 50 years.

The members of this task force would like to thank the SOT staff for their enthusiastic support of our 50th year celebration, and the FAST publication committee would like to especially thank Clarissa Russell Wilson and Martha Lindauer for their dedication and skills in producing this anniversary book.
The Society of Toxicology celebrates its 50th anniversary in 2011, a landmark for what has been considered a young profession. At the time of the 25th anniversary, then historian (and founder) Harry W. Hays recapped the founding of the Society and its early years by means of a year-by-year summary of activities. In preparation for the 50th anniversary, a task force of members of the Society has prepared this book. Other activities of the committee include a series of posters reflecting the history and current state of our Society and profession, an anniversary brochure with short articles on toxicology over a period of decades, and two celebratory events at the March 2011 Annual Meeting. Rather than a continuation of the historical record, this book is a collection of invited essays prepared by former presidents of the Society and esteemed colleagues on subjects of interest to them. The reader will find fascinating chapters on the impact of specialty sections and regional chapters, the SOT foundation, future trends in toxicology, the lineage of toxicologists, diversity in our profession, and much more. This book is not intended to be read from front to back. The reader is urged instead to survey the table of contents and sample, at leisure, writings on topics of personal interest. The reward will be an insight into our science and Society from the pen of those who held leadership positions during each of the first five decades of the Society of Toxicology.

The wealth of members’ experiences and memories created over the past 50 years are not limited to the essays in this book. We encourage you to visit the SOT Web site to view additional articles ranging from academic training programs to memoirs from members. A wide array of photographs are assessable on the Web site and we invite you to submit your SOT photographs.
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Bob Dole

October 6, 2010

Dear Society Members,

On this 50th anniversary of the Society of Toxicology, I want to take a moment to congratulate each and every one of you on a job well done.

Toxicologists serve a vital role in American society. So many aspects of everyday life that we often take for granted have been made possible through the work of toxicologists. We are fortunate to benefit from the advanced research and discoveries of these scientists, and our nation will continue to thrive as this important work expands in the future.

Thank you for all that you do for each and every American. Congratulations on this anniversary, and may the next 50 years bring continued success.

God Bless America,

Bob Dole

Society of Toxicology
1821 Michael Faraday Drive
Suite 300
Reston, VA 20190
Congratulations

Society of Toxicology

50th Anniversary

March 6-10, 2011

As Mayor of the District of Columbia, it is my pleasure to extend congratulations to the members of the Society of Toxicology, on the occasion of your 50th Anniversary.

For over the past 50 years, the Society of Toxicology researchers and clinicians have been dedicated to creating a safer and healthier world by advancing the science of toxicology. As you gather to reflect and celebrate your accomplishments, we appreciate your continued contributions in the field of science that helps enhance the quality of life of others.

On behalf of the residents of the District of Columbia,

HAPPY 50th ANNIVERSARY!

Vincent C. Gray
Mayor, District of Columbia
March 6, 2011

Dear Friends:

On behalf of the Commonwealth of Virginia, I am pleased to extend a warm welcome to everyone attending the 50th Anniversary celebration of the Society of Toxicology.

I would like to commend the organizers of this year’s event for their hard work and dedication to an enjoyable celebration. For the past fifty years, the Society of Toxicology’s members have created a healthier and safer world by advancing the science of toxicology. I applaud the attendees tonight for your high professional standards and commitment to discovering new drugs, saving lives and improving our environment.

I also want to welcome those of you who have traveled great distances to be here. During your stay, I hope you will take the opportunity to visit the many unique opportunities Virginia’s northern region has to offer. Northern Virginia’s location, adjacent to Washington, DC, puts many of Virginia’s historic and natural resources within easy reach. Whether touring one of the area’s many historic sites, visiting George Washington’s majestic Mt. Vernon, or shopping the afternoon away at Tyson’s Corner or Potomac Mills, you are sure to experience Virginia’s hospitality.

I send my best wishes and look forward to many more years of success from the Society of Toxicology!

Sincerely,

Robert F. McDonnell

Robert F. McDonnell
Mr Michael Holsapple  
President  
Society of Toxicology  
1821 Michael Faraday Drive  
Suite 300  
Reston  
Virginia 20190  
Etats-Unis d'Amérique

1 November 2010

Dear Mr Holsapple,

I refer to your letter dated 18 October 2010, addressed to Dr Margaret Chan, Director-General, inviting her to write a short anniversary letter of congratulations to the members of the Society of Toxicology, who will be celebrating their 50th Anniversary from 6 to 10 March 2011, in Washington, DC.

As you can imagine, the demands on Dr Chan's time are enormous and we therefore regret that we are not able to meet this request.

I take this opportunity to congratulate you on reaching this 50th Anniversary.

Yours sincerely,

Dr Ian Smith  
Adviser to the Director-General
Founding Members of the Society of Toxicology
Founding Members of the Society of Toxicology
The first organizational meeting of the Society of Toxicology (SOT) was held on March 4, 1961, in Washington, D.C. Seven of the nine Founders were present: Drs. Frederick Coulston, William B. Deichmann, Victor A. Drill, Harry W. Hays, Harold C. Hodge, Arnold J. Lehman, and C. Boyd Shaffer. Drs. Kenneth DuBois and Paul Larson were available by phone. These nine Founders constituted the initial Officers and Council, with Harold C. Hodge serving as the first President.

The first official Annual Meeting occurred on April 15, 1962, in Atlantic City, New Jersey, with 174 Charter members and the nine Founders in attendance. Six of the nine Founders served as SOT Presidents in the years to come.

Twenty-five years later, on March 3–7, 1986, at the Hyatt Regency Hotel, in New Orleans, Louisiana, Dr. Emil Pfitzer, the President of SOT during the Silver Anniversary year, asked the Founders to stand and be recognized. Those present were: Drs. F. Coulston, W. Deichmann, V. Drill, H. Hodge, P. Larson, and C. Boyd Shaffer. Dr. H. Hays was absent; Drs. K. DuBois and A. Lehman were deceased. The surviving Founders were all proud to acknowledge the emergence of SOT as a prominent global scientific organization, its success due in part to their selfless contributions. Unfortunately, none of the nine Founders will be able to celebrate the Golden Anniversary year in 2011. Yet, because of their legacy, SOT has achieved excellence.

I will attempt in the few paragraphs that follow to introduce to the new generations of toxicologists one of the nine Founders, Dr. Frederick Coulston, known to everyone as “Fred.” He was the fifth SOT President (1965–66), the tenth Merit Award recipient (1975), and the sixth Arnold J. Lehman Award recipient (1985). I have the privilege and honor of calling him my mentor, having worked under him from 1972–78.

Fred was born in New York City, December 4, 1914, and stayed in the city until the end of high school, after which he moved to Syracuse, New York, to study. He obtained his A.B. (1936) and M.A. (1939) in biology, and his Ph.D. in Parasitology and Bacteriology (1942). In 1943, he joined as group leader the parasitology and bacteriology research group of E.I. DuPont de Nemours & Co., Inc., in Newark, Delaware, working against avian, primate, and human malaria. This era saw the first wave of antimalarial chemotherapy, before the emergence of resistant parasites. Concurrently, between 1941–46, Fred was a United States Government consultant with the Committee for Medical Research of the United States Office of Scientific Research and Development. During World War II he and his group were honored by the United States Government for their significant contributions to successfully combating malaria. Fred was a visionary and unique researcher, combining conventional pharmacology with applied molecular pharmacology. He was able to engineer the collaboration of applied chemists, biochemists, pharmacists, and pharmacologists with clinical and anatomic pathologists. It was a novel approach in the forties, something that would later be called “matrix project management.” During this time, Fred observed that although few substances possessed pharmacological properties, all substances demonstrated toxicity when tested at high doses. Hence, he decided to take a closer look at the toxicology and safety of chemical products. He also decided that all pivotal company reports should find their way into the public domain in the form of robust peer-reviewed journal articles that describe all the essentials of the test articles, especially their integrity, and the availability of historical control data sets for the species used.
In 1948, Fred moved to Cincinnati, Ohio, where he continued to be involved with antimalarial chemotherapy as assistant director of Medical Research at the Christ Hospital until the middle of 1952. Later in 1952, Fred and his family (his wife Eileen and his children, Craig and Cynthia) moved to the town of Rensselaer, across the Hudson River from Albany, New York, to join the Sterling-Winthrop Research Institute as director of experimental pathology and Toxicology. This position suited Fred perfectly. It enabled him to become a leader in drug safety and toxicology and led to his being one of the nine Founders of SOT. In his new capacity and true to his operational belief of project management, he created a nexus of government, industry, and academia at Sterling-Winthrop, as well as a bridge between the United States and Canada on one hand and Western Europe on the other. In late 1958, Fred and Arnold Lehman together founded the journal Toxicology and Applied Pharmacology. In 1963, TAAP became the official organ of the very young SOT, with Kenneth DuBois as its first managing editor. In 1961, Fred became the founding editor of Experimental and Molecular Pathology, at a time when very few things were “molecular.” This journal served the community of experimental pathology and toxicology very well, merging conventional academic pathology with drug and chemical product safety. Hence, the mechanism-of-toxic-action concept was introduced for the first time, applicable to both experimental animals and humans. This approach was conveyed to the scientific community between 1961–63, when Fred was chairman of the Gordon Research Conference Section of Toxicology and Safety Evaluation.

In 1963, Fred joined Albany Medical College (AMC) of Union University in Albany, New York, as professor of pathology, pharmacology, and toxicology, and also as Director of the Institute of Comparative and Human Toxicology (ICHT), a separate academic department at AMC and a unique administrative entity in any medical school in the world. The ICHT had the only animal facility on the Albany campus, and also had a primate facility in Alamogordo, New Mexico, which previously was the renowned Air Force Aeromedical Laboratory (AFAL) and Primate Center at the Holloman Air Force Base (HAFB) in New Mexico. AFAL was administered by NASA, which supported the space chimpanzee and baboon deceleration programs. The Holloman AFB facility was a premier biomedical primate facility, which allowed new programs such as vaccine development and comparative primate toxicology research to be mainstreamed. The understanding of toxic findings in rodents and dogs could be applied to research in primates. Within ICHT, the scope of operations had significantly increased to include the education of young toxicologists in research, a discipline at that time without well-defined training and set of skills. Helping with this effort was the addition in 1967 of Dr. Leon Golberg, the Founding director of the British Industrial Biological Research Association (BIBRA), who became the scientific director of ICHT. All research programs were expanded to include a wide range of agents from artificial sweeteners, ethical drugs, and vaccines, to disinfectants, food and feed additives, and pesticides and herbicides. The toxicokinetic and toxicodynamic profiles of agents were ascertained and their toxicity and mechanisms-of-action, evaluated in subchronic and chronic repeat-dose regimens in both rodents and monkeys. This research of comparative safety assessment facilitated the rodent-to-primate extrapolation and development of scaling factors. At the same time, the educational opportunities in both Albany and Alamogordo were expanded to include pre- and postdoctoral training associations with scientists from the United Kingdom, Germany, and other European countries. Fred expanded the international cooperation in the seventies by involving Japanese and Indian toxicologists in publications, scientific meetings, and “visiting resident scholarships,” an arrangement for Ph.D. students to conduct research and collect data for dissertations at either of the two ICHT campuses (Albany and Alamogordo). The Albany School of Toxicology became the hub of toxicology research and education, leading to the establishment of the Chemical Institute of Toxicology in 1976, with Dr. Leon Golberg, the founding director of BIBRA and scientific director of ICHT, as its first President. Here again, behind the scenes, Fred together with Perry Gehring (of the Dow Chemical Company) played a vital role in arranging the establishment of a joint academic and industrial research institution dedicated to the pursuit of fundamental assessment of toxicological hazards for humans, animals, and the environment. All these activities contributed, in turn, to the establishment in 1979
of “good laboratory practices” (GLP) for nonclinical laboratories performing regulatory studies. A robust code of conduct for scientists performing GLP studies was put into place and new assays and technologies were validated as they were developed, which led to the establishment in the eighties of new societies such as the International Society of Ecotoxicology and the International Society of Regulatory Toxicology and Pharmacology. Fred helped establish both societies and was the founding editor of their respective journals.

In 1988, Fred, still active at age 74, was a professor emeritus of toxicology and pathology of Albany Medical College when he founded Coulston International Corporation (CIC), based in Alamogordo, New Mexico, dedicated to research and development of vaccines to combat viral diseases. Initially, there was success. In 1995, the CIC had nearly half of the United States laboratory population of chimpanzees. However, between 1995 and 2000, the industry funding of chimpanzee research was cut back and the National Institutes of Health temporarily funded only about half of the chimp research. Two years later, the CIC was bought by the Florida-based Center for Captive Chimpanzee Care. Fourteen months later, on December 15, 2003, Fred Coulston died peacefully at his home. All his family, relatives, friends, former students, and colleagues, in the United States and abroad, mourned dearly the loss of this practitioner of applied science in the public interest, one of the nine SOT Founders. Fred Coulston, who never retired, was a giant in the field of toxicology.
On March 4, 1961, Dr. William B. Deichmann of the University of Miami School of Medicine joined with six other colleagues in a small meeting room in Washington, D.C., to discuss the formation of a new scientific society. From that meeting came the Society of Toxicology. An election was held that day and Dr. Deichmann was named Treasurer of the fledgling organization. Each of the participants reached into his pocket, came up with a $5 bill, and the Society’s treasury was launched with $35.

How did “Bill” Deichmann get to this place? He was born September 2, 1902, in Kiel, Germany, the son of J. F. Wilhelm and Mathilde Deichmann. He came to the United States in 1924 and was naturalized six years later. He earned his B.S. degree from Western Reserve University in 1932 and an M.S. in 1934. His Ph.D. was awarded in 1939 by the University of Cincinnati. Dr. Deichmann also received an M.D., *honoris causa*, from Christian-Albrechts University in Kiel, Germany, in 1972.

After a brief time at DuPont’s Haskell Laboratory and the Kettering Laboratory of the University of Cincinnati, Bill Deichmann moved full time into academia, eventually being named Chairman of Pharmacology at the University of Miami School of Medicine, in which department he served until his retirement. Through his efforts the Research and Teaching Center of Toxicology was established at the University of Miami in 1965, and by 1967 more graduate students were enrolled with a major in toxicology at the University of Miami School of Medicine than at any other university in the United States. Besides the Society of Toxicology, Dr. Deichmann was a member of several other learned societies in the United States and abroad. He died in 1990.

His early research dealt with the carcinogenicity of amine compounds and nitro-olefins. He also published extensively on the toxicity of DDT and other organochlorine pesticides, on acute poisoning from drugs and chemicals, and the hazard of microwave radiation. His bibliography lists 21 books that he authored or coauthored and 115 peer-reviewed papers. This research, as well as his teaching activities, brought him many appointments and consultancies in the academic, government, and private sector worlds.

Memories of Bill Deichmann are of a warm-hearted, friendly man of considerable learning. He was most gracious to young scientists in the early stages of their careers. He loved living in Florida and was most happy at his vacation home in the Florida Keys. There, the door was open to his many friends and colleagues, and the flying of the American flag, out front meant the professor was in residence.

Sources: Ohio Academy of Sciences Necrology Committee; SOT Merit Award citation
Dr. Victor A. Drill, Founder, Charter member, Past President, and distinguished fellow of the Society of Toxicology, died on December 8, 1988.

Dr. Drill was born on June 10, 1916, in England and as a young child his parents brought him to live in New York City. His early training in science culminated in a B.S. degree from Long Island University in 1938. He then continued in graduate work in the field of pharmacology at Princeton University, where he received the Ph.D. degree in 1941. This was followed by faculty appointments at Columbia and Yale Universities. He received the M.D. degree from Yale in 1948. After an additional five years as Professor of Pharmacology at Wayne University, he became director of Biological Research at G.D. Searle & Company. Shortly thereafter he became director of Scientific and Professional Affairs at Searle. At that time, he continued to hold an academic appointment in pharmacology at the University of Illinois. He never did retire because from 1980 to his death he was a director of and participated daily in the activities of the toxicology consulting firm of Drill, Friess, Hays, Loomis & Shaffer, Inc.

Dr. Drill was a member of numerous committees of the Society of Toxicology, since its beginning. Because of a long-time interest in reproductive medicine, he was an active member of essentially all of the professional societies in that field. He was a member of the American Chemical Society, the American Physiological Society, and the American Society for Pharmacology and Experimental Therapeutics.

His mark as a scientist and educator has been imprinted forever in the form of 180 research publications and as editor or major contributor to eight books, among which are the texts Pharmacology and Medicine and Current Concepts in Cutaneous Toxicity. His academic and medical excellence was recognized early by his election to membership in Alpha Omega Alpha.

In 1940, he married Ruth Craig and they had three sons, all of whom survive him. He had three grandchildren and a sister who also survived him. As a very long-time personal friend and coworker, he will be remembered for his quick and sometimes subtle humor, and his liking for the opera and the ballet, as well as for some spiritedly marching music played by a brass band. He was a connoisseur of good food and a gracious host.

Victor Drill was a scientist to the very last day of his life. His passing is a great loss not only to his family and friends, but also to the sciences to which he devoted his professional life.

Kenneth Patrick DuBois
(1917–1973)

by John W. Doull, M.D., Ph.D., ATS

Kenneth Patrick DuBois was born in Aberdeen, South Dakota, but was raised in Pierre, South Dakota, as the oldest of seven children. After graduating from high school, he attended South Dakota State College where he received a B.S. degree in chemistry and pharmacy in 1939. His interest in toxicology was first stimulated during his undergraduate days, when he worked with Dr. A. L. Moxom in the South Dakota Agricultural Experiment Station. This work resulted in seven papers, six of which were on selenium poisoning and the ability of arsenic to counteract selenium toxicity. Although he also had a Rotary Scholarship, these were depression times and Ken was very grateful for the financial as well as the intellectual benefits of his undergraduate employment. He then went to Purdue as an American Pharmaceutical Association Fellow and received an M.S. in pharmaceutical chemistry in 1940. Shortly thereafter, he was invited by Dr. Van L. Potter (also from South Dakota) to come to the University of Wisconsin’s McArdle Laboratory for his doctoral training, and he was awarded his Ph.D. in physiology and biochemistry there in 1943. In June of that year, he came to the University of Chicago as a member of its newly created toxicity laboratory (United States Chemical Warfare Service).

Thus began an association that lasted for almost 30 years, as he moved from research assistant to director (1953), and from instructor to professor (1956) in the Department of Pharmacology. Ken was clearly influenced in his decision to come to the University of Chicago Toxicity Laboratory by Dr. E. M. K. Geiling, who was the first official investigator in the laboratory. Dr. Geiling was also chairman of the Pharmacology Department, which became Ken’s department.

Kenneth DuBois’ death at the age of 55 from lung cancer was a tragic loss for his wife Jere, his three children, and his family, friends, students, and colleagues. It was also a great loss for the discipline of toxicology, to which he was deeply committed and in which he had played a major role in defining the science and charting its course.

Kenneth DuBois was one of the Founders of the Society of Toxicology and he served as its first Vice President (1961–62). He recognized the importance of a society journal and served as the first managing editor of *Toxicology and Applied Pharmacology* after it became the official organ of SOT in 1963. Arnold J. Lehman and Fred Coulston were listed as editors. Ken nominated Dr. Geiling to be an Honorary Member of SOT, and Geiling, along with W. F. von Oettingen and T. Sollman, became one of the first Honorary Members of SOT. He also chaired the Scientific Program Committee for the first Annual Meeting in 1962 and arranged the first joint SOT-ASPET (American Society for Pharmacology and Experimental Therapeutics) Fall Meeting. During the next decade, he chaired and/or served on many other SOT committees, particularly those relating to education. In 1972, SOT honored him with the Merit Award for a career of meritorious service and contributions to the discipline of toxicology. Kenneth DuBois received many other honors in his career, but the SOT Merit Award was the one that he displayed prominently and valued most highly, because it came from his peers and colleagues.

Although his professional career encompassed less than three decades, Dr. DuBois authored more than 200 research papers, several chapters in books, and a textbook in toxicology that was widely used for both graduate and medical teaching. As an educator, he was the advisor for 25 doctoral programs and several postdoctoral programs, and he introduced hundreds of physicians to the practical importance of toxicology in medicine. He encouraged his students to seek careers in academia and many did (J. Brodeur, G. Carlson, K. Cochran, J. Doull).
The research contributions of Kenneth DuBois included pivotal papers: with Dr. Van L. Potter in cancer research, toxicity studies on natural products and metals, and numerous papers on the mechanism, toxicity, and antagonism of radiation injury. However, the main focus of his research was on the toxicity and mechanism of action of the organophosphate insecticides. His initial studies with TEPP and E-605 (parathion) demonstrated their cholinergic mechanisms and the effectiveness of atropine as an antidote. Dr. DuBois and his associates subsequently characterized the toxicity of a large series of organophosphates, and his studies with Sheldon Murphy elucidated the biochemical basis for potentiation of their effects. He clearly understood the need for mechanistic studies to clarify toxic effects, but recognized that elegant mechanisms in a nonrelevant species contributed little to predictive toxicology. He was also somewhat skeptical of statistics, arguing that if you need statistics to answer the question, you should probably go back and try to ask a different question.

Ken believed that good science was not determined by whether your research was basic or applied, and that massaging someone else’s data or carrying out administrative duties were not substitutes for time spent in the lab and on the daily checking of the rats. To all of us who knew him, and to all who have come to know him through his research and work, Kenneth DuBois was clearly a “real” toxicologist.

Toxicological Sciences, 54, 1–2 (2000), © 2000 by the Society of Toxicology
Harry W. Hays was one of the nine Founders of the Society of Toxicology, serving as Secretary for the Founders during their initial meetings and as the Society’s fourth President.

Dr. Hays was born in Emmitsburg, Maryland, on October 25, 1909. He received a B.S. degree from Franklin and Marshall College in 1933, a M.S. degree in biology from Princeton University in 1937, and a Ph.D. degree in biology from Princeton University in 1938.

Dr. Hays’ first professional post was as a research pharmacologist for the Ciba Pharmaceutical Company, 1938–1948, following which he was appointed an associate professor in the Department of Pharmacology at Wayne State University.

In 1957, he took a leave of absence from Wayne State University to accept an appointment in the National Academy of Sciences-National Research Council as the first director of the Council’s Toxicology Information Center, later named the Advisory Center on Toxicology in Washington, D.C.

After serving as secretary of a National Research Council committee that studied pesticide regulation, Dr. Hays in 1966 was asked by the then Secretary of Agriculture to serve as director of the Pesticides Regulation Division of that department, a position he held through 1970 when he became the senior advisor and staff scientist to the USDA’s Agricultural Research Service.

Dr. Hays subsequently retired from government service and became associated with SOT members (and former SOT Presidents) Victor Drill, C. Boyd Shaffer, Ted A. Loomis, and Seymour Friess in a private consulting practice.

Dr. Hays was widely connected to his chosen field of toxicology. He was the author of numerous scientific publications and presentations and remained a staunch backer in the development and growth of the Society of Toxicology. He was a founding co-editor with Frederick Coulston and Arnold J. Lehman of what became SOT’s official journal, Toxicology and Applied Pharmacology. Following his term of office as the Society’s fourth President, he served as SOT Historian, publishing a book covering the first 25 years of the Society’s history.

He was also a member of other professional organizations, including the American Society for Pharmacology and Experimental Therapeutics. With respect to national service, the widespread recognition of his expertise in toxicology and pharmacology resulted in his appointment as member or chairman of advisory committees in the U.S. Department of Agriculture, the National Institutes of Health, the Council on Environmental Quality, the National Academy of Sciences, and the Committee on Cutaneous Health and Cosmetics of the American Medical Association.

In recognition of his major achievements in research, teaching, and national service and of his outstanding contributions to the advancement of the entire profession of toxicology, he was named the 12th recipient of the Society’s Merit Award.
Harold Carpenter Hodge
(1904–1990)

by Paul E. Morrow, Ph.D.; Hanspeter R. Witschi, M.D., DABT, ATS; M. Vore, Ph.D.; Pertti E. Hakkinen, B.A., Ph.D.; Judith A. MacGregor, Ph.D., DABT; James T. MacGregor, Ph.D., DABT; Marion W. Anders, D.V.M., Ph.D.; and Calvin C. Willhite, Ph.D.

Harold Hodge was the first President of the Society of Toxicology. Elected to the office by the nine Founders of our Society on March 4, 1961, he immediately assumed a very active role in organizing the Society by looking for support from all those who were interested in the science of toxicology. At two national meetings, FASEB (Federation of American Societies for Experimental Biology) in Atlantic City, New Jersey, and the Society of Pharmacology in Rochester, New York, he led discussions in which the goals of the newly created society were explained to interested scientists. Many questions had to be answered. But on April 15, 1962, he would preside over the first Annual Meeting of the Society of Toxicology. The Society was conceived as a learned society for people trained in various disciplines related to toxicology. In his opening remarks, Hodge pointed to the occasion as being truly historical. The Society would draw together all those with an interest in this particular science; the scientific discipline would from now on have an independent and unique voice. He emphasized that criteria for membership would be based primarily on original research publications. He also stressed that the newly born society should encourage universities to develop curricula in toxicology and should help in the development of standards for the training of toxicologists. These two major goals remain as valid today as when they were formulated by our first President in 1962.

The stipulation that membership was contingent upon publication of original research in toxicology—reviews, technical bulletins, or reports were not considered acceptable—did not go unchallenged. At one time, Harold Hodge raised the pertinent question of whether it would not be appropriate having another classification of membership for those engaged in the field of toxicology who had not published, or had not had the opportunity to publish original research, but nevertheless needed the Society and would have access to its meetings. The decision was deferred at the time and publication remained the gold standard for membership. As an aside, it must have been gratifying to publish papers in those days. Toxicology and Applied Pharmacology, published for the first time in 1959 by Academic Press, became the official journal of the new society. One proviso in the contract stipulated that the publisher would make available to the Society 15 percent of the income for reprint orders above 1,000 copies of a given paper. Clearly, reprints were more in demand then than they are now, before the widespread advent of electronic photocopying machines.

It was 25 years later that Harold Hodge, together with the other Founders of SOT, was officially honored at the Annual Meeting. He served as honorary cochair in a symposium, “Frontiers in the Study of Toxic Lung Damage.” He fulfilled his role with his usual grace and, not surprisingly, contributed to the overall success of the symposium with his incisive questions and comments.

Harold Hodge received his B.S. in 1925 from Illinois Wesleyan University and his Ph.D. in 1930 from the State University of Iowa. His first scientific paper was published in 1927, and eventually he published close to 300 papers and five books. In 1931 he came to the School of Medicine and Dentistry in Rochester, New York. At the time, he was fascinated by teeth and fluoride and thereby became involved in early research toward the prevention of dental caries. He spawned a great interest in the university in dental research that continues today. Apparently George Eastman, the Founder of Eastman-Kodak Company had bad teeth and so he gave a lot of money to the...
university to build the medical school, provided that they develop both medicine and dentistry. The development of dental research met Eastman’s proviso and the School of Medicine and Dentistry flourished.

Appointed initially in biochemistry, Hodge pursued dental research including the toxicity of fluoride, as there was a huge stigma against using fluoride for the public health. (It was, after all, a rat poison.) Today, of course, we fully recognize the benefits of adding fluoride to drinking water. When the Atomic Energy Commission came to Rochester at the beginning of World War II, they and the medical school created the Manhattan Project by selecting key people from many departments of the university. Harold Hodge was chosen to head the Division of Pharmacology and Toxicology. The thrust of the project was the toxicology of materials being utilized and developed in the atomic energy program, especially after inhalation. The inhalation toxicology of uranium and beryllium were the first great challenges given to Dr. Hodge’s division. Dr. Hodge had the capable hands of Dr. Herbert Stokinger to lead the early inhalation work. Their inhalation efforts were pioneering—the term “Rochester Chamber” remains well known today—and Rochester soon gained a reputation internationally for its inhalation toxicology program and its work with metals. When a new Department of Pharmacology was created in 1958, Harold Hodge became its first chairman, a post he held until he retired in 1970.

Harold Hodge received many awards. Illinois Wesleyan University bestowed on him an Honorary D.Sc. degree in 1949 and Western Reserve University did so in 1967. Other prestigious awards include the National Institutes of Health Annual Lecture, sponsored by the National Institute of Dental Research in 1954; the SOT Merit Award in 1969 and the first Education Award in 1975; the Lifetime Achievement Award of the Inhalation Specialty Section in 1984; and the First Prize in Preventive Odontology awarded by the Swedish Patent Revenue Research Fund, the Swedish Medical Research Council, and the Karolinska Institute in 1988.

It was fitting that Harold Hodge was the first recipient of the SOT Education Award. He was a superb teacher. The medical students to whom he taught pharmacology as well as the department graduate students really appreciated him. Many of his lectures (fluoride, food additives, and history of toxicology) were polished performances that led graduate students and postdoctoral fellows to attend over and over.

The Atomic Energy Commission, in its first days, relied on many army technicians. Dr. Hodge quickly instituted a graduate program in toxicology and pharmacology and thereby created and expanded major research efforts in both metal and inhalation toxicology. Most of the inhalation programs that developed after World War II throughout the United States were spawned by Harold Hodge’s graduates.

In 1957, the first edition of Clinical Toxicology of Commercial Products appeared, edited together with M. N. Gleason, R. E. Gosselin, and R. P. Smith. Eventually, a total of five editions were published. This volume, considered to be the authoritative and practical clinical guide to poisoning, was important for the establishment of poison control centers throughout the United States and still can be found on the shelves of innumerable emergency rooms.

After his retirement in 1970, Harold Hodge moved to the UCSF, where he stayed until 1983. As professor emeritus in the Department of Pharmacology, he remained very active in developing a toxicology training track for doctoral students. A colleague of his remembers how in his “retirement” status Dr. Hodge worked only five to six days per week, and his work load in the evening was light—he “only dictated letters and such.” Dr. Hodge believed that students should get into the laboratory as soon as possible and should not be loaded up with coursework for two to three years.

However, he insisted that all students, no matter how senior, participate in a two-hour per week course that rotated among various topics in toxicology, and that each student present a lecture each quarter. Junior faculty members were strongly encouraged to attend as well, to their benefit. He always showed interest in what was going on in the labs and classrooms, and always had time to talk with the toxicology graduate students and others. He was firm and principled and became a role model for many toxicologists by example and his advice to “play it straight.” A super negotiator, politician, and ever the gentleman, it was impossible to say no to any of his requests.
Dr. Hodge also religiously visited what he called “the library across the street,” where he routinely trounced the graduate students at squash. As one former graduate student remembers, Harold broadened his UCSF experiences by introducing him to the wonderful sport of squash. He was a very patient and good teacher, playing with a great deal of agility and skill. He was at that time in his early seventies but played like someone in their twenties or thirties. One of the best moments ever in sports was when the student was finally able to beat him after more than a year of playing him almost every week.

Dr. Harold Hodge died October 8, 1990. The Department of Pharmacology at the University of Rochester established a Harold C. Hodge Memorial Fund, and in the fall of 1992, the First Annual Harold C. Hodge Lecture was given. To those who knew him, Harold C. Hodge will always be remembered as an exceptional scholar and a true gentleman.

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Paul Stanley Larson was born in Michigan of Swedish parents. He completed his formal education in Berkeley, where he worked in protein and purine metabolism and electrolyte and water balance. He held academic appointments at Georgetown University School of Medicine (1934–39) and Wayne (State) University School of Medicine (1940–41) before joining the faculty of the Medical College of Virginia (now Virginia Commonwealth University School of Medicine) (1942–72). He was appointed the 13th chairman (and the first chairman with an academic degree; all previous chairman held medical degrees) in 1955, and occupied the Chair of Haag Research Professor in Pharmacology from 1963 until his retirement in 1972. In the early forties, Dr. Larson expanded the graduate training program in pharmacology and toxicology at the Medical College of Virginia, which was started by Dr. Harvey Haag (physician, former chairman of the department, dean of the school of medicine, officer of ASPET), an internationally recognized biomedical scientist. The program became nationally and internationally recognized because of Dr. Larson’s work in general toxicology, as well as the pharmacology and toxicology of nicotine. Dr. Larson was the Third President of SOT (1963–64). He also was active in the American Physiology Society, the American Society of Pharmacology and Experimental Therapeutics, the American Chemical Society, and the New York Academy of Sciences. His research interests ranged through the specialty areas of protein and purine metabolism, water balance, potassium metabolism, actions of anti-spasmodics, biological actions of nicotine, the chemical nature of irritants, and general problems of mechanisms in toxicology.

For his many friends and colleagues in toxicology and pharmacology, the privilege of having known and worked with Dr. Paul S. Larson on scientific and societal matters will be a source of continued pleasure and loving remembrance during our entire lifetime. He is best characterized as a serious scholar dedicated to fundamental research, as an educator intent on creating the next generation of talent in the biological sciences, as a skilled and devoted chairman of a department of pharmacology known for its excellence in teaching and research, and as a scientist committed to advancement in the state of knowledge in physiology, pharmacology, and toxicology.

Paul Stanley Larson was a man of immense dignity, a gentleman and a scholar, the epitome of the “southern gentleman.” He was soft-spoken but positive, highly disciplined but compassionate and caring, always available to colleagues and friends. He was quietly religious with very high ethical and moral standards.

The poet expressed it so well when he said “His life was gentle, and the elements So mixed in him that Nature might stand up And say to all the world, “This is a man.”
Arnold J. Lehman is a true pioneer of American toxicology. Although born into humble surroundings, on a farm in Good Thunder, Minnesota, his life’s work was anything but humble. Lehman obtained much of his advanced education from the University of Washington (UW). He earned a B.S. degree in 1925, an M.S. degree in Pharmacy in 1926, and a Ph.D. in 1930. At that time American toxicology was in its infancy, so his thesis and dissertation appear removed from his toxicological future. His master’s thesis was titled Washington Wild Parsnip and his doctoral thesis The Leaf Oils of Washington Conifers. After his time at the UW, Lehman received an M.D. from Stanford University in 1936.

Following several other academic positions, Lehman moved to the nation’s capital, where he was appointed professor of pharmacology at George Washington University Medical School. Meanwhile, in 1935, the Food and Drug Administration established a division of pharmacology. Although the agency had employed pharmacologists since 1908, it was not until just prior to passage of a successor to the 1906 Pure Food and Drugs Act, the 1938 Food, Drug, and Cosmetic Act, that a formal division was established. The division grew rapidly under the leadership of Dr. H. O. Calvery until his death in 1945. In the early years of the new division, scientist O. Garth Fitzhugh recalled that he and his colleagues had drawn up a short and simple list of substances that needed testing before being used in foods and drugs. Following World War II, however, a chemogastric revolution in foods, as well as the chemogastric revolution in drugs, forced the agency to confront a brave new regulatory world, and Fitzhugh himself gave up his listing of new chemicals and materials when it exceeded 10,000 entries. In 1946, Arnold Lehman was hired to head the Division of Pharmacology, which then included more than 22 scientists, and it was Lehman who organized and led the division’s efforts to confront this new chemical regulatory world. By 1947 manufacturers had proposed no fewer than 500 different chemicals for use in food products. Lehman began the precedent-setting practice of sitting down with industry representatives to discuss the kinds of tests that would be required by the agency to demonstrate the safety of any new chemical for use in foods. He also extended the scope of the testing to include packaging materials used with food products. Lehman, in collaboration with the Division of Food, obtained information on the proposed use, outlined methods for determining the amount, and described the toxicological studies that should be carried out to establish a safe level of the chemical materials or their components that might enter food. In 1949 the Division scientists, with Lehman as principal author, published what soon became known with affection in regulatory circles as the “Bible” of toxicology: Procedures for the Appraisal of the Toxicity of Chemicals in Foods. This publication began to codify the practices Division scientists discussed with industry representatives when they met.

Throughout the fifties, as a select Committee of Congress chaired by Representative James J. Delaney (D-New York) met to consider amendments that would impose premarketing controls over pesticides and color as well as food additives, Lehman and the Division scientists were outspoken in their opposition to the widespread peacetime use of DDT, as well as the more acutely toxic persistent pesticides aldrin and dieldrin. Although a stronger pesticides law was passed in 1954, it was not until 1958 that a
Food Additives Amendment was enacted, followed by a Color Additives Amendment in 1960. Both amendments imposed premarketing testing requirements and forbade approval of any substance shown to "cause cancer" in man or animals. Although scientists, especially toxicologists, were skeptical of these so-called Delaney clauses, they did ensure passage of the legislation.

On the heels of these landmark pieces of legislation, Lehman began to extend his service to the toxicological community. In 1961, he cofounded the Society of Toxicology (SOT). Lehman followed up his cofounding of the SOT with direct participation. Named Honorary President 1961–62, he also served on the Council from 1962–64. Thereafter he served on a variety of important committees. Lehman made another important contribution through his role in toxicological publishing. He cofounded the journal *Toxicology and Applied Pharmacology* in 1958. In 1961, as SOT was forming, discussions were held to consider having the journal become the official scientific publication of the Society. It came to pass in 1962 with the approval of the publisher, Academic Press.

Lehman continued to educate and influence the toxicological community with his extensive writings. He was especially prolific between the late forties and sixties. He often published articles about chemicals in food for such journals as *Advances in Food Research, Journal of Nutrition*, and the *Journal of the Association of Food & Drug Officials of the United States*. He was also a key figure in the publication of the National Research Council Committee on Toxicology’s *Principles and Procedures for Evaluating the Toxicity of Household Substances* in 1964.

Lehman’s importance to American toxicology does not go unnoticed. His original research, professional activities, participation in the SOT, and mentoring has been passed down to those in the toxicological and allied professions. Indeed, one of the coveted annual awards presented by the SOT is the Arnold J. Lehman Award, which is “presented to recognize an individual who has made a major contribution to risk assessment and/or the regulation of chemical agents, including pharmaceuticals.” An award of this stature may be the ultimate tribute to this pioneering toxicologist.

**Suggested Reading**


C. Boyd Shaffer, Ph.D., was one of the participants in the small group that met in Washington, D.C., on Saturday, March 4, 1961, in what emerged as the formation meeting of the Society of Toxicology. How Boyd Shaffer came to be part of that group is a reflection of his reputation in the field of toxicology and his contributions to the science. While private sector scientists were not always well accepted by other toxicologists, Boyd Shaffer, in his role as chief of toxicology at American Cyanamid, was a clear exception. Along with two of the other Founders of the Society, Dr. Shaffer received his physiology degree from Princeton under the direction of W. W. Swingle, probably in the mid-forties. Work published by him at that time centered on vitamin and hormone effects in experimental animals. His career at American Cyanamid featured published studies on pesticides and industrial chemicals, particularly polyglycols.

Boyd Shaffer’s contributions to the new Society were significant. He was elected as the second President (1962–63). During his presidency the Society was incorporated as a nonprofit under the laws of the District of Columbia, 57 new members were added, the treasury had almost $3,000, and the first efforts to work jointly with other scientific societies were begun. Of lasting importance was the contribution of Boyd Shaffer’s wife, Louise. She designed the seal and motto of the Society and they were accepted at the third Annual Meeting.

On his retirement from American Cyanamid, Dr. Shaffer joined with four other Past Presidents to found the consulting firm of Drill, Friess, Hays, Loomis & Shaffer.

Sources: H. W. Hays SOT History: ISI Literature Search

The Society of Toxicology

The First Fifty Years


Ken DuBois

C. Boyd Shaffer

Frederick Coulston

William Deichmann
Photo Gallery I


Society of Toxicology

50th Anniversary
SOT Members: Gone But Not Forgotten
SOT Members: Gone But Not Forgotten
To remember Mary O. Amdur simply as a pioneer in air pollution toxicology, who overcame gender, political, and scientific barriers to proclaim the potential for interactions between sulfur dioxide and particulate matter, would be an injustice. In our discussions of what to highlight in this brief biography, we struggled with accomplishments we thought merited emphasis versus what we thought Mary would want to see accented. Indeed, Mary shunned the spotlight most of her career, for she felt she was simply making inquiries in small, logical steps, in an attempt to unravel the mysteries of how mixtures of air pollutants interacted to adversely affect health. She was never on the conventional academic career ladder, either in fact or in spirit. Mary was a woman of principle, even when this led to decisions that would take her career over the “hard-road,” for she did what she felt was right despite the consequences. She valued her character and loyalty to those she trusted more highly than her career, knowing she was more than a research scientist. Though deserving of a title such as “Mother of air pollution toxicology,” Mary was every bit a Renaissance woman. She was, in addition, an accomplished chemist, a lover of English and French literature and music, a naturalist, an able gardener and baker, a wife and homemaker, and a loyal friend and mentor.

As a woman in the strongly male-dominated field of environmental and occupational health of the late forties through the fifties, Mary Amdur’s research career was blocked by this led to a number of barriers. Mary was an exceptional student throughout her academic life. She received her B.S. in chemistry from the University of Pittsburgh in 1943, and in just three years, was awarded her Ph.D. in biochemistry from Cornell (Role of Manganese and Choline in Bone Formation in the Rat). She soon moved to the Massachusetts Eye and Ear Infirmary in Boston to allow her husband, Ben, to pursue his doctoral degree. In 1949, Mary relocated to the Harvard School of Public Health (HSPH) to work with Professor Phillip Drinker (known as the inventor of the iron lung). Her primary charge was to develop an assay to measure lead in ambient particulate matter. She succeeded at this task, but the success was soon forgotten in the controversy surrounding her endeavors to investigate the role of sulfur oxides and health.

Mary had become interested in air pollution following the infamous Donora, Pennsylvania, smog of 1948. She accepted the task of initiating investigations into the irritancy of sulfuric acid in human lungs, under the direction of Professor Drinker and supported by funds from the American Smelting and Refining Company (AS&R). The company was interested in demonstrating that sulfuric acid was a minor contributor to the adverse health effects in the Donora incident, especially to deny any role it may have had in the observed mortality. They may have hoped that Professor Drinker would keep a “watchful eye” on the research (from Muscle and Blood, 1974, by Rachael Scott). However, Mary produced some very provocative data suggesting potentially adverse effects in human subjects who inhaled either or both sulfuric acid and sulfur dioxide—the latter being the main AS&R emission and the one pollutant they did not want studied. In the early fifties very little work had been done on the cardiopulmonary effects of inhaled pollutants, except in animal studies that typically used lethality as the end point. However, Mary and her husband had conducted some earlier experiments on a long July 4th weekend, 1953, on guinea pigs purchased with their own money. The results of their experiments showed dramatic short-term effects from breathing both irritants. The data had been presented at the American Association for the Advancement of Science meeting in December 1953, with no objections or negative sanctions.
However, her findings of adverse physiologic effects in humans at relatively low concentrations—not unlike those estimated for Donora at the time of the smog incident—were met with great dismay and disparagement by the lawyers of the western smelter industries, as well as by the executives of AS&F. She presented this and her research on lead at the Annual Meeting of the American Industrial Hygiene Association held in Chicago in April 1954. At the meeting she found herself alone, trying to outwit the somewhat strong-armed representatives of AS&F. Meanwhile, considerable pressure, of the financial type, was brought to bear on HSPH, and Professor Drinker specifically, to convince Mary to withdraw her presentation and delay publication of her work. Mary did not concede, and even after Professor Drinker himself withdrew the already submitted paper from the *Lancet*, Mary convinced him to rescind his decision and allow the paper through. The result was termination of the project and the loss of her research associate position under Drinker, on the very day she returned from Chicago.

Professor James Whittenberger, chair of physiology at HSPH, who earlier had said he had interest in her work, quickly hired her as a research associate to expand upon these initial efforts with the help of Dr. Jere Mead, the renowned lung physiologist. One best understands Mary’s frustration under these circumstances as she describes the increasing looseness of her engagement ring on her finger during this period, and one senses the outrage of academic colleagues at such shenanigans, as documented by her correspondence with other historical names in industrial medicine, including Alice Hamilton, Herbert Stokinger, Harriet Hardy, Henry Smyth, Anna Baetjer, and Harold Hodge. In the end, Mary’s Pennsylvania Dutch stubbornness and adherence to principle prevailed. She soon gained a reputation as one who could not be crossed more than once. With the early support of Whittenberger and Mead at Harvard, she was able to launch her air-pollution research and to develop a physiological animal model that, for more than four decades, became the basis of her studies to understand the interaction of particles and gases in the mammalian respiratory tract.

Although Mary was quite successful in funding her research at the HSPH, she left in 1977 for both political and scientific reasons. She was well published and widely known for her provocative research with the guinea pig model. She had demonstrated the irritancy potential of sulfur dioxide and its ability to interact with water-soluble metal salts to further oxidize the sulfur in the particle, which travels to the deep lung, where its potential for irritation would be magnified. Despite this unique and pioneering work, and after nearly 30 years at Harvard, she never rose above the rank of associate professor, without tenure. In a battle with the dean over the tenure of her beloved colleague, Sheldon Murphy, she vowed to take her program elsewhere. She had a vision that a collaboration with metallurgical and chemical engineers would provide answers to her questions regarding the effect of the chemical and physical interaction of particles and gases on the lung. Across the river at Massachusetts Institute of Technology, she saw such a potential, and thus offered her program to MIT, if she could establish those liaisons. She quickly moved there, accepting the unheralded position of lecturer, and focused her energy on spearheading a unique project, funded by industry and federal support, to tie toxicological research to an engineering base that could produce relevant aerosols of freshly-formed combustion products from fossil fuels for inhalation exposure studies. This work led to the demonstrations that physicochemical interactions between sulfur dioxide and fresh metal oxides from coal combustion led to the formation of sulfuric acid on the surface of the metal oxide, which was capable of substantial effects on the physiology and structural integrity of the guinea pig lung.

Despite her highly successful MIT program in terms of funding and notoriety, Mary remained in a non-faculty position for 12 years, and finally realized that air pollution toxicology would remain a stepchild at MIT. Thus, at the age of 67, she moved her program to the Institute of Environmental Medicine of New York University in Tuxedo Park, New York, where she merged her efforts with Drs. Rich Schlesinger and Mort Lippmann. She recruited a team from her staff at MIT and from around the nation to carry on her work. She gained the title of senior research scientist, but was again untenured.
Despite her continued success in acquiring research support funds. Loving her home and gardens in Westwood, Massachusetts, and with the eventual illness of her beloved husband, Ben, she commuted alone from Massachusetts to Tuxedo Park for two days a week, to ensure the direction of her research. After retirement in 1996, she continued to write and consult on scientific papers emanating from New York University, to edit manuscripts, and to preserve the legacy of her 46+ years of effort. The lack of recognition by her employers had had little effect on Mary, and, frequently the contrarian, she reveled in the struggle. Not many of us could have waged the battles of Mary Amdur, achieved such success and respect, and dismissed with such grace the disservice rendered by the academic establishment. We would consider ourselves fortunate to have her character and strength.

Because of Mary’s research accomplishments, she received many awards throughout her career. These included the 1974 Donald E. Cummings Memorial Award from the American Industrial Hygiene Association; the 1984 Henry F. Smyth Award from the American Academy of Industrial Hygiene; the 1986 Career Achievement Award from the Inhalation Specialty Section of the Society of Toxicology; and the 1989 Herbert E. Stockinger Award from the American Conference of Governmental Industrial Hygienists. In 1997 Mary also became the first woman to receive the Merit Award from the Society of Toxicology. Although this last award was the one that gave her the most pleasure, she looked forward to receiving it with dark humor. She was well aware that colleagues, including her close friend Sheldon Murphy, had died within one year of receiving the same award. Unfortunately, Dr. Amdur did pass away just short of one year after the award, in February of 1998.

Mary Amdur directly supervised only a handful of doctoral students, but she mentored many more with her open-door policy. Her scientific and career advice was highly influential in the development of the careers of many. Perhaps her main educational contribution lies within the covers of Casarett and Doull’s: The Basic Science of Poisons. She served as editor on editions 2–4, and she played a significant behind-the-scenes role in providing support and energy to get the first edition out after the death of Louis Casarett during its preparation. Her tireless efforts, her painstaking reviews of the chapters, and her insistence upon up-to-date-accuracy and integrity were central to the success and widespread recognition of the quality of the text.

For those of us fortunate enough to have known or worked with Mary, her personal attributes paralleled her scientific prowess. She was fair and honest, held strong convictions, and possessed a wry wit and demeanor; yet she was infinitely compassionate with students and their plights. Her directness and insightful thinking were refreshing to all, and she was an exquisite writer and editor. But her Easter-season hot-cross buns, and likewise her Halloween ginger cookies, were much more appreciated by her classes than any lecture outline. Mary was very much a modern-day Renaissance person. She was classically literate and loved everything French. During the unusual free time of her retirement years, she traveled around the world exploring and studying regional flora and tending to her gardens and greenhouse at home. Unquestionably, she will be remembered for her impact on air pollution regulation and inhalation toxicology, but for those of us who were fortunate enough to have shared time and space with her, she will be remembered most for her intellectual enthusiasm, her nurturing of good science, and her personal caring.
Lou Casarett was born in Rochester, New York. His forebears, the Casaretti family, emigrated from Italy to Rochester during the Civil War era. Lou attended primary and secondary schools in Rochester and served in the United States Navy during World War II. In 1950, he obtained his B.S. degree from the University of Michigan. In 1951, Lou returned to Rochester, and Paul Morrow, who became a close personal friend, recalls with considerable pleasure picking Lou up each day to take him to and from the university as he had no car. Lou was a determined and successful graduate student who enthusiastically joined Professor Harold Hodge’s research division, a predecessor of the University of Rochester’s first Department of Pharmacology. Lou received his M.S. degree in 1955 and his Ph.D. degree in 1958, both from the Division of Pharmacology and Toxicology of the Department of Radiation Biology at the University of Rochester. Dr. J. Newell Stannard was his advisor for both degrees.

In the early fifties, Lou utilized microscopic autoradiographic methods pioneered in the late forties to define and semiquantify radioisotopic distributions at the tissue and cellular level. By the use of innovative freeze-dry techniques and quantitative studies of isotopic leaching during various histopathologic and autoradiographic procedures, Lou was able to advance the methodology, especially that applied to the study of alpha-emitters, e.g., Po-210 and Pu-239. Important findings from Lou’s autoradiographic investigations of animals exposed to radioactive dusts and from his subsequent studies of alveolar dust clearance in experimental animals include many aspects of lung cell-particle interactions such as endocytosis by lining cells, alveolar macrophage (AM) recruitment, the permeation of the lung epithelium to particles, and the role of perivascular and peribronchiolar lymphatics in the pulmonary clearance of insoluble particles. On the respiratory clearance of insoluble particles, Lou proposed four distinct phases: a rapid mucociliary clearance, a slower AM-mediated clearance, a still slower clearance of sequestered particles by AM, and a concurrent solubilization of sequestered particles. Lou cautioned against extrapolating from this model, based on experimental animal studies, to clearance mechanisms in lower, more realistic particulate exposures.

When Lou joined the faculty at Rochester, his special interest in matters educational began to be expressed. He developed a summer research program for undergraduate students wherein he solicited applications from many academic institutions around the country and then matched the students with appropriate mentors. In addition to laboratory work, the students met once a week for research seminars presented by faculty members. Although this type of program is widely used today, Lou’s summer program at Rochester was one of the first in the nation, a fact noted by Newsweek magazine, which prepared a special article on the program in its second or third year of existence.

One particularly poignant event in Lou’s teaching career occurred at the University of Rochester when a graduate student of his, George Metzger, developed testicular cancer. Although he received the most advanced therapy, Metzger’s cancer rapidly progressed so that for his Ph.D. defense, his committee with an outside member, Dr. Roy Albert of NYU, met in a New York City hospital at George’s bedside. George’s defense was exceptional and he was awarded his doctorate in pharmacology. Sadly, he died shortly after the award. The department, in his honor, created the Metzger Award, an annual award given to a graduate student who has shown particular excellence in his doctoral research.
During his days at Rochester, Lou also took the lead in many extracurricular activities. He was an avid sportsman who especially liked boxing and tennis. He volunteered to organize and prepare many clam bakes and social activities of the department. His abilities to organize and cook were also manifest at home, where he and his wife, Peggy, frequently entertained with gourmet dinners prepared for friends.

In 1967, Lou and Peggy moved from Rochester, New York, to Honolulu, Oahu, where they joined the faculty of the new medical school in its formative stages. With his usual zeal, Lou, now an associate professor of pharmacology, played an active role in getting the Department of Pharmacology up and running and concurrently developed a graduate course in toxicology. For this new course, Lou very much wanted a toxicology textbook that would include not only the classes of toxic agents (metals, pesticides, solvents, etc.) but also the organ systems involved (liver, kidney, CNS, etc.) as separate sections of the book. Lou approached Professor John Doull at the University of Kansas, described his concept, and asked him to join him in the venture. John enthusiastically agreed and since Lou and John were serving together on the NIH Toxicology Study Section, they presented this idea to its members at a seafood dinner in Bethesda. Members who approved the idea, such as Gabbie Plaa and Sheldon Murphy, were quickly signed up as potential authors and Lou then negotiated with Joan Zulch for Macmillan to be the publisher. Subsequently, during a vacation in Hawaii with his family, John worked with Lou selecting potential contributors and addressing matters regarding the scope of the book. Tragically, as the first chapters were received, Lou was diagnosed with brain cancer. As his condition deteriorated, his wife Peggy worked with him reading him the newly drafted chapters that Peggy recalls were, for the most part, outstanding. Concomitantly, Professor Doull, aware of Lou’s problem, became heavily involved in the reviews and decision making and working with Peggy and the contributors to the book.

Peggy recalls sending one somewhat-tardy contributor several Hawaiian picture postcards: “Thinking of you, wish your chapter were here.” When all the chapters were finally received, Peggy turned them over to John Doull, who took the major responsibility for getting the book to press and for sustaining the momentum with subsequent editions. John’s wife Vera did the valuable task of indexing the book. Thus, the textbook was completed due to the perseverance of Peggy, the assumption of the major responsibility for organizing the book and shepherding it into print by John Doull, and the enthusiastic and capable participation of several of Lou’s professional friends and colleagues, including Curtis Klassen and Mary Amdur, who subsequently became co-editors of the book. The emergence of Casarett and Doull’s Toxicology: The Basic Science of Poisons in 1975 was a landmark event in toxicology and a fitting memorial to Lou Casarett’s dedication to toxicologic education. As Dr. Harold Hodge, first President of SOT, wrote in the foreword of this book: “This is the time for exploring the avenues of instruction in toxicology. Drawing from their teaching experience, Drs. Casarett and Doull have pooled their special interests and added contributions from other specialists. A useful plan of organization became apparent to them, grouping toxicologic phenomena according to organ systems. Dr. Casarett fervently brought this book to completion, conceding nothing to his terminal illness, because he bore the conviction that this form serves its purpose well, a conviction shared by Dr. Doull. Their choices are commended; toxicology needs such a textbook.”

Always gregarious and outgoing, Lou was readily accepted by Hawaiian locals who were traditionally wary of “outsiders.” He quickly earned the trust and respect of people in many walks of life, both within and outside of the university. At the community level, he became involved in the issue of drug abuse, which was a major problem on Oahu. He and a graduate student, Randy Baselt, developed a urine analysis program for the island’s methadone clinic. Without this backup, the methadone treatment program probably would not have been successful. Moreover, Lou helped set up an analytical laboratory capable of identifying the drugs in use on the streets so that emergency rooms were able to determine what kind of drug problems they were facing. These volunteer efforts led to Lou serving on the Health and Community Services Council, the State Commission on Drug Abuse, the Governor’s Ad hoc Committee on Education in Alcoholism and Drug Abuse, and several other municipal, state, and university committees. Lou’s major research interest...
at the medical school was the toxicology of penta-
chlorophenol, a pesticide for the ubiquitous problem
of dry-wood termites on the Hawaiian Islands. His
academic and civic activities in Oahu certainly must
have endeared him to many.

While at the University of Hawaii, Lou took
sole responsibility for graduate education in
radiation biology, developed a graduate research
program in pharmacology and toxicology, and
served as chairman of the department's curriculum
committee. Lung clearance mechanisms continued
to be a major research interest. His final treatise
on the subject was published in 1972 in Essays in
Toxicology, Vol. II entitled “The Vital Sacs: Alveolar
Clearance Mechanisms in Inhalation Toxicology.”
For years, he had been intrigued by the possibility
that alveolar macrophages might also be derived
from sources other than the bone marrow, a radical
concept at the time. He argued that lung cells are
likely to have the capacity for differentiation, dedif-
ferentiation, adaptation, and for multiple functions.
“To insist on specific anlagen is to deny a basic
property of biological entities and to ignore what has
been learned in analogous cell populations in other
organs.” Subsequent studies have confirmed Lou's
viewpoint regarding a pulmonary source for AM
(e.g., M. J. Evans and S. G. Shami, 1989, in Lung Cell
Biology, Vol. I Lefant and Massaro, Eds., pp. 1–36,

Despite his untimely death at age 45, Dr. Lou
Casarett's contributions to toxicology were manifold,
selfless, and important. Doubtless, it would be his
wish to be remembered for his efforts in education.
A dedicated, accomplished teacher, he took the
initiative many times in his brief career to institute or
improve how toxicology was taught. His friends knew
him as an engaging, cheerful, modest individual who
greatly enjoyed both intellectual and social pursuits.
The Society of Toxicology is pleased to cite the
accomplishments of this outstanding toxicologist.

Acknowledgments

The authors would like to cite the important contri-
butions made to this profile by Sue Shami (lung cell
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graduate student of Lou's at Hawaii), and Vicki Casarett
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2001 by the Society of Toxicology
Dr. Herbert Cornish was a distinguished scientist who was well known for his teaching and research skills, which spanned nearly four decades.

Cornish was born on September 22, 1916, in Fremont, Ohio, and he married Grace Heater in 1943. He received his undergraduate degrees in science and education from Bowling Green State University and served in the United States Army from 1941–45. He earned his doctorate in biochemistry from the University of Michigan in 1956, and immediately thereafter embarked on a 29-year career as a professor in the School of Public Health (SPH).

Cornish taught the first course in industrial toxicology at SPH and was responsible for development of the school’s Toxicology Program, the first of its kind in the nation. The program established close ties with the departments of pharmacology, biochemistry, physiology, and pathology in the medical school of the University of Michigan, while simultaneously maintaining its own independence. In 1980, the Society of Toxicology, of which he was a Charter member, named Dr. Cornish Educator of the Year.

In an era when there was often a distance between professor and student, Dr. Cornish believed that it was important to engage in frequent dialogue with students during which he encouraged them to think freely. Although the students often had poorly formulated research efforts, he treated them with respect and worked with them to discipline their thought processes. He was the sort of graduate advisor every student wants—he took a personal interest in everyone. Often, when students were having financial difficulties, he would invite them to live in one of the many bedrooms of his rather large, old home until they could get back on their feet. His generosity seemed unbounded.

His fatherly approach, however, did not lower his expectations regarding the performance of his students in their research. Herb had a command of industrial toxicology equal to nearly anyone in the field during the sixties and seventies, and this was recognized when he was asked to author the chapters on solvents in the early editions of the most used toxicology text, Casarett and Doull’s Toxicology: The Science of Poisons. During his career, he published more than 100 peer reviewed articles and numerous book chapters.

Dr. Cornish focused his life almost entirely on promoting the field of toxicology and to furthering the University of Michigan. He served on numerous SPH committees and counseled during his career nearly more than 100 students who earned M.S. or Ph.D. degrees. Furthermore, he made valuable contributions to the resolution of toxicological issues by participating on advisory committees, among them the National Research Council of the National Academy of Sciences, the United States Environmental Protection Agency, and the American Conference of Industrial Hygienists.

His major research contributions focused on the mechanisms of action of a wide range of substances at the biochemical level. His seminal researches on the metabolism and actions of caffeine, hydrazines, ethanolamines, and carbon tetrachloride serve as examples of the pioneering influence of his work on the field of toxicology.

Although he loved teaching and research, he had a nearly equal affection for old clocks and other antiques. Cornish was a member of the National Association of Watch and Clock Collectors and an...
officer for the Fan Association of North America. He was past president of the Ypsilanti Historical Society. He collected both clocks and fans voraciously and was capable of repairing a wide range of clocks. For students who had an interest, once a month they were rewarded by going with him to the large antique auction house on Friday afternoon or Saturday morning, where he would patiently explain the history of the timepieces.

Dr. Cornish was a religious person and a wonderful example of one who embraced the golden rule. He was, not surprisingly, a humble person. He was an elder of the First Presbyterian Church of Ypsilanti. He also served for many years as a Boy Scout troop leader.

In spite of his commitment to teaching, mentoring, and research, he always preserved a considerable amount of time to serve the Society of Toxicology.
Dr. Robert L. Dixon, a friend and colleague, and the 22nd President of the Society of Toxicology, died August 28, 1989, in Albany, New York.

Bob was born in Sacramento, California, and was trained in pharmacy at the University of California, Davis, and at Idaho State University. He received his Ph.D. in pharmacology at the University of Iowa in 1963. Bob’s career was a steep trajectory of successes and contributions to the science of toxicology, the training of toxicologists, and major contributions to a more reasoned regulatory climate in the United States. After leaving Iowa, Bob served a postdoctoral fellowship at the National Institute of Health, followed by several years on the faculty in the Department of Pharmacology at the University of Washington. He was called back to Bethesda to serve as chief of the Laboratory of Toxicology at the National Cancer Institute and then moved to the fledgling National Institute of Environmental Health Sciences (NIEHS), where he served as chief of the Laboratory of Reproductive and Developmental Toxicology. Along with his duties as laboratory chief, Bob was assistant to the director for the Institute’s international programs. During his time at NIEHS, Bob served on detail at the Office of Science and Technology at the White House for two years. Following his service at NIEHS, Bob served as director of the Office of Health Research at the United States Environmental Protection Agency from 1984 until 1985, after which he left to head drug safety at Sterling Winthrop Research Institute and served as vice president of drug safety at the time of his death.

For his many major contributions to the science of toxicology, Bob was recognized by our Society with the Merit Award in 1972, the NIH Directors Award from the National Institutes of Health in 1977, and the EPA Distinguished Career Award in 1986. Many of us knew Bob through his many contributions to the Society of Toxicology, ranging from service on many committees to an extraordinarily productive year as President of our Society from 1982 to 1983. Bob’s contributions are legend. His enthusiasm, drive, and commitment to our Society are recognized by all.

Those of us who had the opportunity to know him well appreciated his warmth, his integrity, his commitment to the growth and development of young people, his warm good humor, and his loyal friendship. Our sincere thanks to Marilyn and the family for sharing Bob with us for these many years. We all are better for having known him.

Robert B. Forney, Sr.
(1916–1997)

by James E. Klaunig, Ph.D., ATS

Robert Burns Forney, Sr., grew up in Terre Haute, Indiana. He received his higher education at Indiana University (IU)—the A.B. (1938), and A.M. (1939) degrees in chemistry at IU at Bloomington and his Ph.D. in Toxicology under Professor Rolla N. Harger at the IU School of Medicine in Indianapolis in 1948 (the first person to receive a Ph.D. degree for graduate studies carried out on the Indianapolis campus of IU). In 1948 he joined the faculty of the Department of Pharmacology and Toxicology and rose to the rank of full professor in 1962. He was appointed distinguished professor in 1977 and distinguished professor emeritus in 1991. His 58 year association with Professor Harger (the inventor of the first practical breath alcohol testing instrument) resulted in seminal contributions to forensic and analytical toxicology.

Forney, who was devoted to his students, established the first federally funded graduate training program granting the Ph.D. degree in Toxicology in 1963. Under his direction, the program produced 36 graduates, most of whom went on to distinguished careers themselves in industrial, academic, government, or forensic toxicology. The toxicology program, which continues to this day, is recognized worldwide for its excellence and rigor.

A world-class contributor to clinical and forensic toxicology, Dr. Forney was internationally respected in the fields of ethanol and marijuana research, recreational drugs, and pesticides, and his advice was sought by authorities worldwide. He pioneered human studies on marijuana, where his group was one of the first to isolate and quantitate delta-9-tetrahydrocannabinol and study its effect on human subjects.

In his studies of the effects of alcohol on human psychomotor and mental/motor performance, Forney and his associates used innovative approaches far beyond the then-traditional laboratory studies. Dr. Forney’s work was instrumental in establishing impairment standards throughout the world. Following his interactions with the Legislature of the State of Indiana, that state became the first to enact a drunk driving statute based on chemical test results. Other states and the federal government then followed. Dr. Forney served with distinction as the first director of the Indiana State Department of Toxicology, a position created for him by the Indiana Legislature in 1954 until 1991. Forney solved numerous criminal cases involving poisons by bringing analytical chemistry to forensic toxicology and contended with legions of lawyers. He also pioneered poison control in America with a card index of poison information available to the public by telephone.

Forney became a member of the Society of Toxicology (SOT) in 1963. Dr. Forney served SOT as President (1981–82) and as a member of the Education Committee (1967–69) and the Ethics Committee (1984–87); he was active in the Ohio Valley Regional Chapter, serving as President (1985–86) and Councilor (1990–91). In 1979 he received the SOT Education Award and in 1983 the DuBois Award from the Midwest Society of Toxicology.
Dr. Forney published over 185 scientific articles and book chapters, covering his research not only on ethanol and its effects, but on many other drug substances, on the techniques of toxicology research, and on the utilization of forensic toxicology in the law. He served on the editorial board for many scientific journals, including the Journal of Forensic Science, Toxicology and Applied Pharmacology, and the Journal of Clinical Pharmacy and Therapeutics. 

Dr. Forney received numerous awards during his career. These included an Honorary Doctor of Laws degree from Indiana Central College (1964), the Rolla N. Harger Award of the American Academy of Forensic Sciences (1985), the United States Army Decoration for Distinguished Civilian Service (1988), and the National Safety Council’s Robert F. Borkenstein Award (1990).
Seymour L. Friess
(1922–2008)

Seymour L. Friess was born in Detroit, Michigan, in 1922. Friess graduated Phi Beta Kappa from the University of California at Los Angeles (UCLA) where he worked on and completed his A.B., M.S., and Ph.D. degrees in chemistry during the years 1939–47. After two years with the Manhattan District and three years teaching at the University of Rochester, he came to the Naval Medical Research Institute, where he served as a research scientist and as chairman of the departments of Physiological Sciences and Environmental Biosciences until his retirement in 1979. During this time he also served as adjunct professor in the medical school of the Uniformed Services University of Health Sciences and honorary chairman of biophysics at the University of Brazil.

He served on the Science Advisory Boards of CIIT and NTP, and on many committees of the National Academy of Science/National Research Council, and he chaired the Scientific Panel for the NASA Apollo-Soyuz Test Project. His research interests focused primarily in molecular biology but among his 130 papers, one can find significant contributions in many other areas of toxicology and pharmacology. He had a particular interest in the effects of diving on the human response to chemicals and the emerging field of neurotoxicology (his first papers were written in the early fifties).

Dr. Friess had a long record of significant contributions to the Society of Toxicology. He was recognized for the major role that he played in shaping the current status of the discipline of toxicology both in this country and throughout the world. He was a Charter member of the Society and after serving on many of the committees and Council, he became the 15th President of the SOT in 1975. During his term as President, he participated in the Sixth International Congress of Pharmacology in Helsinki and, along with others, he became concerned about the proposal to establish toxicology as a section of the International Union of Basic and Clinical Pharmacology.

He became a leader in the movement to develop the International Union of Toxicology as a better way to give toxicology the credibility and stature that it needed to grow and mature. This led to the First International Congress of Toxicology in Toronto in 1977 and his election as the first President of IUTOX.

Seymour demonstrated a key leadership role in the American Board of Toxicology (ABT). He was the first president of this group and here again the success and credibility of ABT and their approach to providing board certification for toxicologists reflected his wisdom and dedication to the field.

From about 1979 to 1997, he was the managing director of a toxicology consulting group that he and four other Past Presidents of the Society of Toxicology established in the Washington area. His partners were Drill, Hays, Loomis, and Shaffer. In 1988, Friess was the recipient of the Society of Toxicology’s Merit Award. The Merit Award is given in recognition of a distinguished career in toxicology.

Those who had the privilege of working closely with Seymour recognized his high standards for ethics, diplomacy, and productivity. Our discipline benefited from his unequivocal and articulate support of good science and the fundamentals of toxicology.
Perry graduated from the University of Minnesota, receiving his Doctor of Veterinary Medicine and a Ph.D. in Pharmacology. He spent three years at Michigan State University as an associate professor in the pharmacology department. The next thirty years were spent with Dow Chemical in various research and management positions. Perry was responsible for the formation of Environmental Health and Safety at Dow. He retired as vice president of research and development for Dow AgroSciences.

Perry was President of the Society of Toxicology from 1980 to 1981 and President of the International Union of Toxicology from 1986 to 1989. The Society of Toxicology presented him with its Merit Award in 1983, and in that same year, he received the Founders Award from the Chemical Industry Institute of Toxicology. Perry had numerous professional and board memberships where he served in advisory and governing capacities.

Perry contributed extensively to SOT, not only as President, but also serving on Council, a number of committees, and as an associate editor for *Toxicology and Applied Pharmacology*. He authored or coauthored over 200 scientific papers, some of which are classics in toxicology.

While at the University of Minnesota, Perry was very proud of being on the Scholastic All-Big Ten and Scholastic All-American Team for football. He also received the Big Ten Conference Medal for the most outstanding combination of athletic and scholastic performance.

After graduation from Minnesota in 1965, Perry started his research career at Dow Chemical. He spent two years at Dow’s biochemical research laboratory and returned to academia at Michigan State University (MSU) in the Department of Pharmacology. Perry’s goal was to make toxicology a part of the pharmacology discipline at MSU. In the three short years he was at MSU, he did accomplish the task of promoting toxicology at the university, and it truly marked a new era in toxicology: What was once the Department of Pharmacology is now the Department of Pharmacology and Toxicology.

In 1970, Perry returned to Dow Chemical at the persuasion of V.K. Rowe, one of the Founding fathers of the Society of Toxicology. Perry became the director of the Dow Toxicology Research Laboratory. Through his leadership, he developed a world-class toxicology laboratory. Perry had a vision of what he wanted to accomplish. When he joined Dow, there were 18 people in the laboratory; ten years later, there were over 300 professionals. His first two hires were Bernie Schwetz and Dick Kociba, both of whom became renowned toxicologists. Throughout the years, other notables who were part of his laboratory were Jim Gibson, Jim Bus, and Phil Watanabe. The laboratory developed many other great toxicologists who helped enhance toxicology.

Perry was instrumental in taking toxicology from “stuff the animals with chemicals and count the dead” to utilizing the newest biological and mechanistic advancements and protocols in order to better understand chemical risk. His laboratories were dedicated to looking for the intrinsic toxicity of chemicals. He had a strong desire to emphasize the importance of dose response, absorption, metabolism, distribution, and excretion of chemicals. The data derived from these studies revolutionized toxicology and established a science-based approach to risk assessment that continues to be refined today.

Perry J. Gehring
(1936–2003)

*by Joe LeBeau, M.S., D.V.M., DABT*
Metabolism was one of Perry’s favorite research disciplines. His knowledge of math, along with his biological acumen, led to some of the first pharmacokinetic models. I think of Perry as the father of the use of pharmacokinetics in toxicology. In fact, he really thought the term “chemobiokinetics” should have been used. This early work led to the science of physiologically based pharmacokinetic modeling. Perry was also an early pioneer of studying chemical metabolism at the cellular and subcellular level.

The one thing Perry was very demanding of in research methodology was the necessity of using protocols. He felt that without a protocol, you really had not thought through what you wanted to accomplish. His drive for protocols was really the start of good laboratory practices before they were mandated by the government.

Perry wanted to utilize all the information available or that could be obtained to truly understand chemical risk. To do this at Dow, he formed an epidemiology group and added a research arm to the industrial hygiene organization. With information from these groups, he could look at real-life data along with the animal toxicology data and try to fully understand the chemical risk to humans. He then added the environmental toxicology group. This fulfilled his vision for having an environmental health and safety organization at Dow, which was one of the first in industry. With this organization, research could be conducted to identify the potential impact of chemicals on the environment and human health.

Perry felt strongly that there was a need for an institute where scientists could focus on doing chemical toxicological research and not have to worry about funding. He convinced his bosses at Dow to talk to other chemical company executives about forming such an institute that would be supported by the chemical industry. In a short period of time, this institute went from being a vision to reality. It was called the Chemical Industry Institute of Toxicology (CIIT). Since its inception, CIIT has contributed extensive information that has helped revolutionize many aspects of toxicology. The institute is also responsible for the nurturing and developing of many toxicologists. Many are currently working in academia, government, and industry, where they have become proven leaders.

I have described only a few of Perry’s contributions to the field of toxicology. It would take an entire volume to completely describe his contributions and research achievements. Since his death, a number of his colleagues have told me, “He was a real leader and person with uncanny vision.” The word respect was the most consistent comment. “You might not always agree with Perry, but you sure respected him.” His work ethic and tireless determination were legendary.

Perry was not only a researcher and manager; he also had many other interests. He was an avid outdoor sportsman, a sports enthusiast, a worldwide traveler, and a voracious reader. He had an unmatched enthusiasm for life. He really enjoyed people and touched so many. It didn’t matter if you were rich or poor. To Perry, everyone was a “rich” person. One of his last phone calls was from a South Dakota farmer named Butch whom Perry had known only a short time. When Perry did not arrive in South Dakota to hunt pheasants this fall, Butch felt compelled to call Perry and tell him he was missed and wish him well.

Leon Golberg left a legacy of substantial contributions to the basic scientific underpinnings of toxicology, the application of that science to important societal issues, and most significantly, through the creation of institutions that have had a lasting impact on toxicology. He was truly a visionary who set high standards of performance for himself and those who had the privilege of working with him.

Golberg was born August 22, 1915, in Limassol, Cyprus, the son of a jeweler. He began his scientific career at the University of Witwatersrand, Johannesburg, South Africa. His earliest interests were in history and mathematics. However, when he was introduced to organic chemistry, it is reported that the experience was “like a blinding flash of light.” His knowledge of chemistry and enthusiasm for its application to human health issues was one of the hallmarks of his career. From the University of Witwatersrand he received a B.S. (honors) degree in chemistry (1935), a B.S. degree in mathematics (1936), and an M.S. in physical chemistry (1937). Later he would receive a D.Sc. degree in biochemistry (1946) from that institution.

He received scholarships that enabled him to continue his graduate and professional studies in England. He received a D.Phil. degree in organic chemistry from the University of Oxford (1939) and an M.A. in anatomy and physiology from the University of Cambridge (1948). In 1951, he received Medical Bachelor and Bachelor of Surgery degrees from University College Hospital Medical School in London. Later, in 1983, he was to receive an honorary D.Sc. degree from the Philadelphia College of Pharmacy and Science in Philadelphia, Pennsylvania.

In 1944, Golberg married Bertha Klempman, also a physician, who was to be both his wife and colleague. The Golbergs had three children: Michael, Aron, and Laura.

Golberg’s most significant early research that led to noteworthy publications was conducted while he was a graduate student and a member of a research team at Magdalen College at Oxford University. The team, under the leadership of Robert Robinson, examined the relationships between chemical structure and estrogenic activity of some stilbene and diphenylethane analogs. This research led to the synthesis of a number of hydroxylated derivatives called stilbestrols (Dodds et al., 1938a,b,c, 1939). Of particular importance was the synthesis of diethyl stilbestrol, which eventually became widely used medicinally as a synthetic estrogen and as a growth stimulant for domestic animals. Robinson was knighted and received the Nobel Prize in Chemistry in 1947 for his work on the organic synthesis of alkaloids and other work, including the synthesis of the stilbestrols. Reflecting on Golberg’s participation in this pioneering research, his knowledge of modes of action of chemicals linked to their structure, and his interest in linking science and public issues, it is interesting to speculate as to how Golberg would have contributed to the “endocrine disruption” debates that began in the nineties had he been alive.

Golberg returned to Johannesburg, South Africa, in 1939, lecturing in chemistry at the University of Witwatersrand and then serving as the head of the Biochemical Research Laboratory of the South African Institute for Medical Research. This portion of his career focused on studies of the chemical composition and nutritive value of common African foodstuffs. Reviewing his publications, one senses an increasing focus on medical issues and the linkage between chemicals and health. No doubt, this was a factor in his return to England and a continuation of his training in medicine.
In 1951, Golberg accepted a position as senior lecturer in chemical pathology in the Department of Pathology at the University of Manchester in England, and in 1955, he became the medical research director of Benger Laboratories Ltd., Holmes Chapel, Cheshire, England. During the fifties, Golberg’s work centered in three areas: 1) the role of administered iron in health and in induced disease (Golberg, 1960; Golberg et al., 1955); 2) galactosemia (Komrower et al., 1956), and 3) lipid and cholesterol metabolism (Golberg and Morantz, 1957).

In this phase of his career there was continued emphasis on developing an understanding of the pathogenesis of disease and, especially, the dynamic and time- and dose-dependent nature of processes by which agents influence the development of disease. The emphasis on understanding the mechanisms of toxicity of chemicals would continue throughout his career.

Examining Golberg’s career and substantial achievements pre-1961, it is easy to project several paths he might have taken. It would have been easy to envision him as a professor at one of England’s leading medical universities providing leadership for an academic-based research team, or alternatively, becoming a leader of a major international pharmaceutical firm’s research and development efforts. Without question, in any of these roles he would have been an outstanding success. As it turned out, he did not pursue either of those courses.

Instead, in 1961 Golberg became the founding Director of the British Industrial Biological Research Association (BIBRA) in London. This new organization, a joint industry government effort, was created to investigate mechanisms underlying toxic effects of chemicals, develop new or improved toxicity tests, and give advice and information on toxicological issues. BIBRA was intended to be an impartial forum for improved communication between industry, government, and academic personnel in addressing toxicological issues of major public significance, issues that were emerging with increasing frequency and contentiousness.

As expected, based on Golberg’s role as head of BIBRA, the nature of his presentations and publications shifted. No longer was the focus on the details of conducting and interpreting scientific experiments. Now the focus was on how science could be used to address societal issues. He and his colleagues conducted noteworthy studies on the mechanisms of action of commercially important agents with a clear orientation to understanding the relevance of findings in rodents to predicting effects in humans (Gangolli et al., 1967; Grasso and Golberg, 1966, 1968). The titles of two articles published in 1963 also reflected this new focus—"The Predictive Value of Animal Toxicity Studies Carried Out on New Drugs" (Golberg, 1963b) and "Guiding Principles and Problems of a Voluntary Scheme to Regulate the Use of Plastics in Food Packaging" (Golberg, 1963a).

Over the next six years, Golberg, as the head of BIBRA, laid the groundwork for an organization that has had international impact. He helped develop the operating principles that would ensure conduct of science of high quality as well as relevancy to public issues, and he assembled a team to carry out the science. An extraordinary group of scientists have been associated with BIBRA, starting with the scientists Golberg recruited and continuing to the present time. Their impact is not related just to what they contributed at BIBRA, but also in their post-BIBRA activities. They learned and applied a way of “doing business.”

In 1967, Golberg was recruited to the United States to become the scientific director of the Institute of Comparative and Human Toxicology at Albany Medical College in New York State. Golberg’s scientific productivity and impact continued at a high level without interruption as he moved his base from the United Kingdom to the United States. He continued to be involved in conducting and interpreting specific science and, as a senior spokesman, for applying high-quality science to important human health issues. His research focused on a range of agents, including ethylene glycol, sodium pyridinethione, carrageenan, monosodium glutamate, cyclamate, and saccharin. He also began conducting studies with nonhuman primates (Coulston et al., 1975). The work on artificial sweeteners in monkeys was to have impact in several ways.
Golberg became one of the strongest proponents for not just testing artificial sweeteners and other agents for their toxicity, and then applying the data through a series of safety factors to humans. Rather, he advocated using all of the available scientific knowledge of agents in the several species to render a judgment as to the safety of the products (Golberg, 1975). In my opinion, Golberg’s views had an important role, ultimately, in government decisions on the regulation of the artificial sweeteners.

Golberg continued to champion the importance of understanding the pathogenesis of chemical-induced diseases in order to make sound decisions on the safety of these chemicals to humans. This was emphasized in a chapter entitled “Modes of Action of Toxic Agents” (Golberg, 1970), which represents one of the earliest uses of the term “mode of action” as a concept in evaluating the safety of chemicals.

The impact of Golberg’s work with nonhuman primates almost led to a shift for him and his family from New York to New Mexico. This was about to occur in 1976 when Albany Medical College was selected to be the operating contractor for the United States Air Force Primate Center at Holloman Air Force Base, New Mexico. The Golbergs were literally packing their bags in anticipation of a move to New Mexico when another opportunity arose. That opportunity related to a new entity, the Chemical Industry Institute of Toxicology (CIIT), which was in the process of gestation. A group of major chemical companies in 1974 had decided it was in their best interest and that of society to create a new organization that would focus on understanding the toxicity of chemicals. The idea of creating the new organization is traceable to Perry Gehring of the Dow Chemical Company, and many individuals were subsequently involved in bringing the concept to fruition.

The early history of CIIT is well documented (Mathias, 1985a,b,c). Specifically, the organization was to have a three-pronged mission: 1) conduct toxicity tests on a prioritized list of commodity chemicals; 2) conduct an in-house research program to develop new test methods and provide information to aid in interpreting the results of toxicity tests; and 3) promote the education of toxicologists. The organizers had made a number of tough decisions: the basic mission of the organization; the method of funding the research (dues payments from member companies); whether to operate as a contracting organization or have a stand-alone laboratory (they decided on the latter); operating guidelines (a focus on independence for the research team and full public disclosure of all findings without prior review by the sponsors); and where the institute would be located (Research Triangle Park, North Carolina, rather than in the “backyard” of one of the member companies). One key decision remained—the selection of a leader.

The search team was becoming quite frustrated with the task of finding the right person to lead this new and unique organization, when one of the individuals by chance heard a presentation by Golberg on the use of animal data in evaluating human hazards. He reported back to the team that he had found the right individual—Golberg—“a man small of physical stature but an intellectual giant in understanding how to develop science that would have an impact on evaluating chemical hazards” (Monte Thordahl, personal communication, 1996).

The rest is history—he was interviewed, hired, and Golberg moved to North Carolina where he would remain for the rest of his life.

Just as he did with BIBRA, Golberg set about organizing a new entity: hiring staff, developing a temporary laboratory in leased space, planning and constructing a new laboratory, selecting priority chemicals for study, and fine-tuning the approach to operating a unique laboratory. Golberg, as always, set high standards that would ensure the credibility of research findings bound to come under scrutiny from the government, academic, and even the industrial community.

Indeed, two key early interactions I had with Golberg related to the issue of credibility. In one case, it involved studies that CIIT had contracted with the Industrial Bio-Test (IBT) organization in Decanter, Illinois, to conduct. When the credibility of work at IBT came into question, Golberg wanted an independent assessment as to whether, as he said, “we continue the studies to completion or pull the plug.” As he requested, I carefully reviewed the in-life studies under way at IBT and reported the findings to Golberg and a decision was made to continue them.
The second situation involved studies with inhaled formaldehyde being conducted with mice and rats by the Battelle Memorial Institute in Columbus, Ohio. I received a call from Golberg in which he related that nasal tumors had been found in high incidence in rats at the highest exposure concentration (15 ppm) with a suggestion of an increase in mice. He related that because of the significance of the findings, CIIT was preparing to release the findings (as stipulated by CIIT operating guidelines) to the government, member companies, and the public at the same time. He asked if I would lead a team to evaluate the findings and determine “if they will stand the light of day including scrutiny by ‘hired gunslingers,’ perhaps even some hired by CIIT member companies.” The team carried out the week-long review and reported that despite a few “warts and blemishes,” not uncharacteristic of two-year studies, the research would indeed stand the light of day. Golberg proceeded to publicly release the findings in the manner specified by CIIT’s operating guidelines. The interpretation of the formaldehyde nasal tumor findings for human relevance have been a major driver of research at CIIT for two decades.

While leading CIIT and after his retirement, Golberg continued to speak and publish on important issues facing the field of toxicology. The topics were far-ranging and included the integration of basic sciences into the training of toxicologists (Golberg, 1976), the importance of viewing toxicology as a predictive science (Golberg, 1978), the importance of clinical toxicology (Golberg, 1980a), a code of conduct for scientists in reporting and reviewing information on chemicals (Golberg, 1982), the role of structure-activity relationships as a tool in toxicology (Golberg, 1983), and the charting of a course for using cell culture alternatives to animal testing (Golberg, 1986). These publications still provide valuable guidance for the field of toxicology.

The foundation that Golberg laid at CIIT has stood the test of time. CIIT has developed a well-deserved international reputation for the conduct of high-quality research on the mechanisms of toxicity of chemicals and the application of that knowledge to assessing human health risks. As was the case with BIBRA, CIIT has also had substantial impact through its former employees who have filled responsible positions in industry, government, and academia. In addition, its substantial training program, especially at the postdoctoral level, has been a major source of toxicologists. Without question, the efforts of Golberg as reflected in the activities of both BIBRA and CIIT continue to have positive impact on the field of toxicology.

After retiring as president of CIIT, he served as professor of community and occupational medicine, Duke University Medical Center. He also played a key role as a consultant in the design of the comparative toxicity testing approach used by R. J. Reynolds in attempting to design and produce a “less harmful” cigarette.

Beyond his scientific and institutional legacy, Golberg had an impact in three other major ways. One avenue of contribution was through his participation on numerous advisory committees. He served on 11 National Research Council Committees, including chairmanship of two committees concerned with carcinogenicity testing of drugs. He also served on major advisory committees to the World Health Organization, the Department of Health and Human Services, and the Environmental Protection Agency. He was sought out for such activities because he could always be counted on to provide sound scientific advice irrespective of the circumstances under which the opinion was expressed.

Golberg was also a major contributor through his editorial role with ten journals. This included service as the founding editor (1963–87) of Food and Cosmetic Toxicology (now Food and Chemical Toxicology) and CRC Critical Reviews in Toxicology (1971–87). I am proud that I was asked to succeed Golberg as the editor of the latter journal.

Golberg also contributed substantially to 14 major professional organizations. He was a founding fellow of the Royal College of Pathologists, a fellow of the Royal Society of Chemistry, and a fellow of the Royal Society of Medicine. He gave freely of his talents to promote the Society of Toxicology, including service as the Society’s President in 1978–79.

Golberg died on May 3, 1987, from a mesothelioma. After Leon’s death, Bertha, his wife, continued to promote the science of toxicology. She was especially interested in working with young people and gave generously of her time and funds to support the Curriculum in Toxicology Program at the University of North Carolina at Chapel Hill. Bertha died on November 29, 1995.
Leon Golberg left the field of toxicology with a rich legacy. The breadth and depth of his training in chemistry, mathematics, physical chemistry, biochemistry, organic chemistry, anatomy, physiology, and medicine are rarely associated with a single individual. Indeed, today many research teams aspire to have this range of expertise represented in the membership of the team. Beyond this remarkable formal education, he had an uncanny ability to analyze an issue and envision an experimental path forward that would not simply result in the accumulation of data, but rather development of key information that would provide insight into the mode of action of the agent. And most significantly, he was always diligent in his interpretation of the scientific information as to its relevance in the assessment of human hazard or safety. He once indicated, “We must pursue meaningful answers to relevant questions, not simply generate negative data for regulatory authorities.”

He was also mindful of the need to communicate not just with regulatory authorities but also with the broader public. Ever the optimist, Golberg believed that the best science and the best communication are compatible. This was emphasized in his remarks on the occasion of the dedication of CIIT’s new laboratory in Research Triangle Park, North Carolina. He said, “I recall a large sign mounted on the wall of a microbiological laboratory in which I once worked. It read, ‘Sterile enough is not sterile enough.’ As practitioners of science in the public interest, all of us at CIIT feel that only our best is good enough” (Golberg, 1980b). This admonishment is equally fitting today for the entire field of toxicology.

References


Wayland Jackson “Jack” Hayes, Jr.
(1917–1993)

Wayland Jackson “Jack” Hayes, Jr., was the 11th President of SOT (1971–72), the chief toxicologist at CDC in Atlanta, Georgia, and professor of toxicology at the Vanderbilt University School of Medicine in Nashville, Tennessee. He made enduring contributions to toxicology and pesticide science in each of these roles. He wrote and spoke often about the importance of first principles of toxicology, and the Hayes’ Handbook of Pesticide Toxicology, 3rd Edition, carries his name to recognize his profound commitment to “improve the knowledge of toxicology, in general, the epidemiology of pesticide poisoning, and the medical management of cases.”

Hayes contributed his first volume to the toxicological literature as the Clinical Handbook on Economic Poisons (1963), replacing “Clinical Memoranda on Economic Poisons,” first issued in March 1950 as separate releases on several new insecticides. The booklet described the diagnosis and treatment of persons who may have had extensive or intensive exposure to economic poisons. It was prepared primarily for the guidance of physicians and other public health professionals. The 1963 booklet concerned use of organophosphorous insecticides and acute toxicities associated with pesticides such as “arsenic, thallium, phosphorous, and kerosene” because they were “leading causes of deaths associated with pesticides.” Hayes acknowledged the great potential value of the materials used as pesticides and urged the careful collection of clinical data and related information concerning poisoning, a theme that became much clearer in the expanded Toxicology of Pesticides (1975). Toxicology of Pesticides and his works that followed gave attention to “those materials that are manufactured in large amounts, that are known to have caused poisoning relatively frequently, or that are of special interest for some other reason.” The subjects of clinical studies included: 1) persons with “heavy occupational exposure”—including malaria control spray operators, farmers, orchardists, spray pilots, and pest control operators; 2) volunteers who take part in strictly controlled experimental investigations; and 3) patients who are sick from accidental over-exposure to pesticides. In the preface to his next major work and the first edition in the present series, he called attention to the need for basic toxicology education. Pesticides Studied in Man (1982) and The Handbook of Pesticide Toxicology represent his commitment to the collection and dissemination of critical research and clinical experience in Hayes’ career as a leader in pesticide science.

Widespread use of the Clinical Handbook on Economic Poisons and active participation in public debate concerning pesticide use encouraged Hayes to write of the general importance of principles of toxicology. In Toxicology of Pesticides and his subsequent books he retained the strong clinical content but offered much-expanded coverage of principles of toxicology, the conditions of exposure, the effects on human health, problems of diagnosis and treatment, the means to prevent injury, and even brief outlines on the impact of pesticides on domestic animals and wildlife.

In the public arena, Hayes spoke out on an expanding role of toxicology to address issues of public and environmental health related to pesticide use that became critical during the sixties and seventies following publication of Rachel Carson’s polemic Silent Spring (1962). Concerning the resulting intense public debate about pesticides, Hayes wrote in the preface to Toxicology of Pesticides: “The pesticide problem is not merely one concerning the chemical industry and professional farmers, foresters, and applicators, or one concerning only those who wish to protect wildlife, or those responsible for control of malaria and other vector-borne diseases...
of man and his livestock. Rather, the pesticide problem concerns every person who wants food at a reasonable price and who wants his home free from vermin. The problem can be solved only on the basis of sound toxicological principles. Knowledge of these principles permits agreement and a cooperative approach on the part of persons professionally responsible for protection of our food, our health, and our wildlife, respectively. Ignorance of these principles limits some other persons to a partisan approach that may be dangerous to the common good.

In dedicating Toxicology of Pesticides to Paracelsus, Hayes sought to bring attention to the “decisive importance of dosage” in determining the effect of exposure. He urged recognition of “tolerated doses” as well as information on doses or blood levels that have produced harm. He clearly viewed modern toxicology as a predictive, interdisciplinary science with great capacity to contribute to the chemical safety evaluation.

His Pesticides Studied in Man (1982) assumed the reader’s mastery of the basic principles of toxicology and offered more in-depth coverage of those pesticides with direct information concerning their effects in humans. The information came from reports of poisoning, from observation of workers or volunteers, or from persons who received certain compounds as drugs. Sections were organized in three parts. The first part gave a concise summary of the chemistry and use of the pesticide. The second part concerned the fate and basic animal toxicity data that contributed to determining important dose-response relationships. The third section reported the human experience with the pesticide. The current edition of Hayes’ Handbook of Pesticide Toxicology applies this basic scheme more loosely in the description of the toxicology of agents.

As professor of biochemistry, School of Medicine, Vanderbilt University, Hayes teamed with his colleague Edward R. Laws, Jr., Department of Neurological Surgery, George Washington School of Medicine, Washington, D.C., to edit the first edition of the Handbook of Pesticide Toxicology. It was published by Academic Press in three volumes and updated and revised both Toxicology of Pesticides and Pesticides Studied in Man. The preface again champions the potential role of toxicology in the resolution of controversy regarding pesticide use and reiterates the importance of the study of dose-response relationships in the diagnosis of poisoning. The book follows a familiar organization, including exposition of principles of toxicology and sections featuring the chemistry and uses of pesticide, biochemistry, and experimental toxicology, and a description of the human experience with the pesticide.

Hayes’ admonition to physicians to collect quantitative information on the effects of different dosages is consistent with his high regard for the fullest possible data concerning the human experience with pesticides. Throughout his career Hayes shaped a vision of modern toxicology as an important means to achieve rational use of chemicals in the environment, much in the spirit of Paracelsus who wrote, “...whenever I went, I eagerly and diligently investigated and sought after the tested and reliable arts of medicine. I went not only to the doctors, but also to barbers, bathkeepers, learned physicians, women, and magicians who pursue the art of healing.”

Wayland Hayes was born in Charlottesville, Virginia, on April 29, 1917. He graduated in 1938 from the University of Virginia, and received an M.A. and a Ph.D. from the University of Wisconsin, where he specialized in zoology and physiological chemistry. He returned to the University of Virginia where he received the M.D. in 1946. He interned in the Public Health Service Hospital in Staten Island, New York, and entered the regular corps of the service from 1948–68. He became Chief Toxicologist of the pesticides program of the Centers for Disease Control in Savannah and Atlanta, Georgia. Hayes joined Vanderbilt University as professor of biochemistry, School of Medicine, in 1968 becoming emeritus in 1982 but remaining active in university affairs until 1991. He died January 4, 1993. His wife of 50 years, Barnita Donkle Hayes; son Wayland J. Hayes, III; four daughters: Marie Royce Hayes, Maryetta Hayes Hacskaylo, Lula Turner McCoy, and Roche Del Moser; and ten grandchildren survived him. In his family and community, he was revered as a parent, gardener, artist, philosopher, and humorist.

Hayes had a full professional life of national and international service. He was a consultant on the toxicology of pesticides to the World Health Organization, the Pan American Sanitary Bureau, the
American Medical Association, the U. S. Department of Agriculture/Environmental Protection Agency, the American Conference of Governmental Industrial Hygienists, and the National Academy of Sciences-National Research Council. He served on numerous governmental committees and editorial boards. He was a Charter member of the Society of Toxicology in 1961 and served as its 11th President, 1971–72. As President of the Society, he staunchly defended the integrity of toxicologists in regulatory affairs (Science 174: 545–546, 1971) and launched criticism of the United States EPA's dismissal of the recommendation of its own scientific advisory committee in response to “external pressure.” As President, Hayes made a strong plea for the inclusion of toxicology in textbooks of biology, zoology, hygiene, and general science (Toxicology and Applied Pharmacology 19, I–II, 1971). Both subjects are topical today. Other society memberships included the American Society of Pharmacology and Experimental Therapeutics and the American Society of Tropical Medicine and Hygiene. He became a Diplomat of the Academy of Toxicological Sciences in 1989.

Hayes was a sought-after expert witness, particularly in cases involving pesticides. His commanding and distinguished presence, his southern accent, and his gracious manner, coupled with his encyclopedic knowledge, rarely failed to win the case. However, there was one case in Wisconsin where he was unable to convince the jury that DDT was not a potent poison. Finally, he walked over to the evidence table, picked up the bottle of DDT and ingested a teaspoon of the evidence. When asked about how that worked out, he replied, “well I walked a little funny, but we won the case.”

Hayes clearly recognized the difficulties associated with collecting meaningful dosage-response information. He suggested that failure to collect such valuable data might result from lack of recognition of its importance in diagnostics. He closed on a theme that has shaped his career and that remains central to the spirit and content of the current volumes now dedicated to his life and career saying, “Clinicians who attend patients poisoned by a pesticide or by any other material are urged to be alert to the possibility of getting new information on dosage.”
One of the modern pioneers of 20th century toxicology, Sheldon D. Murphy made many important contributions to the discipline of toxicology—as a research scientist, a teacher, and a leader. Murphy was a native of South Dakota and received his bachelor’s degree in pharmacy in 1955 from South Dakota State University. With this background in pharmacy, he began his career in toxicology at the University of Chicago under the tutelage of Kenneth DuBois. Dr. DuBois and his colleagues, including John Doull, are recognized as members of the first generation of modern toxicologists in the United States, and are responsible for a long legacy of eminent scholars in the field. At the time that Murphy began his doctoral work in toxicology, the discipline was regarded as mainly descriptive. Under the inquisitive direction of Ken DuBois, Murphy began his exploration of the mechanistic basis of organophosphate pesticide toxicity—an area of research he continued throughout his distinguished career. He received his Ph.D. in pharmacology in 1958, and then joined the United States Public Health Service, subsequently serving as chief of the Pharmacology and Toxicology Section of the Division of Air Pollution in Cincinnati. Here he began research on the application of sensitive physiological methods to the quantitative evaluation of respiratory effects of air pollutants in the laboratory rat.

Murphy then began a long career in academia, first at the Harvard School of Public Health (1963–77), where he established a doctoral and postdoctoral training program in toxicology, then at the University of Texas in Houston (1977–83) as director of the Division of Toxicology in the Pharmacology Department, and, finally, at the University of Washington as Chairman of the Department of Environmental Health, where he continued until his premature death from cancer in 1990.

Contributions to Research

The main theme of Murphy’s research was the study of the toxicology of organophosphorus compounds, particularly the role of metabolism in modulating their toxicity. He held a grant on this topic from National Institute of Environmental Health Sciences for over 20 years, appropriately titled “Factors Affecting Pesticide Toxicity.” His contributions started with the study of the role of oxidative metabolism in the activation of phosphorothioates to potent cholinesterase inhibitors, and continued with important findings on the role of nonspecific binding sites and on esterase-mediated metabolism in the detoxication of organophosphates such as parathion and malathion. The issue of interactions among chemicals was always dear to Murphy, who, in addition to experimental work, also contributed to the theoretical framework for such studies. Some of his publications on the comparative toxicity of organophosphates in different animal species or on the age-dependent toxicity of these compounds are often still cited today, more than 25 years later. Not to be forgotten is his contribution of a cogent chapter on pesticide toxicology to the first, second, and third editions of the now classical toxicology textbook by Casarett and Doull. His research activities were always characterized by his ability to ask the right questions and to design the appropriate experimental approach for answering them. Even in the latter part of his career, when administrative responsibilities kept him from hands-on laboratory research, he was remarkable in his ability to identify the missing link or the weak point in a research project and to suggest appropriate experimental steps. Not to be forgotten, in addition to his inquisitive mind, was his total intellectual honesty and trust of the experimental method and his motto, “let the data speak for themselves.”
Contributions to Leadership in the Discipline

Murphy’s contributions to the discipline of toxicology were many and varied. He was a Charter member of the Society of Toxicology in 1963, and later became one of its youngest Presidents, assuming the position in 1974 at the age of 41. He was also instrumental in the formation of the International Union of Toxicology, and served on many national and international advisory boards and committees for organizations such as the NIEHS, National Institute for Occupational Safety and Health, Environmental Protection Agency, National Academy of Sciences, World Health Organization, and the Health Effects Institute. The Society of Toxicology honored him with virtually every major award possible, including its Achievement Award (1970), the Education Award (1979), and the Merit Award shortly before his death in 1990. He was noted for his ability to listen, weigh all of the evidence, and then make reasoned and rational decisions.

Contributions to Education and Training

The Education Award from the Society of Toxicology testifies to his commitment to the training of young scientists in the discipline. Murphy was responsible for starting, directing, and fostering toxicology programs at three major universities (Harvard, University of Texas, University of Washington) and was always a strong supporter of federally funded training programs for predoctoral and postdoctoral students. Over the years he trained numerous students and fellows who now occupy prominent positions in academia, industry, and consulting firms. Several of them directly followed his path and now head successful toxicology programs at numerous universities in the United States and abroad. All of them recognize the unique role that Murphy had as a mentor in shaping their way of thinking about toxicological issues and toxicology in general. His mentoring style relied on letting the students find their own way and supervising them from a distance, in asking them the questions they should have asked, in giving them general directions, and in teaching them the logic and rationale behind each new experiment.

Sheldon Murphy as Friend, Mentor, and Colleague

Although he should clearly be remembered for his many stellar contributions to the discipline of toxicology, an article about Sheldon Murphy would be inadequate without addressing Sheldon Murphy the person. Although his career was very important to him, he was a dedicated family man as well. His “family” included not only his wife Donna and son Kevin, but also the many graduate students, postdoctoral fellows, and colleagues with whom he unselfishly shared his wit and wisdom. He maintained the highest level of personal and scientific integrity, and served as an inspiration for all who knew him. His personal courage in fighting cancer was both heart wrenching and inspirational. During the last few months of his life, while undergoing chemotherapy at the University of Washington Hospital, he would wheel himself down from the hospital wing to his office so that he could “catch up on a little unfinished business.” His faith and courage during his struggle with cancer so inspired a wealthy retired corporate executive, who was serving on the Department of Environmental Health’s Advisory Committee at the time, that he donated a half-million dollars of personal funds to establish an endowed chair in Murphy’s name at the University of Washington. Additional funds were raised from friends, present and former colleagues, former students, and from several corporations. In addition to an endowed chair, these funds also allowed the establishment of a Student Travel Award in his name to allow graduate students to attend the Annual Meeting of the Society of Toxicology.

One could not complete a short profile of Sheldon Murphy without remembering his love of life, his wit, his enthusiasm, his characteristic goatee, his rotund midsection, and his story and joke telling, which kept everybody amused even during the stressful moments of a grant renewal or a failed experiment.

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In terms of lasting influence on the maturation of the field of environmental health science, Norton Nelson had few peers. He was mentor to many of today’s leaders in the field, and creator and leader for over 25 years of the academic research institute now named for him at New York University. He chaired influential scientific advisory committees for the National Institute of Environmental Health Sciences, National Cancer Institute, Environmental Protection Agency, Department of Energy, World Health Organization, and many other agencies, was advisor to academic centers and research programs, and was a respected voice in numerous hearings and consultations in the halls of the United States Congress. In all of these roles, he was a teller of truth and a practical idealist who earned and maintained the trust of his colleagues.

Dr. Nelson was born in McClure, Ohio, received his undergraduate training at Wittenberg College, and obtained his doctoral degree in biochemistry at the University of Cincinnati. Early in his career as a biochemist, he was noted for important contributions to carbohydrate research. One of his early reports, “A photometric adaptation of the Somogyi method for the determination of glucose” (J. Biol. Chem. 153, 375–380, 1944), was listed in Contemporary Classics in the Life Sciences, Vol. 2, The Molecules of Life (J. T. Bauet, Ed., ISI Press, Philadelphia, 1985) as being among the most frequently cited of publications, having been cited at a rate of about 250 times annually for a total of 4,485 citations between 1961 and 1982.

During World War II, together with other outstanding scientists at the Armed Forces Institute of Medical Research at Fort Knox, Kentucky, Dr. Nelson did ground-breaking work on thermal physiology, which was important to the war effort because of its relevance to tank warfare in the desert.

In 1947, Dr. Nelson joined the New York University School of Medicine, where he served as director of the Institute of Environmental Medicine from 1954 to 1979. Under his leadership, the Institute grew to be a highly productive and prestigious academic unit, noted particularly for its research in cancer, aerosols and pulmonary disease, and environmental radiation. As director, Dr. Nelson continued to contribute actively to research on carcinogen metabolism, the deposition of inhaled particulates in the respiratory tract, and the experimental induction and epidemiology of lung cancer. He is widely credited for having developed the basis for the control of the occupational lung carcinogens bischloromethylether, dimethylcarbamoyl chloride, and epichlorohydrin.

Dr. Nelson received many awards, including the Billard Award for Research in Environmental Sciences from the New York Academy of Sciences, the Environmental Regeneration Award from the Dubos Center for the Human Environment, the Ramazzini Award from the Collegeum Ramazzini Society, the Fellow Award from the American College of Preventive Medicine, and an honorary doctor of science degree from Wittenberg University. He was also elected to the Institute of Medicine of the National Academy of Sciences.
Under Dr. Nelson’s chairmanship, in 1965 the National Advisory Environmental Health Committee submitted a special report to the Surgeon General of the United States Public Health Service recommending the establishment of a federal system for developing occupational exposure standards. This led ultimately to the creation of the National Institute for Occupational Safety and Health (NIOSH). Many other contributions resulted from his membership on advisory committees of the National Academy of Sciences: the Committee on Physical Sciences, Mathematics, and Resources; the National Academy of Sciences Board on Toxicology and Environmental Health Hazards; and on various committees of the NCI and the NIEHS. He was co-chairman with his close colleague, Dr. James Whittenberg, of the panels that produced the first two “Green Books” (Man’s Health and the Environment—Some Research Needs, 1970, and Human Health and the Environment, 1977, published by NIEHS) that proposed long-term agendas for research on environmental health science.

In the mid-eighties, he chaired the Science Advisory Board (SAB) of the Environmental Protection Agency at a time when that agency needed all the credibility and assistance that SAB could provide. He served on the editorial boards of several prominent environmental health journals and was a member of approximately 25 professional societies. He was prominent internationally as the chairman of the Executive Committee of the World Health Organization’s Scientific Group on Methodology for the Safety Evaluation of Chemicals, and was a participant in the United States-Japan Cooperative Medical Science Program, the USA-USSR Cooperative Program in Environmental Health Research, and many other international cooperative programs. On the local scene, he was active in the Health Research Councils of the City of New York and the State of New York, and he was a member of the mayor’s Science and Technology Advisory Council. Altogether, his career encompassed approximately 120 major advisory groups and committees, and his influence on legislation that “benefited and promoted the field of environmental health” was noted by the National Journal in its June 14, 1986 issue, which listed him as “one of the 150 people best able to influence the federal government.”

As stated by Dr. David Rall, a close colleague and former director of NIEHS, Dr. Nelson can rightly be considered the father of the second generation of environmental public health, the first being focused on vector-borne illnesses, pure water supplies, sanitation, and food safety. This second generation is directed toward the possible health effects that humans create in an industrialized society. Furthermore, through his tutelage and example, a third generation of environmental scientists is emerging. These scientists will understand both what the threats and dangers are and how they act, and will utilize and apply techniques such as molecular biology and computer modeling to develop approaches to prevention and mitigation.

Dr. Nelson passed away on February 4, 1990, at the age of 80, after 43 years on the NYU faculty, where the Nelson Institute continues to carry on the research tradition that he established.
Harold Peck was born in 1914 in Ravenna, Ohio, a city located 18 miles east of Akron and 35 miles southeast of Cleveland. Harold graduated with a B.S. degree from Kent State University in 1938. He then attended Ohio State from 1938 to 1939 to take pre-med courses before enrolling at the Western Reserve School of Medicine, where he obtained an M.S. in anatomy followed by an M.D. in 1945. Dr. Peck joined the Army while in medical school. A back injury prevented Harold from assuming active duty; however, he remained in the Army.

In 1942, Harold married Dolores “Dee” Parks. Harold and Dolores have two children, Tim and Wendy, and celebrated their 63rd wedding anniversary just prior to Harold’s passing in December 2006.

Dr. Peck considered himself professionally to be an anatomist. From 1940 to 1942, Dr. Peck held the position of instructor in anatomy at Western Reserve University. Dr. Peck completed a rotating internship at the Cleveland City Hospital in 1946 and then completed a second internship in pathology with the Johns Hopkins Medical School in 1948. In 1946 to 1948 Dr. Peck was first employed by Sharp & Dohme Inc. and remained with Merck Sharp & Dohme for his entire career, retiring on September 1, 1981.

While at Merck Sharp & Dohme for 35 years, Dr. Peck held the positions of pharmacologist from 1946 to 1948; pathologist from 1948 to 1952; director of toxicology and pathology at the Merck Institute for Therapeutic Research from 1952 to 1967; senior director, Department of Safety Assessment from 1962 to 1972; executive director, Department of Safety Assessment from 1972 to 1976; and Vice President of Safety Assessment from 1977 to 1981.

Dr. Peck was a member of numerous professional societies. He was a Charter member of the Society of Toxicology; a fellow of the New York Academy of Sciences; and a charter member of the Environmental Mutagen Society, the Reticuloendothelial Society, and the Microcirculatory Society. In addition he was a member of the American Association of Anatomists, American Society for Pharmacology and Experimental Therapeutics, American Association for the Advancement of Science, and Sigma Xi, and a board member of the National Society for Medical Research.

During his career Dr. Peck served on numerous scientific committees that were directed at the establishment of many of the policies and procedures now followed for the preclinical safety assessment of pharmaceuticals. For the National Research Council he served on the Committee on Problems of Drug Safety, the Ad hoc Subcommittee on the Clinical Relevance of Carcinogenicity Testing of Drugs; the Advisory Center for Toxicology; the Committee on Toxicology and the Environmental Studies Board Committee for the Working Conference on Principles of Protocols for Evaluating Chemicals in the Environment; and the Scientific Advisory Committee of the Registry of Tissue Reactions to Drugs. For the World Health Organization Dr. Peck served on the Scientific Group on Principles for the Testing of Drugs for Teratogenicity.

Dr. Peck’s interests and expertise extended from anatomy, medicine, and preclinical safety assessment of pharmaceuticals into environmental toxicology and risk assessment. Dr. Peck served for the United States Environmental Protection Agency on the Water Quality Criteria Subcommittee and the Science Advisory Committee on Air Pollution. While at Merck, Dr. Peck founded an Industrial Toxicology Advisory Committee, which still exists today, to investigate the occupational and environmental health and safety impacts of pharmaceuticals.
The Society of Toxicology elected Dr. Peck as its President from 1977 to 1978. In 1981 he was awarded the SOT Distinguished Fellow Award and in 1982 the SOT Merit Award.

Dr. Peck is the author of numerous scientific publications and book chapters devoted to the preclinical safety assessment of pharmaceuticals. Dr. Peck’s best known publication is as editor in chief and chapter author for Meyler and Peck’s Drug Induced Diseases, published in multiple volumes from 1962 to 1980.

To Dr. Harold Peck his work was his life. He seldom took vacations and enjoyed a quiet life. His colleagues remember him as being very fair and balanced. His reports say he was one of the best “chiefs” they ever had, never failing to leave a discussion without learning something new about the safety assessment of drugs. After retirement, Harold helped Dee with her gardening and as a handyman spent time building benches, tables, shelves, and the like for displaying Dee’s plants. Dee would like us all to remember Harold for his honesty.
We deeply regret that toxicology has lost a scientist dedicated to elevating the standards of science in our profession. Dr. Emil A. Pfitzer, Past President of the Society of Toxicology, passed away on July 20, 2007, at his home in New River, Arizona, after a long illness with a chronic lung disease. Emil was a very active participant in and strong advocate for our Society, and as President he presided over the Society during its 25th anniversary year (1985–86) and was a member of the 40th Anniversary Task Force.

Emil was born on June 30, 1929, in Chattanooga, Tennessee, son of the late John Joseph Pfitzer and Jennie Margaretha (Hansen) Pfitzer. He was a graduate of the University of Chattanooga, class of 1950. Emil received his doctoral degree at the University of Pittsburgh Graduate School of Public Health in 1961, where he remained on the faculty conducting research and teaching in occupational health. In 1965, he moved to the University of Cincinnati School of Medicine to conduct research on lead, chlorinated insecticides, and their concentration in the environment.

Emil’s career spanned academia and industry, which provided a broad scientific basis from which advice was often requested by various governmental and regulatory agencies.

In 1972, Emil joined Hoffmann-La Roche in the Department of Toxicology and Pathology and over a 22-year career at Roche, rose to vice president of toxicology and pathology. During his tenure at Roche, many important new medicines were brought to market. These included, for example, alpha interferon, the very first biotechnology drug made by human recombinant technology.

Recombinant technology brought in a new era in drug development, including the challenges that these novel agents presented for safety assessment. Since the approaches used for conventional small molecules were not always relevant for large peptides and proteins, new approaches for safety evaluation were needed on a case-by-case basis. Emil recognized the importance of mechanistic toxicology in drug development at a very early stage, and supported research on developmental compounds ranging from mechanisms of carcinogenesis to the function of retinoid receptors. The characterization of mechanisms of toxicity proved to be very important and provided a better perspective for the safety of patients in human clinical trials.

Emil’s demeanor was usually one of quiet listening, asking key questions, and staying constantly involved in making the toxicology department at Roche one of the best in the industry.

For those who visited Emil in his office, they saw stacks of paper, piled high, covering his desk and tables (books, journals, internal reports, memos, etc.). Amazingly, they were as neat as could be and he could find anything at a moment’s notice. Nobody has ever seen Emil angry, frustrated to be sure, but never angry. He always had a calming influence on debates, scientific and otherwise. Rarely was there a derogatory comment made about anyone—critical yes, derogatory no. Usually present was Emil’s subtle sense of humor.

Emil was a member of the prestigious National Academy of Sciences, Commission on Life Sciences, for which he served on a number of the Academy’s committees. He also served on many other prestigious committees such as the Science Advisory Board for the United States Environmental Protection Agency, the National Institute of Environmental Health Sciences, the Committee on Toxicology of the Science Board of the United States Food and Drug Administration, the World Health Organization, and the National Institute of Occupational Safety
and Health, to mention a few. One of Emil’s more impressive and important attributes was that he could almost always find the middle ground on any issue. As a result, he was a very popular and valuable committee member or chair.

During his more than 22 years of service at Roche, Emil had worldwide influence in the field of toxicology and, as noted above, served as President of our Society of Toxicology in 1985–86. In addition, he served as a consultant to numerous institutions and as an adjunct professor at several universities and colleges.

Emil served on the Expert Panel for the Research Institute for Fragrance Materials (RIFM) for five years, and after retiring from Roche in 1995, he served as President of RIFM.

Emil was accredited in toxicology as a Fellow of the Academy of Toxicological Sciences and a Diplomate of the American Board of Toxicology. He was also the recipient of many prestigious awards including the Stokinger award for industrial toxicology from the American Governmental Conference for Industrial Hygienists, the 1995 Arnold J. Lehman award from the Society of Toxicology, and the 1996 Toxicology Ambassador award from the Mid-Atlantic Chapter of the Society of Toxicology.

Emil’s work was obviously a strong passion, but he was also devoted to family, church, charitable causes, and nature appreciation. He was married to the late Jeanne Frances (Prien) Pfitzer for 54 years. He is survived by a sister, Grace Pfitzer of Chattanooga, Tennessee; his children, Gary Pfitzer of San Francisco, California, Greg Pfitzer of Wilton, New York, Gordon Pfitzer of Chino Hills, California, and Margaret Mullins of New River, Arizona; and six grandchildren.

All who knew Emil A. Pfitzer recognized that he was a remarkable human being and that his shining attributes were his ever-present sense of dignity, decency, and love of his family and toxicology. Toxicology has lost a scientist dedicated to elevating the standards of the science and teaching his colleagues how to work by his example.

Gabriel L. Plaa was born May 15, 1930, in San Francisco to immigrants from France, and thus French was his first language. He graduated from the University of California in 1952 with a B.Sc. in criminalistics. As a veteran of the Korean War, Dr. Plaa returned to the University of California for graduate studies in criminalistics. While attending a course taught by Dr. Charlie Hine, he was given the choice of remaining a graduate student in criminalistics without a stipend or becoming a graduate student in pharmacology and toxicology with a stipend. Dr. Plaa became a toxicologist, earning his M.Sc. in 1956 and his Ph.D. in 1958 in comparative pharmacology and toxicology with Dr. Charlie Hine as his mentor.

Dr. Plaa was an instructor and assistant professor at Tulane University from 1958 to 1962 and then was assistant and associate professor at the University of Iowa from 1962 to 1968. In 1968, Dr. Plaa moved to the University of Montreal, where he was chairman of pharmacology for 12 years. Over the years, he held other administrative positions at the university including vice dean of research and graduate studies, all the while conducting an active research program. The University of Montreal acknowledged his achievements and named him professor emeritus in 1996. In 2003, on the occasion of the 125th anniversary of its founding, the University of Montreal recognized Dr. Plaa as one of the pioneers of the institution.

Dr. Plaa was extraordinarily charitable with his time for the advancement of science nationally and internationally. He served on various scientific committees for the Society of Toxicology (SOT), National Institute of Heath, American Society for Pharmacology and Experimental Therapeutics, Society of Toxicology of Canada, Medical Research Council, National Academy of Sciences, Federation of American Societies for Experimental Biology, World Health Organization, International Union of Basic and Clinical Pharmacology, and International Union of Toxicology. He was on the editorial board of nine scientific journals, served as associate editor of Toxicology and Applied Pharmacology, Journal of Pharmacology and Experimental Therapeutics, and Canadian Journal of Physiology and Pharmacology; and was editor of TAAP from 1972 to 1980. Dr. Plaa was President of the STC (1981–83) and SOT (1983–84).

Dr. Plaa's research focused on chemical-induced liver injury. With his Ph.D. dissertation, he was the first scientist to study hepatotoxicity using an isolated perfused liver. He made significant contributions in the: 1) dose-response characteristics of hepatotoxicity; 2) catecholamines and carbon tetrachloride hepatotoxicity; 3) dye clearance technique for assessing hepatic function; 4) potentiation of haloalkane hepatotoxicity; 5) ANIT-induced cholestasis; 6) the manganese-bilirubin model of cholestasis; and 7) potentiation of chemically induced cholestasis. Dr. Plaa published 233 peer-reviewed manuscripts, wrote 48 chapters and literature reviews, and edited five books. He received the first Achievement Award from the SOT (USA) in 1967, an award that recognizes promising young scientists. That recognition was affirmed when in 1996 he received the Society's highest award, the Merit Award, which recognizes career length contributions to the science and profession of toxicology. In the intervening years, he received the Arnold Lehman Award (1981) for his use of sound scientific principles in risk assessment and regulation of chemicals and the Education Award (1987) for his teaching and training of toxicologists. Similarly in Canada, he received from the STC the VE Henderson Award (1969) and the STC Award of Distinction (1984), and was named Honorary President of ICT-XI in Montreal (2007).
Dr. Plaa had high expectations, first for himself and then for those he related to; he relayed these expectations with a witty sense of humor that was inspiring and stimulating. Dr. Plaa summarized his scientific career in an article entitled “A four-decade adventure in experimental liver injury” published in *Drug Metabolism Reviews* (29: 1–37, 1997) in which he concluded “the most satisfying ‘results’ of my research program are not the data or new observations acquired, but the graduate students and fellows with whom I collaborated over a span of nearly 40 years. I am forever grateful for their precious presence and participation in my laboratory.” Gabbie’s influence in training toxicologists was extraordinary. Two of his Ph.D. students later received Achievement Awards from the SOT (Klaassen and Charbonneau), and five graduate students in the pharmacology-toxicology program during Gabbie’s six years at the University of Iowa were later elected Presidents of SOT (Dixon, Gibson, Hook, Klaassen, and McClain).

Dr. Plaa retired from the University of Montreal in 1996. During the last 13 years of his life, he cared for his wife, Colleen, who has multiple sclerosis, much as she cared for Gabbie during his decades in science. Gabbie was also the loving father of eight children, Ernest, Steven, Kenneth, Gregory, Andrew, John, Denise, and David, as well as a grandfather of eight.

Gabbie Plaa had an enormous influence on his children, his “academic children,” as well as the entire toxicology community. We all will miss him, but his contributions to society will survive us all.

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V.K. Rowe, a Charter member and former President of the Society of Toxicology, passed away on February 28, 2004. V.K. Rowe was born in Warren, Illinois. He received his A.B. degree from Cornell College, Mt. Vernon, Iowa, in 1936, majoring in chemistry and biology. In 1937, he was granted the M.S. degree from the University of Iowa, majoring in biochemistry with a minor in bacteriology. In recognition of the major contributions to his chosen field of toxicology, in 1971 V.K. was granted the Sc.D. (Honorary) degree by his alma mater, Cornell College.

In 1937, when the discipline of toxicology was still in its early formative stage, V.K. accepted a position with the Biochemical Research Laboratory of the Dow Chemical Company. He was instrumental in both the development and application of numerous testing methodologies for toxicological endpoints that subsequently became the standard conventions of testing within the field of toxicology. V.K. had the uncanny ability to recall and recite essentially any data point generated in toxicological studies reported by not only his laboratory, but all contemporary industrial, regulatory, and academic toxicology laboratories.

He set very high ethical and scientific standards not only for himself, but for anyone working (or aspiring to work) in his laboratory. A job interview with V.K. was the equivalent of a doctoral thesis defense, combined with Ph.D. prelims, the ABT certification examination, and seven hours as an expert witness in a toxic tort trial. He was a strong proponent of prompt and full publication in the open literature of the data generated during the conduct of studies conducted within industrial toxicology laboratories. He authored or coauthored over 80 scientific publications during these early formative years when the number of journals accepting papers on toxicology was relatively limited compared to today.

As part of the Chartering of the Society of Toxicology in 1961, V.K. served on both the initial Charter Program Committee and the Finance Committee from 1961–62. He was a member of the SOT Council from 1962–65. From 1965–66 he served as President-elect of SOT. In 1965 he also served on the SOT Awards Committee, which established the SOT Achievement Award and also the SOT Merit Award. From 1966–67, V.K. served as President of SOT, and in his welcoming speech at the sixth Annual Meeting of the SOT, V.K. announced that the membership in SOT had now grown to 348 members, and that attendance at this sixth meeting of the SOT had “set an all time high of 475.”

In addition to his active role in SOT, he was a member of many professional societies including the American Chemical Society and the American Industrial Hygiene Association. He was employed by the Dow Chemical Company from 1937 until his retirement in 1979, at which time he was one of only four Dow Scientists to attain the rank of research fellow, the highest Dow title for researchers. The SOT recognized his distinguished career contributions to toxicology by selecting him for the SOT Merit Award in 1976.

Reflecting on the memories collected over the course of the decade of time in which I was honored to be an understudy and colleague of V.K. Rowe, the conclusion is that he was truly a major contributor to both the formation and advancement of toxicology leading to the important and respected scientific discipline that it is today. We all owe a deep sense of gratitude to V.K. Rowe not only for his role in the initial Chartering of the SOT, but also for his major contributions to the entire science of toxicology.
Carrol S. Weil (1917–1999)

by Shayne C. Gad, Ph.D., DABT, ATS

Carrol S. Weil was a pioneer in the field of industrial/occupational toxicology and the first to bring rigorous statistics to the practice of non-clinical and clinical toxicology. His career spanned the period from before the Second World War (in which he served as toxicologist and unit head of the Manhattan Project) until just before his sudden death from pancreatic cancer in 1999. He was internationally known for his early approaches to adding mathematical and statistical rigor to risk assessment and the design and development of practical statistical analysis to toxicology research. He was also well known and respected for his willingness and ability to teach and mentor young toxicologists before academic programs in the field became common.

Carrol was born on December 16, 1917, in St. Joseph, Missouri, and died March 25, 1999, in Pittsburgh, Pennsylvania, where he and Belrose, his wife of 60 years, resided since WWII.

He received his B.A. (in 1939) and M.A. (in 1940) in medical bacteriology from the University of Missouri, and first worked for Ancor Serum Company. From 1942 until December 31, 1981 (except for the period he worked on the Manhattan Project), he worked for the Chemical Hygiene Fellowship (later called Bushy Run Laboratories) of Carnegie Mellon Institute of Research. The last 17 years of his life he worked as an independent consultant and advisor in the field of toxicology.

Mr. Weil was certified in Toxicological Aspects by the American Academy of Industrial Hygiene, was a charter member of the Biometrics Society, and a member of the American Chemical Society, American Industrial Hygiene Association (AIHA), Phi Theta Kappa, and Sigma Xi. He was Secretary of the Society of Toxicology from 1963 to 1967 and President of this Society 1968 to 1969. He was on the technical and advisory committees of several organizations, including serving on the expert panel for the Flavor Extract Manufacturing Association for more than 20 years. He delivered the 1984 Stokinger Lecture for AIHA, received SOT’s Merit Award in 1985, and published more than 80 papers and chapters in the fields of toxicology and risk assessment. He served on committees of the Society of Toxicology and for the federal government, and on the editorial boards of numerous scientific publications. Carrol received awards from numerous societies, including the Society of Cosmetic Chemists, the Chemical Specialty Manufacturer’s Association, the American Conference of Government Industrial Hygienists, and the Toxicology Forum. Union Carbide Corporation bestowed on him the highest research position in that organization by giving him the title of Corporate Research Fellow.

He was a major contributor to multigeneration reproductive studies, where he emphasized that the litter is the proper unit of measurement. He published several papers on the design and results of chronic mouse skin studies as well as on the statistical procedures that are appropriate for these and other carcinogenic studies.

Carrol was also tireless in his willingness to teach and mentor junior toxicologists.
Dr. John Zapp, Jr., was born June 22, 1911, in Pittsburgh, Pennsylvania. He graduated from Haverford College in 1932 with a B.S. degree. He immediately began graduate work in biochemistry at the University of Pennsylvania where he received a master’s degree in 1934. He continued his research in the area of industrial chemicals and earned the a D.Phil. degree in 1938 from the same institution.

From 1932 to 1943, while working on his graduate education, he also served as an assistant instructor and instructor in physiological chemistry at the university’s school of medicine, and as an instructor in research medicine. He was known to be an excellent and thorough instructor.

Unlike so many professionals in the basic sciences, Dr. Zapp’s immediately began to focus on “the toxicology of various chemicals used in the workplace.” In 1943, for example, his first paper was titled “Use of statistics in toxicology and the study of occupational disease,” while his second paper focused on an incident involving chlorine exposure in Brooklyn. He had a particular interest in the chemical carcinogens such as dichlorobenzene and hexamethylphosphoramide, as well as a host of other chemicals, including chemicals related to Teflon, plastics, and classic irritants, as well as ambient air pollutants. Over his long career, which spanned five decades, he published more than 40 different papers in toxicology, industrial hygiene, and occupational medicine.

John A. Zapp, Jr., was director of DuPont’s Haskell Laboratory for Toxicology and Industrial Medicine for 24 years before his retirement in June 1976. He then was a consultant to DuPont and Mobil Oil Corporation. Before joining DuPont (in 1946) he was a commissioned officer in the United States Public Health Service (R), serving with the United States Office of Civilian Defense, the National Defense Research Committee, and the Chemical Warfare Service.

He was well recognized as a leader by his colleagues as he was both a president of the American Industrial Hygiene Association and the Society of Toxicology (SOT). He served as consultant to the Department of Environmental, Public and Occupational Health of the American Medical Association, and was certified in the practice of toxicological aspects of industrial hygiene by the American Board of Industrial Hygiene. He was a fellow of the American Association for the Advancement of Science and the American Institute of Chemists, and served on the committee on ethics of animal and human experimentation of the Society of Toxicology.

Dr. Zapp was a member of the American Academy of Industrial Hygiene, the Permanent Commission and International Association on Occupational Health, the American Chemical Society, American Physiological Society, American Society for Pharmacology and Experimental Therapeutics, the American Statistical Association, and the Biometrics Society.

Dr. John Zapp, Jr., was a SOT President from 1967 to 1968.
Photo Gallery II

The Society of Toxicology
The First Fifty Years
Frederick Coulston, V.K. Rowe

History, Philosophy, and Biography
No one who can stand alone by himself should be the servant of another."

Paracelsus, Philippus Theophrastus Aureolus Bombastus von Hohenheim, the "father of chemistry and the reformer of materia medica," the "Luther of Medicine," the "godfather of modern chemotherapy," the founder of medicinal chemistry, the founder of modern toxicology, a contemporary of Leonardo da Vinci, Martin Luther, and Nicholas Copernicus, was born near or in the village of Einsiedeln near Zurich, Switzerland, on November 10 or 14, 1493. His father, Wilhelm Bombast von Hohenheim, "was the impoverished scion of a noble family of Suabia." He was a physician and an alchemist who "had married a Swiss girl and practised medicine on the pilgrims' road that leads to the Benedictine Abbey of Einsiedeln." In 1502, following the death of his mother, the family moved to the mining town of Villach in Carinthia in southern Austria, where the father became the municipal physician and also taught chemistry. The father combined his interests in chemistry and medicine with his patients' experiences in the mines and in the smelting plants and became an expert in occupational medicine. The young Paracelsus, headstrong, stubborn, and independent, grew up in a home environment where chemistry and biology were paramount and he learned a great deal from his father, who became his role model. He decided he wanted to be a physician/chemist like his father.

Paracelsus grew up during a period of Renaissance humanism when most intellectuals and scholars became enchanted with antiquity, with old manuscripts, with ancient Greek, Egyptian, and Latin writers, philosophers, physicians, and scientists. Answers were sought in these old writings. There was an utter fascination with things old. Medicine turned to (rediscovered) Galen, the “Prince of Physicians.” But there was another school that was developing during this period, and this was the school of the naturalists who sought truths, including divine truths, in the study of nature and in man's relationship to the macrocosm. Which approach would be appealing to young Paracelsus?

Paracelsus studied at a number of universities in Europe, receiving his baccalaureate in medicine in 1510 and his doctorate in 1516 from the University of Ferrara. It was at this time that he assumed the name Paracelsus (para: beside, beyond; and Celsus: a famous Roman physician). His stubbornness had evolved into a rebellious spirit and he began to challenge the system of medicine including teaching and practice. He was disenchanted with universities and noted that “The universities do not teach all things.” To broaden his knowledge, to learn more, and to gain experience, he traveled throughout Europe, the British Isles, Egypt, and the Holy Land; he was exposed to the latest developments in chemistry and medicine. He became an itinerant physician/surgeon. He returned to Villach in 1524 as the municipal physician and remained there until 1527. During that time, and as a result of his wanderings in search of knowledge, he contemplated many fundamental issues such as the meaning of life and death, health and the causes of disease (internal imbalances or external forces), the place of humans in the world and in the universe, and the relationship between humans (including himself) and God. This led to the development of a Paracelsian approach to medicine and a unique philosophy and theology. He was a free thinker, an iconoclast, and a theosophist. He became a reformer (hence the term the "Luther of Medicine"), a scientist, and a mystic. He tried to convince the members of the medical profession and the medical faculties (who conspired against him) and the public about the importance of chemistry in medicine and other concepts, but most refused to listen. “He yelled his message at them and became more and more bitter and aggressive.” For example, in 1527, he accepted the position of municipal physician in Basle. This also involved lecturing at the University of Basle, considered then (as now) a privilege. Because of his fame, his lectures were well
attended. His disenchantment with the teaching of medicine at the university and with the practice of medicine reached its climax on June 24, 1527, St. John's Day, when he publicly burned the standard medical textbooks of the day (e.g., Avicenna, Galen). He challenged the reigning medical experts and lost. This eventually led to his leaving university and the city of Basle—a frustrated and angry free thinker and medical innovator, not understood by the students, not accepted by his medical colleagues, and not appreciated by the local gentry. He continued his travels. He was eventually called to treat the bishop of Salzburg, Ernest of Wittelsbach. Paracelsus died in Salzburg on September 24, 1541, at the age of 48, a bitter, frustrated, and angry reformer.

Paracelsus' publications include several almanacs and a few medical works, but his most famous text was Grosse Wundartzney, published in 1536, which dealt with medical problems and had several chapters on the treatment of gunshot wounds. He published Von der Bergsucht oder Bergkrankheiten drey Bucher, reputed to be the first book on occupational disease, (miners' disease) in 1533 or 1534. He criticized the treatment of syphilis and the use of guaiac in his Vom Holtz Guaiaco grundlicher heylung, published in 1529, and in Von der Franzosischen krankheit Drey Bucher, published in 1530.

Let's examine some of Paracelsus' contributions to medicine, to toxicology, and to philosophy and theology. "The physician must pass through the examination of nature, which is the world, and all its causation. And what nature teaches him he must commend to his wisdom, not seeking anything in his wisdom, but only in the light of nature."

Paracelsus tried to bring chemistry and the scientific method into medicine; he used chemistry and chemical analogies in his teachings to medical students and to the medical establishment, who found them objectionable (and some still do). He believed that body organs functioned alchemically, that is, they separated pure from impure. He discounted the humoral theory of Galen, whose newly rediscovered works became the foundation for medicine. Galen postulated that there were four humors in the body (blood, phlegm, and yellow and black bile); when these were in balance, one enjoyed health, and when there was an imbalance, sickness ensued. Paracelsus, the alchemist, believed in three humors: salt (representing stability), sulfur (representing combustibility), and mercury (representing liquidity); he defined disease as a separation of one humor from the other two. Galenists believed that a disease of certain intensity would be cured by a medicine of opposite intensity (principle of contrariety). Paracelsus and his followers espoused the position that like cures like; that is, "a poison in the body would be cured by a similar poison," (principle of similitude) but the dosage is very important. Although he wrote that "nature hints at cures," he felt that many herbal preparations lacked sufficient potency to treat current diseases. Paracelsus introduced (actually reintroduced) into medicine the use of inorganic salts, metals, and minerals (although some had been used by the ancients). Plants were out and chemicals were in. Paracelsus ushered in the era of "New Chemical Medicine."

Paracelsus also believed that diseases tend to localize in a particular organ (target organ), a concept developed further as target organ of toxicity. He aroused the ire of the medical establishment by denouncing Galen and his works, by bringing chemistry into medicine, by introducing new chemical agents (inorganic salts, metals, minerals) into medicine, by stressing the dosage of the medicines used, and by trying to reform medical education. Because his approach to the body was chemical, he could be considered a chemical anatomist. He also encouraged physicians to use common sense, to sharpen their powers of observation, to gain experience, to travel, and to practice humility (and he wondered why they did not accept his advice!). He believed that medicine should be based on the four pillars of philosophy, astronomy, chemistry, and virtue. He believed that medicine was a divine mission and that physicians should not lose sight of this, and that character was more important than mechanical skill (applicable even today!). All of this was deemed heresy and not acceptable to the medical community of his time. Paracelsus was addressing the issue of educational reform for physicians, the relation of religion to science and medicine, and the value of ancient wisdom (ancient authority) in relation to evidence obtained from observation (and subsequently to experimentation). It seemed that Paracelsus was single-handedly taking on the entire medical profession. However, time would prove him correct. Unfortunately, recognition would come only after his death, but his influence on medicine was very significant.
Paracelsus may have believed that his critics were too harsh and he said of himself: “Nature has not made me subtle, nor have I been raised on figs and white bread, but rather on cheese, milk, and oat bread, and therefore I may well be uncivil to the hyperclean and the superfine; for those who were brought up in soft clothes and we, who were brought up among fir-cones, do not understand each other well. Thus I must seem rough, though to myself I appear gracious. How can I not be strange for one who has never gone wandering in the sun?”

Paracelsus extended his interest in chemistry and biology to what we now consider toxicology. This was undoubtedly due to his father’s interests and influence and to his involvement in occupational medicine. He very clearly expounded the concept of dose response in his Third Defense, where he stated that “Solely the dose determines that a thing is not a poison.” This was used to defend his use of inorganic substances in medicine, because his critics claimed that they were too toxic to be used as therapeutic agents. His belief that diseases locate in a specific organ was extended to include target organ toxicity; that is, that a chemical has a specific site within the body where it exerts its greatest effect. Paracelsus also encouraged the use of experimental animals to study the effects of chemicals for both beneficial effects and to identify toxic effects. As in medicine, the influence of Paracelsus on toxicology was enormous.

Paracelsus was a deeply religious and philosophical person who was concerned with many of the basic issues that still confront us today: who are we, what is our relationship with nature and with God, is there an after-life, what about the soul. This was part of his approach to psychiatry. He believed that there were two forces acting in all humans and these forces, animal and godly, were antagonistic. To be successful (whatever that means) involves suppressing the animal forces within us. Interestingly, he denounced the view that psychoses were demonic in origin. He also espoused the notion that mind/will/spirit/soul can influence the state of the body and can cause or cure a disorder. Was he saying that we can will ourselves good health?

What a role model for toxicologists and physicians! Here was an intelligent, well-educated, free-thinking, deeply religious, and independent iconoclast. He did not blindly accept what was taught and accepted by the academic community, nor did he do what was politically correct. He challenged the experts and demanded that they rely on data/facts and not on authority; one cannot/should not argue without facts. He identified issues, deliberated on them, and developed approaches to resolving them. His approach was scientific. But he also stressed the importance of character, including virtue. Can a cad be trusted as a physician, as a scientist, or even as a human being? Would there be ethical problems in science if all scientists were of impeccable character? Highly unlikely! Paracelsus also stressed the importance of experience, as not everything that is known/knowable is in the university. Knowledge plus experience makes an expert. Maybe it is time to harken back to some of these basic tenets of Paracelsianism. Perhaps Henry E. Sigerist summed it up best when he said (in the preface to his book Paracelsus, Four Treatises, 1941), “In publishing this book we wish to contribute our share in reviving the personality of an honest man who was a great physician and a staunch fighter for what he considered the truth. It is so easy to be orthodox and to reap honors by repeating what people expect and wish to hear. Progress, however, is achieved through the clash of ideas, and heretics like Paracelsus are a ferment without which there would be no life.”

“And this which you must consider is something great: there is nothing in Heaven and on earth which is not in man. And God, who is in Heaven, is in man.”


The Membership Directory of the Society of Toxicology (SOT) for the year 2001 lists over 5,000 individuals. We find listings for 18 different Specialty Sections and 18 Regional Chapters. As well, media resource specialists are identified for 18 issues of public concern, including such diverse topics as air pollution, chlorine-based compounds, endocrine disrupters, and validation of alternative methods for assessing toxicity. What a broad spectrum of toxicological knowledge!

When SOT was founded in 1961, and the membership consisted of 180 Charter members and three Honorary members, what were the characteristics of those individuals who felt the compelling need to organize under a common banner?

During the fifties, one could identify three general orientations in which toxicology was reasonably well developed in the United States. One was related to the safe use of new pharmaceutical agents and cosmetics. Another was concerned with the toxicological assessment of chemical products to establish their safety for commercial use and their safety in the occupational environment. The third group consisted of clinical toxicology and forensic toxicology, the former dealing with the clinical diagnosis and management of human intoxications and the latter with the medico-legal aspects of chemical intoxications.

Of the three areas of expertise, probably the largest in terms of numbers was the one related to pharmaceutical products. The era of therapeutic agents arising from new chemicals synthesized in the laboratory had arrived, and this required rigorous assessment of safety for their proper use as medicinal agents. The scientific leadership of Arnold J. Lehman, as director of the pharmacology division of the Food and Drug Administration, and his colleagues had a lasting impact on the regulatory sphere. The pharmaceutical industry itself expanded its own research programs to include toxicology, and as a sign of things to come, we saw the emergence of private consulting laboratories such as Hazleton Laboratories and Food and Drug Research Laboratories, founded by L. W. Hazleton and B. L. Oser, respectively.

Industrial toxicology and interest in the safe use of chemicals was a natural extension of important societal concerns about establishing safe working environments. Also, the agrochemical industry was in great expansion. Individuals trained as physicians, chemists, biologists, or in public health contributed to the development of this field. Several leading toxicology laboratories emerged within the chemical industry, as exemplified by the Biochemical Research Laboratory (D. D. Irish) of Dow Chemical, the Haskell Laboratory (J. A. Zapp, Jr.) of E. I. DuPont de Nemours, and the Laboratory of Industrial Medicine (D. W. Fassett) of Eastman Kodak. The Mellon Institute (C. S. Weil) in Pittsburgh and such U.S. Public Health Service facilities as the Communicable Disease Center (now the Centers for Disease Control and Prevention) (W. J. Hayes, Jr) in Atlanta and the Cincinnati Inhalation Laboratories (H. E. Stokinger) played important roles.

Clinical toxicology as a medical discipline was a natural extension of human and veterinary medicine. It produced the scientific basis for the diagnosis and management of chemical intoxications. Forensic toxicology in the United States, however, followed a slightly different evolutionary path. This group was smaller in number, and these toxicologists were usually associated with municipal or state laboratories. The major preoccupation of forensic toxicologists during the post-World War II era was the formidable task of the chemical detection of poisonous or illicit chemicals in biological specimens. The field was greatly
dependent on analytical chemistry and the development of analytical instrumentation. The successful qualitative and quantitative identification of toxicants was the driving force of much of the research in this area. Some of the early future Society of Toxicology members who made important contributions to clinical and forensic toxicology during this period include C. N. Thienes (University of Southern California), R. E. Gosselin (Dartmouth Medical School), T. A. Loomis (University of Washington), C. H. Hine (University of California), R. B. Forney (Indiana University), K. B. Dubowski (University of Oklahoma), L. G. Goldbaum (Armed Forces Institute of Pathology), and S. Kaye (Office of the Chief Medical Examiner of Virginia, Richmond).

Also, a few words should be said about the early training of toxicologists in the fifties. Many individuals received their graduate education in other disciplines before coming to toxicology, or they were trained initially as physicians or veterinarians. In addition, a number of graduate programs leading to advanced studies in toxicology appeared in pharmacology departments located in medical schools or pharmacy schools. Shortly after World War II (and well before the emergence of National Institutes of Health training grants), active research programs in toxicology appeared in a number of academic institutions. Examples include the University of Chicago (K. P. DuBois), University of Rochester (H. C. Hodge), University of California–San Francisco (C. H. Hine), University of Miami (W. D. Deichmann), Medical College of Virginia (P. S. Larson), Jefferson Medical College (J. M. Coon), and Purdue University (T. S. Miya). A large number of future members of SOT were initially trained in these institutions.

Where were research results in toxicology published in the late fifties? There were no professional journals in the United States exclusively devoted to toxicology. Publication in the field was largely restricted to the following research periodicals: Journal of Pharmacology and Experimental Therapeutics, AMA Archives of Industrial Health, American Industrial Hygiene Association Journal, Journal of Forensic Sciences, and Journal of Laboratory and Clinical Medicine. Clinically oriented toxicology reports also appeared in some pathology journals, and other journals devoted to human or veterinary medicine. There was an urgent need for a publication devoted to toxicology. In 1959, the establishment of Toxicology and Applied Pharmacology by the founding editors, Frederick Coulston, Arnold J. Lehman, and Harry W. Hays, and published by Academic Press, the owner of the journal, was a landmark historic event in the recognition of toxicology as a fully established scientific discipline.

Regarding professional societies, there were none in the United States that were clearly identified with the field of toxicology in the 1950s. Forensic toxicologists were usually members of the American Academy of Forensic Sciences. Clinical toxicologists were usually members of medical specialty groups, since the American Academy of Clinical Toxicology was established only in 1968. Many industrial toxicologists were part of the American Industrial Hygiene Association. Toxicologists who identified themselves as having a pharmaceutical orientation might be members of the American Society for Pharmacology and Experimental Therapeutics, but in the fifties this organization was largely made up of individuals with university affiliations.

In 1961, the time was right, and the need for a learned society devoted to toxicology was clearly established. A small group of toxicologists met in Washington, D.C., in March 1961 and formed the Society of Toxicology. A key element: that membership in this new society would be open to qualified scientists throughout the world who wished to support a society promoting the science of toxicology. The details of this historic event and its consequences can be found in the 25-year history published by SOT in 1986: Society of Toxicology History 1961–1986, by H. W. Hays, assisted by F. M. Carleton. The Founders of SOT were Frederick Coulston (Sterling-Winthrop Research Institute), William B. Deichmann (University of Miami), Victor A. Drill (G. D. Searle & Co.), Kenneth P. DuBois (University of Chicago), Harry W. Hays (National Research Council), Harold C. Hodge (University of Rochester), Paul S. Larson (Medical College of Virginia), Arnold J. Lehman (U.S. Food and Drug Administration), and C. Boyd Shaffer (American Cyanamid Co.). Dr. Lehman was named Honorary President, and the first elected President was Dr. Hodge. Subsequent organizational meetings were held in 1961 in Atlantic City (at the meeting of the Federation of American Societies for Experimental Biology), Detroit (American Industrial Hygiene Association meeting), Meriden, New Hampshire.
The Society of Toxicology The First Fifty Years

History, Philosophy, and Biography

(Gordon Conference), and Rochester, New York (American Society for Pharmacology and Experimental Therapeutics meeting). The minimum requirements for membership were defined as possession of a graduate degree and evidence of original research in some phase of toxicology.

The first meeting of SOT was held in Atlantic City on April 15, 1962; there were 180 Charter members. In addition, three very distinguished elder statesmen were awarded Honorary Memberships for their exemplary contributions to the science of toxicology: T. Sollmann of Western Reserve University, W. F. von Oettingen of Haskell Laboratories and U.S. Public Health Service, and E. M. K. Geiling of the University of Chicago. It is interesting to note that of the Charter members whose primary interests can be identified from their professional affiliations, about 50 percent appeared to be pharmaceutically oriented toxicologists, about 40 percent tended toward occupational or industrial toxicology, and less than 5 percent could be identified as clinical or forensic toxicologists. Also, 7 percent were from countries other than the United States. At the first Annual Meeting, it was announced that Academic Press and SOT had entered into an agreement, whereby Toxicology and Applied Pharmacology was now recognized as an official publication of the Society, and that SOT would exercise editorial policy and management of the journal through its Board of Publications. What a remarkable beginning for SOT!

The diversity of the science of toxicology was recognized right from the start, as was the need for sound educational training programs. The Educational Committee proposed, at the third Annual Meeting of the SOT (1964), that regardless of subspecialties, a toxicologist would be expected to have knowledge in three areas: 1) chemistry; 2) biology; and, 3) scientific methodology. Core subjects were identified. Particular emphasis was placed on research projects in experimental toxicology. The committee also put forth the notions that an interdisciplinary approach to the training of toxicologists might be more efficient than trying to establish separate departments of toxicology, and that on-the-job training should be considered as an adjunct to formal training (see H. W. Hays and F. M. Carleton, Society of Toxicology History 1961–1986, Society of Toxicology, 1986, pp. 30–31.; G. L. Plaa, Graduate training in toxicology, Am. J. Pharm. Educ. 38, 1974, pp. 330–333). These basic concepts are still applicable 36 years later.

We know that in 1961, probably no one could have anticipated the growth of our discipline and its expansion into what it is today, at the beginning of the 21st century. We can also doubt that we could have predicted the numerous other toxicology periodicals and several other toxicological associations that would emerge into the light of day worldwide. It is fitting, nevertheless, that the Society of Toxicology itself has been able to deal with the great diversity and vast interests of its own membership and to still remain a dominant educational and research forum for the advancement of the science of toxicology.

Toxicological Sciences 60, 3–5 (2001), © 2001 by the Society of Toxicology
To put the role of contract laboratories in toxicology in their proper place, it is necessary to go back into the fifties, well before the establishment of the Society of Toxicology. In that era there came into being an informal group known as The Toxicology Roundtable. Loosely organized and without any formal structure, it originally consisted of organizations that were active in what might be called “industrial toxicology.” That is, studies on the toxic effects of common commercial chemicals, regardless of end use. Among the organizations involved were New York University (Norton Nelson’s lab), the three leading chemical industry toxicology laboratories (DuPont, Union Carbide, and Dow), companies with no animal testing laboratory (Esso, American Cyanamid, and Hercules), and the three major contract testing laboratories (Hazleton, Industrial Bio-Test, and Food and Drug Research Laboratories). The group met once a year, usually in a location that permitted a high degree of informality. One organization volunteered to be the host, set the agenda, and was permitted to invite one or two nonmember representatives. These meetings resulted in a fruitful exchange of ideas regarding laboratory protocols, experiences with control results in various species of laboratory animals, tumor incidences in common species, new clinical laboratory methods and like topics, often driven by the extensive work under way in the contract laboratories. Much of what was discussed anticipated the emergence of “good laboratory practices” and related regulations some 20 years later. No proceedings were published, but a collective effort in round robin testing did generate two very significant publications. One dealt with intra- and interlaboratory variability in the single dose oral test and the other with the skin and eye tests. The major contract testing laboratories provided much valuable input into the Roundtable because of the great variety of materials tested, routes employed, and end points measured.

A laboratory such as Hazleton had clients in the cosmetics, food, food additive, pharmaceutical, color additive, and industrial chemical industries as well as government agencies looking at a range of materials from promising cancer chemotherapeutic agents to candidate chemical warfare materials. These contract testing laboratories had doctorate-level scientists leading the projects with technicians, many of them college degreed, doing the actual studies. Complementing these individuals were pathologists, veterinarians, clinical chemists, and statisticians.

In fact, one of the major contributions of the larger contract laboratories was their role in the training of toxicologists. In granting the 1982 Education Award to Lloyd Hazleton, founder and president of Hazleton Laboratories, the citation noted the number of members of SOT who learned their science in that laboratory. The contract toxicology laboratories were efficient and effective as training grounds because of the wide variety of end effects they observed, the number of laboratory species in their care, and the large number of laboratory procedures in which they were skilled.

If a chemical, pharmaceutical, or consumer products company had its own toxicology laboratory, it was most likely equipped to use the species and do the tests that were required by their product lines. A contract laboratory, however, in order to attract and retain a wide range of clients, found itself in the position of having to deal with all the common laboratory species and have proficiency in all the routine tests and some of the more specialized ones as well. There were also economic reasons for these laboratories to do certain tests. Traditional chronic feeding studies required much time and space and companies often found it economically advantageous to farm out such work. Consequently, the contract toxicology laboratories often had the greatest expertise in carrying out such work if for no other reason than the volume of such studies.
they conducted. The same was true of multi-dose inhalation studies. The requisite chambers for these studies were expensive, sophisticated to operate, and required considerable space in the laboratory.

Probably the easiest way for a contract toxicology laboratory to lose a client would be by poor or inadequate conduct of a given study. The client’s time and money would have been wasted and product development unduly delayed. To prevent such unfavorable outcomes, many laboratories developed written procedures and practices to ensure good quality in all phases of a study. These practices, which began to emerge in the early sixties considerably pre-dated what later came to be known as good laboratory practices, quality assurance programs, and associated government regulations.

An inherent disadvantage associated with contract toxicology laboratories and one which could make recruiting of qualified staff more difficult was the matter of publishing the work done in the laboratory. The client owned the data. There might be proprietary reasons to withhold publication until patent issues were clarified or market trials completed or federal regulatory agency requirements fully met. However, with time, the client population realized that independent publication of data by a qualified laboratory was to their advantage and publication of testing data became more common.

Today, contract toxicology laboratories are multi-million dollar businesses at one end of the spectrum and small, highly focused, very high tech operations at the other end. They continue to provide a valuable service in premarket and other testing of an even wider range of materials and are clearly international in scope. There is an informal association of consulting toxicologists, and, with all this, the Roundtable seems to have outlived its usefulness.
The International Union of Toxicology (IUTOX) was founded in close cooperation with the Society of Toxicology (SOT) and the European counterpart society, the European Society for the Study of Drug Toxicity (ESSDT). Both societies were formed after the thalidomide event, in order to prevent similar toxicological disasters in the future, and to stimulate research in toxicology and in the development of new teratogenic and other testing systems. The founding of SOT was decided upon on March 4, 1961, in Washington, D.C., and ESSDT was founded on September 26, 1962, in Zürich, Switzerland. The latter name was changed to the European Society of Toxicology (EST) in 1974 and to EUROTOX in 1989.

In the beginning of the seventies, SOT invited the European Society to cooperate with them in arranging joint symposia and forming an inter-society liaison committee, the latter from the suggestion of Victor A. Drill, President of SOT in 1972–73. The first joint meeting of SOT and EST took place in Montpellier, France, in June of 1975. The following committee members from EST participated in this meeting: Günter Neuhaus, President; Erwin Eichenberger, Secretary; and Jens Schou, Gerhard Zbinden, Laurie Prescott, and others, together with selected Council members from SOT: Seymour Friess, Sheldon Murphy, and Perry Gehring. An invitation from the International Union of Pharmacology to form a Section of Toxicology was considered; however, it was unanimously decided to maintain the idea of an independent international union of toxicology. The First International Congress of Toxicology was planned for Toronto, Ontario, Canada, in 1977, following the SOT Annual Meeting. A second international congress was planned for three years later in Brussels, and during that meeting, on July 6, 1980, the International Union of Toxicology was founded. The nine founding member societies of IUTOX were the British Toxicology Society; EUROTOX; the Finnish Society of Toxicology; the French Society of Toxicology; the Japanese Society of Toxicological Sciences; the Society of Toxicology, Canada; the Society of Toxicology, India; the Society of Toxicology, United States; and the Swedish Society of Toxicology. These founding member societies were presented, and the following officers were elected for the first Executive Committee: Seymour Friess, President; Dietrich Henschler and Bo Holmstedt, Vice Presidents; Robert Burford, Secretary; Christian Hodel, Treasurer, and Gabriel Plaa, Etienne Fournier, Matsuo Ikeda, Peter Gupta, and Norman Aldridge, Directors.

The general scope of the Union was settled as follows:

*The purpose of the Union shall be to foster international scientific collaboration among national and other groups of toxicologists, and to promote worldwide acquisition, dissemination, and utilization of knowledge in the science of toxicology, in particular by sponsoring international congresses on toxicology, for the benefit of mankind.*

Since IUTOX was founded, the number of member societies has been raised from nine to more than 30 in 2000, which means that about 17,500 national society members, worldwide, are represented by the Union. Together with the revenues from the International Congresses of Toxicology, this has led to an increase in assets, which appear in Figure 1.

![Figure 1: Total Assets of IUTOX on December 31, 2000, in Thousands of US$/SFr.](https://example.com/figure1.png)

The most important activities of the IUTOX have been the international congresses held every third year: Toronto, Canada 1977; Brussels, Belgium 1980; San Diego, California 1983; Tokyo, Japan 1986; Brighton, United Kingdom 1989; Rome, Italy 1992; Seattle, Washington 1995, and Paris, France 1998. Throughout the years, the number of participants has increased from 950 to 2,500.

In 1985, IUTOX started to distribute an annual “broadsheet,” which was replaced in 1993 by the IUTOX Newsletter. The newsletters contain the President’s report on the general progress of the Union and reports by the Secretary General and the Treasurer. In 1997, the subcommittees of the Union were reorganized and now consist of the membership committee as well as “commissions” on strategic development, education, new and developing societies of toxicology, international relations, and communications, the last including the preparation and distribution of the newsletter and the setting up and maintenance of the IUTOX Web site.

This brief history of IUTOX should certainly include mention of the outstanding toxicologist William B. Deichmann of Miami, Florida. As early as 1968, he fostered the idea of establishing an International Union of Toxicology, which he himself abbreviated to IUTOX. At the SOT Annual Meeting in 1968, he invited Frank Blood, Seymour Friess, and Paul Larson to lunch with him for the purpose of “sounding them out on the advisability of recommending to the Council of our society that we consider the organization of an International Union of Toxicology.” His initiative was postponed for several reasons, the main one being a general feeling that SOT was already international. However, this attitude changed gradually, and in the mid–seventies, SOT and ESSDT joined forces to establish the independent International Union of Toxicology, mentioned earlier.

A more detailed history of the foundation and functions of the International Union of Toxicology (written by Christian M. Hodel and Jens S. Schou) was presented to the participants of the VIIIth International Congress of Toxicology in Paris in 1998, and we shall not repeat the contents here. Only two more important activities should be mentioned: the Risk Assessment Summer School (RASS) and the Deichmann Award lectures.

In 1985, RASS I was held in Menstrup, Denmark. The Summer School was sponsored by EST, SOT, and IUTOX, and was organized by the Swedish toxicologist Torbjörn Malmfors. Since then, the Summer Schools have been held in 1987, 1990, 1992, 1994, 1996, and 1998 (RASS VII) in different parts of the world. The Summer School lasts for one week and Torbjörn Malmfors, together with a group of acknowledged experts, introduce the participants to all aspects of risk assessment. Participants may apply for fellowships.

The Deichmann family donated the grant for the Deichmann Award lecture, which has been given by a distinguished scientist at each ICT (International Congress of Toxicology) since Bo Holmstedt of Sweden gave the first lecture in 1983 in San Diego, California, in remembrance and acknowledgment of the first person to officially suggest the formation of an International Union of Toxicology.

Today, 20 years after its founding, the International Union of Toxicology is a respected organization, which has been an affiliated member of the International Council of Scientific Unions (ICSU) since 1996. The Union has an efficient infrastructure and healthy finances. The next international congresses will take place in Brisbane, Australia, in 2001, and three years later, in Tampere, Finland in 2004.

Other Reading
Toxicological Sciences, 61, 199–200 (2001), © 2001 by the Society of Toxicology
Nothing I could write about toxicology training would be complete without a history of my training, since all the positive things I learned, I tried to pass on to my students. Among these were cooperation, integrity, and perseverance. How I ended up at the University of Nebraska is a story in itself. I was a freshman at University of California, Berkeley, when Pearl Harbor occurred. Shortly thereafter all persons of Japanese origin were incarcerated. I ended up at the University of Nebraska since it was the only university that accepted my application from the detention center.

Shortly after enrolling in 1942, I was offered work tending to laboratory animals under the supervision of Dr. H. G. O. Holck. He was a disciple of physiologist Dr. A. J. Carlson and of pharmacologist Dr. E. M. K. Geiling, both from the University of Chicago. Dr. Holck ended up being my mentor until his death at age 94. Even prior to my first course in pharmacology, I had learned important lessons in animal husbandry related to results of animal research.

My bachelor’s thesis was completed and published prior to my last semester of the senior year. A part of that thesis included work with my mentor on a simple LD-50 determination of two well-known therapeutic agents. Explicit directions for the study came from the Physiological Testing Committee and were forwarded to six participating laboratories representing different regions of the United States. Although same source mice and drugs were used, the results were surprisingly different. The LD-50 figures were scattered and far apart, varying as much as three-fold; however, the ratio of the LD-50 figures for the two drugs were similar for all laboratories. One exception came from a laboratory that had failed to follow protocol. Great lessons were learned.

I was drafted two weeks into my senior year. My mentor kept in contact with me during my U.S. Army service. The absence hardly blunted my enthusiasm to complete my B.S. in pharmacy and continue my graduate work in pharmacology. My M.S. project taught me precision and patience. A problem extant at the time was the cost and availability of cats for the official U.S.P. bioassay of digitalis. Pressure was coming from organizations such as People for the Ethical Treatment of Animals (PETA) against the use of cats for such tests. I chose to study the efficacy, reliability, and validity of the common laboratory guinea pig as a replacement. The assay entailed the precise preparation of the tincture from digitalis leaves. Appropriate dilutions were infused into anesthetized guinea pigs every five minutes until ventricular systole. To draw conclusions that were unquestionable, cats were always used simultaneously for comparison. Some higher dilutions took late nights at the laboratory. The guinea pig was found to be a suitable animal for the official assay. A few years later, the active ingredients of digitalis were isolated and identified, ending a need for bioassays. My mentor suggested I pursue my doctorate at Purdue University, where I might be able to receive considerable financial assistance.

At Purdue University, I served as an instructor of pharmacology (1948–52) under Dr. L. D. Edwards, who studied under Dr. Torald Soliman at Case Western Reserve. After four years and full-time summers of graduate work, I received my Ph.D. in 1952. I assumed the chairmanship of the Department of Pharmacology from my Nebraska mentor, but after a year at Nebraska, I was enticed to return to Purdue in 1957 as chairman of the Department of Pharmacology.

At Purdue, students and faculty offices and laboratories were housed in a World War II temporary building where conditions were not pleasant. Several years later, the Department was moved to a botanical garden building. The greenhouse portion was essentially unused. The quarters were only a marginal improvement. We were crowded. Faculty and graduate students literally bumped into each other.
at every turn. Yet, I learned an important lesson in communications. No matter how brief the encounter had been, someone’s minor problem was solved in a sentence or two. When we finally moved into a new building (in 1964), designed by department faculty in consultation with architects, there was ample space. Faculty and graduate students were deployed into individual laboratories. I believe we lost some of our research efficiency because of decreased contact with one another. I compensated for this by trying to visit each faculty and student at least once a week in their laboratory to discuss research progress.

We did not have an overarching theme for a research area, for example, cardiovascular. If anything, it was biochemical pharmacology/toxicology. Excellence was constantly emphasized. Publication of the research in a peer-reviewed journal was considered as validating the research. In the early period, participation in the ASPET meetings was encouraged, but when SOT was formed it took precedence because our activities were more in line with the latter. About the time of the SOT formation, our department name was changed to the Department of Pharmacology and Toxicology. This was a very positive change. The name change reflected more of what our department was about.

The instructional load was shared by all faculty; often several faculty were involved in one course. Not strictly methods, the course on methodology discussed the physiology involved in a particular animal testing procedure for a particular therapeutic category. One example was the use of the pithed rat preparation, which I learned from an Eli Lilly investigator. The method could measure the contribution of the peripheral nervous system response to vasopressor agents. In one of our own ventures, a graduate student and I developed and published a method to measure neurological deficit. It is my understanding that it is still used today, albeit refined.

We attempted to get each and every graduate student involved in the various aspects of undergraduate instruction. During examination periods, we had groups of graduate students led by staff grade the answers one by one. This was a fun time for graduate students as well as a great learning experience. I usually tried to have snacks at these sessions. Seminars were a weekly event in which the graduate students made presentations followed by a vigorous question and answer session. These sessions often resembled a preliminary examination for the doctorate. The students learned not only the contents of the published research paper they were presenting but also all the background leading to the study. As they progressed in their own research, they would present their own research findings in the seminars.

To mix a little fun with the work of being a graduate student, the department had picnics. Christmas was a special time when all the faculty and graduate students were invited to our home for dinner. Even in recent times when I would meet former students, they would comment nostalgically about these parties.

My involvement in graduate education began at a time when smoking drums for recordings and blowing glassware to fit your needs were standard. I remember the introduction of the programmable calculators and recorders, such as the physiograph. Through all this, the constants remained: cooperative ventures, integrity, persistence, communications, and the frequent encouragement of faculty and students.

When I relocated to Chapel Hill as the dean of the School of Pharmacy, I was also appointed professor of pharmacology in the School of Medicine. This was an exciting time, particularly with the Research Triangle Park. It was a gathering place for many toxicologically-oriented scientists employed in research laboratories of the Environmental Protection Agency and National Institute of Environment Health Science, as well as pharmaceutical companies. I participated in the formation of a graduate program in toxicology based in the School of Medicine, with 16 departments and over 50 faculty involved. A number of scientists from the Research Park were appointed as adjunct faculty of the newly formed program. I was privileged to serve as its chairman until my retirement. The support and loyalty of faculty, students, and administrative colleagues ensured its success.

From a personal perspective, my career in an academic setting has given me an opportunity to contribute to the future of toxicology education. The greatest satisfaction is in watching men and women I have taught as they developed in their career paths.
For several years in the mid-seventies, the Society of Toxicology (SOT) had been studying the feasibility of accrediting toxicology laboratories and/or certifying the competency of individual toxicologists. Committee discussions were held, reports were issued in 1973 and 1974, and a proposal was developed by the spring of 1976. At the Annual SOT Business Meeting in March 1976, the membership voted to establish a committee specifically to deal with the problems involved in accreditation and certification, with the mandate that it develop solid models for membership approval and implementation in these areas.

President Robert A. Scala appointed me to chair a Council committee dealing with these issues. Shortly thereafter, because of widespread concern, the Council requested that the Society develop guidelines for conducting toxicologic studies under good laboratory practices. This responsibility was added to the duties of the existing committee dealing with accreditation and certification, and resulted in the formation of a Council Committee on Accreditation, Certification, and Good Laboratory Practices in Toxicology.

The interrelationship of the three areas to be reviewed made practical their inclusion in a single committee. However, the impossibility of having one committee deal adequately with the details of each area resulted in the establishment of three separate subcommittees: Accreditation of Toxicology Facilities, Certification of Professionals in Toxicology, and Good Laboratory Practices in Toxicology. It was felt that the most expert and widely representative individuals in the Society should be called upon to serve on these subcommittees. Hence, a list of highly qualified, select individuals from within the membership was developed, and subcommittees were established granting equal representation to industry-commercial toxicology, government-regulatory affairs, and research-academia positions. Enthusiastic and experienced individuals provided leadership for each subcommittee.

Council determined that the overall committee should be given every opportunity to function efficiently and rapidly, and thus provided financial support and a target date of December 6, 1976, for the final reports. This allowed time for review by Council and submission to the membership in order to permit sufficient discussion and action at the March 1977 Annual Meeting. The subcommittees were organized and initiated during the late summer and early fall of 1976, and each member was provided with specific charges and copies of all documents relevant to the area under consideration. A meeting of the subcommittee chairpersons, FDA-EPA scientists, and myself was held August 31 in Rockville, Maryland, to provide interaction between the Society and the agencies. A working meeting of all subcommittees was then held during the week of September 20, 1976, at Kansas State University, Manhattan, Kansas, to develop the initial documents that would comprise the final report.

The draft documents were circulated to all members of the subcommittees and to Council for review and suggested changes. The subcommittee chairmen developed the documents into the final report, which was forwarded to President Scala on December 3, 1976. The document was reproduced by the then Office of the Executive Secretary and distributed to all members of the Society.
At the Annual SOT Business Meeting in March 1977, the report and the recommendations of the various subcommittees were reviewed. Since many members at that meeting indicated they were unfamiliar with the report or had not received it, President Scala withheld action at that time. Comments on the various proposals were solicited from the membership and reconsideration of the report was proposed.

Concern with the educational aspects of the certification proposal prompted involvement of the Education Committee, and a special meeting of the Subcommittee on Certification of Professionals in Toxicology and members of the Education Committee was held in Kansas City, Missouri, April 27 and 28, 1977. The certification proposal was reviewed extensively at that time, with careful consideration of all the members’ comments made to the subcommittee. The Education Committee attacked the problems of defining the scope of toxicology, outlining the scientific training implicit in the education of a toxicologist, and planning for the possibility of continuing education activities so that toxicologists could maintain competence, following completion of formal education programs. The subcommittees on accreditation of toxicology facilities and good laboratory practices in toxicology informally reviewed their reports, and duly considered comments received, modifications, and drafts of the original reports. The Education Committee then developed a new, modified report in the late spring and summer of 1977.

Suggestions from the membership, the past Presidents, and Council indicated the need for membership reaction to the finally distributed reports. Accordingly, a questionnaire-ballot was prepared by the Council of Past Presidents and the subcommittee chairmen to permit individual member reaction to the report. The questionnaire-ballot and the subcommittee reports were retyped, prefaced with a table of contents, an introduction, and a summary of individual subcommittee activities and reports, to facilitate ease in membership handling and readability. This summary report and the complete reports of the subcommittees were then distributed by the Executive Secretary to the Society membership for approval in October 1977.

In the introduction to that report, as Chairman of the SOT Committee on Accreditation, Certification, and Good Laboratory Practices in Toxicology, I presented the report and its call for action to the membership with this admonition: “Each of the members of the subcommittees has given conscientious and deep thought to each item in the report. It is hoped that the Society members will use equal consideration and judgment in evaluating and reacting to the comments and recommendations made by each expert body. The decisions and direction (or lack of it) generated by this report will affect our profession and each one of us for many years to come. The ultimate effect will be determined by your response during these next weeks” (F. W. Oehme, 1977, Report of the Society of Toxicology Council’s Committee on Accreditation, Certification, and Good Laboratory Practices in Toxicology).

The rest is history, as the recommendations of each subcommittee were overwhelmingly approved by the membership. The resulting Toxicology Laboratory Accreditation Board made a significant impact on the quality of toxicology testing facilities during its span of influence, while the American Board of Toxicology began its highly successful and influential course of providing a statement of expertise as a peer-driven certifying body for professionals in toxicology.

Subcommittee on Accreditation and Toxicology Facilities

This subcommittee evaluated types of facilities currently in use in conducting toxicity investigations (including drug trials, biochemical studies, and other research in industry, academia, and government institutions), and made recommendations and adopted guidelines for adequately performing scientifically valid studies. Included were the review of structural plans, laboratory facility organization, animal care facilities, ventilation, safety features, floor space, instrumentation, and the presence of necessary physical items. Standards, guidelines, and recommendations on how these items should be evaluated were developed. Accreditation or inspection programs for toxicology facilities were considered and mechanisms offered.
This subcommittee was composed of the following individuals: Robert T. Drew, Chairman; Daniel Couri; William D'Aguanno; Harry W. Hays; Theodore O. King; Gordon W. Newell; Jerry M. Smith; and Robert Snyder.

Their report recognized the need for accreditation of toxicology facilities was not new. Comments about the credibility of laboratories conducting toxicology investigations had appeared in scientific communications, and public and regulatory notices of potential problems in laboratories had produced considerable controversy. The accreditation of facilities was an important factor in maintaining public confidence in laboratory test results. The report reviewed and provided guidelines for the physical facilities that should be available in toxicology laboratories, and offered comments on equipment, animal care facilities, administrative procedures, and accreditation mechanisms. It recommended that the utilization of Association for Assessment and Accreditation of Laboratory Animal Care accreditation for animal care facilities be employed, where applicable, as an important part of overall laboratory accreditation. Although guidelines were provided for general use, the report recognized that there is no substitute for scientific judgment and that certain types of laboratories and testing procedures may require unique facilities and techniques. However, it specified that laboratories should be required to keep up with the state of the art, and recommended an inspection accreditation procedure to ensure and to document the maintenance of high-quality standards by toxicology testing laboratories.

This subcommittee recommended the establishment of an Accreditation Board for Toxicology Facilities, and asked membership response in the questionnaire-ballot. It suggested that the Society recognize the need for a mechanism for the accreditation of laboratory facilities and, therefore, that it should create an organization for the purpose of establishing the specific details of such an accreditation procedure. The organization was expected to recognize the basic principles as submitted in the detailed subcommittee reports, but could alter them as deemed appropriate. It was felt that a demonstration model could precede establishment of such an accrediting body, and that membership would have ample opportunity to comment on specific details as they were developed. Before commitment to eventual establishment of an accreditation body for toxicologist facilities, it recommended that the Society establish a group to demonstrate a working model for accreditation. After several trial accreditation exercises, the committee expected to report their results to the membership for further consideration.

**Subcommittee on Good Laboratory Practices in Toxicology**

This subcommittee reviewed the existing practices in laboratories dealing with toxicologic studies (research, industrial, or academic) and developed recommendations, guidelines, and standards on how toxicology procedures and activities should be organized and conducted to yield meaningful results. Past experience with difficulties in laboratory practices received heavy emphasis, and it was felt that standards for the conduct of toxicologic studies must be so documented as to ensure that quality control of all aspects of laboratory procedures and research protocol were professionally and scientifically carried out. It was assumed that adequate facilities and appropriately trained and oriented technical and professional personnel were available, but the actual conduct and control measures to ensure that these studies were indeed valid demanded thorough attention. Thus, a subcommittee that included members of the Society from academia, government, and industry prepared proposed guidelines for good laboratory practice as applied to toxicologic studies in animals.

The scientists comprising this subcommittee were Emil A. Pfitzer, Chairman; John L. Emmerson; Harold C. Grice; Francis N. Marzulli; Paul A. Mattis; Stata Norton; Carrol S. Weil; and Hanspeter R. Witschi.

The report’s guidelines stated the basic principles and practices that should provide the basis for an objective review, with tangible evidence to ensure the scientific reliability of data. There were two major features to the proposed guidelines: the basic principles and practices must be presented in sufficient generality to be equally applicable to all types of toxicological studies; and a mechanism should be described for providing a technical review for specific subjects, requiring 1) further detail, 2) a listing of acceptable procedures, and/or, 3) a consideration of controversial issues. This feature
allowed flexibility for scientifically sound improvements and advancements in methodologies without compromising reliability.

The recommendation that the Society establish panels of scientific experts who would be available to review aspects of and/or make judgments on specific subjects relating to accreditation and good laboratory practices was presented to the membership for comment on the questionnaire-ballot. When there are external reviews of a toxicology laboratory, controversial issues about specific practices may arise. It was suggested that the SOT provide leadership for resolution when such issues are of importance relative to the public good or the advancement of the profession. Certain of these issues could best be resolved by a group of scientific experts. It was envisioned that the panels would include experts from disciplines other than toxicology, as needed. Examples of controversial issues were differences of opinion about the impact of certain “errors” in data collection affecting the validity of the conclusions of the study, or the scientific suitability of a technical procedure utilized in a toxicity study. This panel could poll toxicologists to obtain views describing current practices regarding technical subjects (see examples below). In addition, it was suggested that a master list should be compiled of those practices that are considered scientifically acceptable, and these should be complied with. Certain other specific procedures that would be considered as unacceptable could be listed when necessary. The panel would be responsible for descriptions of procedures providing sufficient flexibility so that they allowed for improved and creative innovations. A mechanism to provide prompt updating of new, acceptable procedures would be needed. When there was sufficient scientific interest in the report of this panel, such as via recommendations for technical procedures in the laboratory, the findings would be considered potentially acceptable for publication as brief communications in one of the Society’s journals or in the Newsletter, or made otherwise available as documents from the SOT.

Following are some examples of subjects that required technical review by such a panel:

- Methods of statistical analysis of data for incidence of tumors, including a definition of the population at risk and the appropriate denominator for the tumor index
- A definition of the term “original data,” which should include use of nonwritten records, e.g., those from computer or recorder
- Methods for recording and securing original data, including use of bound books, pens, and worksheets
- Disposal of animals found dead or killed on test, particularly for those that could not be necropsied immediately; what are acceptable methods for optimal preservation of the tissues prior to necropsy? What is an acceptable time that animals can be held when so preserved?
- What criteria should be used to determine when sick or moribund test animals should be killed, so that tissues would not be lost for subsequent examination?
- Criteria for the protection of female technicians of childbearing age when exposed to potential carcinogens, mutagens, or teratogens.
- Procedures of clinical examination of small laboratory animals
- Procedures to train toxicology technicians
- What data should be available to a pathologist when he performs gross and histopathologic examinations?
- Effective identification systems for rodents, e.g., ear tags
- Criteria for decisions to treat extraneous disease of, or injury to, animals on study
- Schedules for time of retention of specimens and records

**Coordination of Reports on Accreditation of Toxicology Facilities and Good Laboratory Practices in Toxicology**

The initial separation of the Accreditation of Toxicology Facilities and the Good Laboratory Practices (GLP) in Toxicology subcommittees was necessary to address each topic suitably. However, upon completion of the respective reports, the subcommittee chairs met for the purpose of integrating the two reports. They agreed that facilities and GLPs must be addressed by the same accreditation organization. Thus, while the initial subcommittee reports were not combined, it became our intention that they be coordinated.
There was much overlap in the two reports. The subcommittee on GLPs, for example, addressed facilities and equipment on a philosophical basis, whereas these subjects were treated in much greater detail in the Accreditation of Facilities report. The subjects of specific protocols, conduct of studies, quality assurance, and standard operating procedures, which were addressed individually by the subcommittee on GLPs, were collectively dealt with in the section on administrative procedures in the Accreditation of Facilities report.

It was important that the membership recognize these reports as drafts of models for accreditation procedures and guidelines for criteria that would be included in the various steps leading to accreditation. Assuming an accrediting body would be established, it was expected that it would adhere to the basic philosophy of the reports, but the accrediting body would be responsible for all the specific details of the accreditation process and the requirements set forth as part of that process.

Subcommittee on Certification of Professionals in Toxicology

This committee studied certification in various specialty boards in toxicology and developed models of a toxicology specialty board. It examined the qualifications deemed necessary for professional toxicologists and especially those involved in laboratories performing toxicologic studies. Standards, guidelines, and recommendations on how the expertise and capability of these personnel should be evaluated and the type of certification and examination mechanisms necessary to ensure that individuals making judgments on toxicologic matters are appropriately qualified were all considered. Requirements for certification, areas of competency, and methods and types of examination were reviewed.

The toxicologists comprising this subcommittee were Robert B. Forney, Chairman; Robert V. Blanke; Herbert Blumenthal; Ted A. Loomis; Orville E. Paynter; Verald K. Rowe; and Anne M. Wolven.

In its report, the subcommittee recognized that there were many subspecialties in toxicology, as exemplified by the diversity, background, and interests of the Society’s membership; therefore, the subcommittee chose to address, initially, the certification of a toxicologist in the most general sense. It was recognized that the Society might have wished to recognize the five established certification programs then in existence as subspecialties in the general classification of toxicology. It was pointed out that the Department of Health, Education, and Welfare (DHEW) issued a policy statement in June of 1976, for “a proposal for credentialing health manpower.” Since the proposed Society-sponsored certification program was undoubtedly to be health-related, the provisions of the DHEW policy statement had to be considered.

The subcommittee further pointed out that, if a certification program were adopted, a key factor in organizing the certifying board would be that the public interest must remain supreme. Therefore, it would have to be organized as a not-for-profit corporation, meeting the pertinent IRS criteria. The organization of such a corporation would be a highly specialized field, and therefore, competent legal counsel, professional accounting advice, and appropriate insurance coverage would be indispensable. The organization and operation of such a board was seen as expensive. The SOT would have to underwrite the costs involved in establishing and incorporating such a board and its operation for at least a three-year period on a renewable basis, or until, possibly, the board became financially self-sustaining. The need to establish a certification program for professional toxicologists may not have been readily apparent to all members of the Society, but it was necessary that those who were in favor of it understood that it would be an expensive, time-consuming effort if it were to succeed.

It was recommended that the subcommittee’s report be carefully reviewed by the membership and that opinions be provided on the questionnaire-ballot.

The Education Committee

The Education Committee was asked to contribute to the Committee on Accreditation, Certification, and Good Laboratory Practices in Toxicology report, because of the membership’s concern at the 1977 Annual SOT Business Meeting regarding the scope and training of individuals working in toxicology, and because of the obvious interaction between continuing education programs and any developing certification programs. The
Education Committee was asked to offer their collective expertise in providing a definition of toxicology, a workable definition of a toxicologist, a proposed curriculum model for training toxicologists, a listing of areas of current specialization in toxicology with additional areas that the committee felt would develop within the next ten years, and a listing of continuing education programs in toxicology that should be developed to assist the membership in maintaining competency standards in the rapidly developing toxicology specialties. Although the other groups had addressed several of these items, the Education Committee discussed and considered how the Society could relate to the educational needs in toxicology.

Since the Education Committee was in the midst of a membership change, President Scala asked the two recently elected members to meet with the individuals still comprising the committee. The expanded Education Committee was composed of Carl C. Smith, Chairman; James E. Gibson; James E. Long; Stata Norton; Andrew L. Reeves; and Joseph C. Street.

The Education Committee’s report provided a basis upon which future educational efforts could be developed. Definitions of the terms toxicology and toxicologist were given, and curricula for undergraduate and graduate programs in toxicology were formulated. Maintaining competency in toxicology was encouraged, and a review of the Society’s existing continuing education program was provided. Organizers of workshops, symposia, and short courses were advised to inform the Society of their programs as soon as possible, so that this information could be made available to members. The interaction of continuing education programs and their relevance to the certification and maintenance of certification for toxicologists was emphasized. Future education committees were encouraged to stress the necessity for providing appropriate continuing education opportunities for Society members.

Are you impressed with the number and variety of continuing education (CE) offerings at our Annual Meetings? Well, it wasn’t always so. For quite a few years there were no CE programs given. The Annual Meetings started on mid-afternoon the day before the scientific papers and sessions were given. Since the “real” scientific meeting was initially held early in the week, that left Sunday afternoon for the business and political activities.

With the growth of membership and the increasing number of young toxicologists attending the Annual Meetings and seeking insights into the numerous growth specialties in toxicology, the need and opportunities for general education topics being presented as part of the Annual Meeting seemed an appropriate next step for the development of our future colleagues. The Sunday afternoon timeframe was an obvious nitch and an overview (of what now seems rudimentary) of toxicological principles was an early point of initiation to offer an educational effort to the membership.

Council and the Program Committee allowed the organization of a five-lecture course entitled “The Basic Principles of Kinetics” to be offered at the 19th Annual Meeting at the Sheraton Washington Hotel in Washington, D.C., March 9–13, 1980. The session was planned for Sunday afternoon, March 9. Several well-respected toxicologists were pulled into the program, and it was hoped that the idea and topics would find interest from the meeting attendees. Were we ever surprised! Seats rapidly were filled, the brief mimeographed notes were used up, and standing room only was available for those that arrived several minutes before the announced starting time.

Following my moderator’s opening statement, Ellen O’Flaherty (University of Cincinnati) presented “Concepts of Toxicokinetics.” The next 45 minutes were devoted to “Absorption of Chemicals through Biological Membranes” presented by Donald Ecobichon (McGill University, Montreal). A brief break allowed everyone to stretch. At 3:00 PM Robert Neal (Vanderbilt University) updated us about “Metabolism and Biotransformation of Chemicals,” and then Curtis Klaassen (University of Kansas Medical Center) instructed about “Excretion of Toxins.” Dr. O’Flaherty then put all the pieces in their appropriate places with a half-hour “Kinetic Wrap-Up.”

That year there was considerable interest in the Society assisting in the development of accreditation processes for individual toxicologists (being “boarded” in toxicology) and for laboratories in the business of testing the safety of current or newly developed compounds (meeting regulatory requirements or following good laboratory practices). Accordingly the remainder of the afternoon was devoted to American Board of Toxicology (Seymour Friess) and Toxicology Laboratory Accreditation Board (Emil Pfitzer) information presentations. The audience had many questions and the discussions carried over into the “happy hour.”

The overflowing and enthusiastic audience was a fore-shadow of the years to come for formal CE offerings. Council approved the Program Committee having more of the same in 1981 at the San Diego Annual Meeting. “Respiratory Toxicology” was the theme for speakers discussing “Anatomy and Comparative Architecture of the Lung and How It Responds to Various Toxicants” (Walter Tyler, University of California-Davis), “Technology of Meaningful Inhalation Exposures” (Robert Drew, Brookhaven National Laboratory), “Deposition and Clearance of Gases and Particulates in the Respiratory Tract” (Paul Morrow, University of Rochester Medical Center), and “Non-Pathological
Endpoints Measured in Pulmonary Research” (Drummond Bowden, University of Manitoba Faculty of Medicine). Once again the member and laboratory certification processes were spotlighted by Seymour Friess updating on the American Board of Toxicology and Harry Hays doing the same for the Toxicology Laboratory Accreditation Board.

For the first time a fee was charged for the 1981 CE course. Approximately 285 tickets were sold generating an estimated profit of more than $4,200 after the refreshment and handout expenses were paid. The Society's Treasurer was delighted—and has been smiling ever since!

At the following years’ Annual Meetings, morning and afternoon courses were given, and the number and variety has been multiplied. And with it the providing of formal bound notes and the expansion of topics with the growth of disciplines and new developments in toxicology followed. The interest of the membership in expanding their knowledge base has paralleled participation at the sessions and continues to be a highlight of the Sunday before the week’s scientific sessions. As an income-generating event the CE courses have developed into arguably the most profit-generating effort of the Society—and all because of the Society's response to foster toxicology training for members desiring updated information about specialties within their chosen discipline.
As the seventies were nearing their term diverse forces were impinging on toxicology. Regulators and members of the public voiced criticism following a spate of reports suggesting less than professional standards on the part of some conducting long-term toxicity studies. Government agencies with some input from nongovernmental scientists formulated a new set of rules (“Guidelines”) to ensure control of the quality of studies to be used when assessing safety of new and established products. SOT members were instrumental in creating the American Board of Toxicology (ABT) as a vehicle to attest to the expertise of toxicologists in assessing product safety and the Toxicology Accreditation Board (TLAB) as a means of qualifying laboratories in the use of the newly developed good laboratory practices. ABT and TLAB were organized and incorporated as separate and distinct entities, independent of SOT.

Concurrently, science underpinning the field of toxicology was exploding. New technologies and new approaches to understand how chemicals react with the environment and cellular function in animals and humans were being developed in many fields. The challenge facing SOT leadership was to ensure that this new science would continue to be focused on toxicology and, equally important, to ensure that this new breed of scientists would feel at home in SOT. Other basic sciences had suffered loss of membership as many of their young, creative members found homes in newly created system-specific organizations. SOT leaders recognized the opportunity to develop new and focused science within SOT and, in their wisdom, created Specialty Sections and Regional Chapters.

President Leon Golberg (1978–79) called for a reassessment of the Society’s organizational structure, including additional categories of membership, regional and local sections, and specialty groups. An ad hoc committee, chaired by Victor Drill, conducted an extensive review of the major organizational structure of the Society and in September 1979, 15 recommendations were made including appointment of a committee to study the feasibility of having Specialty Sections in toxicology.

A questionnaire on the subject was sent to the members and the results were published in the November 1979 issue of the Newsletter. The majority of the members favored the idea and the Council concluded that it was advisable and feasible to establish sections within the Society of Toxicology. A “Task Force on Subsection Formation,” chaired by Steve Cohen, rapidly produced a report that: 1) provided descriptions and functions of both regional chapters and specialty sections; 2) outlined a procedure for recognition of chapters and sections; 3) recommended that Council monitor the organization and functioning of the chapters and sections; 4) provided a model of by-laws; and 5) recommended that provisions be made for meeting rooms at the Annual Meeting where these groups could meet. These recommendations dovetailed with the recommendations of a strategic planning exercise, The Tox-80s Commission, which had been created by President Miya (1979–80), held on October 1–3, 1979, which similarly recommended an assessment of Specialty Sections and Regional Chapters. Council by this time was well aware of the clamoring for organizational changes by individual scientists and organized groups of SOT members. Indeed, a groundswell of support for a Mechanisms of Toxicity section was gaining momentum and a Metals Special Interest Group was functioning by the fall of 1979. Taken together it was apparent that the membership strongly favored formation of Specialty Sections and Regional Chapters. The process of putting these groups into official status was put into place by Council.
The official history of SOT reports that Steve Aust organized and chaired the first Mechanisms of Toxicology Specialty Section meeting and symposium, “Mechanisms of Toxicity” on March 2, 1981. Regional Chapters were equally rapid in their development, with the highly populated Mid-Atlantic and North Carolina Chapters taking the lead.

In fact, by February, 1981, there were four Regional Chapters and three Specialty Sections in various stages of development:

**Regional Chapters:**
- Mid-Atlantic
- Michigan
- Midwest
- North Carolina

**Specialty Sections:**
- Mechanisms
- Metals
- Reproductive Toxicology

These groups were officially chartered by Council in 1982 and were well received by the membership of SOT. By 1984, membership in each appeared in the SOT Membership Directory. The Charters of five Specialty Sections and six Regional Chapters were all recommended for reauthorization in 1985. The significance of Specialty Sections and Regional Chapters in the governance of SOT was recognized when a new procedure was adopted for nominating candidates for officers and members of elected committees. Specialty Sections, Regional Chapters, and Past Presidents each selected a slate of candidates from which SOT members elected one member each for the next Nominating Committee. Over the next few years, Specialty Sections and Regional Chapters grew in number and increasingly contributed to the mission of SOT. In 1986 the 25th Anniversary of SOT, there were 13 Regional Chapters and 7 Specialty Sections with over 400 members. On the eve of SOT’s 50th Anniversary, the Membership Directory identifies 26 Specialty Sections with 5,936 members, 18 Regional Chapters with 3,616 members, and six Special Interest Groups with 982 members!

Regional Chapters provide opportunities for scientists at the grass roots level, regardless of SOT membership, to participate in the affairs of the Society, particularly for those who may find it inconvenient to travel to the Annual Meeting, by organizing scientific programs, helping to educate the public on the need for use of animals in research, assisting young developing scientists interested in toxicology as a career, and developing good interdisciplinary relations with other scientists in the area. The concept of Regional Chapters has certainly succeeded and they are a viable, contributing force in toxicology.

As predicted, the major impact of the Specialty Sections has been on the scientific program at the Annual Meeting. At their inception Specialty Sections offered to organize and present symposia. The success of these early ventures was followed by more and as these excellent sessions grew in number, Council approved funding of speakers from outside SOT, new formats such as poster discussion sessions, and the advent of plenary sessions. The continued rich and varied program at the Annual Meeting reflects the efforts of the members of the Specialty Sections.

Specialty Sections have led the Society in developing recognition programs and student awards, and are now aiding the Endowment Fund in evaluating applications and presenting awards that reflect excellence in science.
Although I arrived at The Dow Chemical Company (Dow) at mid-career, I was amazed to learn of the contributions that Dow had made to the disciplines of toxicology, industrial hygiene, epidemiology, environmental toxicology, and occupational medicine. I joined the company as director of toxicology affairs in 1989 after having been a professor of pharmacology and toxicology at Michigan State University and vice president and director of research at the Chemical Industry Institute of Toxicology. During those times I was closely connected to Dow toxicology as a consultant and as an employee of a nonprofit institute supported by a consortium of chemical companies of which Dow was a leader. As a new member of an established group I felt very much at home with my new colleagues.

Recall that Dow was founded by Herbert H. Dow, and in 1897, he and an associate designed a “bleach lifters bonnet or helmet” to protect workers from exposure to chlorine vapors. This was something of a first in industrial hygiene. As important, however, was the establishment of the first toxicology research laboratory in 1933 to study the effects of chemicals and chemical intermediates to determine the potential for adverse reactions to exposure.

While the field of toxicology was not unknown in 1933 it was beginning to take on a very serious role in occupational health. In the early 1930s the importance of having toxicological data to predict the likelihood of adverse effects was well appreciated by many of the pioneers in the field, such as Henry Smyth of Union Carbide, John Foulger of DuPont, Horace Gerade of Exxon, Arnold Lehman of the FDA, and of course, Don Irish of Dow. It was this group and others that developed toxicology into a science.

Don Irish (Ph.D., biochemistry, University of Cincinnati) turned his training toward toxicology almost immediately after joining the company. He developed an internationally recognized laboratory with dedicated people in industrial toxicology, industrial hygiene, and microbiology. This was a seminal feat given that he was devising a vision for a science that had little history or experience. Don established an interdisciplinary approach to environmental health that continues to this day in toxicology as a truly interdisciplinary science. Don had an open approach to the exchange of ideas, data, methods, and interpretation that hastened the development of toxicology as we know it today. He was a frequent author and encouraged the publication of results in the open literature by his staff. Don was a Charter member of the Society of Toxicology, a Distinguished Fellow of the Society, and the 1970 recipient of the Merit Award.

In 1937 V.K. Rowe accepted a position with the Biochemical Research Laboratory (as it was known then) of Dow and quickly became instrumental in the development and application of numerous testing methodologies for toxicological endpoints. These methods became standard conventions for testing in the field. He later became the director of the laboratory and added additional dedicated staff scientists who are well known in their own right. Like Don Irish, V.K. was a strong supporter of the publication in the open literature of the data developed in the conduct of work within the laboratories. He himself was author or co-author of many papers. Don and V.K. were pioneers in the field of inhalation toxicology and invented and used the equipment needed for these complex studies. In so doing, they established the baseline for the conduct of inhalation studies and their analysis and reporting. Like Don Irish, V.K.
was a Charter member of the Society of Toxicology, a former President (1966–67), and a recipient of the Merit Award.

In 1965, V.K. hired Perry J. Gehring, D.V.M., Ph.D., from the University of Minnesota to join the Dow toxicology laboratory now called the biochemical research laboratory. However, at the urging of Dr. Ted Brody of Michigan State University’s Department of Pharmacology, Perry moved to East Lansing to establish toxicology within the department, a goal that he accomplished. In 1970 Perry was persuaded to return to Dow as the director of the Dow Toxicology Research Laboratory where he established a truly world-class toxicology facility that was dedicated to the determination of dose–response, absorption, metabolism, distribution, and excretion of chemicals. This approach provided a foundation for the scientific basis of risk assessment. One thing led to another and Perry’s leadership pioneered the study of chemical metabolism in a manner that provided a basis for advances in physiologically based pharmacokinetic modeling, another scientific breakthrough in the risk assessment process.

To fill out his vision for risk assessment, Perry placed more emphasis on the acquisition and use of epidemiology and industrial hygiene data within the Dow labs. Once again, he provided a basis for greatly improved risk assessment through the combination of animal data and real world human data. To complete his vision, he established the environmental toxicology group to fill knowledge gaps in the fate of chemicals in the environment. Like V.K. before him, Perry was a Merit Award winner and an SOT President.

Perry was with Dow until 1988 when he located to Indianapolis to take the research leadership of a new joint venture company in agricultural chemicals and biotechnology. This joint venture was known as DowElanco, where he was vice president for research and development. Before this, Perry had been promoted to vice president of the agricultural division of Dow Chemical.

During the middle seventies Perry was instrumental in the creation and implementation of the Chemical Industry Institute of Toxicology (CIIT). He played in a behind-the-scenes role in persuading CEOs of leading chemical companies to support an independent toxicology research institute that would be charged to pursue toxicological mechanisms and improve the risk assessment process. This endeavor was exceptionally successful, but that is another story.

Herewith I have touched on a few of the people that made Dow a leader in the development of toxicology as a respected science and in the process have omitted many details concerning the role of many other scientists who played an equally important role in the success of Dow. Suffice it to say that there is no question that the industry leadership in the development of toxicology is significant and long-lasting.

**Notable achievements within the Society of Toxicology (SOT) of Dow toxicologists:**

**Merit Award:**
- Don D. Irish, 1970
- V.K. Rowe, 1976
- Perry J. Gehring, 1983
- Bernard Schwetz, 2002

**Arnold J. Lehman Award:**
- Bernard Schwetz, 1991

**Achievement Award:**
- James E. Gibson, 1977
- James S. Bus, 1987

**Frank R. Blood Award:**
- Perry J. Gehring, 1978
- E. O. Madrid, 1978
- G. R. McGowan, 1978
- Philip G. Watanabe, 1978

**Founders Award:**
- James S. Bus, 2010

**Presidents, Society of Toxicology:**
- V.K. Rowe, 1966–1967
- Perry J. Gehring, 1980–1981
- James E. Gibson, 1988–1989
A tradition of giving of personal time and talent to advance the Society of Toxicology (SOT) and, in turn, the science of toxicology has been a tradition of SOT from its very beginning. In addition, many individuals have given financial and other support to the SOT from its earliest days. In this brief treatise, I will briefly recount some SOT history including the ultimate development of the SOT Endowment Fund.

In the fall of 1961, my mentor, the late Dr. Leo K. Bustad, encouraged me to attend a meeting of the American Society for Pharmacology and Experimental Therapeutics (ASPET) at the University of Rochester. At the time I was working in the Hanford Laboratories, Richland, Washington, conducting research on the toxicity of internally deposited radionuclides such as Sr\(^{90}\), I\(^{131}\), and Cs\(^{137}\), having only recently received my D.V.M. degree from Washington State University (1960). When Leo offered the opportunity to attend the meeting, I jumped at the chance. As usual with Leo, he had some ulterior motives: “Before the ASPET meeting you can spend a day at the University of Rochester (U of R) and meet some of the folks in the U of R radiation program; Paul Morrow, George Casarett, Lou Casarett, Newell Stannard, and Harold Hodge. And, by the way, Professor Hodge is going to be hosting a meeting to discuss the formation of a new toxicology society.” As they say, the rest is history. I did make my first of many visits to the U of R, began enduring friendships with those I met, and attended the seminal meeting that was the genesis of the SOT.

Harold Hodge, who would become the first President of the SOT, presided at the meeting on the River Campus of the U of R. Early in the meeting, Harold asked everyone to sign in on a clip board that was passed around—“Be certain your handwriting is legible, you will all be Charter members of the SOT.” Not surprisingly, between the clip board and the official list of Charter members of the SOT, one name was dropped—mine. That was not an inappropriate omission, because I did not have a track record in the field. I am proud that later, Paul Morrow and John Doull, who was at the U of R meeting, sponsored my membership application to the SOT when I had legitimate credentials.

Let me return now to an early “gift” to the SOT. During the course of that very special meeting at the U of R, several individuals indicated they would be pleased to help the SOT get off to a fast start. One of the volunteers was the late Dr. Frederick Coulston. He noted that he had recently started a new journal, *Toxicology and Applied Pharmacology*. With a bit of bravado he indicated that he would be pleased to “give” the new journal to the new Society to serve as its official journal. For many years *TAP*, which was published by Academic Press, was the SOT’s official journal. Unfortunately for the SOT, the journal was owned by Academic Press so Dr. Coulston could not give it to the SOT. However, for many years the payments from Academic Press to the Society were a steady source of income.

Fortunately, many other gifts did actually materialize over the years. On occasion, SOT members and corporations gave financial support that was of immense assistance in advancing the Society. Some of these gifts were helpful in making the Annual Meeting a success, including in the early years the Annual Banquet which was a very enjoyable event. Some of the gifts helped fund Student Awards.
Soon after the Mechanisms Specialty Section was created, Carl C. Smith, University of Cincinnati, assumed a key role in managing and promoting the Section’s Student Awards. In the early years of the Awards, Smith indicated he had financial support from an “anonymous donor” to fund the Awards. Later the “anonymous donor” left the picture and the Student Awards were continued with special support from Carl and his wife, Tee. Later, a Carl C. Smith Student Award Fund was created, a Fund that has grown over the years with generous contributions from Carl’s many friends.

Later, Frank C. Lu, a Charter member of the SOT, gave a generous gift to the Society to create the Frank C. Lu Student Award Fund, a Fund aligned with the Food Safety Specialty Section.

One of my goals during my term as the 29th President of the SOT was to create a formal Endowment Fund for the Society. The approach that I elected to follow was to create a companion nonprofit (501(c)(3) organization, the Toxicology Education Foundation (TEF), that would serve as a supporting organization for the SOT. This approach was similar to that used by many universities. With this arrangement, the role of the supporting organization is to raise funds, invest them wisely, and each year to pass a portion of the assets to the supporting organization. In this role, the Foundation does not have operating responsibilities. The SOT Council approved the creation of the Toxicology Education Foundation and I served as its first President. The TEF began to function as planned. However, within a few years with turnover of the initial Board members for TEF and turnover of SOT Officers and Council members, concerns began to be raised about TEF. Some individuals became concerned that TEF was not doing anything, not appreciating that TEF was not intended to be an operating Foundation. They expressed the view that if TEF were to be “worth its salt,” it needed to demonstrate that it was carrying out useful activities. In short, they wanted to turn TEF into an operating Foundation. Indeed, this happened and TEF began operating independently from the SOT. During this time period, the late 1990s and early 2000s, the SOT continued to realize a modest level of giving, typically less than $5,000 per year, to the several existing Awards Funds linked to Specialty Sections.

In 2004–05, Linda S. Birnbaum, during her tenure as the SOT’s 44th President, promoted the idea of increased giving to the Society, including gifts linked to estate planning by individual SOT members. Some individuals, including the author, were concerned that in the absence of a formal structure this well-intentioned effort would not gain traction. Kendall B. Wallace (the SOT’s 45th President) and James A. Popp (the SOT’s 46th President) recognized the need for establishing an SOT Endowment and proceeded to create an Endowment Task Force to develop a detailed plan for the operation of an SOT Endowment Fund. The Task Force was led by I. Glenn Sipes (who had served as the SOT’s 33rd President). Other members of the Task Force were Norbert Kaminski, James Klaunig, Roger O. McClellan, James Popp, Rick Schnellmann, and Jacqueline Smith. The Task Force, after many spirited sessions, ultimately prepared a set of by-law amendments (now Article Seven of the SOT By-Laws) and operating guidelines for the Endowment Fund. The SOT Council endorsed the amendments and they were approved by the SOT membership in the early winter of 2006. Key provisions of the by-laws provided for the Endowment Fund to be embedded within the SOT, although the SOT Endowment Fund Board (EFB) was accorded substantial independence.

The SOT Endowment Fund (EF) has a “mission of assisting in advancing the science of toxicology by providing financial support for the Society’s programs. The vision for the SOT Endowment Fund is to establish and increase in net worth a set of Endowment Funds that will provide significant, stable, long-term financial support that complements the Society’s revenue from dues and other sources, to aid in achieving the Society’s strategic objectives.” The management of the Society’s Endowment Fund is vested with an EFB. All actions related to the Endowment responsibility for investing the assets of the SOT EF are vested with the SOT Finance Committee with input from the SOT EFB.
In accordance with the SOT By-Laws, four positions on the EFB are filled by individuals by virtue of their immediate past service as either President or Treasurer of the SOT. Each fiscal year, the Society’s Immediate Past President begins a two-year term as a Board member. Every other year, the Society’s immediate Past Treasurer begins serving a four-year term as a Board member. Each year the incoming President of the Society appoints to the Board one individual to serve a three-year term from among the Society’s Past Presidents, Past Treasurers, Past Council members, and substantial contributors to the EF. Three individuals serve as ad hoc (nonvoting) members of the EFB; the current SOT President, the current SOT Treasurer, and the Society’s Executive Director. The Society’s Deputy Executive Director and the Society Legal Counsel, provide staff support to the Board.

James Popp asked me to serve as the first Chair of the EFB. The other initial members were Norbert Kaminski, James Klaunig, James Popp, I. Glenn Sipes, Jacqueline Smith, and Kendall Wallace. The EFB got off to a very quick start as a result of the preparatory work done by the Task Force in creating the by-law amendments and policy guidelines. When I accepted the Chairmanship of the EFB, I indicated to Jim Popp that it was going to be important for the EFB and SOT Officers and Council to lead by example in making generous contributions to the newly created Endowment. Indeed, I urged that these individuals contribute at the Paracelsus Circle Recognition Level, a contribution of $500 or more in a fiscal year, and Lifetime Membership in the Paracelsus Circle with contributions of $5,000 or more within ten years. I am pleased that this challenge was quickly accepted. I recommended the Paracelsus Circle Recognition Levels as being amounts that most SOT members could aspire to give at some point in their career. It turned out to be right on target—if they had been higher the Fund would likely have had fewer donors and lower receipts. If they had been set lower there would have likely been lower receipts. Other lower Recognition Levels encouraged other individuals to contribute according to their means.

The Fund By-Law Amendments wisely included provision for creating both General Purpose Funds (Education, International Activities, SOT Priority Needs, and Student Travel) and Specific Purpose Funds. Shortly after the EF was created I received a telephone call from my long-time friend, Joe LeBeau. Joe was an active member of the SOT for many years and had a very productive career at the Dow Chemical Company, where his principal mentor was the late Perry Gehring (the SOT’s 20th President). Joe indicated that he and his wife and Barbara Gehring (the widow of Perry) and his children would like to create a Specific Purpose Fund in memory of Perry Gehring. Their contribution was of sufficient recognition that it helped the SOT membership appreciate, when I announced its creation at the Charlotte, North Carolina, 2007 Annual Meeting, that the EF was going to be a reality with assets soon surpassing $100,000.

The SOT Council was pleased with the early success of the EF and passed a Resolution advanced by the EFB for the SOT to provide funds to match contributions dollar-for-dollar to the EF. The Council ultimately approved the use of up to $500,000 as a “50th Anniversary Match,” doubling the impact of each contribution. Without question the “match” encouraged giving and the creation of additional Specific Purpose Funds. By June 30, 2008, there were 20 Specific Purpose Funds and the EF had total assets of $807,302. As of June 30, 2009, the EF had 24 Specific Purpose Funds and total assets of $869,256.

As specified in the By-Law Amendments, each year there is planned turnover in the EFB. On June 30, 2009, I “retired” as Chair and Jacqueline Smith was appointed to that position by incoming SOT President Cheryl Walker. The SOT Council approved a continuation of the “match” on all contributions to both General Purpose and Special Purpose Funds made through December 31, 2009 and for contributions to General Purpose Funds after that date. As of June 30, 2010, the EF had assets totaling $1,342,209.

The SOT Endowment Fund: Providing Support for a Margin of Excellence
Not unexpectedly, there has been discussion of the relative balance between the assets in the General Purpose Funds and collectively in the Special Purpose Funds. As of June 30, 2010, the four General Purpose Funds had assets of $270,118 and the 30 Special Purpose Funds had assets of over $1,072,041. I am personally not surprised by the distribution. It reflects the wishes of the donors to give to named Special Purpose Funds and have some voice in setting up the Funds so they will know how the proceeds will be used over time. I can appreciate the enthusiasm of Council for growing the General Purpose Funds since Council has discretion in how proceeds from these Funds will be used. My personal hope is that the Council and EFB will continue to encourage the creation of even more Special Purpose Funds. At the end of the day, the vast majority of the Special Purpose Funds support Awards to Students, reflecting the membership’s strong support for educational activities and the encouragement of students.

It is a testimonial to the generosity of SOT members that in less than four years, and on the eve of the SOT’s 50th Anniversary, the EF has assets of over $1 million. I am confident that the EF will continue to grow in the years ahead through generous contributions and the wise stewardship of its assets. Without question, the EF is providing support for creating a margin of excellence for the SOT.
Over 50 years of chemistry, biochemistry, and toxicology have been a major part of my career filled with a great many opportunities and experiences. Who would have imagined that such a career was possible for someone born and raised on a small farm in north central Kansas during a great depression and dust bowl era—a lifetime filled with curiosity, discovery, and participation in the development of toxicology as a scientific discipline and the training of young investigators. Much of the growth of toxicology as a field has been led by the Society of Toxicology as it celebrates its 50 year anniversary.

Even during my Nampa, Idaho, high school course in chemistry I knew that I had a strong attraction to the study of chemistry and the interaction of chemicals with biological systems. This was magnified during my chemistry major at the College of Idaho as I completed a B.S. degree while working part-time in a drug store. My master’s degree in chemistry at Oregon State College (now University) focused on the application of radiochemicals to the elucidation of amino acid biosynthesis in baker’s yeast. A Ph.D. followed this in 1957 on the biochemical aspects of fungi metabolism with a commitment to future studies on the adverse effects of chemicals on biological systems. My career was helped along by the Russians orbiting Sputnik into space in 1957, which caused a renewal of science training in the United States and made available an academic position for me at Montana State College in Bozeman (1958–62). In 1962, I accepted a position at Oregon State to teach chemistry, radiochemistry, and biochemistry and study the chemistry, metabolism, and toxicology of rocket propellants, including hydrazines, boranes, and halogen-containing compounds.

Sabbatical leaves to NIH Bethesda, Maryland (1969–1970, 1992), and the Karolinska Institute, Stockholm, Sweden (1976–77), made possible studies on drug metabolism with freshly isolated organ cells and microsomes from mammals including hepatocytes. These studies greatly expanded my interest in glutathione and mechanisms of chemical injury.

These studies were initiated during the sixties at the time that microsomal metabolism of xenobiotics was being elucidated, which led to many questions about the fate and effects of highly reactive chemicals including a number of antitumor drugs such as procarbazine, 2-chloroethyl nitrosoureas, and Adriamycin. Soon thereafter came questions about events at the cellular level that were concerned with cellular protective systems dependent on intracellular glutathione including mitochondrial glutathione.

Opportunities to participate within many SOT activities included being President (1991–92). I also served a term on the NIH Toxicology Study Section (1971–75) and in turn the International Union of Toxicology (IUTOX) (1992–98), and was a member of the National Advisory Environmental Health Sciences Council (1992–96). All of these activities increased my appreciation for SOT as a Society that serves both the advisory and scientific aspects of toxicology for its members as well as worldwide.

My career has been tightly interwoven with that of toxicology as a discipline. The combination has been both profoundly worthwhile and challenging to me. Of particular importance to me has been the opportunity to participate in the training of young scientists at the undergraduate, graduate and post doctorate levels. These individuals have provided the contributions to make my work enjoyable and worthwhile. SOT has been very advanced in providing opportunities for young toxicologists to participate in the activities of the Society. The Annual Meeting of SOT has continued to be a “must” not only for SOT members but also for spouses of SOT members in part due to SOT providing the spouses with a hospitality room for their use. Such attention to the needs of Society members and their guests is greatly appreciated by Society members.
In the late seventies, the Society of Toxicology developed a strategic alliance with the Burroughs Wellcome Fund with the expressed purpose of promoting the development of the discipline of toxicology. At that time toxicology was evolving from what was considered an applied, descriptive subject, to a field of inquiry that could and should be considered a basic science. Toxicologists on a much greater frequency were beginning to ask: How are these chemicals producing biological effects? What are the biochemical and molecular mechanisms that result in tissue injury? How does the host modify a chemical; does it make it more or less toxic? These may appear as simple questions, but in reality they are quite complex. This complexity is apparent when one considers the number of tissues that are targets for chemicals, the vast number of biological processes that can be impacted and the tremendous number of chemicals that need to be evaluated.

To address such questions as those presented above, an emphasis on new approaches was required. At that time, a variety of in vitro approaches were becoming available that assisted investigators in asking “mechanistic questions.” On the horizon were the molecular tools that would further elucidate potential mechanisms. Thus, the timing was right for the development of sustained and creative ways to promote the transition of toxicology to a more basic science.

One creative and sustained program that had a positive, lasting effect on the development of toxicology was the Burroughs Wellcome Fund Toxicology Program, which in conjunction with the Society of Toxicology, established the Burroughs Wellcome Fund Toxicology Scholar Award. From 1981–97, 23 scientists were the recipients of this Scholar Award. According to the Burroughs Wellcome Fund, the purpose of these scholar awards was to foster “the development of key scientists” who would help shape “the landscape of toxicology.” Over the years this “landscaping” occurred as a result of the financial resources provided by the Scholar Award and the ability of the scholars to leverage these awards locally and nationally. The funds were used for both career development and program development. The legacy of these Scholar Awards is very real—outstanding scientific contributions and development of centers of excellence in toxicology that continue to this day to promote interdisciplinary training and research in toxicology.

The Burroughs Wellcome Fund Scholar Award that I received was instrumental in developing the Center for Toxicology at the University of Arizona. The University’s Board of Regents approved the Center in the early 1980s, but as often happens, the funding was not forthcoming. The funding obtained from the Burroughs Wellcome Fund Scholar Award was the stimulus that allowed us to proceed with the development of the Center for Toxicology. As a result of the award, new faculty were hired. Their productivity and their dedication to an interdisciplinary approach to scientific inquiry resulted in additional funding from local and state resources. Ultimately, this Center flourished and today serves as the administrative home for a National Institute of Environmental Health Sciences (NIEHS) Center of Excellence (The Southwest Environmental Health Science Center), and a Superfund Award. It is a true multidisciplinary center. It lives up to Dr. Tom Miya’s characterization of toxicology: “Toxicology is not a pure kind of science. It borrows from all.” However, toxicology does not only borrow, it also repays. Toxicologists integrate new science and technology into research that focuses on...
how chemicals affect biological processes. In return, results of such research provide critical new information on the basic biology of these processes. At the same time we question if a chemical’s effect on a biological process is translated into a negative human health outcome or has a negative environmental impact. Looking at the big picture, it is clear why scientists from many disciplines can be involved in toxicological research and call themselves toxicologists. The Burroughs Wellcome Fund and the Society of Toxicology, of course, realized this and found a creative way to promote toxicology as a multidisciplinary science. We at Arizona are extremely grateful to the Burroughs Wellcome Fund for providing the Scholar Award. Without its timely support, our multidisciplinary center may never have had the opportunity to develop.

I know personally the other Burroughs Wellcome Fund Toxicology Scholars that are listed below. I am confident they are as grateful as I am for being recognized and funded by this innovative program.

It has made a difference. On behalf of all of us, thank you Burroughs Wellcome Fund and the Society of Toxicology.

In the mid 1990s, the Burroughs Wellcome Fund redirected its funding program to support new investigators. The program’s goal was to foster the development and productivity of scientists early in their careers who will bring new ways of thinking and experimental approaches to pharmacology and toxicology. The awards gave them considerable freedom and flexibility to engage in higher-risk research projects that had the potential for moving their respective fields in promising new directions. From 1997 to 2001, 22 young scientists were designated as New Investigators in Toxicological Sciences.

Clearly, the Burroughs Wellcome Fund has been a strong supporter of toxicology both in conjunction with and without the Society of Toxicology. Our discipline has progressed much more rapidly because of this support.

Recipient of the Burroughs Wellcome Fund Toxicology Scholar Award:

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alan P. Poland, M.D.</td>
<td>1981</td>
</tr>
<tr>
<td>Curtis D. Klaassen, Ph.D.</td>
<td>1982</td>
</tr>
<tr>
<td>Frederick P. Guengerich, Ph.D.</td>
<td>1983</td>
</tr>
<tr>
<td>R. Craig Schnell, Ph.D.</td>
<td>1983</td>
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<tr>
<td>Philip S. Guzelian, M.D.</td>
<td>1984</td>
</tr>
<tr>
<td>I. Glenn Sipes, Ph.D.</td>
<td>1985</td>
</tr>
<tr>
<td>Daniel Acosta, Ph.D.</td>
<td>1986</td>
</tr>
<tr>
<td>Bruce D. Hammock, Ph.D.</td>
<td>1987</td>
</tr>
<tr>
<td>Richard P. Mailman, Ph.D.</td>
<td>1987</td>
</tr>
<tr>
<td>Harihara M. Mehendale, Ph.D.</td>
<td>1988</td>
</tr>
<tr>
<td>Stephen H. Safe, Ph.D.</td>
<td>1989</td>
</tr>
<tr>
<td>Mahin D. Maines, Ph.D.</td>
<td>1990</td>
</tr>
<tr>
<td>Robert A. Roth, Jr., Ph.D.</td>
<td>1991</td>
</tr>
<tr>
<td>Janice E. Chambers, Ph.D.</td>
<td>1992</td>
</tr>
<tr>
<td>Debra L. Laskin, Ph.D.</td>
<td>1993</td>
</tr>
<tr>
<td>Leona D. Samson, Ph.D.</td>
<td>1993</td>
</tr>
<tr>
<td>Kim Boekelheide, M.D., Ph.D.</td>
<td>1994</td>
</tr>
<tr>
<td>Dennis J. Thiele, Ph.D.</td>
<td>1994</td>
</tr>
<tr>
<td>Ellen Li, M.D., Ph.D.</td>
<td>1995</td>
</tr>
<tr>
<td>Curtis J. Omiecinski, Ph.D.</td>
<td>1995</td>
</tr>
<tr>
<td>Christopher Bradfield, Ph.D.</td>
<td>1996</td>
</tr>
<tr>
<td>Bennett Van Houten, Ph.D.</td>
<td>1996</td>
</tr>
<tr>
<td>Titia de Lange, Ph.D.</td>
<td>1997</td>
</tr>
</tbody>
</table>
As stated in the Constitution, the main purpose of SOT shall be to promote the acquisition and utilization of knowledge in toxicology and to facilitate the exchange of information among its members as well as among investigators of other scientific disciplines. In short, research and education! This is an account of one odd type of the latter, briefly supported by SOT, and selected for the Education Award, which illustrates how this purpose can be successfully fulfilled in a somewhat advanced way.

Education is usually associated with acquiring knowledge and knowledge with facts. However, knowledge regarding toxicology is not just facts but also skills, recognition, and understanding. Therefore training in toxicology requires a broader approach than ordinary education. Furthermore, toxicology is just not a scientific discipline but also a profession, which also underlines the necessity to consider the special training needed. This article describes the Risk Assessment Summer School (RASS) programme sponsored by IUTOX, but initiated by SOT together with the European Society of Toxicology (EST), with the aim to provide a specialized training taking these aspects into account.

Before the birth of modern toxicology (around 1960), toxicology was an unnoticed discipline and most toxicologists were self-made, coming from various biomedical professions. Toxicology dealt mainly with poisonings in humans—safety and risk assessments were not on the agenda. When the thalidomide calamity fired off the “big bang” in toxicology, education became high fashion. New “modern” toxicologists were needed because of the “discovery” that all chemicals could be poisonous to everything alive. Investigations and inventories were made to solve the problems of recruiting toxicologists. Curricula and programs were put together in the developed world, and they looked almost the same all over. The pedagogic principles were almost the same as for other scientific disciplines. To promote toxicology as a science and a profession, societies of toxicology and certification of toxicologists were created.

The History of RASS

At the beginning of the eighties Bo Holmstedt suggested that EST and the U.S. Society of Toxicology should initiate a summer school in toxicology to foster the qualified toxicologists needed for the future development of the field. As a model for a summer school he had in mind the Gordon Conferences and the meetings between Nobel laureates and young scientists at Mainau, where the main principle was informal discussions in order to share knowledge and experience. The term “summer school” implied not only that it was conducted during the summer but also that its main pedagogic principle was the fulltime interaction between students and masters under pleasant conditions.

When Holmstedt became president of IUTOX in 1983, it was decided that the summer school should be cosponsored by this global organization to reach an international audience. Risk assessment was chosen as an appropriate topic for the intended pedagogic model, as it is based to a great extent on judgments and experience. Torbjörn Malmfors was asked to organize...
RASS—One Role of SOT in Education and Professional Development of Toxicologists

13 courses have been conducted during 25 years. The students have been scientifically qualified in toxicology at the doctoral level, had some practical experience, academic, industrial or regulatory affiliation, are not more than 35 years of age, and are able to communicate in English. Three hundred and thirty students from 53 countries (37 from USA) have attended, (see table). SOT has been a strong supporter of the RASS program by promoting the activity among its members and giving financial support.

In order to fulfill the intentions of Holmstedt two problems were given special attention, the faculty and the study material. The faculty members were carefully selected among experienced toxicologists who were interested in the concept of the summer school and agreed to participate during the whole course. They were all outstanding experts with long-time experience in evaluating in the major areas of toxicology. The following experts have participated as faculty members, given lectures, and acted as tutors: Anthony Dayan, Jack Dean, Elaine Faustman, Helmut Greim, Marie Haag Grönlund, Ernie Harpur, Sonja Jeram, Martin Kramer, Bengt Källén, Bo Lambert, Torbjörn Malmfors, John Newman, Tony Palmer, Paul Peters, Emil Pfitzer, Iain Purchase, and Garry Williams. Besides toxicologists, a psychologist, Paul Slovic, a well-known expert in risk perception, was invited to cover the judgmental issues of risk assessment.

The study material consisted of lectures and discussions. After introductory lectures each faculty member presented their topic of expertise in two 45-minute sessions, followed by discussions both in plenum and in breakout groups. Instead of the faculty providing material for the discussions, which were the major activity, the students were instructed to write a study case on risk assessment of a real chemical or product in advance. First the cases were discussed in detail in the breakout groups with a faculty member as tutor. Then the cases were further discussed among the group members or with the tutor, if necessary, and after that the author prepared himself/herself for the plenary discussion a day later. All cases were discussed in plenum. After a short presentation by the author, two groups were prepared to ask questions or make comments before all students and faculty members were invited to take part in the discussion.

Table. Time, venues and number of students/countries of origin of the RASS courses

<table>
<thead>
<tr>
<th>RASS</th>
<th>Date</th>
<th>Venue</th>
<th>Country</th>
<th>Students/Countries</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>August, 1985</td>
<td>Menstrup Kro</td>
<td>Denmark</td>
<td>23/7</td>
</tr>
<tr>
<td>II</td>
<td>August 1987</td>
<td>Airlie House, Virginia</td>
<td>USA</td>
<td>27/8</td>
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<tr>
<td>III</td>
<td>October 1990</td>
<td>Hotel Europa, Anacapri</td>
<td>Italy</td>
<td>28/14</td>
</tr>
<tr>
<td>IV</td>
<td>August 1992</td>
<td>Grotto Hotel</td>
<td>Bermuda</td>
<td>20/11</td>
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<tr>
<td>V</td>
<td>August 1994</td>
<td>Manor Groves</td>
<td>England</td>
<td>24/15</td>
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<tr>
<td>VI</td>
<td>Aug- Sept 1996</td>
<td>Royal Garden, Hua-Hin</td>
<td>Thailand</td>
<td>24/11</td>
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<td>VII</td>
<td>August 1998</td>
<td>Toftagården, Gotland</td>
<td>Sweden</td>
<td>28/16</td>
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<tr>
<td>VIII</td>
<td>October 2000</td>
<td>Pueblo Acantilado, Alicante</td>
<td>Spain</td>
<td>32/23</td>
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<tr>
<td>IX</td>
<td>October 2002</td>
<td>Ta Cenc, Gozzo</td>
<td>Malta</td>
<td>26/20</td>
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<td>X</td>
<td>Sept-Oct 2004</td>
<td>Höri, Hemmenhof</td>
<td>Germany</td>
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<td>XI</td>
<td>September 2006</td>
<td>Höri, Hemmenhof</td>
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<td>TOTAL</td>
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There were also some other aspects, albeit not that important, which were considered from the beginning. To facilitate transportation for participants from all over the world the venue should be located close to a convenient airport, but still be fairly isolated to prevent the students from disappearing to other activities. To promote the learning process, the venue was selected to provide a stimulating and creative environment for both mind and senses—combining pleasure and education. Each course lasted nine days, including two half-days of excursions.

The RASS Approach

Hopefully future education in toxicology will, at least to some extent, be based on the ideas of RASS in order to fulfill the visions of the old toxicologists. Even if the learning methods and overall program have been fairly similar on all occasions, some basic principles have evolved during the years. These principles of the conduct and experience of the RASS program are summarized below. More details can be found in a written manual published on the IUTOX Web site.

Risk Assessment

Risk assessment is more than a collection of facts and data. It is an intellectual process. While the amount of data describing the toxicity of chemicals has grown enormously, even with the aid of modern technology, such as computers, our capacity to interpret this information wisely poses a continuing challenge. Risk assessment involves a thorough understanding of the scientific basis of the toxic phenomena, the overall process of risk assessment, and the ability to integrate the critical information necessary to present the risk of exposure to a chemical.

Experience, judgments, perceptions, and various philosophical ideas influence the way in which individuals conduct risk assessments. Thus it is no surprise that different experts may reach different conclusions from performing risk assessment on a chemical in similar circumstances. Semantics, or the meaning and use of words, also has an influence on how one perceives risk assessment. Thus definitions of concepts, like hazard, exposure, toxicity, and risk, are important when discussing risk assessment issues.

It follows from this analysis that risk assessment, as it is generally practiced, is not a discipline by itself but a way of making use of and organizing scientific data and skills.

There are different ways to structure the risk assessment process, but the structure used at RASS covers:

- a critical scientific evaluation of data,
- extrapolation of experimental data to real life,
- prediction of what might happen in the future to humans and the environment,
- an understanding of the impact of risk assessment on attitudes of the public to risk, and
- evaluation of the probability and the severity of the possible harmful effects.

Thus, risk assessment forms the final phase of a process, which uses the results of all available scientific work in toxicology. It utilizes what is known about the adverse effects observed in experimental or epidemiological studies, including all inherent uncertainties of these studies, and must take account of the fact that there will be insufficient data in virtually every risk assessment.

We have to realize and accept that risk assessment is a judgmental process different from the more familiar methods of recording and reporting data objectively. Thus it is obvious that risk assessment requires knowledge, both of the data related to the chemical and the experience of integrating it into a risk assessment. However, one of the most important uses of risk assessment is to present qualitative and quantitative statements about the risk to humans of exposure to chemicals and to inform decisions on how various chemicals can be used in an acceptable way.

RASS—A Method for Training in Risk Assessment

Goal, objectives, and means of RASS:

- RASS offers young toxicologists the opportunity to broaden their knowledge and experience in the field of chemical risk assessment and to achieve a better understanding of how to evaluate data and inform decision makers.
RASS has few formal lectures but provides ample time for discussion initiated by the lectures, for cases prepared by faculty members, and, most important of all, for study cases, written by the students themselves before the course. The student cases form an excellent basis for hands-on training.

The purpose of the discussions is to convey the knowledge and the experience of the faculty to the students and to open new vistas for those who are eager to learn and to take on new challenges.

RASS combines the principles of participatory education with a stimulating and creative environment for both the mind and the senses.

RASS offers sufficient incentives for the students to continue their risk assessment training indefinitely with an emphasis on broad, international perspectives.

RASS provides an informal atmosphere for establishing good relations between faculty members and other students, and provides valuable future contacts in the field of risk assessment. It promotes an exchange of thoughts and ideas, which in the future will be a valuable means of keeping up with the development of the subject.

The Educational Principles of RASS

Knowledge in a broad sense can be thought of as facts on the one hand and experience or tacit knowledge on the other. Experience can be considered as the acquisition of skills and the ability to recognize and understand these certainties. Facts, like numbers, can easily be described in writing or in lectures, and hence teaching can be used for conveying facts. Other types of knowledge, e.g., experience and skills, are more effectively acquired by learning, which includes training and practicing using practical examples. Thus an educational program combining teaching and active learning is the best method of improving an individual’s ability to carry out risk assessment.

These principles follow the basic tenets of educational theory, which rely on promoting participation and active learning. Individuals retain information best when they are actively involved in problem-solving exercises and hands-on learning. It is said that they remember 20 percent of what they hear, 40 percent of what they hear and see and 80 percent of what they hear, see, and do. "Hands on learning" refers to activities such as abstracting information, critical appraisal, or other applications of knowledge.

The training approach used in RASS is participatory and is characterized by the following features:

- it is interactive,
- it is based on real-life experience,
- it incorporates dialogue between and among teachers and students, and
- it critically analyzes facts and conclusions.

Education is most effective when it recognizes the context in which it takes place and provides students with the opportunity to engage in multiple learning modalities: listening, looking at visual aids, asking questions, role playing, reading, writing, and discussing critical issues. The use of participatory methods should include activities that help students develop critical thinking, practice problem solving and decision-making, and gain confidence in their profession.

It is important to create a positive and stimulating environment, as learning is not just a cognitive process but is also influenced by perceptions and emotions. The training atmosphere should be open-minded, exploring, courageous, honest, nonprestigious, nonprejudiced, warm-hearted, and friendly. It is the responsibility of all participants, including both faculty members and students, to contribute to this environment.

Training, like risk assessment itself, is based on communication. The principles of communication are simple to enunciate but communication itself is not that easy. Many languages are used in the minds of the faculty members and students as they have different mother tongues, even if English is used as the written and spoken language during the training. Not only are there language differences, but education, culture, and personal experience vary considerably in a group of international students. It often happens that what is obvious to one student can be a complete riddle to another. Thus, all communication has to be performed in a proper way; this means not just providing information but ensuring that it has been received and understood.
The methodology used for risk assessment training is important but following that methodology is not sufficient to achieve the objectives of RASS. It is also necessary for the trainee to contribute to the outcome, or as Axel Munthe, a Swedish physician, stated: “You can get help to improve your knowledge but you have to find wisdom by yourself.”

The Experience from RASS

We have accumulated some useful information and experience from the 13 RASS courses. Besides the practical arrangements, e.g., the announcement, program time schedule, etc., there are many details, that play an important role in the overall outcome of the course.

The following features are worth mentioning:

➢ the preparation of study cases in advance by the students;
➢ the presence of all faculty members during the entire course, which makes the interaction between teachers and students most effective;
➢ the social activities, including excursions, which break down barriers and give new cultural perspectives; and
➢ the venue and accommodations which provide a pleasant environment despite hard work.

The Evaluation of RASS

The outcome of the courses has been surveyed at the end of each session. From these surveys it is obvious that the overwhelming value of RASS to the students has been the preparation, discussion, and presentation of their written study cases. However, the real value of the course for each individual can only be judged by the individuals themselves.

The faculty continuously evaluates the progress and its work during the course and between the courses. In short, the value of RASS is well described by Iain Purchase in a report from RASS IV:

“What benefit is it to the students? Right before the eyes of the faculty, they learn to challenge the assumptions, seek out the weakness in their own and others’ work. They grow in confidence as they work with a small team supervised by a member of the faculty; they present their own case and argue the issues constructively. Even the most shy student glows with a sense of achievement, develops a network of contacts, and makes good friends.

But it is not only the students who learn. Faculty members are seen discussing issues late into the night, coaching individual students and generally learning more about the other disciplines. And where else would they have the chance to debate the merits of assessments of risks of a number of industrial chemicals, microbial pesticides, arsenic in the diet, lead in the dust, food chemicals, medicines, personal care products, and even the toxic risk of cassava consumption, all subjects of students’ risk assessment? Carcinogenic, mutagenic, reproductive, phototoxic, and other toxic risks were all discussed. There is also the satisfaction of seeing the students flex their minds and visibly grow in knowledge and confidence.

There were unexpected pleasant surprises. One afternoon we had a tour of the island by bus and the bus driver gave us an impromptu course in herbal remedies—most successfully, as one of the faculty was seen curing his headache by wrapping leaves around his somewhat balding head!

The students were encouraged to express their views during the course or later in writing. Some citations from letters received from the students after the course:

“I came away with a broader knowledge of toxicology and its implications for different societies.”

“The greatest amount of information was gained in conversations that occurred outside the formal sessions.”

“I feel I have gained a much greater critical awareness. I now realize that I have a different attitude as regards my and other people’s work.”

“The way I think about risk has been deeply changed.”

“The friends I made should be very useful in the future for keeping abreast of scientific advances in the rest of the world.”

“I had an unforgettable experience and left very stimulated as a result of the discussions and the interactions which took place throughout the week.”

“I came to the course frightened that I was very behind and confused in my approach to risk assessment and came away with enthusiasm and confidence.”

“I must confess that initially I felt like a stranger in a strange land.”

“It was the single most effective education experience of my professional life.”
Conclusion

It is difficult to know if RASS has fulfilled the hopes of the late Bo Holmstedt, i.e., that it should promote toxicology, but it is noteworthy that many former RASS students can be found at leading toxicology positions even within SOT. Furthermore it has successfully combined pleasure and toxicology education.

Besides the satisfaction of the students, the success of RASS is evidenced in the fact that the faculty members have kept on coming back course after course without any extra compensation than accommodation and sometimes travel expenses. During the years the faculty has become a strong team, which enthusiastically has supported and further developed RASS into a very special event. They have really fulfilled the vision of a summer school by being present all the time to share their experience with the young experts-to-be. Their contribution has been invaluable, very much appreciated by the students and heartily acknowledged by the organizers, of which Birgitta Lewander has carried out most of the administrative burden.

Now it is over and hopefully the effort has not been in vain!
Past, Present, and Future Trends in the Pharmaceutical Industry and the Impact on Toxicology

by Jack H. Dean, Ph.D., Sc.D., DABT, ATS

The Golden Age of the Pharmaceutical Industry

During the past half century, the global and U.S.-based biopharmaceutical industry has been markedly successful in terms of the introduction of important new medicines, increased sales and revenue growth, innovation, important medical discoveries, and a perceived societal benefit. This period is often called the “Golden Age” of the pharmaceutical industry because of the many innovative and successful drugs. Growth was driven by the development of mass marketed drugs (“blockbusters”) that were efficacious across large population segments. A blockbuster drug is one by definition that generates more than US$1 billion in sales. A total of 114 distinct blockbuster drugs were identified with 2006 sales of more than US$1 billion each. Total revenues from sales of all blockbuster drugs in 2006 were US$233.7 billion, of which 23.1 percent were achieved by biologics (1). The best-selling classes of blockbuster drugs were again HMG-CoA-reductase inhibitors (statins), anti-depressants, proton pump inhibitors, and medicine to treat cardiovascular disease and blood pressure.

Supporting this area has been good patent protection in the markets of developed countries. The sales for U.S. pharmaceutical firms, during the period of 1996–2006, rose from $102 billion to $276 billion (2). More importantly, many advances in medicine were introduced through the deployment of these innovative drugs. The improved health benefit is evident by the fact that since 1930, life expectancy in the United States increased by more than 20 years, which is also attributable to better medical care, diagnosis and the introduction of new innovative medicines that have significantly improved health and prevented disease (3). A study by Prof. Lichtenberg (3) noted that new cancer drugs alone account for 50–60 percent of the cancer survival rate gains achieved since 1975. What is often lost in the debate over the cost of health care is that only $0.11 cents of every health care dollar in the United States is due to the costs of drugs (Figure 1). It is interesting to note that generic drugs will grow at a compound annual growth rate of 9 percent between the years 2010–12 and currently represent 78 percent of the prescription drug market (5). Likewise, nearly eight in ten prescriptions are being filled today by a generic drug. What is difficult to understand is why generic drug manufacturers, outside of the graduated coverage of the Medicare Part D “Donut Hole” starting in 2011, were not required to accept concessions in the Health Care Reform Act, unlike research and development (R&D) pharmaceutical companies.

During 1996–2006, R&D spending across pharmaceutical companies rose from $17 billion to $43 billion (2) and by 2008 the industry’s investment in medical R&D was $62.5 billion. Likewise, the number of employees grew from about 35,000 in the typical big pharmaceutical company to nearly 68,000 employees by 2006 (2).
A significant portion of headcount growth was in the pharmacology, toxicology, pathology, and drug metabolism groups within these companies.

The Case for a U.S. Biopharmaceutical Industry and Its Economic Importance

Our politicians and the news media often forget that the pharmaceutical sector directly provided 686,442 jobs as of 2006 and indirectly supported an estimated 3.2 M additional jobs across the U.S. economy (4) (Figure 2). The annual employment growth rate in the pharmaceutical sector from 1996–2006 was 3.1% vs. 1.4% for the rest of the U.S. economy (4). In the last quarter of the 20th century, job opportunities for graduating toxicologists, pharmacologists, and veterinary pathologists were plentiful in the pharmaceutical industry.

These are likewise good paying jobs, since the average employee in the biopharmaceutical sector paid more than $22,000 per year in federal taxes in 2006 vs. an average $7,300 paid by employees in the rest of the economy (4). It should now be clear that the biopharmaceutical industry represents a strong “economic engine” in the United States and Europe. In the United States, for example this sector contributed $88.5 billion (2006) to the GDP (Figure 3), which is approximately three times more than the other economic sectors (4). These data clearly reflect the innovation, public acceptance, and societal benefits of new and efficacious medicines.

The industry has also broadly supported medical research throughout every region of the country through its vast clinical trial program. In 2008, a total of 21,795 active clinical trials were ongoing in the United States (4). Unless our Congress, the administration, and federal regulatory agencies develop a more business friendly attitude toward the pharmaceutical industry, all of the new innovative drugs in the future could come from India or China.

**Figure 2. Employment Supported by U.S. Biopharmaceutical Sector (2006)**
Source: Archstone Consulting Analysis, Minnesota IMPLAN Group, Inc.

A Pharma sector employee paid $22K in federal taxes (2006) vs. $7.3K for rest of economy

**Annual Growth in Direct Employment, 1996–2006***
Biopharmaceutical Sector .................. 3.1%
Rest of Economy ................................ 1.4%

*Indicates compound annual growth rate, which measures year-over-year growth during a multiple-year period

**Figure 3. Contribution to GDP Supported by U.S. Biopharmaceutical Sector (2006)**
Source: Archstone Consulting Analysis, Minnesota IMPLAN Group, Inc.

**Pharma is an “Economic Engine”**

**Types of Direct Biopharmaceutical Jobs**
- 22.3% Life
- 12.3% Office & Administrative Support
- 12.2% Architecture & Engineering
- 11.8% Production Occupations
- 10.5% Management Occupations
- 9.6% Computer & Mathematical
- 7.5% Business & Financial Operations
- 6.8% Installation, Maintenance, and Repair Occupations
- 3.5% Clerical Support Occupations
- 3.3% Sales & Related Occupations
- 3.3% Other**

**Other includes 15 occupations, each representing less than 3.0% of the total. These occupations include, for example, Installation, Maintenance, and Repair Occupations (2.9%) and Sales & Related Occupations (2.9%).**
Analysis of Convergent Forces Impacting Pharma

During the past 15 years, a series of convergent forces began to impact the global pharmaceutical industry. The most significant of these forces is patent expirations that are occurring between 2006–12. This will result in the generic conversion of 36 blockbusters drugs, and represents a >$59 billion decline in U.S. pharma revenue, which represents approximately 25 percent of ethical drug sales in the United States (1,6,7) (Figure 4 provides examples). This impact is often referred to in the industry as a “patent cliff.” The general consensus is that the huge increase in investment in pharmaceutical R&D made in the past two decades has been unreliable in terms of the discovery of new drugs. R&D costs have increased at a significantly greater rate than productivity and development time, which have both declined (Figure 5).

Over the past 20 years the efficiency from discovery of a new molecular entity (NME), through preclinical and clinical development, to the approval of a new drug has remained unchanged. On average if one starts with 10,000 NMEs one will produce only one new approved drug (1,2) (Figure 6). Even high throughput screening against vast chemical libraries of mass scale has not translated into superior performance. What is most disturbing is that the projected cost of an NME has increased significantly, to approximately $2.3 billion (5). Using this number to examine the total industry R&D investment, leaves output below that required for 3 NMEs per company/year. This is further evidence that the current blockbuster business model is unsustainable.

When a group of pharmaceutical industry senior executives from large companies were polled in 2007 the majority agreed that the industry’s dependence on blockbuster drugs was untenable for the future and that in the next decade most discovery and early stage research will be conducted outside large pharma companies (7). This has resulted in many big pharma companies shifting their portfolios toward cancer drugs, biologics, and vaccines since they generally represented a shorter development time and often less risk.

Another factor that has impacted the industry during this period is the larger number of mergers and acquisitions (M&A) that resulted in corporate restructuring or transforming, massive staff layoffs, and the closing of several large pharmaceutical R&D
sites (1,2). Figure 7 demonstrates consolidation among some of the bigger players in the industry that has turned 53 companies into 9 companies today. Since 2000, this extraordinary biopharmaceutical industry consolidation has resulted in excess of 200,000 staff layoffs. This trend has continued into 2010 with the recent announcements of downsizing and consolidation by Pfizer, Merck, and AstraZeneca (8).
Additionally, the U.S. biotechnology industry, a sweetheart of the venture capitalists for 20 years and an engine for growth of the industry, became a victim of the global “economy crisis” in 2007 resulting from a major reduction in capital markets. It was reported that 45 percent of small to mid-sized biotechs had less than 12 months of funding at the end of 2007 (9). This has resulted in significant M&A activity among the biotechs and between biotechs and large pharmaceutical companies (7) (Figure 8). Likewise, the IPO market also dried up during this period, with a 97 percent decrease, which made public funding unavailable to many of the smaller biotech companies.

Finally, the industry has seen a “paradigm shift” in their sales and marketing organizations resulting from a change and consolidation of the “decision-makers,” which in the past had been the local doctor, who has now been replaced by the payers or managed care provider (e.g., HMOs, PPOs and insurance companies) (1). This consolidation of payers has resulted in more powerful and fewer payers with a single payer controlling access to one to several million patients. The federal government, through Medicare, Medicaid, and the Department of Veterans Affairs has also become a major payer and decision-maker. It is also clear that most payers and the federal government are moving to “outcome based” and “relative effectiveness” analysis in their decisions on which of the new medicines to put on their formularies, which will further impact the price allowed for a new drug. We see this trend already in the U.K. Yet to be determined is the impact of the new National Healthcare Reform Act of 2010 on the pharmaceutical industry beyond the graduated funding of the Medicare “donut hole,” although it is expected this legislation will put further pressure on price, profitability, and R&D budgets.

**An Unsustainable Business Model and Its Impact**

For the past 20 years the larger pharmaceutical firms have increasingly pursued similar strategies that emphasized growth through the development of “blockbuster” drugs—a small molecule drug effective for large patient populations. This has become a “catch-22” in that the more effective the companies were at developing blockbusters, the more effective they needed to be in developing even larger revenue replacements (2). This was especially critical as patents on existing products expired and markets were quickly lost to generics. Since generic conversion can result in up to 85 percent attrition in revenue the first year that the patent is lost, one can appreciate the impact of the “patent cliff” on the industry and R&D spending.

Some have labeled the behavioral trends observed among some large pharma companies e.g., resistance to change, the emergence of a standard business model, a belief in only one “right” strategy such as the blockbuster, a growing focus on improving internal efficiencies and a continuing decline in innovation as symptomatic of a “maturing industry” (2). These should not be recognized as complementary to the sector. In contrast, this author views the pharmaceutical industry as still dynamic, although under terrific portfolio, pricing and government pressure, but capable of embracing change and implementing winning strategies necessary to manage the future.

**How These Convergent Forces Are Transforming the Pharmaceutical Industry**

As explained above, the realization of the approaching patent cliff without new drugs to fill the gap started a paradigm shift among large pharma companies. In an attempt to fill the gap by obtaining marketed products or NMEs in late-stage development and cost savings through synergy and staff reduction, a wave of corporate mergers and restructuring has resulted.
There was also an increasing trend toward forming partnerships or acquiring NMEs from small to mid-size biotherapeutic companies instead of discovering compounds in-house in order to share risk and improve development speed. This is based on the premise that biotechnology companies are more flexible and faster in development. This is somewhat borne out by the observation that the number of NMEs approved for biotech companies increased by 54 percent from 1998–2004, while large pharma approvals decreased by 15 percent (9).

More recently, large companies began to rely more heavily on outsourcing and off-shoring some of their R&D activities (1,2). Large pharma companies are outsourcing more work and even whole departments to CROs and “off-shoring” some R&D by establishing research centers in China and India. It is generally believed that greater outsourcing improves flexibility in the R&D process and allows one to focus on the value chain. This trend is now beginning to impact the number of toxicology positions globally and puts a greater emphasis on finding a good preclinical CRO partner for outsourcing non-value-adding studies.

For several years now most large pharma companies have tried to improve early-stage R&D efficiency since it would have the greatest economic impact. It is estimated that $2 million is lost every day a potential blockbuster drug is delayed to market. Most of these efforts to “fill the gap” have shown little improvement in yielding a greater number of successful NMEs. This is why many of the companies have turned more and more to biotherapeutics (e.g., monoclonal antibodies, enzymes, and regenerative cell therapy).

For the toxicologists, one outcome of some of these efficiency programs has been a more rapid turnaround of toxicology studies in both large companies and CROs (Dean, personal observation).

Another transformation has been that most large pharma companies have reviewed, reduced, and, refocused their portfolio by dropping projects not in their core business area, by examining the value chain to focus on their core strengths, and by dropping their vertical integration in favor of integrated therapeutic areas containing all of the functions from discovery to marketing (2). Another trend has been the introduction of therapeutically targeted stand-alone R&D centers that allowed the devolving of R&D responsibility and authority for R&D decisions down the organizational structure. There is also a trend toward integrated therapeutic area business units with a specific disease and patient focus (1).

**Strategic Initiatives to Increase R&D Innovation—Filling the Gap**

For the past 20 years it was believed that high-throughput screening against vast chemical libraries would supply the future pipeline with innovative NMEs, but mass scale has not translated into superior performance or a rash of new molecular entities. All major pharmaceutical companies also embraced with enthusiasm genomic, and molecular and cell biology approaches to provide better target selection, which also has not provided the return on investment anticipated.

Finally, many companies have or are moving toward greater external collaboration and reliance on alliances/partnerships with small biotech companies and universities to increase flexibility of the R&D processes, share the risk, and better focus on their value chain (7) (Figure 8). Some pharmaceutical practice consults have recommend that 30–50 percent of R&D be done through external collaborations (Dean, personal knowledge). If R&D spending continues to be systematically downsized and outsourced by 30–50 percent over the next few years within big pharmaceutical companies, it is easy to predict that this will produce a major reduction in the number of NMEs being produced, the corresponding number of toxicology studies required, and size of toxicology, drug safety, and animal husbandry departments within these companies. Unfortunately, in some companies, these departments have grown in the past few years to include multiple, global sites with toxicologists, pathologists, veterinaries, and support staff numbering in the hundreds, accompanied by large animal facilities that are expensive to operate. If portfolio reduction, outsourcing, and downsizing trends continue one can expect that CROs will have to help fill the gap because internal toxicology resources are not available.

Another initiative has been to introduce genotyping and biomarker assays into clinical trials to measure patient responses with a hope of better understanding which patient will or will not respond to the NME or therapy being studied (10). Clearly, drugs that have a well defined patient population predicted to respond to the new therapy...
based on a diagnostic or genotypic marker assay will command a premium price and better serve patient needs.

**Summary: Trends in Pharma and Their Impact on Toxicologists**

R&D spending growth in big pharma companies will be negative to flat or at best single digit for the next few years (11). The industry will continue to be impacted by M&A activity, a depressed global economy, the U.S. Healthcare Reform Act, and the pressure from the federal governments in all countries to reduce and control health care costs. Companies will continue to focus on synergy through transforming, downsizing, closing R&D centers (e.g. Pfizer & Merck have projected $7.5 billion in synergies with approximately 50 percent coming from R&D/manufacturing) (8), external collaboration, and partnerships to acquire NME, devices, and technology.

The “patent cliff” is no longer in the distant future, but is here today! It is expected this could result in up to $110 billion in lost U.S. revenue through 2015 due to the patent expirations on blockbuster drugs.

What will the impact be on the toxicologists in the pharmaceutical and CRO industry? Between 2000 and 2010 membership in the Society of Toxicology grew from 4,958 to 6,514 (+24%). Members listing pharmaceutical companies as their place of employment ranged from 307 to 483, with peak year, pharma membership (2006–2009) reaching 508 (12). This trend appears to decline in 2010 and this author believes it will decline significantly in 2011 due to all the pharma downsizing and site closures. On a more positive note, 2011–2015 should be an increasingly good period for CROs in the lead optimization, preclinical development, and drug safety areas as portfolios and internal resources are rationalized (“synergy”) in big pharma following “transformation” and M&A activity. This author believes that some of the downsizing required to manage the patent cliff and M&A activity will create pockets of “virtual toxicology departments” within some companies. This author also believes, as with most trends, this trend could be cyclical and that the industry may in the future be forced to re-staff to regain internal expertise—specialists needed for development speed unless CROs can fill this gap successfully.

Thus, CROs and universities may become the only “safe harbor” for ex-pharma industry toxicologists, pathologists, and support staff impacted by these trends. This author believes these changes will impact the total number of scientists in the pharmaceutical sector unless CROs and universities can absorb the surplus staff or eligible members of the pharma staff retire. Finally, this author expects that many displaced industry toxicologists will also become consultants as in the past. These changes will probably reverse the growth trend we have seen in toxicology in the United States over the past three decades and reduce the number of graduate students entering the field. On the plus side, the addition of scientists with industrial experience into academic departments should be enriching for both.

**References**


3. What goes into the cost of prescription drugs? ... and other questions about your medicines, *Pharmaceutical Research and Manufacturers of America (PhRMA) Web Site: www.pharma.org*.


5. R&D Leaders’ Forum Conference (March 2007), Presentation by Dr. Wayne Rosenkrans, Scientific and Medical Director, AstraZeneca, “Demonstrating the Value of Pharmaceuticals.”


The Department of Pharmacology was established at Michigan State University (MSU) in 1965. Toxicology soon became a strong and growing focus area of research and, in recognition of this expertise, it was renamed Department of Pharmacology and Toxicology in 1978. Indeed, it is noteworthy that seven individuals who have close ties to the department, either as current or former faculty (or adjunct faculty) members or Ph.D. students, have enjoyed the privilege of serving as President of the Society of Toxicology. We actually have two examples where a faculty member and his student were both elected President of SOT: Jerry Hook and Ken Wallace, and Jim Gibson and Jim Bus. These seven individuals are described below, and a concluding section acknowledges service on SOT Council provided by members of the department’s faculty and former Ph.D. students.

Perry J. Gehring
(SOT President 1980–1981)

Perry Gehring received both his D.V.M. and Ph.D. (in pharmacology) degrees from the University of Minnesota in 1965.

Perry began his career at the Dow Chemical Company’s Biochemical Research Laboratory in 1965. He was recruited to join MSU’s Department of Pharmacology (renamed the Department of Pharmacology and Toxicology in 1978) in 1967, as an associate professor, and was recruited back to Dow in 1970, where he had a distinguished career for 30 years. Perry became the director of the Dow Toxicology Laboratory and guided its development into a highly renowned, comprehensive laboratory that included epidemiology and environmental toxicology, in addition to a focus on mammalian toxicology. Perry’s leadership provided Dow with an organization that could conduct research in order to discern potential impacts of chemicals on the environment and human health. It is noteworthy that Jim Gibson, Jim Bus, and Mike Holsapple, discussed below, spent time in this facility. Indeed, Perry played an important role in moving toxicology from its primarily descriptive phase toward the mechanistic toxicology that we appreciate today. He combined an interest in the importance of dose-response, absorption, distribution, metabolism, and excretion. And, with his mathematical skills, Perry played a seminal role in developing the area of physiological-based pharmacokinetic (PBPK) modeling that dramatically improved how dose levels are extrapolated between animal test models and humans. Perry concluded his career at Dow by serving for a number of years as vice president of research and development, Dow Agrosciences.

Perry received a number of awards and honors, including the SOT’s Merit Award in 1983 and being elected President of the International Union of Toxicology, 1986–1989.

A little known side of Perry was that while at the University of Minnesota, he was an all Big 10 and an academic All-American football player. He was selected by the Washington Redskins as a defensive end in the 1958 NFL draft. However, because of his love of science, he chose to pursue a career in science. Indeed, this was fortunate for the discipline of toxicology.


In honor of Perry’s accomplishments, three funds have been established within SOT’s Endowment: the Perry J. Gehring Biological Modeling Student Award Fund; the Perry J. Gehring Diversity Student Travel Award Fund; and the Perry J. Gehring Risk Assessment Student Award Fund.
Jerry B. Hook
(SOT President 1987–1988)

Jerry Hook received his Ph.D. from the Department of Pharmacology, University of Iowa, in 1966. Dr. Harold E. Williamson served as his thesis advisor.

Jerry joined the faculty of MSU’s Department of Pharmacology (renamed the Department of Pharmacology and Toxicology in 1978) in 1966 as an assistant professor and quickly rose through the ranks to professor. From 1980 to 1983 he was the founding director of the Center for Environmental Toxicology (currently the Center for Integrative Toxicology). Additionally, Jerry was board-certified by the American Board of Toxicology from 1980 until his retirement. Though he left the University in 1983, Jerry continued as an adjunct professor until 2008.

Jerry embarked initially on two research programs: substrate stimulation of organic anion transport systems in the developing kidney, which was funded by NIH for 14 years; and mechanisms of diuretic action on tubular and vascular receptors, funded by Michigan Heart and Michigan Kidney until his interests shifted to toxicology.

In the early 1970s, biochemical mechanisms of cellular toxicities were being identified and assessed in the context of human health hazards. Students and postdoctoral fellows in Jerry’s laboratory demonstrated that several agents of interest had no measurable effect on kidney function in animals, yet profound biochemical changes in the kidney could be quantified. Ultimately this research demonstrated that these changes were cell specific in the kidney and rendered these cells vulnerable to other agents leading to cell-specific toxicity in the kidney. This work was funded by two grants from National Institute of Environmental Health Sciences and was ongoing when Jerry left MSU.

Upon leaving MSU in 1983, Jerry’s career path involved spending ten years at what is now Glaxo-SmithKline, enjoying increasing levels of responsibility in the areas of drug safety and general drug development. He retired in 1993 as senior vice president and director of development, which encompassed all aspects of nonclinical drug development, worldwide.

As founding president and CEO of Lexin Pharmaceuticals in 1993, Jerry was involved in fund raising and creating a functioning company, which
was purchased in 1996 by a publicly traded company, Sparta Pharmaceuticals. As president and CEO, and ultimately chairman, of Sparta, he was involved in fund raising and monitoring several major clinical trials. In 1999, Sparta was merged into SuperGen and Jerry retired to a life of board of directors meetings, journal editorial boards, consulting with emerging biotech companies, and monitoring construction of his new home on Solitude Creek, Maryland. When the house was completed in April, 2002, Jerry “walked away from all that professional stuff” and began to live the good life.

When Jerry was President of SOT, in 1987–88, “it was a good year.” We did not go bankrupt and there were no insurrections. There were, however, two items of note. In the fall of 1987, Jim Gibson lobbied Council to develop a strategic plan to ensure a comprehensive and logical pathway into the future to keep SOT focused on the most important issues, current and future. In response, Council established the Tox-90s Commission, which was charged to develop a strategic plan to focus and direct programmatic planning into the future. The Commission met in January under the leadership of Tom Miya, who as President had chaired a similar commission a decade earlier. This collection of many of SOT’s thought leaders provided insight and guidance that resulted in a final document during Jim’s presidency that served as his administration’s defined strategic plan, which was implemented and served as a model for future Councils as they debated direction of SOT activities in a changing world.

The second item of note is that during Jerry’s term, specific efforts were expended to ensure that all appointed committees would have women members (seems odd to bring it up today, doesn’t it?) and, at the Annual Meeting in Dallas, in 1988, the first meeting of Women in Toxicology was held under his auspices.

James E. Gibson
(SOT President 1988–1989)

Jim Gibson received his Ph.D. from the Department of Pharmacology, University of Iowa in 1969. Dr. Bernard Becker served as his thesis advisor.

Jim joined the faculty of MSU’s Department of Pharmacology (renamed the Department of Pharmacology and Toxicology in 1978) in 1969 as an assistant professor. Indeed, he was the department’s first bona fide toxicologist. Jim’s early research was in the area of teratology where his interest was in the pharmacological mechanisms involved in the induction of birth defects. This work evolved into examining new endpoints of adverse effect and Jim was the recipient of the first two NIH grants awarded to study behavioral teratology. Additionally, along with graduate student Jim Bus, the mechanism of toxicity for paraquat was described and really began the long history of a role for reactive oxygen species in all manner of toxicity. Jim was quickly promoted to associate professor and was named an Alexander von Humboldt Senior Scientist by the German Organization and spent a one-year sabbatical at the University of Mainz working with the well-known cytochrome P-450 pioneer, Prof. Dr. Karl J. Netter. Jim left MSU shortly after returning from Germany in 1976.

Jim left MSU to become vice president and director of research at the Chemical Industry Institute of Toxicology, Research Triangle Park, North Carolina. He established the scientific staff and research programs from the inception of this independent, nonprofit research institute, created by a consortium of major chemical companies. In 1990 Jim moved to Indianapolis, Indiana, to become global director of Regulatory, Toxicology, and Environmental Affairs at DowElanco, where he integrated the regulatory laboratory functions (toxicology, environmental chemistry, and critical quality assurance) in the joint venture creation of DowElanco from the agrochemical businesses of Dow Chemical Company and Eli Lilly and Company through successful management of people and processes. In 1995 Jim was promoted to director, North America Research and Development. He was responsible for field development of products through management of an extensive field staff located in all geographic areas of the region and for all product registration activities in the United States, Canada, and Mexico. In 1997 DowElanco became Dow Agrosciences, a world leader in the development and manufacture of chemicals and biotechnology for agriculture, and Jim was promoted to vice president, Health, Environmental Sciences/Regulatory. He was responsible for protecting $3 billion in sales by obtaining and maintaining global registrations for chemicals and biotechnology products with a staff of 275 scientists and technicians working in 30
Jim retired from Dow Agrosciences in 2002 and turned his career full circle by accepting his current position as research professor of pharmacology and toxicology in the Department of Pharmacology and Toxicology, Brody School of Medicine, East Carolina University. In addition to teaching and establishing a program in toxicology, Jim is pursuing his research interests in developing and evaluating innovative in vitro methods for the safety assessment of, and exposure assessment of, products of biotechnology, nanotechnology, dietary supplements, and algal toxins. In 2004 Jim took on an additional role at East Carolina University as adjunct professor of biology. During Jim’s career he served on many commissions, boards, and study groups, including eight years as secretary-general of IUTOX and eight years on the NIEHS study section. He was, and is, a member of several professional societies and for most held a leadership position.

Jim is the recipient of a number of honors and awards. The Alexander von Humboldt U.S. Scientist Award, 1975–76, from the Alexander von Humboldt Foundation, presents the Senior U.S. Scientist Award to a limited number of established scholars to continue their studies in Germany for a period of one year. He also received the Society of Toxicology Achievement Award in 1977. Additionally, Jim is a Fellow of the Academy of Toxicological Sciences.

As noted by Jerry Hook, Jim Gibson lobbied Council in 1987 to develop a strategic plan to ensure a comprehensive and logical pathway into the future of SOT. The Tox-90s Commission was established and charged to develop a strategic plan for the future. The Commission met in January under the leadership of Tom Miya, who had chaired a similar Commission a decade earlier. The plan so developed served as Jim’s administration’s defined strategic plan that was implemented and served as a model for future Councils as they debated direction of SOT activities in a changing world.

James S. Bus
(SOT President, 1996–1997)

Jim Bus received his Ph.D. from MSU’s Department of Pharmacology in 1975 and Jim Gibson, an associate professor at (renamed the Department of Pharmacology and Toxicology in 1978) the time, served as his thesis advisor. Jim has been an adjunct professor in the department since 1987. In recognition of his achievements, the Department presented its Distinguished Alumnus Award to him in 2001.

Jim’s career path involved: 1975–77, assistant professor of environmental health, toxicology department, University of Cincinnati; 1977–86, scientist, Chemical Industry Institute of Toxicology; 1986–89, associate director of toxicology and director of drug metabolism, The Upjohn Company; 1989–present, The Dow Chemical Company (currently director of external technology, toxicology, and environmental research and consulting). Additional highlights include, service on the Environmental Protection Agency’s Chartered Science Advisory Board; the National Center for Toxicological Research’s Science Advisory Board; National Academy of Science, National Research Council’s Board of Environmental Studies and Toxicology (BEST); the National Institute of Environmental Health Science’s Board Scientific Counselors (bioassay committee); President, American Board of Toxicology (1986–87); recipient of the SOT’s Achievement Award, 1986; and the SOT’s Founders Award, 2010. Jim is board-certified by the American Board of Toxicology and is a Fellow of the Academy of Toxicological Sciences.

Jim’s research interests are focused on toxicological defense mechanisms in modulating chemical toxicity; value of mode of action analyses in assisting science-based decision-making in chemical risk assessments; role of pharmacokinetics in assisting dose–selection for toxicity tests; and interpretation of toxicity test findings.

During the time that Jim was a member of Council and SOT President, the significant accomplishment was development and implementation of a comprehensive strategic plan for the SOT, termed Horizons 2000. The primary objective of the plan was to “be the leading organization world-wide for stimulating state-of-the-art science in toxicology.” The fruits of that plan have now been realized: SOT is unequivocally the leading organization representing toxicology today. The strategic planning approach remains the hallmark of sustaining and growing SOT functions today, and it contributed to providing an integrated organizational framework for coordinating the activities of the various SOT committees and Council activities.
The key elements of the strategic plan implemented during his presidency included:

- Initiation of the “Task Force to Improve the Scientific Basis of Risk Assessment.” The primary objective of the task force was to seek ways to ensure that efforts in mechanistic toxicology would be effectively implemented in science-based risk assessments. The task force activities culminated in the publication of their report in *ToxSci* (“Stimulating Research to Improve the Scientific Basis of Risk Assessment,” Conolly, Beck and Goodman, *ToxSci*, 1999). One of the key messages delivered by that task force was that toxicity findings at many multiples above actual human exposures were of limited, if any, relevance to human risk assessment.

- SOT began the restructuring of *Fundamental and Applied Toxicology* (FAAT) to better service the needs of SOT. This restructuring ultimately resulted in the formation of *Toxicological Sciences* (*ToxSci*) as the successor to FAAT. *ToxSci* not only provided comprehensive coverage of toxicological science, but equally important, dramatically improved the contribution of SOT journal activities to the financial success of the Society.

- Improved understanding of toxicological sciences within the SOT itself, the public, and other key external stakeholders. Thus, SOT plenary lectures highlighted presentations by Peter Sandman (a risk communicator) and John Stossel (a leading media journalist) in order to raise awareness within the Society of how external parties are using or reacting to toxicology. SOT also piloted the “Paracelsus goes to High School” program at the SOT Annual Meeting as an outreach opportunity to high school educators and students (program continues today).

Jay I. Goodman  
(SOT President 1999–2000)

Jay received his Ph.D. in Pharmacology from The University of Michigan in 1969, and Thomas R. Tephly served as his thesis advisor. From 1969 to 1971 he was a Postdoctoral Fellow, University of Wisconsin, McArdle Laboratory for Cancer research, in the laboratory of Van R. Potter. Jay attributes much of the professional success he has enjoyed to his outstanding mentors.

Jay joined the faculty of MSU’s Department of Pharmacology (renamed the Department of Pharmacology and Toxicology in 1978) in 1971 as an assistant professor. He is currently a professor in the department, continues to be actively engaged in graduate education, and is a member of the University’s Center for Integrative Toxicology.

Jay’s research interests are focused on the role of altered DNA methylation, an epigenetic mechanism, underlying the aberrant gene expression involved in chemical-induced carcinogenesis and other toxicities, e.g., immunotoxicity and hepatotoxicity. He is testing the hypothesis that susceptibility to carcinogenesis (and perhaps other toxicities, too) is related inversely to the capacity to maintain normal patterns of DNA methylation. What excites Jay about research in toxicology is that it combines the theoretical with the practical. While pursuing research aimed at understanding the mechanism(s) of action of the chemical(s) of interest, we learn more about fundamental aspects of biology. On the practical side, the new knowledge gleaned facilitates the enhancement of science-based safety assessment of chemicals.

Jay has served on numerous advisory boards, including the Board of Scientific Counselors of the National Toxicology Program; the Board of Directors of the American Board of Toxicology; the Board of Directors of the Academy of Toxicological Sciences; the Food and Drug Administration's Pharmacology and Toxicology Subcommittee of the Pharmaceutical Sciences Advisory Committee; and the Advisory Committee to the Director of the Centers for Disease Control and Prevention. Jay was chair of the Board of Trustees of the International Life Sciences Institute’s (ILSI) Health and Environmental Sciences Institute (HESI), and he is currently a member of the board. He was an associate editor of *Toxicological Sciences*, and is now a member of the editorial board of *Toxicology*. Jay is currently a member of the Board of Scientific Counselors, National Institute of Environmental Health Sciences. Additionally, Jay’s honors and awards include: Distinguished Alumnus Award, Long Island University, College of Pharmacy, 1998; Distinguished Alumnus Award, Doctoral Program in Pharmacology, The University of Michigan, 2000;
the John Barnes Prize lecture, awarded by the British Toxicology Society, 2005; and the George H. Scott Memorial Award, awarded by the Toxicology Forum, 2007. He was also invited to make a keynote, plenary presentation at the September 2009 EUROTOX meeting. Jay is board-certified by the American Board of Toxicology and he is a fellow of the Academy of Toxicological Sciences.

During the time Jay served on SOT Council, he played an integral role in the development of the following statement of Principles for Research Priorities in Toxicology, which was adopted by Council and published in the Communique (special issue, p. 9, 1998):

1. A focus on basic research aimed at discerning the mechanism/mode of action of the agent of interest is of fundamental importance. Toxicology is a basic biomedical science because the study of mechanisms of toxicity leads to enhanced insight regarding our understanding of essential aspects of biology.

2. Knowledge of mechanisms underlying the toxicity of the agent of interest is required in order to facilitate the incorporation of sound science into risk assessment. This is a critical aspect of our Society’s strategic plan. The overall goal is to enhance our ability to make reasonable estimates as to whether or not harm might occur to people, or the environment, under realistic conditions of exposure. This entails hypothesis-driven research and it is consistent with the notion that it is the dose that makes the poison.

3. The scientific basis of risk assessment can be enhanced by the development of improved test systems (not simply adding to the number of existing “tests”) and improved means for interpretation of results. Key aspects of any risk assessment include an emphasis on: 1) dose selection; 2) dose-response relationships, including extrapolation from high to low doses; 3) species to species extrapolation; and 4) exposure assessment.

4. Research should be judged on the basis of scientific merit, without regard for funding source or where the studies are conducted (e.g., academia, government, or industry).

Jay devoted a good deal of the time of his presidency to publicizing the notion that “toxicology is a part of the solution.” He indicated how unfortunate it is that, all too often, toxicology is viewed as simply focused upon the “discovery” of more poisons. Jay emphasized the point that we need to remember/understand, and teach, the fact that much of the very good life we enjoy is attributable directly to the proper use of chemicals (including medicines) to benefit people. Toxicology has played a key role here by defining the conditions of use under which we may employ chemicals for good causes.

Kendall B. Wallace
(SOT President 2005–2006)

Ken Wallace received his Ph.D. in 1979, from MSU’s Department of Physiology. Michael D. Bailie and Jerry B. Hook, professors at the time, served as his co-thesis advisors. His thesis research involved studying the development of nonrespiratory lung function (drug metabolism) in rats. Actually, Ken worked in Jim Gibson’s laboratory for one year prior to entering graduate school.

Ken’s career path involved: postdoctoral study, Toxicology Center, Department of Pharmacology, University of Iowa, 1979–81; assistant/associate professor, Department of Pharmacology, University of Minnesota School of Medicine, Duluth 1981–96; and professor of biochemistry & molecular biology, University of Minnesota Medical School, Duluth, 1996–present. Ken’s research interests continue to focus on the mitochondrion of the cell as a key target or critical element in the mechanism of pathogenesis of assorted xenobiotics.

Ken has served as a reviewer for NIH, the Science Advisory Panel for the U.S. EPA, and chaired an expert working group with the FDA to identify biomarkers of drug-induced preclinical cardiotoxicity. He is co-editor-in-chief of the journal Toxicology. He is also a member of the Board of Directors for the Health and Environmental Sciences Institute of ILSI and the United Mitochondrial Disease Foundation. Ken is board-certified by the American Board of Toxicology (ABT) and served as the chair of the Board of Directors of ABT (2001–02). Additionally, he is a Fellow of the Academy of Toxicological Sciences.
Ken attributes his professional success and the opportunities he has enjoyed within SOT to the fact that he had exceptional mentors during his graduate training who instilled in him a deep appreciation and sense of loyalty for SOT. Ken indicated that, “it was my graduate advisors and the many persons they introduced me to through SOT that afforded me opportunities that were critical to my professional advancement and success throughout my career.”

During the time Ken was a member of Council and SOT President he recognized SOT had done very well during the preceding years and was continuing to grow in both numbers and activities. An enthusiastic membership brought to Council for approval a host of new activities/committees that were incorporated into the existing infrastructure of the Society. However, as the number of committees proliferated, it became apparent that the existing framework could no longer support the objectives of all committees and that the business of SOT had become less than maximally efficient. The growing redundancy among committees blurred the organizational structure and the expenditure of resources was out of alignment with the priorities of the Society. It was for these reasons that during his year as President he persuaded and energized SOT Council to launch a multiyear “re-visioning” process whereby we took a totally fresh look at the goals and priorities for the Society, and subsequent Councils developed a wholly new administrative framework upon which to cast the future success of the SOT. Indeed, this exercise served the Society well.

**Michael P. Holsapple**  
**(SOT President 2010–2011)**

Mike Holsapple received his Ph.D. from Purdue University’s Department of Pharmacology and Toxicology in 1981. George K. W. Yim served as his thesis advisor. His thesis research addressed the unique anti-inflammatory actions of a clonidine-like imidazoline analogue.

Mike became an adjunct professor in MSU’s Department of Pharmacology in 1994 and continues to serve in that position. He began his career at the Medical College of Virginia (MCV), Department of Pharmacology in 1981. In 1994, after attaining the rank of associate professor, Mike left MCV for a position in the Dow Chemical Company’s Toxicology Laboratory, Midland, Michigan. At the time Mike left academia there was a new graduate student in his laboratory and an NIH grant to study dioxin. He arranged for both to transfer to MSU’s Department of Pharmacology and Toxicology (with a current faculty member, Norb Kaminski serving as PI). Mike has frequently served as a member of the Guidance Committee for several of the Department’s students and he has presented lectures in its graduate courses. Even after moving from Dow to his current position as executive director of the International Life Sciences Institute’s Health and Environmental Sciences Institute, in 2002, Mike maintained an active association with the department. He currently serves as a member of the External Advisory Committee for MSU’s Center for Integrative Toxicology’s NIEHS-funded Superfund Program Project.

Mike received the SOT Achievement Award in 1992 and spent a week on the campus of Mississippi State University as a 1996 SOT Colgate-Palmolive Visiting Professor. He was elected a fellow in the Academy of Toxicological Sciences in March 2007, received the American College of Toxicology (ACT) President’s Award for the best paper of the year in 2008, and received the Vos Award for Career Achievement in Immunotoxicology from the SOT Immunotoxicology Specialty Section in March 2009. Mike served on the Council for the ACT, 2005–07, and on the Council for the SOT, 2006–08. He will be President of SOT during the March 2011 meeting and, thus, will preside over the Society’s 50th Anniversary celebration.

Mike’s goals for his year as SOT President include: expanding outreach to government agencies and international toxicology-related societies, to continue discussions with the NIH Center for Scientific Review regarding clustering toxicology-related NIH grant applications, and to improve membership engagement with the Society.
MSU Department of Pharmacology and Toxicology Faculty Members and Former Students Who Served as Members of SOT Council

Over the years, numerous MSU Department of Pharmacology and Toxicology faculty members and former Ph.D. students have served as members of SOT Council.

➢ **Current Faculty Members:** Robert A. Roth, Member of Council, 1993–95; Norbert E. Kaminski, Treasurer, 2004–07; and Patricia E. Ganey, Member of Council, 2008–10

➢ **Individuals Who Received Their Ph.D.’s from the Department:** Mary E. Davis (mentor: Ted Brody), Treasurer, 1994–1997; Jacqueline H. Smith (mentor: Jerry Hook), Treasurer, 1998–2001, and Chair of the SOT Endowment Fund, 2009–; Robin S. Goldstein (mentor: Jerry Hook), Member of Council, 1998–2000; Elaine M. Faustman (mentor: Jay Goodman), Member of Council, 2004–06

➢ **Postdoctoral Fellow:** John G. Dent (mentor: Jim Gibson), Member of Council, 1991–93
Reflections on Building for the Future of SOT: Graduate Student and Postdoctoral Scholar Leadership

by Lauren Aleksunes, PharmD, Ph.D.; Patricia Ganey, Ph.D.; Jay I. Goodman, Ph.D.; and James Luyendyk, Ph.D.

Creation of the Student Advisory Committee

From its inception, the Society of Toxicology has recognized the importance of paying attention to our graduate students and postdoctoral fellows. Initially, this was reflected in opportunities for presentation of their research at the Annual Meeting. Poster presentations were the primary vehicle and this expanded to include oral platform talks. SOT provided travel funding for graduate students presenting abstracts. The Society and its Annual Meeting grew, and opportunities increased further with the advent of Regional Chapters and their meetings. A Student Luncheon was instituted at the Annual Meeting so that students could meet their contemporaries and recognize recipients of Student Awards. In 1999, Council decided to provide more visibility for the Student Awards by including them in the Sunday afternoon SOT Awards Ceremony. Jay Goodman was Vice President and he saw this as a chance to do something different in place of the Student Luncheon. He proposed that SOT institute a Graduate Student/Postdoctoral Fellow Mixer immediately following the Annual Meeting Opening Reception. This would provide an informal atmosphere conducive for students to make new acquaintances, and these friendships could be reinforced during the meeting. A second related aspect of his proposal was to initiate a dialog between SOT Council and Graduate Students/Postdoctoral Fellows, to be accomplished through a meeting scheduled toward the end of the Annual Meeting. Council approved the proposal.

The first Graduate Student/Postdoctoral Fellow reception was held on Sunday, March 14, 1999, and the SOT Council meeting with Graduate Students/Postdoctoral Fellows was held on Wednesday, March 17, 1999. The constructive exchange of ideas at the meeting led to a discussion regarding the formation of a Student Advisory Committee (SAC).

Jay Goodman’s tenure as SOT President began on May 1, 1999, and at the Council meeting later that month he presented a formal proposal to establish a SAC as an ad hoc committee for a three-year trial period. The Committee would consist of a student representative from each of the Regional Chapters, meet once by conference phone call in the fall to draft an agenda for their meeting at the beginning of the Annual Meeting, and then meet with SOT Council at the end of the scientific sessions on Wednesday afternoon. The proposal was received enthusiastically and approved promptly.

The first meeting of the Student Advisory Committee and their subsequent meeting with SOT Council took place during the March 2000 Annual SOT Meeting. Indeed, the three-year trial period proved to be a success, resulting in the SAC being recognized as a full-fledged committee. As Dr. Goodman stated, “Thus, a grassroots link between Council and the next generation of toxicologists was established. Empowering young toxicologists strengthens the pipeline of toxicologists, encourages them to continue to be engaged with the Society, helps to develop future SOT leadership, and, therefore, serves as a key component of our strategy to build for the future of toxicology.”

Early Years of the Student Advisory Committee and Founding of the Postdoctoral Assembly

It has been nearly 10 years since graduate student James Luyendyk was first approached by Patricia Ganey about taking on the position of the Michigan Regional Chapter SOT Student Advisory Committee Representative. Dr. Luyendyk served on the SAC from 2001–2004, then on the Postdoc Task Force from 2004–2005. He said, “This has provided ample time to reflect on the positive impact my experience in the Society and its student/postdoctoral structure has had on my career. I am
indebted to my various mentors in the Society, who are too numerous to list here, for the opportunity to serve. It is without hesitation that I conclude that this deepened involvement in the SOT has been one of the three most important components of my career development as a toxicologist. The effort of hundreds of students and postdocs, with the unwavering support of the Society’s leadership and general membership, has transformed the Student Advisory Committee and Postdoctoral Assembly into organizations worthy of envy by other professional societies. Integration of the SAC and PDA membership within Regional Chapters, Specialty Sections, Special Interest Groups, and both appointed and elected Committees, has contributed greatly to the success of these groups in the Society.”

Programs and opportunities now considered mainstays at the Annual Meeting, such as Lunch with an Expert, the Annual Meeting Planner, and the Student/Postdoctoral Mixer, have been developed by the substantial effort of the SAC. The popularity of the mixer typifies the excitement of our graduate student and postdoctoral membership for the Annual Meeting.

While the Society now offers a separate postdoctoral membership category, this was not always the case. The SAC (and the Society at large) long recognized the unique needs of the Society’s postdoctoral membership. To this end, in 2004 at the end of Dr. Luyendyk’s tenure as SAC chair, in collaboration with former SAC members Jennifer Duringer, Mark Powley, and L. Peyton Myers, these officers developed an informal organization, the SOT Postdoctoral Task Force. They led a Web-based discussion group for postdocs with the aim of exploring the viability of and developing a proposal for the formation of the SOT PDA. Based on the success of this group and the proposal put forward, SOT Council approved formation of the SOT PDA, for which Drs. Luyendyk, Duringer, Powley, and Myers served as the originating leadership.

According to Dr. Luyendyk, “Since this time, the SOT PDA has made vertical progress far exceeding the expectations of myself and the other PDA Founders. The effort of the PDA leadership in the Society deserves our recognition. For those who know me, it would not be surprising to hear that I could expand on my excitement for these programs in the Society for several pages. Thankfully, the Association Innovation & Management, Inc. (AIM) staff suggested I stick to one page. Below you will find the comments of other previous SAC and PDA leaders. There is no better evidence of the success of the SOT SAC and SOT PDA than hearing about the impact this experience had on its leaders, present and former. It was my distinct pleasure to serve on both the SAC and PDA, and subsequently, additional SOT committees, and I look forward to continued service in the SOT.”

**SOT Leadership and Growth: Comments from SAC and PDA Officers**

“I was fortunate to be in on the ground floor of the SAC, as co-chair of the inaugural committee (2000) and chairman the subsequent year (2001). Serving on the SAC as a member and chair was one of the most significant and rewarding experiences of my graduate education. The many teleconferences with committee members were my first foray into effective long-distance collaboration, which serves me well to this day. The opportunity to establish working relationships with Council members and future SOT leaders so early in my career was invaluable. As SAC chair, I was privileged to see the inception and growth of the "Lunch with an Expert" program, a great idea conceived by fellow SAC member Ellen Cannady. My experience with the SAC provided early leadership development that did not go unnoticed by prospective employers. I believe the work of the SAC has contributed to the vibrancy of SOT, and encourage graduate students to continue that legacy by plugging in early and often.”

—Michael H. Lumpkin, Ph.D., DABT
(SAC Chair 2000–2001)

“My first experience with the SAC was in 2006 as a Specialty Section (SS) representative. Despite a few years of SAC operation, 2006 was the first year in which student representatives from the Specialty Sections were invited to participate in SAC activities. At first, the SS representatives were an informal side group, but it soon became clear that these representatives sought to contribute in a more substantial way to the SAC and the Society. The SAC proposed a revised organizational structure that would incorporate SS representatives as a recognized committee with well-defined roles and goals. The Student
Advisory Council would ultimately consist of the leaders of two equal groups, the Regional Chapter/Special Interest Group Committee and the Specialty Section Graduate Committee. The proposal was approved by Council. This was a very exciting time for the group, as members were beginning to gain operational experience within the Society and to become more engaged with the student membership. During the first year of reorganization in 2007, I served as the Chairperson of the newly established Specialty Section Graduate Committee. The SS-GC solidified its role organizing the Lunch with An Expert program and the SAC continued its outreach efforts with student members. Experience with this group made a lasting impression on my career and former SAC members have become close professional contacts. Later, as an officer on the Postdoctoral Assembly, I very much enjoyed meeting with the new leadership of the SAC and observing the excitement within that group to not only improve upon existing programs, but also to institute new initiatives. I am confident that the SAC will continue to be an increasingly integral part of SOT, producing not only valuable programs, but also competent, energetic leaders for years to come."

—Alison Hege Harrill, Ph.D. (PDA Secretary 2009–10, SAC Secretary 2007–08)

“SAC helped me grow both personally and professionally. It provided me with an opportunity to build leadership skills beyond my normal academic experiences—a valuable skill that strengthened my self-confidence and is sought by organizations hiring for positions. It further gave me the opportunity to network with prominent members of the field, glimpse “behind the scenes” in SOT operations, and give back to SOT as well. In a field where the Ph.D. is a prerequisite, serving in SAC helped me develop an edge that helped me earn a fulfilling position at the FDA.”

—Miyun Tsai-Turton, Ph.D., M.S. (Postdoctoral representative 2008–09, SAC Chair 2002–03)

“At the 2009 SOT Annual Meeting in Salt Lake City, I was constantly approached by numerous attendees. At first, I thought I was getting so much attention because of the awesome outfits I had put together for the conference. Perhaps checking my suitcase was worth the $25 fee after all? But, alas, my beautiful slacks and sweaters were not the ones garnering attention; it was actually the numerous multi-colored ribbons that were masking my outfits that were hogging all the attention! Blue, light blue, red, green, and others: each ribbon represented a committee or position that I served—SAC, RC/SIG GC, Membership, Chairperson-elect, etc. At one of the meetings at the conference, I finally realized that I had almost the same number of ribbons attached to my name badge as some of the previous presidents of SOT! One even commented on that fact. But all jokes aside, I have enjoyed serving on each of the committees, especially SAC. I have made several professional connections that I hope will one day serve to help me when I am in search of a job. Although those ribbons do serve as a mechanism that draws people towards me and may lead to conversations, being a part of SAC has given me the confidence to approach others myself and initiate dialogue about the Society, about science, and about the weather. Bonding with the other students through SAC has also been an amazing experience since we all get together during the Annual Meetings each year and bring our lab mates together (bonding in such a way has definitely made conference calls more interesting!). Furthermore, connecting with SOT staff has been an excellent way to observe and learn the ways of great leaders and initiators. Serving on SAC has opened up doors and led to wonderful networking experiences. Thank you to the Society and SAC for giving me such great opportunities.”

—Ofek Bar-Ilan, B.S. (SAC Secretary-Treasurer 2009–10, Chair 2010–11)

“As the President of the SAC, I had an opportunity to not only be a voice for the student members of SOT, but also to serve them by creating programming and events that enabled them to expand their professional networks. Personally, the SAC provided me with leadership experience, an opportunity to work as part of a team, and to interact with leaders of SOT to shape the future of the Society, as well as expand my professional network. The time that I spent serving on the SAC has been one of my most valuable professional experiences.”

—Erica Marie Sparkenbaugh, B.S. (SAC Chair 2009–10)
“Serving on the Specialty Section Graduate Committee and Student Advisory Council improved my communication, networking, and leadership skills. These positions provide students with a role in inner workings of the Society and afford us the opportunity to contribute to the experiences of all student members.”

—Sheppard A. Martin, M.P.H., Ph.D.  
(SAC Secretary 2008–10)

“In 2007, the Council of the Society of Toxicology enthusiastically supported the PDA proposal for the creation of the Best Postdoctoral Publication Award by specifically designating budgetary funds for this award. This was an important benchmark for postdocs in the Society, for it created a mechanism to publicly recognize the scientific achievements of postdocs on a professional level that paralleled that of other awards given during the SOT Annual Meeting. It also provided me and other Postdoctoral Assembly officers an opportunity to experience a rigorous review of our peers’ science, for our review was based on the tenets of the NIH grant review process. We then had conference calls with scientific experts who helped us weigh all of the factors in determining who ultimately received the awards, providing a window into the world of peer review we would soon be entering.”

—Jennifer M. Duringer, Ph.D.  
(PDA Chair 2006–07)

“Needs-Based Initiatives Provide Added Value to PDA Membership

Lauren Aleksunes, PDA Councilor 2008–10, has noted that, during the development of the PDA, and even before the implementation of the current SOT strategic planning model, the PDA officers began to conduct annual surveys of its membership. This information provided insight into the demographics, current positions, and educational training of its postdoctoral fellows and painted a vivid picture of the postdoctoral experience within toxicology. What the annual survey also revealed were the deficits and frustrations of the PDA membership. With these problems recognized, the PDA Board initiated a review of its activities and developed a strategic plan (in line with the Society’s Strategic Plan) to begin addressing deficits.

The Board faced five major requests from its membership that largely focused upon professional development:

➢ Higher visibility of postdocs at the Annual Meeting
➢ Events outside the Annual Meeting
➢ Career development resources for early career scientists

Through the many career development activities for early career scientists, the PDA is in accordance with the SOT strategic plan to build for the future of toxicology and to help achieve important aims such as increasing the global outreach to toxicologists to create a better and safer environment around the world.”

—Betina J. Lew, Ph.D. (PDA Chair 2009–10)
Greater attention to the needs of international postdocs working in the United States

Highlight research accomplishments of postdocs

The PDA Board used these survey results and turned them into goals for the next few years. New activities or approaches were developed to address each concern. A portion of these activities was incorporated into the Annual Meeting. The remaining ones were periodic in order to maintain active involvement year round. Assessment of impact has been incorporated with each activity.

Career Sessions at the Annual Meeting

It was not surprising to the PDA Board that professional development would be an area that postdocs would like improved. This was in line with ongoing efforts of the National Postdoctoral Association and largely reflects the fact that postdoctoral training is a transient period during one’s career. Beginning in 2008, the PDA Board began workshops at the Annual Meeting that provided career advice and skill development for the PDA. The first career workshop sponsored by PDA focused upon interviewing skills and included lectures as well as a dynamic session, where participants pretended to be prospective employees. In 2009, the PDA Board teamed up with the Toxicologists of African Origin (TAO) to develop an across-the-spectrum career workshop aimed at job opportunities for early career scientists including postdocs as well as highlighted how an established toxicologist transitions from one sector to another. This session included well-known scientists from government, contract laboratories, the chemical industry, and nonprofit organizations. They provided their perspectives and advice as well as served on a panel for a dynamic question-and-answer session. More recently, the PDA sponsored a well-rounded career session for postdoctoral fellows at the 2010 Annual Meeting that aided participants in identifying skills and passions, improving networking, and developing independent grant applications. Each career-focused session has been well-attended (often over 200 attendees) and the survey results have been highly favorable. The PDA is continuing this initiative and is hosting additional career sessions at the 2011 Annual Meeting that will highlight opportunities for toxicologists outside of academia and a second session that will provide tangible advice for improving one’s scientific writing skills.

Scientific Sessions at the Annual Meeting

Postdoctoral fellows are often the unsung heroes in their laboratories. In addition to mentoring graduate students and running the laboratory, they provide the scientific data for a number of critical findings of their mentors. Recognizing that their contributions to a laboratory often go unrecognized, the PDA in conjunction with the SAC began to submit scientific proposals to the Program Committee and in 2009 the first joint SAC-PDA scientific session appeared at the Annual Meeting. It focused upon epigenetics as a key mechanism underlying gene-environment interactions in toxicology. The following year, both groups developed a session on MAP kinase signaling as a critical pathway in toxicology of different organ systems. Once again, this session was a success and clearly demonstrated the integral roles of graduate students and postdoctoral fellows in major scientific advancements within the field of toxicology. The 2011 scientific session on the fetal origin of adult disease will highlight work from a diverse group of laboratories.

Webinars throughout the Year

In 2009, the PDA committed to sponsoring webinars throughout the year to provide resources for our membership and to connect outside of the Annual Meeting. The PDA produced several successful webinars on a variety of career development topics for early career scientists.

Careers in the Chemical and Pharmaceutical Industry

Careers in Academia

Transitioning from Graduate Student to Postdoctoral Fellow

From Postdoc to Permanent Position: A Panel Discussion for Non-U.S. Citizen Early Scientists

These webinars continue to be a resource for SOT members and can be accessed on-line at: http://www.toxicology.org/ai/spd/PD-Resources.asp.
The PDA has gone one step beyond and has developed a webinar that describes how one develops their own webinar. This interactive session is a great resource for anyone looking to organize an on-line program.

**A Few Words about the Value of the SAC and the PDA**

We conclude these reflections with some comments from Patricia Ganey, who has been the research mentor for numerous SAC and PDA officers, was the 2009–10 Council Contact for SAC and PDA, and has important perspectives as a chair of the Membership and Membership Services Strategy Committees. She said, “There is a recent movement that graduate and post-graduate education should include more than what one learns in a classroom or in the laboratory. Academic institutions are beginning to offer trainees sessions that enrich their educational experiences and address development of skills that will enable smoother transitions to the next phase of their careers. The SOT has been well ahead of this movement in the creation of the SAC and the PDA. There are many benefits to the participants beyond the obvious one of affording opportunities to meet colleagues and forge lifelong relationships. These groups provide trainees with the opportunity to witness the inner workings of a professional society and to influence that society’s direction, thereby contributing to their own future. This fosters an allegiance to the SOT that benefits both the trainees and the Society. Serving on the PDA board or the SAC requires working as a team and learning principles of delegation, cooperation, and responsibility that will be useful throughout any career. Often members of the SAC and PDA are forced to think strategically, which is a new and sometimes intimidating experience but one that can be immensely valuable in the future. Those who choose to participate in the SAC or PDA get a taste of the breadth of activities that are expected of an independent scientist and can use that experience to make decisions about engagement in future activities. The SOT should be commended for providing students and postdoctoral trainees with these unique career-development opportunities.”
In 1958 I was finishing up a Ph.D. program in physiology at the University of Rochester School of Medicine. My thesis research was on structure-activity relationships of certain riboflavin analogs, although at that time we didn’t call it that. Like any other “about-to-graduate” biomedical scientist, I went to the federation meeting in Atlantic City that Spring to give my first paper and to search for a job. In a casual conversation with another U of R graduate student I mentioned that what I’d like to do more than anything else was study the effect of changes in chemical structure on biological activity. He responded that he knew someone who was looking for an individual to do just that. He sent me to Harold Hodge, then chairman of Pharmacology at the U of R. Harold made a phone call; I had a job interview, followed by an offer, followed by a move to the Washington, D.C., area a week after graduation. The offer was to work with Dr. Harry W. Hays, the director of what eventually became known as the Advisory Center on Toxicology at the NAS-NRC. Among the professionals on the center’s staff was a part-timer who had just retired from NIH as the senior toxicologist in the Public Health Service, Dr. W. F. von Oettingen. (How I learned toxicology from “Dr. Von” is another story for another time.)

In 1961 the offices of the center were located in the American Chemical Society building on 16th and M Streets in Washington, D.C. Those offices were the incubator for the Society and the first organizational meetings were essentially held in secret. The first one, March 4, 1961, was on a Saturday. Present were seven of the nine Founders—Harry W. Hays, Fred Coulston, Victor A. Drill, William B. Deichmann, Harold Hodge, Arnold Lehman, and C. Boyd Shaffer. Invited, unable to attend but available by telephone were the other two Founders, Paul Larson and Kenneth DuBois. In this time period the Pharmacology Society was very strong and many toxicologists were members. Toxicology got very little play in that society and even less in their journal. The central concern of these Founders was the need for a forum where toxicologists could meet, exchange ideas, and discuss their research without seeming to be splintering the Pharmacology Society. In the end, it was agreed to form a Society of Toxicology (SOT). To underwrite this new enterprise those present dug into their pockets for $5 each and the initial treasury had that $35 for Bill Deichmann to shepherd.

The Early Days

The first formal meeting of the SOT occurred on April 15, 1962, in Atlantic City. The initial officers and Council were the nine Founders. At that time there were 183 Charter members. These included 37 accepted by invitation and the remainder by application. The criteria for membership were a graduate degree and evidence of having published original work in toxicology. From the beginning, the question of membership for those persons engaged in the field of toxicology but without publications was considered but deferred until 1968. That year the Constitution and By-Laws were amended to consider those who were “generally recognized as expert in some phase of toxicology.” Three Honorary members were also named in that first year: Torald Sollmann, Wolfgang von Oettingen, and Eugene M. K. Geiling. Membership dues in 1962 were $10 and the Society had $1512.82 in the bank.

Geiling was a strong supporter of the new Society and provided sound advice based on his earlier experiences in sharply distinguishing the new discipline from the more established one of pharmacology and identifying the societal benefits that toxicology would provide. He suggested defining toxicology as the science of poisons to separate it from pharmacology and suggested that safety evaluation be included to justify public support for this emerging discipline. Geiling felt that if toxicology were defined solely as the study of the adverse effect of chemicals on living systems, without noting the
use of that information to evaluate safety or predict risk, we would be describing what we do but not why we do it. He is owed a great debt of gratitude for getting this nascent science (and as a corollary, its Society) off in the right direction.

The seal of the Society of Toxicology was adopted in the third year of the Society at the same time that the SOT was formally incorporated. Louise Shaffer, wife of Founder and second President Boyd Shaffer, designed the seal. The overall idea was to express safety and protection from poison through increasing knowledge. The components of the seal are the word "salus," Latin for safety; the ribband (or ribbon), a token of preeminence or superiority; the arrow, representing the toxicon or poison arrow; and the shield, representing protection. The wreath is a symbol of success and the radiating lines are force manifesting itself, victory over ignorance. Of course, we see that seal on the journals and other publications, as well as the award plaques, letterhead, etc.

In those early days, everything was worked to a “fare-thee-well.” Debated extensively was the relationship of the Society to its journal, Toxicology and Applied Pharmacology (TAAP). The journal was founded in April 1958 by three of the SOT Founders, Harry Hays, Fred Coulston, and Arnold Lehman, and was to be published by Academic Press. By September of that year enough papers had been received, reviewed (what a process that was), and approved for inclusion in Volume 1, Number 1, January 1959. There then ensued a number of discussions about making TAAP the official journal of the Society and about the nature of the relationship between SOT and Academic Press. By September of that year enough papers had been received, reviewed (what a process that was), and approved for inclusion in Volume 1, Number 1, January 1959. There then ensued a number of discussions about making TAAP the official journal of the Society and about the nature of the relationship between SOT and Academic Press. It seems as though these discussions have taken on a life of their own, and every president since Harold Hodge has had to deal with some issues relating to the journal and its publisher. In 1981, the Society, which did not own TAAP, established a second journal, Fundamental and Applied Toxicology, which it did own. The journal was retitled Toxicological Sciences in 1998 and the scope broadened to include reviews, editorials, and coverage of contemporary issues. It has also begun a series on profiles in toxicology, which highlights key persons in the field.

A Period of Growth

Where to hold the Annual Meetings was also a concern of the early Councils. As noted before, the first meeting was in Atlantic City, the second was in Cincinnati, and the third was in Williamsburg, Virginia. The latter was a most comfortable venue as the meeting attracted about 270 participants. The next two meetings were also in Williamsburg, and the attendance grew steadily to just over 400. Council realized that to hold space in desirable locations, advance planning was needed, and from 1966 they went on a rotating three-year cycle of meetings in Williamsburg, Atlanta, and Washington, D.C. Somehow Atlanta was not available in 1973 and the meeting was held in New York City. After 1975 the meetings began to be held more broadly across the country. This reflected the movement westward of membership and the availability of attractive meeting sites. In 1977, the SOT went outside the United States for the first time, holding its meeting in Toronto, Ontario, Canada. The first International Congress on Toxicology followed that meeting, also in Toronto. In 1978 the SOT crossed the Mississippi River and held its meeting in San Francisco. By 1992 the SOT had outgrown its practice of holding the scientific sessions and exhibits in the headquarters hotel, and the Seattle meeting utilized a convention center for the first time.

As might be expected, the format and content of the meetings evolved over the years. Many of us recall that weekends were special times, not to be given over to meetings. That changed abruptly when the airlines began offering substantial discounts for Saturday night stays. Very promptly, the Society moved everything ahead by one day and people began arriving on Saturday with the continuing education courses and small meetings being held on Sunday.

The March 1976 meeting in Atlanta saw the introduction of another meeting innovation, the presence of commercial exhibits. My recollection is that there were only a handful of exhibitors, but the numbers grew steadily with time. Very shortly hereafter the Society engaged the services of an exhibits contractor to handle all aspects of the commercial exhibits, including setting and collecting an exhibits fee.
The SOT received a portion of that fee as meeting income. Once the Society had paid staff this issue was reexamined and today (2001) the management of over 150 exhibits is handled internally. The nature and variety of the exhibits reflects the changes in our science. In the beginning, the exhibitors were animal suppliers and booksellers primarily. Today, just look around the exhibit hall in the Moscone Center and see what is offered.

In early 1965, President Harry Hays received a letter and a substantial check to establish an award for whatever purpose Council decided. Soon thereafter Council established two awards: an Achievement Award to be given during the first decade of an individual’s career for meritorious contribution to the science of toxicology, and a Merit Award to be made in recognition of a career of outstanding merit in the profession or of noteworthy contributions to the science of toxicology. Council, using the gifted funds, set the Achievement Award at $500 and the Merit Award at $1,000. In addition, a plaque and certificate were to be given. The first Merit Award was presented in 1966 to Henry F. Smyth, Jr. In 1967, the first Achievement Award was made to Gabbie Plaa. Those persons who selected Gabbie certainly knew how to identify talent in the field of toxicology. Gabbie, now retired, went on to be Editor of TAAP, receive the Education Award in 1987, and the Merit Award in 1996. He was also President of the SOT from 1983–84.

The number of awards given not only by the Society but also by other sponsoring organizations has grown. Today you will meet the winners of the Achievement, Lehman, Education, Public Communications, Board of Publications, and Merit Awards as well as the newer awards. As an interesting sidelight, when I was secretary of the Society I learned the identity of that first donor for the awards. He continued to underwrite those awards for several years, always insisting on anonymity. Although the official history of the Society does not mention it, I believe he was given a special award by the Society for his contributions to the field without specifying that we were recognizing his generosity in underwriting the Merit and Achievement Awards for many years.

The Society Changes

Just as the meetings grew and evolved over the last 40 years, so has the Society itself. Two features of that change seemed of special importance to me. They are the newsletter and the development of Regional Chapters and Specialty Sections. The first newsletter appeared in July 1964 and was intended to be a bimonthly report to members on activities of the Society, including reminders for meeting registration, calls for papers for the meeting, activities of Council, and information about members. The elected Secretary of the Society initially wrote the newsletter. Once the SOT had a paid staff, the Secretariat began to handle the newsletter.

In the eighteenth year of the Society, 1978–79, Council examined the idea of Regional Chapters and Specialty Sections. The Society was growing and the size of the meeting was growing just as rapidly, if not more so. There was concern that the increasing breadth of scientific interests encompassed in toxicology would lead to a sense of homelessness, that individuals working in a geographic area or narrow subject area might not feel comfortable in the larger Society. These Chapters and Sections would afford the “home” that they desired. The November 1979 newsletter had the results of a questionnaire submitted to members on the feasibility and advisability of these innovations. The membership strongly approved the concept and by early 1981 there were four regional Chapters (Mid-Atlantic, Michigan, Midwest, and North Carolina) and three Specialty Sections (Mechanisms, Metals, and Reproductive Toxicology). Today (2001) there are 18 Specialty Sections with 40 to over 300 members each and 17 Regional Chapters. The smallest geographically is Allegheny–Erie, covering a couple of counties in Western Pennsylvania. The largest is Mountain West, which covers Arizona, New Mexico, Colorado, Utah, Nevada, Wyoming, and the southern half of Idaho!
Today (2001)

Today, toxicology is taught and the science advanced in scores of medical, dental, veterinary, pharmacy, and public health schools across the country. In the view of John Doull and Fred Coulston, among others, it came of age in the 1940s. That coming of age was typified by its transition to an academic discipline with journals, texts, degrees, curricula, societies, meetings, certification, etc. The transition may have begun at the University of Chicago with the establishment of the “Tox Lab” under E. M. K. Geiling to study chemical warfare agents. About the same time the Rochester group under Harold Hodge began the study of agents associated with the emergence of a nuclear weapons program. A third center was at New York University under the guidance of Norton Nelson. When NIEHS began significant support of graduate training in toxicology it afforded many more students the chance to enter this increasingly important field. Today, the SOT has over 5,000 members, about 400, like me are retired. Private sector support is now represented by 50-some SOT associates.

Why has the SOT grown and flourished while many of the sister organizations in other disciplines appeared to flounder? It may well be because the SOT has embraced the newest science, drawn it into the Annual Meeting, and made it part of the practice of toxicology. Molecular biology, immunology, neuroscience and on and on have been applied to questions facing toxicology and risk assessment and been welcomed into toxicology. Here is where the regional chapters and specialty sections have made their real contribution. These new sciences have been incubated at the regional or specialty level and then offered to the program committees who, in turn, have shown a receptiveness to that new science. If one also considers the further evolution of the meeting away from the ten-minute platform session and more into poster sessions, poster-discussions, and debates, it is clear that the quality of our science and its presentation have kept the SOT at the forefront.

What will be said about our Society at the 50th anniversary? As expressed by past president J. Hook, state of the art science is the bedrock upon which the SOT was built and will continue to grow (Hook, personal communication). Let us both hope and work to keep that so. See you then. Thank you.


*Toxicological Sciences* 63, 3–5 (2001), © 2001 by the Society of Toxicology
The first Officers and Council of the Society of Toxicology elected by its members for its inaugural year, 1961–62, were essentially, in the vernacular of today's generation, "old white men." Of course, these men had the wisdom and foresight to establish an organization and forum where toxicologists could meet and discuss their research. SOT is now synonymous with the highest standards of toxicological research throughout the world. We are greatly indebted to these pioneering toxicologists who helped establish SOT by providing the foundation for the current success of the Society.

In this brief essay, I will not go over the history of these early pioneers (please see Society of Toxicology History, 1961–1986, by Harry W. Hays, published by SOT for its 25th anniversary). Instead, I wish to focus on some "other pioneers" who are not white and male. Individuals selected to be members of SOT are expected to have high ethical and moral standards and to promote and support sound toxicological principles in improving the health and safety of living beings and their environment. Therefore, the elected officers of SOT should reflect these standards and goals of the membership, and, by default, usually have similar educational and cultural backgrounds. Because not many women or minorities pursued careers in toxicology in the early years before the Society was formed, it is not surprising that, for many years after the formation of SOT in 1961, most of the elected officers were white men.

In the next few pages, I will highlight those individuals who made breakthroughs from the usual composition of the officers of SOT. Due to space constraints, I will not be able to provide much biographical information about those individuals whom I consider the "other pioneers" of SOT.

Gender Breakthroughs

From 1961 to 1968, the only elected individuals for the operation of SOT were the President, Secretary, Treasurer, and four Council members; in 1968–69, members were elected to three major committees: 1) Membership; 2) Education; and 3) Finance. So, after ten years of SOT existence, the first women ever elected to any major position were Dorothy B. Hood (Membership) and Mary O. Amdur (Education) in 1971–72. Their efforts on these two committees opened the doors for more women to participate in the running of the organization. Seven years later in 1978–79, Mary Amdur became the first woman elected to Council, which, to me, represents a significant event in SOT history. The following year Margaret Hitchcock joined Mary on Council and thus for the first time, 50 percent of Councilor positions were held by women. In subsequent years, more women were elected to Council and the three major committees of SOT, hinting at the possibility of a woman to be elected as a major officer of SOT. In 1990, Florence K. Kinoshita became the first woman elected to a major office in SOT, as Secretary. Florence was recognized by the membership for her many years of service on elected and appointed committees and for her stature as a toxicologist. Thirty-one years after the formation of SOT, Meryl H. Karol was the first female elected into the Presidential chain, as Vice President-Elect, in 1992. Meryl had broken the so-called glass ceiling and became a major role model for women in toxicology. That same year three women held 50 percent of the major offices in SOT: Meryl; Marion F. Ehrich, Secretary; and Judith A. MacGregor, Treasurer-Elect. More women continued to be elected and appointed to the major offices, Council, and committees in the next two decades, culminating with the election of three more female Presidents: Marion F. Ehrich, 2003–04; Linda S. Birnbaum, 2004–05; and Cheryl Lyn Walker, 2009–10.
Racial Breakthroughs

African American

The first African American to be selected to serve on Council was Sidney Green in 1999, after many years of distinguished service at FDA and after serving on several appointed committees at SOT. Elaine Valerie Knight, through very active participation in a number of SOT committees and programs, was elected to Council in 2006. These individuals have been instrumental in mentoring a number of young African American toxicologists who are becoming more active in SOT.

Asian Heritage

One of the great pioneers in toxicology was Tom S. Miya, who was elected as the first Councilor and President of Asian heritage in 1975 and 1979, respectively. Tom was a wonderful mentor to all individuals who had an interest in science and toxicology. As mentioned before, Florence K. Kinoshita, who was also of Asian heritage, was the first woman elected to a major office as Secretary in 1990. Subsequently, several Asian Americans have served on a number of committees for SOT, including James M. Fujimoto, who was elected to the Education Committee in 1978; Philip G. Watanabe, who was elected to the Membership Committee and Council in 1983 and 1989, respectively; and Serrine S. Lau, who was elected to Council in 2002.

Hispanic Heritage

Over the years, there has been increasing participation by Hispanics in SOT activities, with several elected to the three major committees and to Council. Daniel Acosta, Jr., was the first Hispanic to be elected for Council and President in 1992 and 2000–01, respectively. Kenneth S. Ramos was elected to Council and President in 2000 and 2008–09, respectively. (I believe there are several examples of former Ph.D. students and postdoctoral fellows following their advisors as President, such as Marion Ehrich and Steve Cohen; Ken Ramos and Dan Acosta; Curt Klaassen and Gabbie Plaa; and Dave Eaton and Curt Klaassen.) Through his energetic and enthusiastic participation on numerous SOT committees and activities, José E. Manautou was elected to Council in 2003.

International Breakthroughs

Because the strategic vision of SOT now has a distinct global perspective, our international members are becoming increasingly more critical to SOT’s outreach efforts beyond the United States. So, it is important to recognize those individuals who have brought an international flavor to SOT. The first “international” President of SOT (not residing in the United States) was Gabriel L. Plaa (a native of California), elected in 1981, who spent a good portion of his career at the University of Montreal. Gabbie is internationally renowned for his pioneering research in environmental and hepatic toxicology of industrial chemicals and drugs. A number of other Canadian toxicologists were original members of SOT in 1961, and several of them served prominently on Council and committees. Notably, Harold N. MacFarland was elected to the Finance Committee in 1968; Council, 1974; and Treasurer, 1977. A more recent Canadian (now a true-blue Texan), who has served on Council, is Steve Safe. He was responsible for the renaissance of toxicology in Texas. Leon Golberg, former Director of the British Industrial Biological Research Association in London, was elected to Council in 1971 and as President in 1978, a time when he was Director of CIIT in North Carolina. He definitely brought an air of distinction to the office and provided a global perspective to toxicological problems. Some more recent examples are Ruth Roberts from Great Britain for her leadership on the Global Strategy Focus Group and Martin Philbert (British West Indian descent), who has provided valuable advice and leadership as the outgoing Secretary on SOT Council.

Final Thoughts

SOT has made excellent progress in promoting toxicology as a career to all young people, including women and minorities. Please be certain to read the articles by Marion Ehrich and Ken Wallace on different aspects of this theme.

Evidence of SOT’s concern to increase diversity in its membership is the strong support to the Committee on Diversity Initiatives, the Student Advisory Council, and the creation of Special Interest Groups to recognize members sharing a particular demographic interest or culture, such as the American Association of Chinese in Toxicology;
Association of Scientists of Indian Origin; Hispanic Organization for Toxicologists; Korean Toxicologists Association in America; Toxicologists of African Origin; and Women in Toxicology.

In a discussion with my wife about this article, she suggested that some members of SOT may believe that I am diminishing the contributions and importance of the founding fathers and early pioneers of the Society. She also remarked that some of the women and minorities highlighted in the article may not want to be recognized as a female or minority toxicologist; they may simply want to be known as a good toxicologist without any qualifying adjective. As usual, she had an excellent point, but since I tend to disagree with her at times, I countered that my intent in writing this article was to really show how well the Society has grown and progressed in recognizing the diversity of membership of our discipline. It should be noted that many of the other professions, such as medicine, engineering, law, pharmacy, and the hard sciences (e.g., physics and mathematics), have taken many years to include women and minorities in their fields, while toxicology has shown greater progress in a shorter period of time. A major reason for our success has been the role that the first toxicology pioneers played in mentoring and promoting the careers of women and minorities in toxicology and in encouraging them to become members of SOT.
Ethical Issues and the Science of Toxicology

Although my primary expertise is certainly not as a “bioethicist,” it is a topic in which I am interested and indeed have even written a smattering on this topic with my colleague Steve Gilbert. Thus, I’m happy to share my thoughts and experiences, with reflections about ethical issues that have confronted the SOT in the past.

The SOT was established in 1961, but did not have a formal “ethics” statement until January 31, 1985, when the first SOT Code of Ethics was adopted. However, Bob Scala and others in SOT and the new American Board of Toxicology were actively discussing how these organizations should address ethical issues in toxicology well before that date. Indeed, they developed informal guidance that served as the basis for the 1985 Code of Ethics. The SOT’s Code of Ethics was again revisited and revised in June of 2005. The current Code of Ethics states the following:

“...each Member must maintain high ethical standards, recognize a duty to share this knowledge with the public, and be a thoughtful advocate for human, animal, and environmental health. To this purpose, this code requires a personal commitment.”

Society of Toxicology Members Shall:

- Conduct their work with objectivity and themselves with integrity. Being honest and truthful in reporting and communicating their research.
- Hold as inviolate that credible science is fundamental to all toxicological research and is the basis for communicating results.
- Recognize a duty to communicate information concerning health, safety, and toxicity in a timely and responsible manner, with due regard for the significance and credibility of the available data.
- Give due consideration to the ethical, legal, social, and policy implications of their research and communications.
- Be a thoughtful advocate for human, animal, and environmental health.
- Abstain from professional judgments influenced by undisclosed conflict of interest, disclose any material conflicts of interest, and avoid situations that imply a conflict of interest.
- Observe the spirit, as well as the letter of laws, regulations, and ethical standards with regard to the conduct of human and animal research.
- Practice high standards of environmental and occupational health and safety for the benefit of themselves, their coworkers, their families, their communities, and society as a whole.

Of potential interest to this statement is that the Code of Ethics pertains to the Members of the Society, and not to the organization itself. This became a subject of intense debate during my tenure as SOT President (2001–02). At that time, there was considerable public awareness about “corporate ethics,” based largely on the highly visible “tobacco wars” and the publication of David Kessler’s revealing book, A Question of Intent: A Great American Battle with a Deadly Industry, where he described his efforts as commissioner of the FDA to regulate tobacco products. At a similar time (released in 1999), a very popular movie, The Insider, featuring Russell Crowe as the tobacco industry whistleblower, increased public awareness of ethical issues that one could argue were directly related to toxicology. I was intrigued by Kessler’s story and, as vice president of SOT in 2000–01, worked with the Program Committee to invite Dr. Kessler to be SOT’s Plenary Lecturer. Kessler agreed, and gave what I think was a very memorable lecture, with a substantial...
contribution of certain SOT members selected at random for some role-playing. With the visibility of this issue at a peak, I was struck when I entered the Convention Center for the meeting to see that we had several prominent tobacco companies listed as Corporate Sponsors of SOT. At about this same time, my friend and colleague at the University of Washington, Larry Loeb, was elected as President of the American Association for Cancer Research (AACR), the largest and arguably most prominent cancer research organization in the world. Larry had little trouble convincing the leadership of the AACR that it was unethical for them to accept corporate contributions from companies whose products, WHEN USED AS DIRECTED, clearly caused more cancer deaths in the world than any other single factor. AACR was one of many professional scientific societies that adopted such a policy. As both a cancer researcher and toxicologist, in my heart of hearts I felt the same way, and was troubled that SOT received substantial financial support from corporations whose primary goal was the manufacturing and marketing of cigarettes. Thus, in my year as President, I decided that I would work with my Council colleagues to develop a policy that would preclude SOT from accepting corporate donations from companies whose primary business was the manufacture and sale of tobacco products.

This proposal was the primary focus of the incoming President’s Town Hall Meeting in 2001, and it received lively discussion and debate. Although many colleagues were very supportive of my proposal to establish a policy that precluded SOT from accepting corporate donations from tobacco companies, many were opposed, including some very prominent SOT members and past Presidents whom I admired greatly. The primary argument against adopting the policy was that of the slippery slope, which basically said that if SOT begins judging companies that market consumer products that could be adverse to public health, it would have to go beyond just tobacco companies, and include companies that manufacture and market alcoholic products, pesticides, drugs, etc., etc., all of which have the capability of adversely impacting health. While I recognized that there was some merit to that argument, I felt—and still feel today—that there was one very large difference that distinguished tobacco products from all other consumer products—which was that the negative public health impacts were huge, AND occurred when the products were basically used as intended. Furthermore, there was a large volume of toxicological science that demonstrated that, when used as intended, these products presented unreasonable risks to human health. That tobacco company executives stood in front of Congress and, one by one, took oaths that they believed that their products were “safe,” when their own scientists and the rest of the scientific community didn’t support that notion, simply added fuel to the fire. One point that I stressed was that the proposed policy did not pass judgment on the science or the scientists that worked for these companies. I emphasized that we should continue to welcome them into our membership, encourage their participation in our Society, and judge their research based on the value of the science and NOT who their employer is—just as we do for any other area of research.

I’m happy to note that, exactly ten years later, SOT still does not accept corporate contributions from tobacco companies, and there has been no effort (that I am aware of) to extend this to other corporations. Private sector support remains an important part of the SOT’s financial health, and it is critical that we continue to provide a venue for open discussion of corporate and individual ethics that impact the field of toxicology.

In 2004, the SOT officially sanctioned a new Specialty Section titled “The Ethical, Legal, and Social Issues (ELSI) Specialty Section.” The ELSI SS provides SOT members “a forum in which to discuss the ethical implications of results from our science as well as the resulting legal and social implications. In addition, this Specialty Section can serve as a forum for discussing issues related to research integrity and the conduct of research with animals and humans.”

The objectives of the ELSI Specialty Section are:

➢ To explore the contributions and implications of toxicological-based research on bioethical thinking and public policy.

➢ To serve as the focal point for interaction of members of the Society of Toxicology interested in ethical, legal, and social issues related to toxicology.
➢ To develop, propose, and conduct programs and educational activities that emphasize the latest developments in ethical, legal, and social issues related to toxicology.

➢ To relate developments in the field of ethics to the activities of the Society of Toxicology and to stimulate interest and growth in ethical, legal, and social issues as they relate to the science of toxicology.

➢ To act as a resource to the Society in the area of the ethical, legal, and social issues related to the science of toxicology, with a particular emphasis on the bioethical issues raised by advances in the toxicological sciences.

One thing we can be sure of: The science of toxicology and the actions of toxicologists will continue to have major impacts worldwide on public policies and regulatory actions that impact a great number of people. It is paramount that our members, and our organization, continue to operate with the high ethical standards set forth in our Code of Ethics to ensure that public policies, regulations, and corporate actions are based on the best available toxicological science.


In 1978, I had the opportunity to join the first class of seven postdoctoral fellows training at the Chemical Industry Institute of Toxicology (CIIT). CIIT was an extraordinary vision of eleven founding chemical companies to create an independent research institute to address human health issues related to environmental chemical exposures. Through the recruitment of outstanding leaders, many of whom have served in SOT leadership positions, and talented scientists, CIIT gained recognition as one of the premier research institutes of its kind in the world. That recognition clearly was grounded in the quality and credibility of its science, but was driven in large part by the creation of an innovative, interdisciplinary postdoctoral training program.

CIIT postdoctoral fellows benefitted from an institutional commitment to their education and training that supported and expanded their laboratory research experience with a chosen mentor. During the typical two-year fellowship, CIIT postdoctoral trainees participated in evening courses/workshops in pathology, statistics, metabolism/pharmacokinetics, genetic toxicology, chemical carcinogenesis, risk assessment, and other related disciplines. Many of the trainees did not necessarily come from graduate toxicology programs, but had strong training in biomedical sciences, chemistry, chemical engineering, and mathematics. Through their postdoctoral training at CIIT, their core expertise was expanded and integrated into a unique understanding of toxicology—leading to innovative approaches to developing predictive models for human health assessments.

CIIT has a proud legacy of training that includes nearly 300 postdoctoral fellows (in partnership with Research Triangle universities) and 50 visiting scientists. CIIT also has been the home institute to nearly 100 summer interns—many of whom have gone on to graduate and professional careers in toxicology. The legacy of CIIT lives on today as The Hamner Institutes for Health Sciences. The Hamner’s research and training programs build on a health outcomes systems biology platform that is both multi-disciplinary and highly integrated, fostering the development of the next generation of predictive health outcomes models. Like CIIT, The Hamner’s training program is highly Socratic and there continues to be an institutional commitment to the education and professional development of all trainees. Trainees learn and experience first-hand the importance of applied scholarship to address the challenges of assessing potential health risks in the context of the complexities of chemical exposures, the diversity of the human population, and the critical need to assess and interpret biological systems perturbations as a function of dose.

Through an expanded platform that now includes drug safety and targeted human translational research programs, The Hamner toxicology training experience incorporates cutting-edge genetics, high throughput/broad coverage genomics/proteomics/metabolomics, computational modeling, systems engineering, cloud computing, chemical biology, and clinical medicine. The Hamner is now home to major academic centers, shared resource facilities, and a biotechnology/bioscience accelerator facility. Toxicology training contributes to and draws from the broadened, but highly leveraged platform in chemical and drug safety sciences and drug development.

Today’s Hamner trainee has the opportunity to participate in advanced workshops and courses developed by The Hamner faculty. Examples include:

- Physiologically Based Pharmacokinetic (PBPK) Modeling in Drug Development and Evaluation
- PBPK Modeling and Risk Assessment
Interpretation of Biomonitoring Data Using PBPK Modeling

Computational Systems Biology and Dose Response Modeling

New partnerships in Europe and China offer the opportunity for trainees to gain a global perspective on environmental health and to have direct research experiences in major academic and government research institutes abroad. Last October, The Hamner joined with the Shanghai Centers for Disease Control to create the International Institute for Health and Safety Sciences, housed both on The Hamner Campus and at the Shanghai CDC. Toxicology truly knows no boundaries and as world economies continue to evolve based on strong strategic partnering relationships, toxicology will play a vital role in protecting public health and assuring the development of safe chemical products and medicines.

Training the next generation of toxicologists must also focus on creating research opportunities and educational programs for undergraduate and K through 12 students. The Hamner continues to offer summer undergraduate research fellowships and is proud to be the North Carolina home to Project Seed, a program developed by the American Chemical Society to encourage economically disadvantaged high school students to pursue careers in chemical sciences by providing a comprehensive internship in scientific research. Under the leadership of Mr. Ken Cutler, the track record of Project Seed students is impressive. As an example, all of last year’s class of 30 students received scholarships to attend universities throughout the US, and ten Project Seed alums are now pursuing Ph.D. degrees at leading institutions including MIT, Stanford, Duke, and the University of North Carolina Chapel Hill.

In October 2007 the National Research Council of the US National Academy of Sciences published a groundbreaking report, Toxicity Testing in the 21st Century: A Vision and Strategy. It serves as a blueprint for both toxicology research and training. Programs and partnerships between leading government environmental health agencies that include the NIEHS and EPA, academic institutions and research institutes have been established, providing exciting opportunities for advancing risk assessment sciences and training the next generation of toxicologists. The promise of the era of genomic medicine based on personalized medicine, high throughput/broad coverage technologies, and in silico modeling now clearly defines the path for toxicology in the next decade and beyond.
The Society of Toxicology (SOT) now has a national record as a leader in working for diversity in science, an activity that was initiated over 20 years ago. The activity continues today, and SOT’s influence has impacted the recruitment and retention of toxicologists. Special recognition of SOT’s program was provided at the 2009 SOT meeting. The paragraphs that follow provide information that goes beyond the few historical aspects noted at the 20th anniversary. Many features have made this a program that has changed the face of SOT.

The first toxicology presentations made by SOT members to undergraduates occurred at the Annual Meeting in Atlanta in 1989. The program was initiated when Faye Calhoun (NIH) made contact with the Education Committee (Mary Jo Vodicnik, Chair) to discuss NIH’s interest in promoting minority undergraduates to continue their studies and obtain research graduate degrees, and institutions in the Atlanta area were invited to attend. The Education Committee (Marion Ehrich, Chair) did another local program in Miami in 1990, with this event noted for the first time in the SOT’s Annual Meeting program. Those who made presentations for the undergraduate attendees at that time were Marion Ehrich, Harihara Mehendale, Faye Calhoun, Dwayne Hill, Claude McGowan, Ricardo Rodriguez, and Robert D’Amato.

In order to increase the impact of SOT activities beyond the local area in which the Annual Meeting was held, Faye Calhoun suggested that NIH might have an interest in sponsoring attendance of nonlocal students through a grant program. NIH has long had an interest in increasing the representation of underrepresented groups in science and toxicology is a science with recognizable relevance to such groups. SOT Council approved an attempt to do this (Curt Klaassen, Liaison) and the Education Committee (Marion Ehrich, Chair) was charged with writing a grant to NIH (after brainstorming with Faye Calhoun, Jay Gandolfi, and Claude McGowan). The grant included sponsorship of undergraduates and of undergraduate advisors, because many advisors from small institutions without graduate programs needed better information on what it takes to help prepare their advisees for successful admittance to graduate programs. Furthermore, toxicology was an undergraduate major at only a very few institutions. Both students and advisors, therefore, needed to be made aware of toxicology as a career choice that offered many options.

The first year of NIH funding (a three-year grant) sponsored the program at the SOT Annual Meeting in 1991 in Dallas—members of the Education Committee (Marion Ehrich, Jay Gandolfi, Linda Birnbaum, Stephen Safe, Serrine Lau, and Robert Roth) selected awardees and set up the program. The program was attended by a standing-room-only crowd and this activity for undergraduates was accompanied by a poster session organized by the Tox 90’s Committee. Robert D’Amato, from Procter & Gamble, now deceased, was an important industrial supporter at the beginning of SOT’s undergraduate program.

It may seem today that the undergraduate program is certain to be a part of the SOT Annual Meeting, but such was not the case in earlier years. Although the initial grant was for three years, Principal Investigator (PI) Marion Ehrich had to send reports to NIH every year in order to obtain the approved funding. These reports included information on award recipients, the sessions the awardees attended, the value of the program to the awardees, evidence of SOT’s commitment to the program, and a prospective program for the upcoming year. These detailed annual reports aided renewal of a new grant for an additional three years, but annual reports were also necessary during the second award cycle. During
this time, it was also necessary for SOT Headquarters and Jim Yager of the Tox 90’s Committee to provide information on summer internship possibilities so funding could continue.

Submission for the third renewal was not as onerous as the first and second times the grant was funded. By that time, SOT could demonstrate progress, and PI Marion Ehrich had visited the offices of NIH responsible for funding. However the PI was told that SOT was still the only professional organization receiving this type of grant.

Chairs and members of SOT’s Education Committee deserve recognition, as this program was a lot of work for them in the years between 1991 and 1995. It was not until then that Bob Roth on the SOT Council suggested an Education Subcommittee for the Minority Program. This subcommittee was first listed in the program for the 1997 SOT Annual Meeting; Ken Ramos was the first Chair, Claude McGowan the first Co-Chair. At least two members of the Education Committee were part of this subcommittee, so they essentially did double service. Members of SOT’s Education Committee continued to make these major contributions until 2005, when the subcommittee became its own entity, the Committee on Diversity Initiatives. This committee now had the sole charge and the responsibility of encouraging undergraduates to seek graduate training and careers in toxicology.

It is to be noted that, in addition to individuals listed as members of the subcommittee or the eventual Diversity Committee, speakers and mentors have been important contributors throughout the years the SOT has been providing a program for undergraduates. The speakers are listed in the SOT Annual Meeting Programs—the mentors have to be appreciated without written recognition for their Annual Meeting participation. Many of these mentors contributed their time for multiple years. They deserve considerable thanks for making a difference in the lives of these people and for SOT’s vitality.

The contributions of SOT members deserve to be recognized. For example, grant renewals required that chairs of the Education Committee write supporting letters. In particular, the letter of Rick Schnellmann was so strong it was specifically recognized by the NIH reviewers. The contributions of cosponsors also deserve recognition, because SOT had one year when the rules changed after the proposal for renewal of the NIH grant had been submitted, and these additional sponsors allowed SOT to still do a program at their Annual Meeting, although at a reduced level. Michael Waalkes chaired the subcommittee that year, and support from SOT, Pfizer, and Johnson & Johnson made it possible to run a reasonable program. These sponsors still contribute to the program today.

SOT recovered the grant within a year and the NIH grant (MARC program, funds from NIEHS) were renewed a fourth time with Marion Ehrich as PI before she was replaced by Myrtle Davis and then by José Manautou, who has managed to secure EPA funding as well for the program. Considerable assistance over the years has been received from Betty Eidemiller at the SOT Headquarters.

From the beginning, the programs presented to undergraduates and their advisors at SOT’s Annual Meeting have been exceedingly well received by the attendees. The enthusiasm of the people doing the programs (including the mentors) has certainly contributed to this positive response.

SOT deserves to be proud of its record as a leader in working for diversity in science and the discipline of toxicology. An excellent measure of the outcome of these efforts is that many of those who participated as undergraduates are now members of SOT. Some are serving in leadership roles. The face of the Society is, therefore, fresh, and this bodes well for SOT’s future.
I call myself (among many things) a government toxicologist. The title has carried tremendous significance for me and has profoundly shaped my 30-year career—first at NIEHS, then at EPA, and now back at NIEHS. But the field is incredibly broad and invokes so many roles, that the words can only be fully understood when the field’s wide-ranging diversity is appreciated.

The Heart of Toxicology

In 1979, I took my first job in the government at the NIEHS, with the NTP that was just getting started. I’m not sure I had even heard the word “toxicology” at this point in my young career and never took a tox course in my life. And I certainly didn’t know anything about environmental chemicals. So coming from microbiology, I went from studying bacteria to exposing rats. My first assignment was to do a pharmacokinetics study on a dioxin-like compound, TCDF. Admittedly, I had no idea what I was doing, but I had a great mentor who helped me to use my background in molecular genetics, biochemistry, physical chemistry, and basic biology. This application of many fields and skills to solve complex problems is the heart of toxicology.

The best practitioners thrive in the complexity of their craft, drawing from chemistry, biology, pathology, physiology, statistics, and human behavior. In large part, they are detectives, following leads and tenaciously asking questions. They must also understand the complexity of the organisms they study to procure a safer course for future generations. Indeed, toxicologists have similar and other roles throughout the government. People are looking at environmental chemicals, drugs, food, food additives, and devices, and understanding air and water pollution.

There are toxicologists in the Departments of State, Energy, Defense, and Transportation; in NOAA, NASA, USGS, Fish and Wildlife; in the Departments of the Interior, Agriculture, Justice, and, of course, Health and Human Services, as well as the U.S. EPA and the Consumer Product Safety Commission. Major laboratories maintain the capability to conduct safety assessments of many types of products including human and veterinary drugs; to analyze occupational exposures; and to evaluate environmental stressors—both to wildlife and to people. And in order to better assess the safety or risk of both physical and chemical exposures, basic studies are conducted to elucidate the mechanisms of injury and of protection.

Diverse Occupations, Common Goals

In many government settings, toxicologists thrive in specialties from environmental to ecotoxicology, animal to human toxicology, risk assessment to regulatory toxicology, judicial to legislative toxicology. At the NIEHS and NTP, toxicologists are involved in basic research, applied research, evaluative studies, and safety and risk assessments, all of which contribute to decisions that affect the entire country. Indeed, toxicologists have similar and other roles throughout the government. People are looking at environmental chemicals, drugs, food, food additives, and devices, and understanding air and water pollution.

Different agencies operate under different legislative mandates, so regulatory requirements vary dramatically. For example, depending upon whether a carcinogen is in the air, water, food, or soil may lead to different allowable levels of exposure. A known carcinogen such as benzene at hazardous waste sites is treated differently depending on its presence in drinking water or in the ambient air. In another example, a single product, like a baby bottle, can fall under different federal jurisdictions with separate criteria to determine exposure risk and enforcement methodology. Additionally, while drug safety undergoes extensive preclinical testing by toxicologists at FDA, release of potent drugs into the
environment currently remains unregulated by EPA. But regardless, regulatory decisions should be based on the best science.

With all the breadth and depth of what is accomplished by toxicologists in the government, we do have intrinsic, elemental commonalities. We have ultimate responsibility to two masters: truth and the American people. We have the privilege to be truly objective, evaluating and conducting only the best and most honest science. It’s a big responsibility, one that we vow to keep when sworn into public service. The honor to have a positive impact on the health of this country, and maybe worldwide, is why I stay involved.

If someone just starting a career were to ask for my guidance, I would respond with advice my parents gave me: have some fun every day. Look for something that intrigues you—something interesting. Ask yourself, am I doing things that can make a difference?

From my early days at NIEHS and now coming full-circle after nearly two decades at EPA, toxicology has been my professional home. There have been lots of changes along the way, but in this field, taking on different roles clarifies the scientific mind and enhances the capacity to solve problems and issues. It’s been a soul-satisfying career, and best of all, I’m having fun! I love the research and the science; it maintains my sanity. That’s my perspective—as one of many toxicologists in government.
Looking back at the first 45 years of our history reveals a long and consistent record of success of the SOT. Its membership grew from the founding nine members in 1961 to over 5,800 members from 45 countries in 2005. The activities of the Society increased proportionately as reflected by an annual budget of over $4.5M (USD) and a growing list of more than 25 committees, subcommittees, and task forces commissioned by Council to take on the various activities of the organization. With rare exception, these groups developed and implemented their charge with great success, oftentimes serving as examples for other professional societies to emulate. Legacy activities of SOT during these years included its strong financial management, its top-rated scientific journal, its commitment and investment in encouraging students and trainees, and its commitment to diversity and equal opportunity amongst its members. The Society was on a solid foundation and a trajectory for growth; there was every indication that SOT would continue to thrive well into the future.

However, the 45th Council of SOT saw the approaching anniversary as an opportunity to re-evaluate the mission and administration of SOT to best suit the Society as we move into the second half-century. Two critical observations led Council to this decision. New committees, subcommittees, and task forces were being added annually to the organizational chart for the Society, which because of the inherent redundancies and overlapping mandates was morphing from a chain of implementation and reporting to a complex web of communication. It appeared that SOT was outgrowing the administrative infrastructure needed to best coordinate and optimize the effectiveness of each activity. This perspective was further propagated by the results of a poll of Council members that revealed that the resources of the Society were not well aligned with our priorities; there were examples where the Society was spending a great deal of human and financial assets on activities that were ranked relatively low by Council, and other examples where we were investing relatively small amounts on activities that were considered primary to our mission. It was this sense of imbalance and lack of administrative efficiency that compelled the 2005–06 Council to undertake this bold, top-to-bottom reassessment and revisioning of the strategic plan for the future of SOT.

The 2005–06 SOT Council devoted a great deal of time and energy framing the scope of the strategic plan, but it was the ad hoc strategy committees that actually gave definition to each area of focus. The Society is fortunate to have such a wealth of members with keen and thoughtful insight who so generously served this critical task of chartering the new vision for SOT. These thought-leaders included:

- **Science Strategy Committee**—Cheryl Walker (Chair), Debra Cory-Slechta, Ronald Hines, Kenneth Olden, Bernard Schwetz, and Gerald Wogan.
- **Communications Strategy Committee**—Bernie Goldstein (Chair), Matt Bogdanoff, Ann de Peyster, Annie Jarabek, and Jim Lamb.
- **Membership Strategy Committee**—Patty Ganey (Chair), Ernie Harpur, Serrine Lau, Jim Luyendyk, José Manautou, and Mike McClain.

Such an enormous effort could not be completed within the frame of 12 months; fortunately for SOT and its members, successive Councils have carried through with optimizing and further developing the strategic plan for the organization. We owe a great deal to the past several Councils who collectively did the heavy lifting and difficult decision-making needed to most clearly define and implement a strategic vision that will best serve the Society as we enter into the second half-century.
By many criteria, the Society of Toxicology membership comprises a very diverse population of dedicated scientists. The Society proudly stresses and indeed advertises the diversity in many ways. The geographical dispersion of the membership across the United States but also across the globe is a point of great pride and a strength to the Society. Likewise, the presence of the Society membership in very diverse employment sectors is noted repeatedly in the announcements and published data sets characterizing the membership. While the identification of academic, government, and industrial employment sectors is regularly identified, we are well aware that this characterization is an oversimplification—perhaps an over-classification of the membership since there is extreme diversity in the activities and responsibilities within each of these major employment sectors. The ethnic diversity of the Society has been apparent and a source of pride of the Society for a number of years. However, the relatively recent establishment of Special Interest Groups within the Society has provided a greater opportunity for recognition of this diversity as well as providing an expanded opportunity for interaction and support of members of common ethnic and cultural background. The Society has long recognized diversity of specific areas of scientific interest through the development and expansion of the Specialty Sections that play a very vital role in the functioning of our Society, particularly the development of the program for the Annual Meeting. Despite the recognition of diversity based on geographical location, employment sector, ethnic background, and scientific interests, these generally appreciated diversity characteristics of the Society do not fully capture all the important diversities of the Society. The extreme diversity of technical background, training, and expertise are essential but frequently overlooked aspects of the toxicology profession.

While data on the diversities noted above may be somewhat limited, there is certainly a more limited characterization of the diversity of membership based on either technical training or current technical expertise. Information is available on the “Field of Highest Degree for Toxicologists,” as noted in Table 1, that is derived from the Society’s Web site.

**Table 1: Field of Highest Degree for Toxicologists**

<table>
<thead>
<tr>
<th>Field of Highest Degree for Toxicologists</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicology</td>
<td>56.7%</td>
</tr>
<tr>
<td>Physiology/Biology/Zoology</td>
<td>17.2%</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>8.3%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5.7%</td>
</tr>
<tr>
<td>Pathology</td>
<td>3.6%</td>
</tr>
<tr>
<td>Veterinary Medicine</td>
<td>3.1%</td>
</tr>
<tr>
<td>Genetics</td>
<td>2.0%</td>
</tr>
<tr>
<td>Medical Degree</td>
<td>1.5%</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>0.9%</td>
</tr>
<tr>
<td>Biomedical Systems</td>
<td>0.9%</td>
</tr>
<tr>
<td>Molecular Engineering</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

Source: [www.toxicology.org](http://www.toxicology.org)

Despite the limitation of the data set, the table demonstrates several important points. First, nearly half of the toxicologists that are members in the Society received their primary training in an academic discipline not defined as toxicology. Second, the range of academic training outside of a toxicology-defined discipline is extreme, with representation of basic sciences (e.g., biochemistry and chemistry), medical sciences (e.g., veterinary medicine, pathology, medical degree, and pharmacy) and engineering. This snapshot of training certainly does not capture the full breadth of the technical training since individuals categorized in any of these areas will have very diverse training. For example, biochemistry training may run the gamut from basic enzymology to genetic-based approaches to understanding biochemical control systems. In addition, the biochemical discipline may include multiple areas related to molecular toxicology.
Likewise, training in pathology may focus on basic experimental approaches to understanding disease processes to diagnostic pathology either utilizing morphologic or clinical chemistry approaches. Although the examples are indeed endless, the point is that the training of individuals contributing to toxicology is extremely diverse. It must also be noted that the various training programs that are primarily defined as toxicology and have produced slightly over 50 percent of the Society’s membership are extremely diverse in terms of technical approaches that are utilized and are trained within the respective degree programs.

The recognition of basic technical training as defined by degree is an oversimplification of the technical expertise of toxicologists. Many toxicologists have transcended their original training by developing expertise in additional technical areas as part of their innate scientific curiosity or even dictated by the requirements to stay productive and competitive in the job market. While we are all well aware of examples of training and expertise beyond the field of original academic training, there is simply no documentation of this diversity of expertise.

The value of the technical diversity represented in toxicology and the membership of the Society should not be underestimated. The diversity of technical expertise provides the broad opportunity to contribute, particularly in a world where there is increasing demand for interactions that will address societal issues. It is clearly evident today that narrow training, narrow thought processes, and narrow approaches will not be successful for the individual toxicologist or for the profession of toxicology. Indeed, the broad perspectives, approaches, and technical expertise contributing to the activities and advancements of toxicology are key elements in the current and future success of the profession.

In summary, technical diversity is a very important cornerstone that supports the value of toxicology and ensures the future of the profession. Such diversity should not only be encouraged but should be expanded in the future so that the profession continues to thrive and reach its full potential of service to humanity. The Society should continue to keep the borders of toxicology open and should never try to define the limits of the profession based on technical background. Simply stated, technical diversity in toxicology will ensure that the profession and the Society continue to be productive contributors to “creating a safer and healthier world by advancing the science of toxicology,” as stated in the Society’s Vision Statement.
2007–08 was a year of considerable note for the Society of Toxicology. Of the many significant events, changes, and challenges, I choose to highlight three representative examples—a new plan, a nettlesome challenge, and a joyous celebration. In the face of rapid changes in society and in science, the Society reflected on its future, and a strategy to ensure not just the survival, but the relevance and the excellence of our society. There was the problem that toxicology researchers had faced since the elimination of two NIH toxicology study sections in 2002, but forces aligned to offer toxicologists a new opportunity. And finally, the 50th anniversary of the Society was on the horizon and we began to think of celebrating our golden anniversary in a style befitting our august and deserving membership.

I. The 2008–2011 SOT Strategic Plan

Origins. As the future of toxicology evolved across many fronts, the 2005–06 Council asked whether our direction and our organizational structure, which had evolved over many years, supported our current vision and mission. Between the summer of 2005 and January 2006, Science, Communications, and Membership strategy committees were drawn from our membership to give Council an independent view of future directions in these key areas. The strategy groups reviewed recent reports of the Liaison Task Force, the Recruitment and Retention Task Force, and the Communications Committee. Strategy Committee reports were evaluated by membership on-line and at the 2007 Town Hall Meeting in Charlotte. Over the spring, summer, and fall of 2007, during four 2-day meetings, Council consolidated strategy reports and member input, and developed a three-year draft Strategic Plan for consideration by membership and their review at the 2008 Town Hall Meeting in Seattle.

Guiding Values. The values that directed our strategic planning included the following: Integrity; Diversity of representation of women, minorities, and young investigators, along with geographic, specialty, and affiliation balance, in meetings, conferences, committees, and governance processes; Contribution to society; Life-long learning; Intellectual scientific stimulation; and Serving the needs of the scientific discipline and of the Society members.

Council was committed to the concept that strategic planning involves an ongoing progression of formulation, implementation, review, and adjustment. We adopted specific approaches used by organizations with high strategic effectiveness. These inspired us to formulate a good strategic plan quickly (versus slowly formulating a more perfect plan); move immediately to implementation; review progress on implementation regularly and make needed adjustments based on quality of fit to Strategic Priorities; and focus on results, not activities.

Vision. Successful organizations thrive under an accurate and concise summary of what they aspire to achieve. This provides for long-term continuity in organizational direction and resource allocation. The SOT vision is creating a safer and healthier world by advancing the science of toxicology.

Central Challenge. Council identified critical issues affecting SOT, its members, and its discipline. They included defining and communicating the role of toxicology in impacting human health.
and safety (increasing recognition and perceived relevance; creating a positive impact on funding and recruitment); defining and enhancing the role of SOT for greatest impact; maintaining a pipeline of well-trained toxicologists; restoring funding for research; collaborating with other societies and across toxicology; aligning and serving a diverse internal constituency; playing a role globally; excelling in communication; improving advocacy; adapting to the changing role of toxicology; providing value to members; and speaking in a unified voice. These issues defined our central challenge: to increase the impact and future vitality of toxicology.

Strategic Priorities. Council undertook a process of identifying SOT strengths, needs that were not being met, and critical issues facing the organization, the members, and the discipline. The contributions of SOT to solutions for each issue were identified and prioritized based on immediacy of need and on the ability of SOT to accomplish the objective. This assessment yielded the strategic priorities and the key objectives for the plan.

Our vision, central challenge, and critical issues defined five strategic priorities:

➢ Increase scientific impact
➢ Advocate for the value of scientific contributions with key audiences
➢ Build for the future of toxicology
➢ Expand and deepen member engagement
➢ Strengthen SOT’s organizational effectiveness

Aligning SOT Structure to the Plan. Organizational effectiveness is dictated by leadership, direction, and structure, as well as the relationships among these factors. Leadership, which is the most powerful, will overcome weak direction, but weak leadership will negate strong direction. The SOT organizational structure was reviewed for its ability to accomplish the strategic priorities of the plan. Structure and function reviews were conducted for council, staff, and committees, task forces, and other units. It was concluded that council must devote most of its time, effort, and resources to strategic thinking and action, while meeting its fiduciary, legal, and ethical responsibilities. Council must reduce time, effort, and resources devoted to day-to-day management. The latter should be increasingly performed by the Society’s association management firm, Association Innovation and Management (AIM) and appropriate organizational units like committees, chapters, and sections, with periodic review by Council. The Society was seen to be in a strong staff position because of the superiority of its management company, AIM. Some staff adjustments were identified. Committees, task forces, and other member groups such as Regional Chapters, Specialty Sections, and Special Interest Groups were judged to be in an excellent position to play an increased role in implementing the plan.

Gaps in Structure. Some high-priority objectives of the plan could not be addressed with our current structure, resulting in the formation of new committees and task forces, including the 1) Communication Committee, 2) Needs Assessment Task Force, 3) Data Development Task Force, 4) Research Funding Committee, 5) Awards Nominating Committee, 6) Scientific Liaison Committee, 7) Prevention Task Force, and 8) Contemporary Concepts in Toxicology Committee. Council set a plan in motion to access structures for streamlining to enhance operational efficiency during 2009–11 and make appropriate policy and procedure changes.

Resource Alignment. Council reviewed all SOT resources, including budget, administrative personnel, volunteers, and other assets; identified each SOT activity and associated asset utilization, and defined them as: 1) part of the core mission or 2) part of discretionary activities. Council aligned existing and new committees, task forces, and activities under the five SOT strategic priorities. All activities in the discretionary category were reassessed for alignment to priorities and return on investment.

Vetting the Plan. The draft plan was presented to SOT membership and stakeholders between January and April 2008. This included telephone conference presentations to SOT past presidents, committee chairs, and Specialty Section, Regional Chapter, and Special Interest Group Presidents during February 2008, and in person to these and other groups at the 2008 Annual Meeting. All comments and recommendations were recorded and transcribed, and a compilation was placed on the Strategic Plan section of the SOT Web site for public review. The Web site remained open for one month following the Annual Meeting for a final round of comments and recommendations that may stem from presentations of the plan at the Annual Meeting.
Perspective. Several tenets guided strategic planning and selecting desired outcomes of the process. It was important for the planning process and timeline to be compact and nimble, allowing Council to formulate an effective path forward, without prolonging the planning process to fine tune and achieve what might be a more perfect plan. Councilors agreed that planning outcomes with high consensus would be implemented now, rather than deferring them until most stages of plan were implemented. New committees and task forces were launched immediately, while other actions were deferred. A five-year long-range plan was recognized as less valuable than in previous times, and that frequent visitation and revision of the plan must occur over short time intervals and be based on outcomes analysis rather than enumeration of actions. The implementation steps outlined in the plan were designed to place the Society on a course that embraces best practices of professional society oversight and leadership, and that introduces change in a manner that advances the Society and all of its members to achieve our mission and vision.

Acknowledgments. Many individuals made important contributions to the plan. Efforts began under Kendall Wallace (2005–06 President) and included members of the 2005–08 Councils. Dr. Wallace asked whether SOT resources were appropriately allocated to support our long-range plan and priorities, and launched three Strategy Committees in 2006. Strategy Committee members are acknowledged for their valuable contributions: Communications (Bernard Goldstein, Chair, Matthew Bogdanffy, Ann de Peyster, Annie Jarabek, James Lamb, with Michael Holsapple and Elaine Knight, Council liaisons, and Shawn Lamb, staff liaison); Member Services (Patricia Ganey, Chair, Jon Cook, Ernie Harpur, Serrine Lau, John Lipscomb, Jim Luyendyk, José Manautou, with George Corcoran, Council liaison, and Betty Eidemiller, staff liaison); Science (Cheryl Lyn Walker Chair, Debbie Cory-Slechta, Bruce Fowler, Ron Himes, Kenneth Olden, Lewis Smith, Gerald Wogan, and Bernard Schwetz, with Janice Chambers and Yvonne Dragan, Council liaisons, and Clarissa Russell Wilson, staff liaison).

Valuable recommendations were made by Members, committee chairs, and Specialty Sections, Regional Chapter and Special Interest Group officers at all stages of the development and finalization of the plan. The working groups that developed the plan included 2005–08 Officers and Council members Linda Birnbaum, Kendall Wallace, James Popp, George Corcoran, Kenneth Ramos, Cheryl Walker, Gary Carlson, Janice Chambers, Martin Philbert, Norbert Kaminski, William Slikker, Bruce Fowler, Elaine Faustman, Michael Holsapple, Yvonne Dragan, Scott Burchiel, Elaine Knight, Kim Boekelheide, and Denise Robinson-Gravatt. Association Innovation and Management leadership and staff, including Shawn Lamb, Clarissa Russell Wilson, Marcia Lawson, Betty Eidemiller, and Mary Cohen (Communications Consultant), participated at all stages of planning. Tim Fallon and Laurie Schulte of TSI Consulting Partners facilitated and documented two Council strategic planning retreats and contributed essential support and guidance.

II. A New Toxicology Study Section

Background. The NIH reorganization that began under Center for Scientific Review (CSR) Director Dr. Ellie Ehrenfeldt in the early 2000s realigned study sections and Integrated Review Groups (IRGs) along a disease and organ system structure. The overall impact of this strategy was a strong net positive. There were, however, important areas in human health that fit poorly or failed to fit into the new CSR structure. This was true for toxicology, a multidisciplinary, integrated discipline that cuts across disease and organ systems. Two of three existing toxicology study sections, Alcohol-Toxicology 1 and Alcohol-Toxicology 4, were eliminated, leaving only Alcohol-Toxicology 3, which was limited to neurotoxicology, intact. SOT leadership actively worked with the NIH to reverse this oversight. No progress was made until a meeting in 2007 with new CSR Director Dr. Antonio Scarpa, when several key problems faced by toxicologists were discussed and acknowledged.

The Problems. 1) Review System Bias: Human health and disease as affected by chemicals and drugs in the environment, medicinal therapeutics, and nutritionally-based origins were not addressed by the reorganized peer review structure. There was no natural home for the review of these applications. 2) Dispersal of Toxicology Applications: Without a natural study section review home, toxicology proposals that were not related to neurotoxicology were dispersed across a very larger number of review panels, much larger than seen for other disciplines.
The result was less clustering of toxicology grants in a given study section, and no critical mass of trained reviewers for balanced evaluation. 3) Application Abundance: Data from NIH show that when grants in an area make up 5 percent or less of reviews by a study section, irrespective of discipline, they are more often unscored. NIEHS applications present at under 5 percent were more frequently unscored and less often ranked below the 20th percentile. 4) Program Office Knowledge and Feedback: When toxicology grants were spread across a large number of study sections, it was not feasible for program office staff to attend many of the reviews, particularly for NIEHS staff in North Carolina, who needed to travel several hours to the Washington area. Toxicology applicants received less support from their program offices. The decrease in SRA feedback reduced the success rates of resubmissions. 5) Reviewer Critical Mass: None of the reorganized study sections had a critical mass of scientists studying human health and disease related to chemicals, drugs, and nutrition. This resulted in inadequate appreciation of human health and safety issues related to toxicology.

**The Search for a Solution—An Experiment.** On February 20, 2008, CSR Director Dr. Antonio Scarpa and NIEHS Director Dr. Sam Wilson announced the formation of a new Systemic Injury by Environmental Exposure (SIEE) Special Emphasis Panel (SEP) in the Digestive Disease IRG. This SEP was created to review applications related to the pharmacological and toxicological mechanisms whereby xenobiotics (including toxicants, alcohol, drugs, biopharmaceuticals, phytochemicals, and other non-drug chemicals) affect distinct organ systems, other than the digestive and nervous systems, including cardiovascular, musculoskeletal, hematopoietic, renal, respiratory/pulmonary, immune, endocrine, and reproductive systems. Other covered areas are skin, oral, dental and craniofacial tissues, pregnancy, and development. Applications addressing the effects of xenobiotics at the multi-organ level would also be considered. The creation of this SEP established a temporary review body, populated by toxicologists, to review toxicology grant applications.

The temporary SIEE SEP would review toxicology applications for a one-year probationary period (three cycles from February through October 2008). To be viable for conversion to a standing Study Section, SIEE would need to meet normative metrics established by the CSR for other permanent panels. Director Scarpa made a presentation at the 2008 Annual Meeting in Seattle entitled “Enhancements in the Review of NIH Grant Applications.” He answered questions about how the new Systemic Injury by Environmental Exposure Special Emphasis Panel would operate. Dr. Scarpa presented some early results of the experiment at the 2009 Annual Meeting in Baltimore and indicated that a partial analysis of outcomes indicated that toxicology grants fared more poorly under the SIEE SEP, but this was based on only two cycles, and a final decision about SIEE would not be made until data from all three cycles were evaluated. SIEE was not extended beyond its probationary status.

**An Update.** In June 2009, Dr. Seymour Garte joined the CSR as Director of the Division of Physiological and Pathological Sciences, under which toxicology-related applications fall. Dr. Garte is a former member of our Society and understands issues faced by SOT and a number of other disciplines placed in a similar circumstance by the new review structure. He and the CSR state they are fully committed to resolving problems in the review of toxicology grants. The experiment remains ongoing. Dr. Garte is implementing two strategies: 1) clustering most toxicology grants into just three standing study sections (XNDA, III, and LIRR), and increasing the number of permanent members on these IRGs who are cross-trained in toxicology and the area of emphasis of the study section. Toxicology is now clearly stated as a review area criterion for each of these IRGs. This experiment has been under way for two rounds of grant reviews in 2010. Dr. Garte is preparing to present the results of this dual strategy experiment at the 50th Anniversary Meeting of the SOT in Washington, D.C., in March 2011. Our hope is that there will be a positive outcome.

**III. Our 50th Anniversary**

**Background.** In 1961, the Society of Toxicology was created in Washington, D.C., by nine Founding members who organized its inaugural meeting in conjunction with the FASEB meeting in Atlantic City. The first Annual Meeting was held in 1962 when the Society had 183 Charter members. From these humble beginnings, SOT has grown in scope, stature,
and size to its present form as the leading toxicology society with the largest annual gathering of toxicologists in the world. As the Society approaches its Golden Anniversary, it was desirable to begin preparations to recognize and celebrate our founding, our history, and our colleagues who forged our future, during the year of the 50th Annual Meeting of SOT in Washington, D.C.

**Charge.** The Fiftieth Anniversary Task Force (FAST) was approved by unanimous vote of Council, and charged to explore and establish means of promoting the 50th Anniversary of the Society of Toxicology culminating during the year beginning with the 50th Annual Meeting in Washington, D.C., in 2011. This would be carried out primarily through the members of the committee and SOT Headquarters staff, with the assistance and support of such other groups as appropriate or necessary. The Task Force was asked to report on its planning, progress, and needs not less than semi-annually to Council through 2009 and at each Council Meeting through the end of anniversary celebrations. The Task Force was asked to develop an annual budget proposal in conjunction with Council.

**Membership.** Members were appointed to the Task Force through the culmination of its charge. Members included Ernie Hodgson, (SOT Historian and Chair); Meryl Karol (Past President and Co-Chair); Robert Scala (Past Historian and Past President); Gary Carlson (45th Anniversary Task Force Chair); William Hays (Founding Co-Counsel); John Doull (Charter member and Past President); Gabriel Plaa (Charter member); David Eaton (Past President); Linda Birnbaum (Past President); Jack Dean (Past President); James Bus (Past President); Martin Philbert (Member); Dennis Devlin (Member); Lisa Opanashuk (Member); Dennis Paustenbach (Member); Ronald Tjalkens (Member); George Corcoran (Council Liaison, followed by Michael Holsapple); and Clarissa Russell Wilson (Deputy Executive Director).

**IV. Epilogue**

There can be no question that SOT is one of the remarkable organizations of our time. The three examples of events during 2007–08 described here in detail, offer but a glimpse of an impressive, coordinated array of hundreds of programs, initiatives, events, and services provided on behalf of each member of our society. The SOT brings together many disparate wonders within our discipline of toxicology for professional fellowship, synergy, and excellence. I say with great confidence that the SOT is on the forefront of many of the pressing issues facing scholarly societies, whether it be in the area of governance or in our commitment to compelling and urgent professional issues. With your active engagement and support, and with an effective strategic path forward, the future of SOT is bright. I close with words I have spoken before and will speak again. The Society changed my life in many ways, and helped me to approach my full potential by means other societies could not have done and did not do. One of the greatest honors one can receive in a lifetime is to be chosen by one’s peers to lead their profession, the most significant and successful toxicology organization in the world, the SOT. Other incoming Presidents have said this as well as it can be articulated—leading SOT as its President is both a privilege without peer, and a daunting responsibility, one for which I am eternally grateful.
C

ross-Fertilization in Toxicology

by Kenneth S. Ramos, Ph.D., ATS

As one of the oldest intellectual endeavors of mankind, toxicology has shaped the course of history. In so doing, toxicology has penetrated all facets of human life, generating applications in medicine to establish new cures and prevent devastating diseases, in agriculture to eradicate pests and enhance the viability of crops, in the military to attack the enemy, and in industry to help the modern world afford many of the luxuries of daily living, to list a few. The profound impact of toxicology in our world would not have been possible without cross-fertilization among different sectors within the discipline itself, as well as cross-fertilization between toxicology and other fields of science such as biochemistry, cell biology, genetics, mathematics, medicine, molecular biology, pathology, pharmacology, and veterinary medicine. The celebration of the 50th anniversary of the Society of Toxicology is a time to delight in our history, as well as a time to reflect on our vision for the future.

My decision to write this brief commentary on cross-fertilization and its impact in toxicology is driven by my conviction that major scientific legacies at the individual or collective levels depend on two elements: the penetration of scientific discoveries across disciplinary boundaries and the impact of scientific contributions beyond the confines of “ivory tower” science.

Toxicology is unique among the biomedical sciences in that it bridges the most fundamental aspects of 21st century science with the applications needed to safeguard human and animal health, as well as the environment. During its first 50 years, SOT made possible the establishment of toxicology as the most authoritative discipline focusing on the adverse health impacts of chemical, physical, and biological agents on living systems. The health and safety of nations, and the world, have been protected by the efforts of SOT members who have foreshadowed the negative health impacts of toxic agents, or who have tackled some of the great chemical disasters of modern history. This legacy of achievements has been made possible by internal and external cross-fertilization. The unique talents of toxicologists and their ability to cross-fertilize are perhaps best demonstrated by the proliferation of consultancy-based efforts within the SOT membership, tangible evidence that our science is needed on a broader scale to support the infrastructure of different economies, the evolving structures of the health care system, and the well-being of the citizens of the world. The cross-fertilization between theory and practice so ably mastered by toxicologists has required implementation and refinement of a systematic approach that addresses questions of relevance to practitioners and to the scientific community at large based on a body of knowledge that is rooted on testable hypotheses. Whereas many toxicologists make liberal use of such representations, some of us have at times remained inward looking and self-contained, thereby risking stagnation and irrelevance. To overcome the possible negative impacts of such a stance, fruitful exchanges should continue to be promoted by the Society, with toxicologists making claim to those elements that are best served by the expertise that resides within the Society.

The time is ripe for us to take a fresh look at how SOT can further promote cross-fertilization to effectively undertake the scientific questions of the future, and to make toxicology readily accessible to the contemporary global world. Indeed, concerted efforts must be made to minimize the silos that can significantly hamper our ability to contend with shrinking budgets, prolonged time from discovery...
to application, and further distance between science and policy, science and medicine, and science and education. A question that remains unanswered is whether SOT should expand cross-fertilization beyond the dissemination of information among different constituencies to also include the conceptualization and implementation of trans-disciplinary projects of societal concern. Such a paradigm would not only lead to significant changes in the way that science is carried out on a global scale, but also influence evolving structures within our scientific society, and the nature of the scientific dialogue within and outside the organization. In my view, a clear vision of how we implement cross-fertilization must be attained to minimize barriers internal and external to the organization, and to define the manner in which we guide the evolution of the field. We must determine how best to balance SOT’s efforts to promote a practitioner-oriented approach, with the enhancement of fundamental scientific foundations that bridge the gap between theory and practice, and that sustain the strategic alliances required to advance the state of the science of toxicology.
Food Safety (Toxicology for Everybody!)

by Joseph F. Borzelleca, Ph.D.; James C. Griffin, Ph.D., DABT, CBiol FIBiol; Ray A. Matulka, Ph.D.; and Kenneth A. Voss, Ph.D.

The Food Safety Specialty Section (FS3) of the Society of Toxicology (SOT) has a unique position within the panoply of SOT Specialty Sections (e.g., pharmaceutical, environmental, industrial) because each and every one of us must eat to survive. The availability of food and its lack of overt toxicity have been the concern of humans since the beginning of time “I do not live to eat, but eat to live” (Qniliarnus, c. 300 AD). All other basic drives: quest for knowledge, quest for companionship, quest for a Mediterranean cruise, or a house in the Hamptons—all grind to a halt without regular and safe nutrition. As stated by Mary F. K. Fisher circa 1950 “First we eat, then we do everything else.” Short of death by extreme exposure, nothing will shut down life as we know it as quickly and completely as the cessation of food intake. The importance of food was known throughout antiquity, as indicated by the statements “Let food be your medicine—and medicine your food” (Hippocrates circa 500 B.C.) and “Without proper diet, medicine is of no need” (Ayurvedic saying, circa Antiquity). This concept has not changed, as recently indicated by Meryl Streep “It’s bizarre that the produce manager is more important to my children’s health than the pediatrician.”

As food became more dependably available, a need for some control of purity/quality/safety developed. Food safety regulations followed and, with them, the regulators.

Judeo-Christian writings would have us believe that the first bona fide food safety regulation (a prohibition) occurred in the Garden where the Lord commanded that Adam and Eve avoid a certain food, “From that tree you shall not eat; the moment you eat from it you are surely doomed to die.” (Genesis 3:3).

Primitive humans determined which foods were safe by simply eating them, “trial and error”; if they lived, the food was safe; and if they died, the food was unsafe. Very straightforward experiment—no extrapolation necessary and no safety factors required—but costly, especially during the “puffer fish” phase. Man has been continually defining and redefining what is thought of as “edible,” which may be simply defined as “Good to eat, and wholesome to digest, as a worm to a toad, a toad to a snake, a snake to a pig, a pig to a man, and a man to a worm” (Ambrose Bierce, c. 1900). However, not everyone always agrees on the safety of all foods. “Everything I eat has been proved by some doctor or other to be a deadly poison, and everything I don’t eat has been proved to be indispensable for life. But I go marching on” (George Bernard Shaw, c. 1930).

The first major compilation of food safety regulations was the Kashrut, the Jewish dietary laws. Foods were divided into three classes: fleisig (meat), milchig (dairy), and parveh (everything else). These were kosher or clean (safe and in accordance with the law) or treif and unclean (unsafe and not in accordance with the law). The basis for this classification was the word of God, Yahweh. There are 677 regulations in Leviticus. These Mosaic regulations had to be obeyed even if not understood. “Even, therefore, if every Divine precept were a riddle to us and presented us with a thousand unsolved and insoluble problems, the obligatory character of the commandments would not in the slightest degree be impaired by this. Whatever command or prohibition of G-d it may be that prompts one to ask why one should do this and not do that, there is but one answer: Because it is the will of G-d...” Rabbi Samson Raphael Hirsch (Foreword to Horeb).

The Christian approach was simpler and also recognized the power of Yahweh/G-d. Paul instructed his fellow Christians thus: “So whether you eat or drink or whatever you do, do everything for the glory of God.” (1 Corinthians 10:31). God was the first regulator of food safety.
The first legal requirement for a label on food was the Assize of Bread and Ale (Assisa panis et cervisiae) in 1266 in England. Each food had to declare its owner and its point of origin. This resulted in regulatory licensing systems, with arbitrary recurring fees, and fines and punishments for lawbreakers. It is also interesting that the statute formed a basis of measurement that has residual units even to this day, often most noted in the foods we eat—ounces and pounds, cups and pints (“...defined the various units of measure, declaring that, by the consent of the whole realm of England, the measure of the king was made; that is to say: that an English penny, called a sterling round, and without any clipping, shall weigh thirty-two wheat corns in the midst of the ear...").

In his Report on Public Health and Sanitation, Lemuel Shattuck, in 1850, clearly identified adulteration of foods as a major public health problem. He further noted that the decline in life expectancy from 1810 to 1845 was due to adulteration of food.

Harvey Washington Wiley was the father of the Pure Food and Drug Act (1906), the initial and successful attempt by the U.S. government to regulate the safety of food and food ingredients through the U.S. Department of Agriculture. His interest in food safety can be traced to his years working at the Imperial Food Laboratory in Germany and his proficiency in studying sugar chemistry. His first published paper in 1881 focused on the adulteration of sugar with glucose. Dr. Wiley was appointed Chief of the U.S. Department of Agriculture’s Chemical Division, which eventually became the Bureau of Chemistry, where he did extensive work on food adulteration and food safety. His “Poison Squad” (BoC staff and Georgetown Medical College students) received “free food,” special meals prepared in the bureau’s kitchen with specific amounts of chemical additives (e.g., borax, boric acid, copper sulfate, potassium nitrate, saccharin, salicylic acid, sulfuric acid, formaldehyde). The Pure Food and Drug Act regulated the development and production of safe foods and drugs and culminated in the founding of the Food and Drug Administration. He published extensively on food preservatives, artificial colors, nutrition, and beverages. The most interesting title of Wiley’s is probably The History of a Crime Against the Food Law: The Amazing Story of the National Food and Drug Law Intended to Protect the Health of the People, Perverted to Protect Adulteration of Foods and Drugs (c. 1929).

The Federal Food Drug and Cosmetic Act, a subsequent more comprehensive set of regulations, was passed in 1938, and has been amended several times. The U.S. Food and Drug Administration was charged by the U.S. government to oversee compliance with the law, specifically with food ingredients. The U.S. Department of Agriculture, however oversees the farming, storage, and distribution of raw foods, meats and meat products, and dairy and dairy products.

Arnold Lehman is another toxicology pioneer with a strong influence in the world of food safety. Following World War II, there was a tremendous upsurge in the number and type of discrete food additives, such that by 1947, approximately 500 different chemicals were in use in food products. Dr. Lehman began the practice of sitting down with industry representatives to discuss safety testing criteria and the paradigm by which the nascent FDA would be able to render an opinion on the safe use of a specific ingredient. In 1949, as principal author, he released the Division of Food’s Procedures of the Appraisal of the Toxicity of Chemicals in Foods. He was instrumental in the passage of the 1958 Food Additives Amendment and 1960 Color Additives Amendment. Both amendments required premarket testing and more interestingly, forbade the approval of any substance shown to cause cancer (the “Delaney Clause”). Dr. Lehman cofounded the Society of Toxicology 50 years ago, and continued to be a champion for food safety in his prolific writing in journals such as Advances in Food Research, Journal of Nutrition and the Journal of the Association of Food and Drug Officials.

The toxicological evaluation of food ingredients has continued to grow extensively since the pioneering efforts of Wiley and Lehman. The FDA has codified the requisite testing, i.e., procedures and methods for determining the safety of food and color additives, in a guidance to industry. The FDA published its original guidelines in 1982 as the so-called Redbook (Toxicological Principles for the Safety Assessment of Direct Food Additives and Color Additives Used in Food). Updates have occurred over
the years, culminating in the issuance of a draft Redbook II in 1993. The definitive version now being used is simply referred to as Redbook 2000 (the year of release).

In short, the Redbook provides guidance to industry and other stakeholders (e.g., academia, other regulatory groups) regarding toxicological information submitted to the Center for Food Safety and Applied Nutrition (CFSAN), Office of Food Additive Safety, regarding food ingredients. It is a guidance document that is intended to assist petitioners and notifiers in:

➢ determining the need for toxicity studies
➢ designing, conducting, and reporting the results of toxicity studies
➢ conducting statistical analyses of data
➢ the review of histological data
➢ the submission of this information to the FDA as part of the safety assessment of food

The term “food ingredients,” as used in the Redbook and by CFSAN, includes food additives and color additives used in food, substances classified as food contact substances (formerly known as indirect food additives), and those substances classified as generally recognized as safe. The toxicity studies included in this guidance document can also be used in the safety assessment of constituent residues of ingredients.

The WHO FAO established a Joint Expert Committee on Food Additives (JECFA), which also published a set of guidelines patterned after those proposed by the FDA; these were accepted internationally through the supranational Codex Alimentarius Commission. An attempt for international harmonization in testing protocols resulted in the publication of the Organisation for Economic Co-operation and Development (OECD) Guidelines in 1993. These guidelines are recognized and accepted by regulatory agencies worldwide. Besides the Codex and JECFA activities, the Food Chemicals Codex has an almost a 50-year history of providing quality monographs, specifications, analytical test methods, appropriate acceptance criteria, and authenticated reference materials to determine the identity and purity of hundreds of food chemicals, food ingredients, functional food moieties, etc., that are in international commerce.

The evaluation of the safety of food ingredients was, and is still, the subject of much activity by members of the Society of Toxicology. Many of the early members and officers were actively involved in the safety assessment of food ingredients, including direct and indirect additives. The results of these studies appeared in Toxicology and Applied Pharmacology (TAAP), co-founded by food safety pioneer, Arnold Lehman. Because other professional societies would not recognize toxicology as a scientific discipline and would not publish results of safety studies, the Society of Toxicology was formed 50 years ago.

The Food Safety Specialty Section (FS3) is a group within the Society of Toxicology; it was formed in March 1993 to provide a forum for the interaction of toxicologists and other professionals involved in food safety. The purpose of this Specialty Section is to provide a vehicle where state-of-the-art research involving food safety and regulations can be communicated and to serve as a scientific resource for critical issues involving food safety.

Toxicology applied to food safety utilizes the methodology and experiences of the past to both analyze the potential toxicants that could currently be in the food and to look forward to develop those methodologies and assays that could be used to assess future issues that pose a toxicological concern. Although it is impossible to know what future toxicological issues will occur, there are already several indications of the unique issues that the future may bring.

Nanotechnology has already been introduced to several different commercial areas (e.g., textiles, electronics, automotives), and has even been introduced to food packaging applications. However, food toxicologists will soon be (if they aren’t already) analyzing the toxicology of nano-sized food ingredients, which could alter bioavailability, absorption properties, or increase sequestration in specific organs. Much is still unknown about what happens when nanoparticles are added to food.
Natural contaminants of fungal, bacterial, or other microbiological origin remain a challenging area for food toxicologists. The development of improved analytical methods, exposure biomarkers, and mechanism of action-based experimental models will fill “data gaps” and reduce uncertainty of safety and risk assessments. On a tangential front, food matrices have given rise to toxic moieties, such as acrylamide, which has generated significant scientific and lay press, not to mention control techniques, in recent years. Food contamination, usually biological in nature (think Salmonella, E. Coli, Listeria, etc.) and food adulteration (think melamine, diethylene glycol, leather waste protein, etc.) are past, present, and future challenges. Toxicological research also plays an important role in the development of cost-effective interventions to reduce exposures in vulnerable populations. These and other initiatives will contribute to better protecting consumer health while at the same time avoiding unnecessary restrictions in the food supply.

The future of food safety not only concerns what potential toxicants are on the horizon, but also how toxicology will be determined. Much of the biological sciences are moving to analyzing the effects of chemicals on enzymes, proteins, or segments of DNA or RNA, and toxicology is already moving in that direction, although most of the work is only in the development stage for toxicological applications on the regulatory aspects of food safety. As the understanding of the toxicological effects on different biological systems becomes more complete, the ability to study the toxicity through a dose- and time-dependent transition on relevant biochemical pathways will become better understood. This, in turn, will allow food toxicologists to differentiate from normal variability through adaptive response to a food ingredient or contaminant, to the formation of an actual toxicologically relevant adverse effect, all through the analysis of effects on DNA, RNA, and protein changes conducted in vitro.

The Food Safety Specialty Section can trace its formal roots back almost 20 years, but in reality the founding of this Society was by the strength of food safety pioneers. Food safety is of paramount importance to each and every one of us. Safe and nutritious food (and that goes for not too little and not too much) is a birthright and an absolute requirement for day-to-day survival. In this day of convoluted and globe-spanning raw material supply chains, year-round availabilities, heavily processed packaged convenience, and the complexities of balancing the right intake of the right foods, never has the analysis of food safety, food contamination, food adulteration, and food mismanagement been more important for SOT.
Why Become a Leader in the Society of Toxicology?

by Cheryl Lyn Walker, Ph.D., ATS

Should you consider seeking higher office in SOT? Will the effort and time you expend have a positive or negative (or both) impact on you and your profession? In the final analysis, will it be worth it?

Absolutely! The returns, both tangible and intangible, are many. Here are a few from my perspective as a Past President of the Society.

I. A golden opportunity to promote others to high-visibility advisory positions and elected offices.

The advice and council of leaders of professional societies are highly sought-after. Often this includes being asked for nominations to high-visibility advisory boards and national and international awards. During my tenure in the Presidential Chain of SOT, I had the opportunity to work with Council to nominate SOT members for appointments to (among others) Advisory Boards for several of the National Institutes of Health (NIH), the Food and Drug Administration (FDA), the Board of Scientific Councilors of the National Center for Environmental Health/Agency for Toxic Substances and Disease Registry (NECH/ATSDR), and the Science Advisory Committee on Alternative Toxicological Methods/National Toxicology Program (SACTM/NTP). This is in addition to the opportunity to promote other Society members for elected and appointed positions within the Society, as well as for the Society’s own prestigious awards. Would as many SOT member’s names been on the list of extramural nominations if the Society were not proactive in this regard?

II. Having an impact on your profession in many ways, both expected and surprising.

If you have ideas for new directions for your field, innovative ideas for how your Society can meet its goals, or just a vision of how things could be better (and who doesn’t?), this is your chance to make a difference! SOT has well-defined roles for each of their leadership positions, and a review of these will provide some insight into many of the avenues where you will have the opportunity (and expectation) to have an impact. For example, the first two years in the Presidential Chain carry the responsibility for first co-chairing, and then chairing, the Program Committee for the Annual Meeting. While the many organizational aspects of this responsibility can be reasonably anticipated, what in my experience was unanticipated were the many opportunities to interact with world-class scientists who were not (yet) members of the Society. For example, in the course of organizing the Annual Meeting, which at >6,000 attendees is a major scientific venue, I was privileged to interact with several Nobel Laureates on both a professional and personal level, opportunities that I could not have anticipated at the time I agreed to stand for election. Similar opportunities occurred in the course of building liaison relationships between SOT and key government organizations, including meetings with two FDA commissioners, the EPA administrator, and directors of several NIH Institutes. These thought leaders and policy-makers welcome input from their stakeholders, including the leadership of professional scientific societies such as ours. This type of access is difficult if not impossible to achieve as a single individual. However, as a
leader in the Society, you have opportunities to build relationships at the highest level, and in so doing, advance SOT's mission in areas of shared values with these organizations. For example, during my tenure in the Presidential Chain, SOT leadership worked closely for several years with the director of the NIH the Center for Scientific Review to help establish a grant review process that would ensure funding of the best possible research in the toxicological sciences. Similarly, we formed an SOT-NIEHS Liaison Group, which has worked closely with the Director of NIEHS to 1) enhance scientific discourse of complex scientific issues, 2) promote the shared goal of serving as a resource for scientific conferences, and 3) increase support for toxicological research, with the objective of promoting toxicology and environmental health research. In addition, the SOT-NIEHS Liaison Group recognizes our shared commitment to support training in the environmental health sciences, including toxicology, with a goal to explore new avenues to partner in training young investigators. This later goal is based on our shared value that the pipeline for researchers in the toxicological sciences must remain strong, and that these young investigators must be prepared for the challenges of toxicology research in the 21st century.

III. The opportunity to advocate for the value of your discipline.

Many societies, including SOT, have advocacy activities on Capitol Hill. As a leader of the Society, you will have the opportunity to promote both critical enabling (e.g., support for funding agencies) and sound regulatory legislation, and in so doing, have a positive impact on your discipline. A leadership position in SOT helps you accomplish this in many ways. We have had great success with congressional briefings on the Hill, such as on “Advances in Toxicity Testing to Inform Chemical Policy” and “Pharmaceuticals in the Drinking Water.” We have also increased recognition for legislators who strongly support science through our Congressional Science Leadership Award. This award, established during my tenure as President, has now recognized two outstanding legislators, Representatives David Wu (D-OR) and David Price (D-NC). Along with testimony at congressional hearings and one-on-one meetings with legislators and their staff, leaders of our Society can have a significant impact on important policy makers as advocates for your discipline.

So, how do you become a leader in the Society?

1. Become involved at the local and regional level. SOT has a strong culture of mentoring, with junior members actively sought out and given opportunities for leadership and recognition. This culture helps recharge the leadership pool and keep it invigorated, and has helped ensure diversity of SOT leadership. The many Regional Chapters, Specialty Sections, and Special Interest Groups do a remarkable job in this regard, with the majority having elected and appointed positions specifically for trainees, and in some instances, underrepresented minorities. In addition to our active and effective Postdoctoral Association (PDA), these and many other SOT activities reinforce the Society's culture of successful mentoring.

2. Obtain scientific recognition in your area of expertise. Scientific accomplishment is the first step to peer-recognition in a scientific society, and often leads to peer recommendations for high-visibility positions, such as advisory and committee appointments, and seminar and conference program invitations. These activities, combined with Society participation at the local/regional level (see above), develop name recognition by more senior Society leaders. Be aware that most societies (including SOT) provide their Nominating Committee with a list of members who have been active within the Society along with details of their elected and/or appointed responsibilities. Phrases such as “So-and-so did a great job on that Committee” or “So-and-so never showed up for the meetings” are often heard at the Nominating Committee when slates of candidates are determined. A strong track record of service to your society and name recognition in your field is a sure-fire combination for being considered for leadership roles in your society.

3. Run for elected positions: Win some, lose some, but stand for office! It is OK to ask yourself the question “Can I do it?”, but remember, your (more objective) colleagues think you can, or you would not be asked to run. I encourage you, when asked, to accept your Society’s nomination for elected office. Don’t be discouraged if you lose; many have stood for an elected office more...
than once, including many SOT Presidents. Leadership in the Society will offer an unmatched opportunity to promote the mission of our Society of “Creating a Safer and Healthier World by Advancing the Science of Toxicology,” and when your service is completed, to utilize your leadership experience to continue to make an impact inside and outside of SOT.
I want to dedicate this article to what I consider to be two of our most important operating principles: Our commitment to diversity, and our global strategy; and to one of the most important elements of our organizational structure in regards to these two principles: Special Interest Groups or SIGs.

Diversity has been a long-standing commitment of the Society of Toxicology. The diversity of our science is not surprising, given the multidisciplinary approaches that characterize toxicology. The diversity of our science is manifest in the breadth and depth of the scientific programs at our Annual Meetings. The diversity of our membership has always been cast as one of the major strengths of our Society. Besides the multidisciplinary nature of our science, and therefore our scientists already mentioned, our members represent different sectors of the professional community (e.g., academics, consulting, government, industry), as well as the full spectrum of the career development path.

The diversity of our membership also has a global perspective, and it is estimated that almost 15 percent of our membership (less than one in every seven members) represents regions of the world from outside the United States. This latter facet of our member’s diversity has proven to be a significant asset as we have set about fulfilling our mission: Creating a safer and healthier world by advancing the science of toxicology. Given this mission, as well as the global nature of the issues and opportunities confronting us, it was recognized that the SOT has a responsibility to think and act globally. When I joined Council in spring 2008 as a member of the Presidential track, I had the distinct pleasure of working with Denise Robinson Gravatt as co-Council liaisons with the Global Focus Group. Through the efforts of the Global Focus Group and Council, the Society developed a global strategy that can be framed in the context of supporting the following strategic objectives:

- Become a Global Forum for Novel Discoveries
- Strengthen Global Partnerships
- Increase Reliance of Global Decision Makers on Science
- Strengthen and Deepen Member Engagement to Address Global Needs

As our global strategy was being developed, it was recognized that many of our existing committees, task forces, and other structural elements could incorporate a global component into their own strategic thinking, and that there is an expectation that implementation of our global strategy could be carried out largely through existing structures.

As noted above, there are few elements of the structure of the SOT that so clearly fit at the intersection of our commitment to diversity, and of our need to think and act globally than the SIGs. The concept of a new type of “interest group” within the Society was first considered by Council in August 2004. Shortly thereafter, the Special Interest Group Task Force was created to develop a plan that would allow SOT to achieve its strategic goal of increasing the diversity and inclusiveness of the organization, particularly as it relates to forming groups of individuals within SOT with special interests in nonscience areas. At that time, José Manautou served as the Council Liaison of the SIG Task Force. In January 2005 it was noted that the SIGs wanted to have more than a networking function, and believed that they “could be an avenue for recruiting international members.” As such, very early in the formulation of the concept of SIGs, a role in our global strategy was being articulated. I had the great pleasure of replacing José as the Council Liaison for the SIG Task Force in Spring 2005 when I joined Council for the first time—an
effort that was made significantly easier because he agreed to continue to serve on the SIG Task Force as its Chair. Early in my association with the SIG Task Force, it became apparent that the Women in Toxicology (WIT) Specialty Section should be included in future discussions about the evolution of SOT’s SIGs. At that same time, it became apparent that Council needed to devise a plan “to distinguish the identity, purpose, and activities of SIGs from those of Specialty Sections and to clearly articulate that both types of groups are considered value-added elements to the Society.” The inclusion of WIT in the SIG discussions proved to be very fortuitous as the transition of WIT from Specialty Section to SIG could only be possible if their ability to continue to provide proposals for the Annual Meeting scientific program was maintained. This decision meant that all SIGs should have the ability to submit proposals to the Annual Meeting Scientific Program Committee. At the same time, it was recognized that it was important “to develop a structure for SIGs that is sustainable, and that is distinct from the Specialty Sections and Regional Chapters.” In August 2006 Council informed the SIG Task Force that it was their consensus that the by-laws of the SIGs “needed to become more consistent in their wording and their goals should be broadened to become more global in scope.”

Besides the WIT, the following associations were formally recognized as SOT SIGs in 2006: the Association of Scientists of Indian Origin (ASIOA), the Hispanic Organization for Toxicologists (HOT), and the Korean Toxicologists Association in America (KTAA). The American Association of Chinese in Toxicology (AACT) and the Toxicologists of African Origin (TAO) were formally recognized as SOT SIGs in 2007 and 2008, respectively. Within the by-laws of these SIGs are the following objectives:

- To develop, propose, and conduct programs and educational activities in toxicology with an emphasis on India;
- To stimulate new growth in toxicological issues related to the Hispanic community inside and outside the United States as it relates to the science of toxicology;
- To promote collaboration in toxicological research and relevant issues between the United States and Korea;
- To foster interactions among professionals of Chinese background and/or ethnicity in toxicological or related sciences through the exchange of information in education, technology, employment, or business opportunities; and
- To enhance the focus within SOT on environmental and public health issues relevant to populations of African origin.

Based on these objectives alone, it is not difficult to see the connection between the SIGs and SOT’s global strategy; representatives from the SIGs were active participants on the aforementioned Global Focus Group. Moreover, in July 2008 Council recognized that the SIGs were already bringing value to the SOT Global Strategy through their mentorship for new members, their networking functions, and their contribution of diversity to SOT’s scientific program topics. At that time, Council developed the following input to SIGs for their potential roles in our Global Strategy:

- Provide input to Council on needs assessment, outreach mechanisms, and strategy from their region/area of emphasis (e.g., key themes of interest and concern);
- Identify global health issues for our Annual Meeting;
- Translate existing SOT education/training, and other communication materials, and play a role in disseminating these materials; and
- Provide recommendations for awards, nominations, and appointments.

Council clearly recognized that SIGs are an important component of our global strategy. The SIGs have continued to play active roles in SOT’s Global Strategy Task Force (GSTF), which was convened in spring 2009 and are represented by the following members: Satheesh Anand (ASIO), Laura Andrews (WIT), Ji-Eun Lee (KTAA), Tony Ndifer (TAO), Benzabet Quintanilla (HOT), and Tao Wang (AACT). These individuals have joined the following previous members of the Global Focus Group: Silvia Barros, Kok Wah Hew, Ruth Roberts (Chair of the GSTF) and Denise Robinson Gravatt. I have the pleasure of serving as co-Council Contacts for the GSTF with Jon Cook.
The GSTF conducted a “brainstorming session” in January 2010 and identified a number of gaps in our global strategy, along with initiatives to address those gaps. In the context of our global strategic goal to Become a Global Forum, the GSTF recommended that venues were needed at our Annual Meeting to educate our members on global issues, and a time slot was dedicated for SIGs to highlight a global issue. For this same goal, SIGs were identified as a good resource to review Continuing Education (CE) courses and to select courses that would be of the most value for global distribution. In the context of our global strategic goal to strengthen global partnerships, SIGs were asked to assess optimal ways to partner with IUTOX and other key partner global scientific organizations. Specifically, SIG members were asked to consider their interest in championing the development of an implementation plan for travel fellowships for scientists from developing countries. The application of this plan could be managed, in part, by SIGs in partnership with IUTOX. SIGs could also play a role in exploring the concept of identifying “sister” universities in developed countries for developing countries, and in suggesting the development of a common core curriculum by leveraging CE basic courses. In the context of our global strategic goal to deepen member engagement to address global needs, SIGs were tasked with developing a survey questionnaire to share with their members to determine how to better serve the needs of non-U.S.-based members, why some SIG members are not members of the Society, and how the SOT could provide services to improve toxicological sciences throughout the world.

Council and the GSTF clearly recognize that SIGs provide access to an important, but limited component of our global audience. They are a component of our global outreach, but not the complete scope for that outreach. It is hoped that the SIGs will continue to expand the diversity of our Society, and will provide significant models on how we can expand our global outreach.
One of the Society’s true highlights is the annual SOT Awards Ceremony at the Annual Meeting, during which the Society recognizes outstanding achievement and contributions in fulfilling the Society mission of creating a safer and healthier world by advancing the science of toxicology.

From early on in the Society’s history, the need to establish a number of Society awards was recognized to advance the science of toxicology and its practitioners. Based on the recommendations of an ad hoc committee established in 1965 to recommend a suitable Society Award, two awards were established.

**Society of Toxicology Achievement Award**

This award may be made to a person during the first decade of his/her career for meritorious contribution to the science of toxicology.

**Society of Toxicology Merit Award**

This award may be made in recognition of a career of outstanding merit in the profession, or of noteworthy contributions, to the science of toxicology.

Guidelines for the procedure to nominate candidates for either of the awards were published in the Society newsletter in September 1965 and an Awards Committee was appointed to consider potential recipients of these first awards. The chairman of the committee and two additional members were appointed by the President of the Society from members of the Council.

Just as the SOT Awards program has decidedly grown over the decades, so too has the Awards Committee. Presently, the Awards Committee consists of seven voting members elected from the membership, including a Committee Chair, currently Harold Zenick in 2010–11. The Awards Committee reviews all nominations and applications for awards that the Council has designated it to confer. It is the trusted duty of the Awards Committee to select the recipient or recipients for each such award and notify Council of its decision. The great increase in the number of awards attests to the value placed on them by the membership as well as interested sponsors.

Since the first recipient of the Merit Award, Henry F. Smyth, Jr., was recognized at the traditional SOT banquet held on Tuesday evening, March 8, 1966, there have been dozens of distinguished recipients of these first SOT awards and hundreds of recipients of many more SOT Awards. A complete listing of awards administered by the SOT Awards Committee administered may be found on the SOT Web site as well as in the Annual Meeting Program and the SOT Membership Directory. It is testimony to the number and quality of awards as well as all the distinguished recipients that there are far too many to include here in this brief history.

**Committee note:** in 1966, the Achievement Award was not given since all of the nominees were past the first decade of their professional career; in 1967, Arnold J. Lehman was the recipient of the Merit Award and Gabriel L. Plaa was the first recipient of the Achievement Award. Contents of this brief history were liberally excerpted from *Society of Toxicology History 1961–1986* by Harry W. Hays, Ph.D.

**SOT Awards Committee 2010–2011:**

**Chair:** Harold Zenick, U.S. EPA

**Members:**

Robert E. Chapin, Pfizer Global Research and Development

Lori A. Dostal, Exponent Inc.

Jay I. Goodman, Michigan State University

Douglas A. Keller, sanofi-aventis

Serrine S. Lau, University of Arizona

Ruth A. Roberts, AstraZeneca UK

**Council Contact:** William Slikker, Jr., U.S. FDA-NCTR
The Society has always placed a high priority on professional networking and relationship building within the community of toxicologists and related scientists. In the infancy of the Society, when membership numbered in the hundreds rather than the thousands of today, networking that opened doors to the leaders of the field, cultivated collaborations, and launched careers was entirely informal.

In 1970, the SOT took steps to define our professional advancement structure and gave it official status with the establishment of the Placement Committee, which has evolved into the multi-dimensional Career Resource and Development Committee (CRAD), renamed in 2004 to reflect its expanded mission.

I first became active in SOT leadership through my involvement as a volunteer with the Placement Committee. I can attest to the fact that the careers of many hundreds of scientists were made within the hallowed halls of the Placement Center. In the early days, the tools were primitive by standards of today—envelopes and 3x5 cards, binders of CVs, push pins, bulletin boards, and heavily subscribed meeting cubicles. The operation was decidedly low-tech, and lines often extended out the door and far into the hallway. Despite these challenges, the Placement Center offered needed information about candidates and featured a high concentration of relevant employment opportunities in a single place; this one-stop shopping center for toxicology was incomparable. The leadership of the Society was careful to locate the Placement Center in a semi-private area for confidentiality and was pleased to see that these rooms became key gathering areas at SOT Annual Meetings.

My early involvement with the Placement Committee was formative. I met stellar SOT Members who were instrumental in encouraging me, in allowing me to develop, and in nurturing my progress through the ranks of the Society.

At the 47th SOT Annual Meeting in Seattle, Washington, in 2008, the Placement Rooms were renamed the Annual Meeting Job Bank and became fully electronic. Today, most of what once took up a considerable expanse of a Convention Center or a conveniently located nearby hotel is available from your laptop. What remains are the interview rooms for face-to-face meetings. Many employers continue to say that the Job Bank is exceptionally cost-effective for identifying and hiring the best new recruits.

The CRAD Committee also has had a significant impact on the development of the Annual Meeting program. Historically, this group planned a single career seminar for each Annual Meeting on late Monday afternoon. Now, the committee is a leader in submissions and endorsements of informational sessions focusing on professional development across all stages, from early career to senior leadership.

The CRAD Committee is now charged with a number of forward-looking activities that will help to “Build for the Future of Toxicology” by:

- Identifying future training needs;
- Conducting and publishing surveys that identify future employment trends in toxicology; and
- Identifying the needs of the unemployed, self-employed, and retired, and developing programs to meet those needs.
The Career Resource and Development Committee stands as a unique and deeply valued resource that excels in assisting our members to reach their professional aspirations. It is difficult to estimate the enormity of the impact that this committee has had on our members and on our profession. It has made a difference for countless scientists and their families, for an impressive array of employers, for the products and services that rely upon the science and art of toxicology, and finally for the health and safety of humans, animals, and the environment. CRAD has earned our congratulations and gratitude for helping to shape a much brighter future.
The Society’s 5th Strategic Priority: Increase Organizational Effectiveness

by Shawn D. Lamb

Other contributors to the 50th anniversary history book have commented on the development of the science of toxicology, the broadening of the scientific scope of SOT, and the scientific implications of Council decisions to move forward in one strategic direction or another. As someone who has had the privilege of working with SOT for 20 years, 17 as Executive Director, I would like to reflect on SOT, the association, and its growth and maturation as an effective organization.

Merriam Webster defines an association as “an organization of persons having a common interest.” Wikipedia (as of the date of this writing) states that an association is “a group of individuals who voluntarily enter into an agreement to accomplish a purpose.” Certainly the founders who assembled on March 4, 1961, had a shared interest in furthering the science of toxicology and a desire to provide a focused forum for toxicologists to discuss their work.

In the book, Leadership: Strategies for Organizational Effectiveness,1 James Cribbin describes the lifecycle of an association, with each stage marked by distinctive characteristics. During the last 50 years, SOT has moved successfully through many of the organizational stages, from the precariousness of Conception to the maturity of Adulthood.

Conception
A group of people see an advantage to voluntarily coming together to start an association.1

In addition to the scientific and strategic challenges the Society faced at its inception, there was the more practical challenge of how to operate. The nine founders handily solved this by contributing $5 each and rolling up their sleeves. The group elected officers and councilors, and set about forming an association. They sent personalized letters to several hundred scientists who were thought to have a particular interest in toxicology, numerous calls were made to arrange organizational meetings, supplies were purchased, etc. At its first Annual Meeting, the Society adopted a name, approved a constitution and by-laws, held elections, defined qualifications for membership, appointed committees, and affiliated with the Academic Press journal, Toxicology and Applied Pharmacology (TAAP). Quite impressive!

In 1962, SOT had 180 charter members and reserves of $1,500. The Annual Meeting had 72 attendees.

Infancy
The founders are still in charge as the organization struggles to survive. Every job requires more work than the founders can do.1

After the very successful start, there were a number of organizational challenges still to be considered, as were pointed out in the Society of Toxicology History 1961–1986.2 In the year following the 1963 official incorporation of SOT, the Society developed a newsletter and held its first independent Annual Meeting. From 1964 to 1975 membership criteria were debated and updated, by-laws were changed annually, journal production backlogs grew and were reduced, the Society struggled with difficulties with mail lists and collection of dues, and the number of committees increased to accommodate a growing workload. As the Society grew, an all-volunteer organization became harder to manage. Keeping SOT running required more and more time and seemed overly ambitious even with over 10 percent of the membership participating in the affairs of the Society. The 1975–76 Council decided that an Executive Secretary “was needed to cope with the ever-increasing volume of business to be dealt with by the officers and committees.”
In 1976, SOT had more than 800 members and $61,000 in reserves. The Annual Meeting had over 900 registrants and 240 abstracts.

In 1976, SOT signed a contract with the American Industrial Hygiene Association (AIHA) in Akron, Ohio, for William McCormick to serve as Executive Secretary with duties that included maintaining a master file of member names and addresses, printing the Annual Meeting Program, corresponding with members on abstracts, ballots, and dues, as well as assisting the secretary and registrar with the Annual Meeting. In the same year, an outside firm was hired to develop and manage an exhibit program for the Annual Meeting. An Editorial Assistant had been hired previously to relieve the TAAP editors and associate editors of some of the routine and time consuming tasks of putting the manuscripts in final order for publication.

**Puberty**

The organization grows steadily, but suffers awkwardness in its dealings with outsiders and with internal coordination. Entrepreneurial skills are gradually replaced by more professional management techniques and skills. ¹

Without a focus on pure survival and administration, the 1978–79 Council began a tradition of long-range planning that continues today. To keep the Society’s momentum of achievement on a steady course, subcommittees and commissions were appointed to “assess the responsibilities of the Society in view of the rapidly changing environment in which it operates and to determine how the Society could operate more effectively.” Over the next few years, the recommendations of these groups resulted in significant contributions to the Society and science. Specialty Sections, Regional Chapters, Fundamental and Applied Toxicology (FAAT), government liaison relationships, the American Board of Toxicology, the International Union of Toxicology, and Toxicology Laboratory Accreditation, Inc., were initiated, to name a few.

When William McCormick retired in 1983 he was replaced by Joseph R. Wasdowich and, after many years of discussion, the Council decided to create an official headquarters office. A number of association management firms were interviewed and in 1985 the International Management Group (IMG), in Washington, D.C., was selected. Joan Cassedy, Chairman of IMG, was named Executive Secretary. By utilizing the services of a management group, the Society purchased hourly services from professional meeting planners, exhibit managers, graphic designers, accountants, and administrators, without needing to hire each staff person on a full-time basis.

Professional management techniques resulted in an electronic member database that allowed for search and retrieval of information, a computerized job placement service, and an automated registration process. The printed promotional pieces were enhanced to give the Society a more polished look. Many advances followed; however the organization still lacked a strong operational structure. Following the 1990 Annual Meeting, the SOT Council called for formal procedures for meeting, administrative, and financial management.

In 1990, the Society had over 3,000 members and reserves of over $300,000. The Annual Meeting had 3,238 registrants, more than 1,400 abstracts, and 140 exhibit booths.

**Young Adulthood**

Accepted management practices are implemented including formalized personnel practices. The beginnings of bureaucracy and internal politics are evident. ¹

In the next years, timelines, policies, and procedures were instituted for all functional areas. At first, the task was to hold steady, initiate no new projects, execute only critical tasks, and attempt to accurately predict income and expenses, while at the same time setting standard operating procedures.

In 1992, the Council participated in a facilitated long-range planning retreat that mapped the direction of the Society for the next 5 years. The extended planning horizon allowed SOT to avoid costly mid-term changes in priorities. The Society’s finances improved and the five-year trend in which expenditures exceeded income (for most years) was reversed. Cash reserves once again returned to the target level of 50% of operating expenses.
In 1993, the Society’s management company, IMG, entered into a joint venture and moved to Reston, Virginia, with the newly formed management company called Association Development Group (ADG). Most of the IMG staff transitioned to ADG; however, soon after the move Joan Cassedy unexpectedly left the organization and Shawn Lamb became Acting Executive Secretary. Following a search and evaluation of management options, in 1994 the Council entered into a rolling three-year contract with ADG, with Shawn Lamb as Executive Director (the new name for the Executive Secretary as a result of a by-laws change).

The Council continued to review and revise its strategy for the Society—trying multiple methods to “live” the planning documents rather than allowing them to sit on a shelf. In 1995, SOT entered the electronic age with the acquisition of e-mail capability, a homepage on the World Wide Web, and continued efforts to enhance member communication, including through electronic media. Council adopted official financial and investment policies, and restructured and renamed the Society owned journal, from Fundamental and Applied Toxicology to Toxicological Sciences, in order to more fully reflect a journal intended to publish the top papers in all aspects of toxicology.

In 1999, changes in ownership and infrastructure at the management company required a reassessment of management options. SOT leaders felt that the Society was prospering while peer associations were struggling and Council credited this to the fact that, with a strong management company focused on operations and personnel management, Council members were able to concentrate on science and strategies. Discussions resulted in the creation of the new management firm Association Innovation and Management (AIM), led by Executive Director Shawn Lamb that would exist to manage SOT and societies with common interests. Twelve employees became owners in the new company and today, six of the founders continue their partnership with SOT.

With no operational and management responsibilities and with a management company co-dedicated to the mission of the Society, the Council has been able to focus on the “strategy of growth” while the headquarters office manages the “business of associations.” As noted by other authors in this book, in the years between 2000 and 2011, the number of Society initiatives has multiplied. The Council’s strategic decisions are made from a knowledge base that includes information about member needs, the strategic position of the organization, and current and anticipated external conditions. Efforts have been put in place to expand the borders of toxicology, increasing member diversity in every way, building communities for small group interaction, while increasing opportunities for cross-pollination and cooperation. Outreach efforts have been expanded and the SOT Annual Meeting and journal are the leading global venues for discussing and publishing toxicological information.

A strong and stable staff has helped to enhance growth and permit more effective service to members. The staff management team determines costs of effective action on strategies, secures approval for administrative costs and/or action plans, and implements the approved programs in a timely and efficient manner. The management team draws upon a wealth of resources regarding association trends to ensure SOT is well informed and current with best practices. Improved tools continue to be implemented to address member needs. The association management company offers continuous updates to technology solutions, including web-based databases, encrypted servers, state-of-the-art e-commerce and e-marketing solutions, and a private and secure social networking platform, ToXchange.

In 2011, the 50th Anniversary of the conception of SOT, the Society has 6,700 members and reserves in excess of $12 million dollars. The Annual Meeting has an expected attendance of more than 7,000, with over 3,000 abstracts and over 500 exhibit booths.

In 1999, the Society had 4,958 members and reserves of over $3,600,000. The Annual Meeting had 5,039 attendees, 1,968 abstracts, and 289 exhibit booths.
What’s next? Anyone counting realizes that there are three additional stages in the organization lifecycle: Late Adulthood, Old Age and Revitalization/Obscurity/Dissolution. As is often pointed out to executives at the American Society of Association Executives (ASAE) leadership meetings, Adulthood is the hardest period of the association’s life cycle and care must be taken to assess the changing environment constantly, evolving to stay relevant. With the SOT Council committed to working strategically, as evidenced by the Society’s 5th Priority: “Increasing Organizational Effectiveness,” I have no doubt that the group of excellent and dedicated scientists who make up SOT will continue to create a safer and healthier world through the science of toxicology.

3. AIM leadership: Shawn Lamb, President; Clarissa Russell Wilson, Executive Vice President; Debbie O’Keefe, Treasurer; Directors: Betty Eidemiller, Veronica Fisher, and Tonia Masson; with Sue Pitsch joining in 2002.
Society of Toxicology 50th Anniversary Book

2005 Award Ceremony

Tao Wang, Ireen Abraham, and Karen Steimnetz

1997 Registration

Kim Boekelheide

Dan Acosta, Marion Ehrich, and Don Reed

MaryJane Selgrade

1996 New Orleans Poster Session

Jacque Smith and Jerry Hook

Susan Henwood

Ken Ramos

Lori Dostal
Toxicology Training Centers
Building the Foundation for Toxicology: Toxicology Training Centers

The famous Greek philosopher Socrates once said, “The direction in which education starts a man will determine his future in life.” From the beginning, toxicology training centers have played an important role in helping young and eager students forge their way to selecting toxicology as their career of choice. These centers have offered students the opportunity to conduct research, and work with dedicated and respected scientists who have spent their lives in this diverse and complex field of work.

The following is a listing of academic programs here in the United States and abroad for which articles have been submitted as part of the Society of Toxicology’s 50th Anniversary. These articles include historical and current information about the institutions that have influenced and enriched our history and appear on the SOT Web site at www.toxicology.org. Although the listing is not be complete, it represents an accounting of those institutions of higher learning that have helped transform students into the scientists and researchers who make up this scientific discipline.

A

Ain-Shams University
Cairo, Egypt

Alexandria University
Alexandria, Egypt

Arizona, University of
Center for Toxicology
Tucson, Arizona
Author: A. Jay Gandolfi

Arkansas for Medical Sciences, University of
Interdisciplinary Toxicology Program
Little Rock, Arkansas
Author: Donald E. McMillan

Azabu University
School of Veterinary Medicine
Kanagawa, Japan

B

Boston University
School of Public Health
Department of Environmental Health
Boston, Massachusetts
Authors: Jennifer J. Schlezinger, Thomas F. Webster

Brown University
Department of Pathology and Laboratory Medicine
Providence, Rhode Island
Authors: Kim Boekelheide, Agnes B. Kane

Buffalo, University of
Department of Pharmacology and Toxicology
Buffalo, New York
Author: Sara S. Goodman

C

Cairo University
Cairo, Egypt
Author: Sameeh A. Mansour

California, Berkeley, University of
School of Public Health
Departments of Nutritional Science and Toxicology, Chemistry, and Engineering
Berkeley, California
Author: Leonard F. Bjeldanes

California, Davis, University of
Department of Environmental Toxicology
Davis, California
Author: Alan R. Buckpitt

California, Los Angeles, University of
Interdepartmental Doctoral Program in Molecular Toxicology
Los Angeles, California

Chiba University
Graduate School of Pharmaceutical Sciences
Chiba-shi, Japan
Author: Tetsuo Satoh

Chicago, University of
Toxicity Laboratory
Chicago, Illinois

Cincinnati, University of
Kettering Laboratory of Applied Physiology
Cincinnati, Ohio
Authors: Elizabeth Kopras, Howard G. Shertzer
Clemson University
Institute of Environmental Toxicology
Pendleton, South Carolina
Author: Stephen J. Klaine

Columbia University
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Authors: David W. Hein, L. C. Noite, William J. Waddell

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Cairo, Egypt

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Madison, Wisconsin  
Authors: Colin E. Jefcoate, B. A. Lewis, M. D. Marohl, Richard E. Peterson
Photo Gallery IV

The First Fifty Years in Photos

SOT 50
2002–2003 Council, Salt Lake City, UT

2009 Annual Meeting, Baltimore, MD

2007 Board of Publications Award for the Best Papers in Toxicological Sciences Winners
Photo Gallery IV

Gary Carlson and Rory Conolly

Council at Work, 2003 Annual Meeting, Salt Lake City, UT

Exhibit Hall at the 2002 Annual Meeting, Nashville, TN

Jayne Mackta and Elaine Faustman

Dan Acosta

Cheryl L. Walker and Ken Ramos

Past Presidents at the 2004 Annual Meeting, Baltimore, MD

Mary Dereski

2009–2010 Council, 2010 Annual Meeting, Salt Lake City, UT

Bob Scala
25th Anniversary Banquet, 1986 Annual Meeting, New Orleans, LA

2010 Annual Meeting, Salt Lake City, UT

Pfizer Undergraduate Award Recipients, 2009 Annual Meeting, Baltimore, MD

Poster Session at the 2010 Annual Meeting, Salt Lake City, UT

Past Presidents at the 25th Anniversary Annual Meeting, New Orleans, LA

Meryl Karol
Xiaoling Zhang


Rudy Jaeger

Michael Holsapple

Curt Klaassen and Lois Lehman-McKeeman

Parcelsus K-12 Outreach Program at the 2003 Annual Meeting, Salt Lake City, UT

K-12 Program, 2003 Annual Meeting, Nashville, TN
Photo Gallery IV

Exhibit Hall at the 2009 Annual Meeting, Baltimore, MD

Jim Gibson, Glenn Sipes, and Ernie Hodgson

Betina Low

Emil Pfitzer and Gabbie Plaa

Melissa Barhoover

Paracelsus Outside the Classroom at Port Discovery Children’s Museum in Baltimore, 2009

Mike Gallo

Mary Jo Vodicznik Walker

Brinda Mahadevan

Peter Bui
2003 Specialty Section Presidents and Officers Meeting, Salt Lake City, UT

Vernon Walker and Helmut Zarbl


Jim Luyendyk, Joan Tarloff, Dennis Paustenbach

Alexander Buerkle, Silvia Barros, Torbjoun Malmfors, and Birgitta Lewander

Past Presidents at the 1999 Annual Meeting, New Orleans, LA

HOT SIG at 2010 Annual Meeting in Salt Lake City, UT

Carol Kimmel and Jim Bus
The Founding of the Society

On Saturday, March 4, 1961, a small group met in Washington, D.C., to talk about the need for providing a forum where toxicologists could meet and share their research findings. By the end of their day-long meeting the Founders had concluded that the advantages of forming a society outweighed the disadvantages. They had even suggested a name, “The Society of Toxicology” and it was to be an international learned society drawing together persons trained in the various disciplines related to toxicology.

The follow-up work from this organizational meeting required preparation of a draft constitution, by-laws, scheduling presentations at upcoming scientific meetings, and notifying key people in the field of their plans. To finance all this, each attendee at the first meeting contributed $5 to the treasury. Accordingly, the Society of Toxicology was launched with assets of $35.

The First Annual Meeting of the Society of Toxicology was held in Atlantic City, New Jersey, on April 15, 1962. There were 180 Charter members and 3 Honorary members by that time.

This meeting followed organizational meetings in Atlantic City, New Jersey (FASEB), Detroit, Michigan (AIHA), Meriden, New Hampshire (Gordon Conference), and Rochester, New York (ASPET).

The Founding

Society of Toxicology Founders

Top Row (from left): Paul Larson, Medical College of Virginia; C. Boyd Shaffer, American Cyanamid; Victor A. Drill, G.D. Searle & Company; Frederick Coulston, Sterling Winthrop Institute; Kenneth DuBois, University of Chicago. Seated (from left): Harry W. Hays, National Academy of Sciences-National Research Council; Harold C. Hodge, University of Rochester School of Medicine; Arnold J. Lehman, Food and Drug Administration; and William B. Deichmann, University of Miami School of Medicine.

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Regional Chapter Year Founded

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<td>1983</td>
<td>South Central</td>
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<td>1984</td>
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<td>Lake Ontario</td>
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Specialty Section Year Founded

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<td>1981</td>
<td>Metals</td>
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<td>Reproductive and Developmental Toxicology</td>
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<td>1982</td>
<td>Inhalation and Respiratory</td>
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<td>Risk Assessment</td>
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<td>1991</td>
<td>Food Safety</td>
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<td>1992</td>
<td>Regulatory and Safety Evaluation</td>
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<td>In Vitro and Alternative Methods</td>
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<td>Occupational and Public Health</td>
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<td>Comparative and Veterinary</td>
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<td>Biological Modeling</td>
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<td>Toxicologic and Exploratory Pathology</td>
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<td>Dermal Toxicology</td>
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<td>2004</td>
<td>Ethical, Legal, and Social Issues</td>
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<td>2005</td>
<td>Drug Discovery Toxicology</td>
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<td>Mixtures</td>
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<td>Stem Cells</td>
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Special Interest Group Year Founded

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<tr>
<td>2001</td>
<td>Women in Toxicology (founded as a Specialty Section)</td>
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<td>2006</td>
<td>American Association of Chinese in Toxicology</td>
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<td>2006</td>
<td>Association of Scientists of Indian Origin</td>
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<td>2006</td>
<td>Hispanic Organization of Toxicologists</td>
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<td>2006</td>
<td>Korean Toxicologists Association of America</td>
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<tr>
<td>2008</td>
<td>Toxicologists of African Origin</td>
</tr>
</tbody>
</table>
Fifty Years of Outstanding Leadership

1961 1962
Harold C. Hodge C. Boyd Shaffer

1962 1963
1963 1964
Paul S. Larson Harry W. Hays

1964 1965
1965 1966
Frederick Coulston

1966

1971 1972
Wayland J. Hayes, Jr. Victor A. Drill

1972 1973
1973 1974
Joseph F. Borzelleca Sheldon D. Murphy

1974 1975
1975 1976
Seymour L. Friess

1976

1981 1982
Robert B. Forney Robert L. Dixon

1982 1983
1983 1984
Gabriel L. Plaa Frederick W. Oehme

1984 1985
1985 1986
Emil A. Pfitzer

1986

1991 1992
Donald J. Reed John L. Emmerson

1992 1993
1993 1994
I. Glenn Sipes Marion F. Ehrich

1994 1995
1995 1996
Meryl H. Karol Jack H. Dean

1996

2001 2002
David L. Eaton William F. Greenlee

2002 2003
2003 2004
2004 2005
2005 2006
Linda S. Birnbaum Kendall B. Wallace

Celebrating Fifty Years of Service to the
SOT Presidents 1961–2011

1966 1967
Verald K. Rowe

John A. Zapp, Jr.

1968 1969
Carrol S. Weil

Ted A. Loomis

1970 1971
Robert L. Roudabush

1976 1977
Robert A. Scala

1977 1978
Harold M. Peck

Leon Golberg

1979 1980
Tom S. Miya

Perry J. Gehring

1986 1987
John Doull

1987 1988
Jerry B. Hook

James E. Gibson

1989
Roger O. McClellan

Curtis D. Klaassen

1996 1997
James S. Bus

1997 1998
R. Michael McClain

Steven D. Cohen

1999 2000
Jay I. Goodman

Daniel Acosta, Jr.

2006 2007
James A. Popp

2007 2008
George B. Corcoran

2008 2009
Kenneth S. Ramos

Cheryl Lyn Walker

2010 2011
Michael P. Holsapple

Science and Profession of Toxicology
# Fifty Years of Strong Leadership


<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Harold C. Hodge, P</td>
<td>Carrol C. Weil, P</td>
<td>Wayland J. Hayes, Jr., P</td>
<td>Robert A. Scala, P</td>
<td>Robert B. Forney, P</td>
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<tr>
<td>Harry W. Hays, S</td>
<td>Donald L. McCollister, T</td>
<td>Robert A. Scala, S</td>
<td>Gale C. Boxill, S</td>
<td>Gabriel L. Plaa, VP-E</td>
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<tr>
<td>William B. Deichmann, T</td>
<td>Robert L. Roudabush, T</td>
<td>Donald L. McCollister, T</td>
<td>Hans P. Drobeck, T</td>
<td>J. Wesley Clayton, Jr., S</td>
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<tr>
<td>Arnold J. Lehman, Hon P</td>
<td>Frederick Coulston, PP</td>
<td>Robert L. Roudabush, PP</td>
<td>Seymour L. Friess, PP</td>
<td>Richard Stefan Waritz, T</td>
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<tr>
<td>Frederick Coulston, C</td>
<td>Earl H. Dearborn, C</td>
<td>Joseph F. Botzelleca, C</td>
<td>Robert L. Dixon, C</td>
<td>Perry J. Gehring, PP</td>
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<tr>
<td>C. Boyd Shaffer, C</td>
<td>Horace W. Gerarde, C</td>
<td>Kenneth P. DuBois, C</td>
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<tr>
<td>Paul S. Larson, C</td>
<td>David W. Fassett, C</td>
<td>John P. Frawley, C</td>
<td>Tom S. Miya, C</td>
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<tr>
<td>C. Boyd Shaffer, C</td>
<td>Herbert E. Stokinger, C</td>
<td>Leon D. Golberg, C</td>
<td>Frederick W. Oehme, C</td>
<td>Ian C. Munro, C</td>
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<td>Orville E. Paynter, C</td>
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<td>Arnold J. Lehman, C</td>
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<td>Edward D. Palmer, C</td>
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<td>Bernard L. Oser, C</td>
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<td>Frederick W. Oehme, P</td>
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<td>Frederick Coulston, P-E</td>
<td>Robert L. Roudabush, P</td>
<td>Seymour L. Friess, P</td>
<td>Perry J. Gehring, P-E</td>
<td>Emil A. Pittser, P</td>
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<td>Carrol S. Weil, S</td>
<td>Robert A. Scala, P</td>
<td>Joseph L. Friess, P-E</td>
<td>J. Wesley Clayton, Jr., S</td>
<td>Jerry B. Hook, VP-E</td>
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<td>Joseph F. Botzelleca, S</td>
<td>Robert A. Scala, S</td>
<td>Robert B. Forney, P-E</td>
<td>I. Glenn Sipes, S</td>
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<td>Hans P. Drobeck, T</td>
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P—President
P-E—President-Elect (1962–1980)
VP—Vice President (1961; 1981–Present)
VP-E—Vice President-Elect (1981–Present)
P-E—President-Elect
T—Treasurer
T-E—Treasurer-Elect
S—Secretary
S-E—Secretary-Elect
Hon P—Honorary President (1961)
PP—Past President
C—Councillor
SOT Council 1961–2011

1986–1987
John Doull, P
Jerry B. Hook, VP
James E. Gibson, VP-E
I. Glenn Sipes, S
Gary L. Lage, T
Emil A. Pfitter, PP
Michael A. Gallo, C
Curtis D. Klaassen, PP
John A. Thomas, C
Chris F. Wilkinson, C

1987–1988
Jerry B. Hook, P
James E. Gibson, VP
Roger O. McClellan, VP-E
Steven D. Cohen, S
Gary L. Lage, T
John Doull, PP
John L. Emmerson, C
Michael A. Gallo, C
I. Glenn Sipes, C
Chris F. Wilkinson, C

1988–1989
James E. Gibson, P
Roger O. McClellan, VP
Curtis D. Klaassen, VP-E
Steven D. Cohen, S
Gary L. Lage, T
Jerry B. Hook, PP
Jack H. Dean, C
John L. Emmerson, C
Meryl H. Karol, C
I. Glenn Sipes, C

1989–1990
Roger O. McClellan, P
Curtis D. Klaassen, VP-E
Donald J. Reed, VP-E
Florence K. Kinoshita, S
James S. Bus, T
Jack H. Dean, C
Meryl H. Karol, C
John A. Moore, C
Philip G. Watanabe, C

1990–1991
Curtis D. Klaassen, P
Donald J. Reed, VP
John L. Emmerson, VP-E
Florence K. Kinoshita, S
James S. Bus, T
Michael McClain, T-E
Roger O. McClellan, PP
John A. Moore, C
Mary Jo Walker, C
Philip G. Watanabe, C
James S. Woods, C

1991–1992
Donald J. Reed, P
John L. Emmerson, VP
I. Glenn Sipes, VP-E
Florence K. Kinoshita, S
Marion F. Ehrich, S-E
Michael McClain, T
Curtis D. Klaassen, PP
James S. Bus, C
John G. Dent, C
Mary Jo Walker, C
James S. Woods, C

1992–1993
John L. Emmerson, P
I. Glenn Sipes, VP
Meryl H. Karol, VP-E
Marion F. Ehrich, S
Michael McClain, T
Judith A. MacGregor, T-E
Donald J. Reed, PP
Daniel Acosta, Jr., C
John G. Dent, C
Robert A. Rout, C
Hanspeter R. Witschi, C

1993–1994
I. Glenn Sipes, VP
Meryl H. Karol, VP
Jack H. Dean, VP-E
Marion F. Ehrich, S
Jay L. Goodman, S-E
Judith A. MacGregor, T-E
John L. Emmerson, PP
Daniel Acosta, Jr., C
William F. Greenlee, C
Robert A. Rout, C
Hanspeter R. Witschi, C

1994–1995
Meryl H. Karol, P
Jack H. Dean, VP-E
James S. Bus, VP-E
Jay L. Goodman, S
Judith A. MacGregor, T
Mary E. Davis, T-E
I. Glenn Sipes, PP
William F. Greenlee, C
Debra L. Laskin, C
Robert A. Rout, C
James A. Swenberg, C

1995–1996
Jack H. Dean, P
James S. Bus, VP
Michael McClain, VP-E
Jay L. Goodman, S
David L. Eaton, S-E
Mary E. Davis, T
Meryl H. Karol, PP
Carole A. Kimmel, C
Debra L. Laskin, C
H. B. Skip Matthews, C
James A. Swenberg, C

1996–1997
James S. Bus, P
Michael McClain, VP
Steven D. Cohen, VP-E
David L. Eaton, S
Mary Jo Walker, T-E
Jack H. Dean, PP
Linda S. Birnbaum, C
Robert A. Rout, C
Raymond F. Novak, C

1997–1998
Michael McClain, P
Steven D. Cohen, VP-E
Jay L. Goodman, VP-E
David L. Eaton, S
A. Jay Gandolfi, S-E
Mary Jo Walker, T-E
James S. Bus, PP
Linda S. Birnbaum, C
Robin S. Goldstein, C
Raymond F. Novak, C
Stephen H. Safe, C

1998–1999
Steven D. Cohen, P
Jay L. Goodman, VP-E
David Acosta, Jr., PP
A. Jay Gandolfi, S
Janet E. Chambers, S-E
Jach L. Walker, T-E
Michael McClain, PP
Robin S. Goldstein, C
Nancy L. Kerckvliet, C
James A. Popp, C
Stephen H. Safe, C

1999–2000
Jay L. Goodman, P
David Acosta, Jr., VP
David L. Eaton, VP-E
A. Jay Gandolfi, S
Kendall B. Wallace, S-E
Jach L. Walker, T-E
James S. Bus, PP
Linda S. Birnbaum, C
Nancy L. Kerckvliet, C
Charlene McQueen, C
James A. Popp, C

2000–2001
David Acosta, Jr., P
David L. Eaton, VP
William F. Greenlee, VP-E
Kendall B. Wallace, S-E
Jach L. Walker, T-E
Rick G. Schnellmann, T
Jay L. Goodman, PP
Sidney Green, C
Lois D. Lehman-McKeeman, C
Charlene E. McQueen, C
Kenneth S. Ramos, C

2001–2002
David L. Eaton, P
William F. Greenlee, P-E
Marion F. Ehrich, P-E
Kendall B. Wallace, S-E
George B. Corcoran, S-E
Rick G. Schnellmann, T
Daniel Acosta, Jr., PP
George P. Daston, C
Lois D. Lehman-McKeeman, C
Kenneth S. Ramos, C
Cheryl Lyn Walker, C

2002–2003
William F. Greenlee, P
Marion F. Ehrich, P
Linda S. Birnbaum, P-E
George B. Corcoran, S
Rick G. Schnellmann, T
David L. Eaton, PP
Jon C. Cook, C
George P. Daston, C
Serrine S. Lau, C
Cheryl Lyn Walker, C

2003–2004
Marion F. Ehrich, P
Linda S. Birnbaum, VP
Kendall B. Wallace, VP-E
George B. Corcoran, S
Gary P. Carlson, S-E
James E. Eklund, S-E
William F. Greenlee, PP
Jon C. Cook, C
Ann de Peyster, S-E
Serrine S. Lau, C
Jose E. Manattou, C

2004–2005
Linda S. Birnbaum, P
Kendall B. Wallace, VP
James A. Popp, VP-E
Gary P. Carlson, S
James E. Eklund, S-E
Norbert E. Kaminski, T-E
Marion F. Ehrich, PP
Ann de Peyster, C
Yvonne P. Dragan, C
Elaine M. Faustman, C
Jose E. Manattou, C

2005–2006
Kendall B. Wallace, P
James A. Popp, VP
George B. Corcoran, VP-E
Gary P. Carlson, S
Janice E. Chambers, S-E
Norbert E. Kaminski, T-E
Linda S. Birnbaum, PP
Yvonne P. Dragan, C
Elaine M. Faustman, C
Bruce A. Fowler, C
Michael P. Holsapple, C

2006–2007
James A. Popp, P
George B. Corcoran, VP
Kenneth S. Ramos, VP-E
Janice E. Chambers, S
Norbert E. Kaminski, T
William Slikker, Jr., T-E
Kendall B. Wallace, PP
Scott W. Burchiel, C
Bruce A. Fowler, C
Michael P. Holsapple, C
Elaine Valerie Knight, C

2007–2008
George B. Corcoran, P
Kenneth S. Ramos, VP
Cheryl Lyn Walker, VP-E
Janice E. Chambers, S
Martin A. Philbert, S-E
William Slikker, Jr., T
James A. Popp, PP
Kim Boekelheide, C
Scott W. Burchiel, C
Elaine Valerie Knight, C
Denise Robinson Gravatt, C

2008–2009
Kenneth S. Ramos, P
Cheryl Lyn Walker, VP
Michael P. Holsapple, VP-E
Martin A. Philbert, S
William Slikker, Jr., T
Lawrence R. Curtis, T-E
George B. Corcoran, PP
Kim Boekelheide, C
Patricia E. Gaine, C
Ronald N. Hines, C
Denise Robinson Gravatt, C

2009–2010
Cheryl Lyn Walker, P
Michael P. Holsapple, VP-E
Jon C. Cook, VP-E
Martin A. Philbert, S
Peter L. Goering, S-E
Lawrence R. Curtis, T
Kenneth S. Ramos, PP
Matthew S. Bogdanoff, C
Susan J. Borghoff, C
Patricia E. Gaine, C
Ronald N. Hines, C

2010–2011
Michael P. Holsapple, P
Jon C. Cook, VP
William Slikker, Jr., VP-E
Peter L. Goering, S-E
Lawrence R. Curtis, T
John B. Morris, T-E
Cheryl Lyn Walker, PP
Matthew S. Bogdanoff, C
Susan J. Borghoff, C
Donald A. Fox, C
Michael P. Wawruck, C

SOT Council 1961–2011
Celebrating 50 Years
of Service to Science

SOT
Building on the Foundation of Our Membership

The Founders of the Society of Toxicology, March 4, 1961:
(top row, from left) Paul S. Larson, C. Boyd Shaffer, Victor A. Drill, Fredrick Coulston, Kenneth P. DuBois;
(bottom row, from left) Harry W. Hays, Harold C. Hodge, Arnold J. Lehman, William B. Deichmann.

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1962 ..... W. F. Von Oettingen
1962 ..... Torald H. Sollman
1963 ..... Ethel Browning
1966 ..... R. Tecwyn Williams
1976 ..... Norton Nelson
1982 ..... George H. Hitchings
1986 ..... Bernard B. Brodie
1986 ..... Herbert Remmer
1991 ..... Hyman J. Zimmerman
1994 ..... Ronald W. Estabrook

1994 ..... Wendell W. Weber
1995 ..... Gertrude B. Elion
1995 ..... Charles S. Lieber
1996 ..... Sten G. Orrenius
1996 ..... Dennis Parke
1997 ..... John E. Casida
1997 ..... Roger W. Russell
1998 ..... Jud Coon
1998 ..... Michel Mercier
1999 ..... William O. Robertson
1999 ..... Takashi Sugimura

2000 ..... Findlay Russell
2001 ..... Herbert Needleman
2007 ..... Mario Molina
2008 ..... Lee Hartwell
2008 ..... H. Robert Horvitz
2009 ..... Gilbert S. Omenn
2009 ..... Sir John E. Walker
2010 ..... Sir Philip Cohen
2010 ..... Ferid Murad
2011 ..... William C. Hays, Esq.
2011 ..... Frances Kathleen Oldham Kelsey

The Society of Toxicology recognizes nonmembers who embody outstanding and sustained achievements in the field of toxicology with Honorary Membership. Candidates are nominated by two Full or Associate members of the Society. Seconding letters and information regarding career achievements in toxicology should accompany the nomination. A two-thirds vote of Council determines recipients, with not more than two Honorary Members elected during any one term of Council.
The SOT Council Thanks and Recognizes Some of the Many Members Who Have Contributed to the Success of the Society

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Tibor Balazs, D.V.M.
Bernard A. Becker, M.S.
Karl Friedrich Benitz, M.D.
Karl H. Beyer, Jr., M.D., Ph.D.
Frank R. Blood, Ph.D.
Albert N. Booth, Ph.D.
Charles G. Durbin, V.M.D.
William F. Durham, Ph.D., DABT
Harold F. Diermeier, Ph.D.
Charles S. Delahunt, D.Sc.
William L. Downs, M.S.
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Charles R. Linegar, Ph.D.
Ted A. Loomis, M.D., Ph.D., ATS
Frank C. Lu, M.D.
Lehman M. Lusky, B.A.
William E. MacDonald, Ph.D.
Harold N. MacFarland, Ph.D., FRCP
Willard Machle, M.D.
William A. Mannell, Ph.D.
Gilbert J. Manning, Ph.D.
Hiromu Matsumoto, Ph.D.
Paul A. Mattis, D.Sc.
Elliot A. Maynard, Ph.D.
John D. McColl, Ph.D.
Donald D. McCollister, B.S.
Francis P. McGrath, M.S.
Herbert McKennis, Jr., Ph.D.
Bernard P. McNamara, Ph.D.
James C. Munch, Ph.D.
John I. Munn, Ph.D.
Sheldon D. Murphy, Ph.D.
John H. Nair, M.S.
Joe B. Nash, Ph.D.
James W. Newberne, D.V.M., Ph.D., ATS
Gordon W. Newell, Ph.D., ATS
Fred W. Oberst, Ph.D.
Yyo T. Oester, M.D., Ph.D.
Donald L. Opdyke, Ph.D.
Bernard L. Oser, Ph.D.
Elias W. Packman, Sc.D.
Arthur J. Pallotta, Ph.D.
Edward D. Palerm, Ph.D.
Orville E. Paynter, Ph.D.
Harold M. Peck, M.D.
Rafael A. Penalver, M.D.
Harold M. Peck, M.D.
Orville E. Paynter, Ph.D.
Edward D. Palerm, Ph.D.
Orville E. Paynter, Ph.D.
Harold M. Peck, M.D.
Rafael A. Penalver, M.D.
Gabriel L. Plaa, Ph.D., DABT, ATS
Albert J. Plummer, M.D., Ph.D.
Urbano C. Pozzani, M.S.
Charles D. Proctor, Ph.D., D.Sc.
Charles L. Punte, B.S.
Jack L. Radomski, Ph.D., ATS
Virgil B. Robinson, Ph.D.
Harry Rosen, Ph.D.
Robert L. Roudabush, Ph.D.
Vera C. Rowe, M.S.
Jack P. Saunders, Ph.D.
Jean Scholler, Ph.D.
Joseph Seifert, M.D.
C. Boyd Shaffer, Ph.D.
Martin Sherman, Ph.D.
Gary J. Sibert, D.V.M., Ph.D.
Jacob Siegel, Ph.D.
Frank A. Smith, Ph.D.
R. Blackwell Smith, Jr., Ph.D.
Fred H. Snyder, Ph.D.
Torakl Hollmann, M.D.
Frederick Sperling, Ph.D.
William B. Stavinoha, Ph.D.
James H. Stember, M.D.
Herbert E. Stokinger, Ph.D.
Joseph L. Svirbely, Ph.D.
Maurice L. Tainter, M.D.
Anton A. Tamas, M.D.
Jean M. Taylor, Ph.D.
Clintion H. Thienes, M.D., Ph.D.
Richard F. Tislow, D.Sc., M.D.
Joseph F. Treon, Ph.D.
Thomas W. Tusing, M.D.
Clarence G. Van Arman, Ph.D.
Leonard J. Vinson, Ph.D.
Wolfgang Felix Von Oettingen, M.D., Ph.D.
John W. Ward, Ph.D.
Francis X. Wazeter, Ph.D.
Lawrence C. Weaver, Ph.D.
Stewart H. Webster, Ph.D.
Maurice H. Weeks, M.S.
John H. Weikel, Jr., Ph.D.
Carrol S. Weil, M.A.
John H. Weisburger, Ph.D., M.D. (Hon)
Bob West, Ph.D.
Norman G. White, Ph.D.
Martin W. Williams, Ph.D.
Geoffrey Woodard, Ph.D.
Alastair N. Worden, M.A.
Frederick F. Yontman, M.D., Ph.D.
John P. Zapp, Jr., Ph.D.
Virginia Zaratzian, Ph.D.
Benjamin R. Zeitlin, M.S.
Robert E. Zwichley, D.V.M.
# Society of Toxicology Annual Meeting

## Annual Meeting Locations by Year

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<tr>
<td>2011</td>
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</tbody>
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## Annual Meeting Participation and Scientific Presentations

- **Annual Meeting Attendees**: In five-year intervals
- **CE Registrants**: In five-year intervals
- **Scientific Presentations**: In five-year intervals

## Membership Growth

- **Membership**: Reflects all member types in five-year intervals
Annual Meeting Sessions

In five-year intervals

- CE COURSES
- EDUCATION-CAREER SESSIONS
- FEATURED SESSIONS
- HISTORICAL HIGHLIGHTS
- INFORMATIONAL SESSION
- PLATFORMS
- POSTER DISCUSSIONS
- REGIONAL INTEREST
- ROUNDTABLES
- SATELLITE
- SYMPOSIA
- WORKSHOPS

SOT Member Employment by Sector
(As of 2008)

- Industry 41.4%
- Academic 21.4%
- Consulting 10.9%
- Nonprofit Research 2.7%
- Government 14.9%
- Contract Laboratory 6.7%
- Other Industry 1.6%
- Chemical Industry 5.7%
- Pharmaceutical Industry 26%
- Consumer Product Industry 1.6%
- Other Industry 3.6%

ToxExpo™ Success
In five-year intervals

- EXHIBITOR COMPANIES
- EXHIBIT BOOTHs

Society of Toxicology Annual Meeting

- 1962 Atlantic City, NJ
- 1963 Cincinnati, OH
- 1964 Williamsburg, VA
- 1965 Williamsburg, VA
- 1966 Williamsburg, VA
- 1967 Atlanta, GA
- 1968 Washington, D.C.
- 1969 Williamsburg, VA
- 1970 Atlanta, GA
- 1971 Washington, D.C.
- 1972 Williamsburg, VA
- 1973 New York, NY
- 1974 Washington, D.C.
- 1975 Williamsburg, VA
- 1976 Atlanta, GA
- 1977 Toronto, Canada
- 1978 San Francisco, CA
- 1979 New Orleans, LA
- 1980 Washington, D.C.
- 1981 San Diego, CA
- 1982 Boston, MA
- 1983 Las Vegas, NV
- 1984 Atlanta, GA
- 1985 San Diego, CA
- 1986 New Orleans, LA
- 1987 Washington, D.C.
- 1988 Dallas, TX
- 1989 Atlanta, GA
- 1990 Miami Beach, FL
- 1991 Dallas, TX
- 1992 Seattle, WA
- 1993 New Orleans, LA
- 1994 Dallas, TX
- 1995 Baltimore, MD
- 1996 Anaheim, CA
- 1997 Cincinnati, OH
- 1998 Seattle, WA
- 1999 New Orleans, LA
- 2000 Philadelphia, PA
- 2001 San Francisco, CA
- 2002 Nashville, TN
- 2003 Salt Lake City, UT
- 2004 Baltimore, MD
- 2005 New Orleans, LA
- 2006 San Diego, CA
- 2007 Charlotte, NC
- 2008 Seattle, WA
- 2009 Baltimore, MD
- 2010 Salt Lake City, UT
- 2011 Washington, D.C.

and ToxExpo™ Growth
Celebrating Achievements

Honorary Membership

The Society of Toxicology recognizes non-members who embody outstanding and sustained achievements in the field of toxicology with Honorary Membership. Candidates are nominated by two full or Associate members of the Society. A two-thirds vote of Council determines recipients, with no more than two Honorary Members elected during any one term of Council.

Inductees
- 1982 Eugene M.K. Gellings
- 1980 W. F. Von Oettingen
- 1977 Torald H. Sollman
- 1976 W. C. Hays
- 1973 M. J. Schlosser
- 1971 H. Robert Horvitz
- 1970 J. C. Kapeghian

Achievement Award

The Achievement Award is presented to a member of the Society of Toxicology who has less than 15 years experience since obtaining his/her highest earned degree (in the year of the Annual Meeting of the Society of Toxicology) and who has made significant contributions to toxicology.

Award Recipients
- 1997 Gabriel L. Plaa
- 1996 James E. Gibson
- 1995 Curtis D. Klaassen
- 1994 Ronald B. Harbison
- 1993 Melvin E. Andersen
- 1992 John F. Rosen
- 1991 Arthur G. Rosen
- 1990 Fredrick Coulston
- 1989 Donald A. Fox
- 1988 R. J. Kavlock
- 1987 J. C. Kapeghian
- 1986 Calvin C. Wilhite

Best Postdoctoral Publication Awards

The Best Postdoctoral Publication Awards were created by the Postdoctoral Assembly to recognize talented postdoctoral researchers who have recently published exceptional papers in the field of toxicology.

Award Recipients
- 2006 N. A. Bouloukos
- 2005 S. L. Vonderfecht
- 2004 M. J. Koller
- 2003 J. C. Kapeghian
- 2002 J. D. McKinney
- 2001 R. B. Harbison
- 2000 A. G. Rosen

Best Paper in Toxicological Sciences Award

The Best Paper in Toxicological Sciences Award is presented to the author(s) of the best paper published in this official SOT publication during the year prior to the Award Meeting, at which the award is presented. The award is known as the Frank R. Blood Award.

Award Recipients
- 2015 J. L. S. D’Angelo
- 2014 B. E. Butterworth
- 2013 D. A. Fox
- 2012 J. D. McKinney
- 2011 R. B. Harbison
- 2010 M. J. Koller
- 2009 J. C. Kapeghian
- 2008 J. C. Kapeghian
- 2007 J. C. Kapeghian
- 2006 J. C. Kapeghian

Best Paper in Toxicological Sciences Award (formerly published as Fundamental and Applied Toxicology)

Award Recipients
- 2015 J. L. S. D’Angelo
- 2014 B. E. Butterworth
- 2013 D. A. Fox
- 2012 J. D. McKinney
- 2011 R. B. Harbison
- 2010 M. J. Koller
- 2009 J. C. Kapeghian
- 2008 J. C. Kapeghian
- 2007 J. C. Kapeghian
- 2006 J. C. Kapeghian

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of the Past 50 Years

2005 Orrin G. Hatch, Foundation for Biomedical Research (FBR)
2006 Joyce Mackta

Distinguished Toxicology Scholar Award
The Distinguished Toxicology Scholar Award is presented to a member of SOT who has made substantial and seminal contributions to our understanding of the science of toxicology. Nominations should be active scientists involved in toxicological research. Nominees should contribute to the teaching and training of toxicologists who is distinguished by outstanding contributions to understanding fundamental mechanisms of toxicity.

Award Recipients
2009 John Katzenellenbogen
2010 Richard S. Paules
2011 William B. Yamamoto

Merit Award
The Merit Award is presented to a member of the Society of Toxicology who has made a major contribution to broadening public understanding of toxicological science through any aspect of public communications. The award should reflect accomplishments made over a significant period of time.

Award Recipients
1996 Henry F. Smyth, Jr.
1997 Arnold J. Lehman
1998 R. T. Williams
1999 Harold C. Hodge
2000 Don D. Irish
2001 Kenneth P. DuBois
2002 Gar Fitzhugh
2003 Herbert E. Stokinger
2004 Gerald N. Wogan
2005 Donald S. Birmbaum
2006 Thomas A. Gwaltney
2007 H. Atif Khan
2008 Maarten Heeres
2009 Adel Saye
2010 Huiwu Gao
2011 Daxu Chen

Education Award
The Education Award is presented to an individual who is distinguished by the teaching and training of toxicologists and who has made significant contributions to education in the broad field of toxicology.

Award Recipients
1975 Harold C. Hodge
1976 Ted A. Loomis
1977 Robert B. Forney
1978 Sheldon D. Murphy
1979 Herbert H. Cornish
1980 Frederick Sperling
1981 Lloyd W. Hasleton
1982 Julius M. Coon
1983 Frank Guthrie
1984 Paul B. Brookes
1985 William B. Buck
1986 Robert I. Krieger
1987 Gabriel L. Plaa
1988 John Autian
1989 Tom S. Miyahara
1990 Charles H. Hine
1991 Hanspeter Witschi
1992 Dean E. Carter
1993 Curtis D. Klaassen
1994 Robert A. Neal
1995 William J. Carlson
1996 Robert Snyder
1997 Albert E. Munson
1998 David J. Holbrook
1999 Jules Brodeur
2000 Gary Carlton
2001 Harihara Mehandale
2002 Joseph Borzelleca
2003 Frederick P. De Meine
2004 A. Jay Gandolfi
2005 Ganna Shakhmetova
2006 Suresh V.S. Rana
2007 Maritza Rojas Martini
2008 Deepak Argwal
2009 Ping-kun Zhou
2010 Tetsuo Satoh
2011 Michael Gallo
As an academic discipline, toxicology has its roots in medical, pharmacy, pharmacology, and environmental/public health training programs. Most of the larger programs in toxicology were formalized in the early 1960s, but their organization has evolved and can be quite varied. Currently there are relatively few stand-alone departments. More often, programs are either combined with pharmacology or broader environmental health programs; others exist as less formal interdisciplinary programs with faculty drawn from a number of related sciences. Of these programs, some grant degrees in toxicology or environmental health, while others award degrees in pharmacology.

Because of space issues and the quantity of articles we received from toxicology training centers, we have taken the liberty of placing all toxicology training articles on the SOT Web site, which will be permanently dedicated to training centers. The write-ups will be updated to include additional programs and any new information about existing programs that have already been posted to the Web site.
In the 1950's the field of toxicology was experiencing significant growth and recognition. More and more academic institutions were offering teaching and research programs, and the industrial sector, which had laboratories dating from the 1930's, was generating more and more toxicity studies on commercial products. Government agencies were also publishing a significant number of papers. At that time, the only publication outlets available were in journals of occupational health, industrial hygiene, or pharmacology. In 1959, the first domestic journal devoted to this field was established. Volume 1, Number 1 of Toxicology and Applied Pharmacology was dated January 1959, with Frederick Coulston, Harry Hays, and Arnold Lehman as the founding editors. It was an immediate success with ever-increasing numbers of manuscripts being submitted. At the time of SOT's founding in 1961, one of the first decisions made by the Society's Council was to make this journal the official journal of the Society. The Society's second journal, Fundamental and Applied Toxicology, began publication in 1981 as a bi-monthly, with William Carlton and Philip Watanabe as co-editors. It soon became a monthly publication and in January 1998 was retitled Toxicological Sciences with Curtis Klaassen as editor.

This poster illustrates how the growth in toxicological research was accompanied by the establishment of new journals in the field of toxicology and its subdisciplines. The display shows a few of the leading English language toxicology journals, from among the 77 now publishing new research work in toxicology.
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The Importance of Animals in Research

Research involving laboratory animals is necessary to ensure and enhance human and animal health and to protect the environment.

In the absence of human data, research with experimental animals (in concert with relevant in vitro data) is the most reliable methodology to detect important toxic properties of chemical substances and to estimate risks to human and environmental health.

In the European Union and the United States, as well as many other countries, research institutions are required by law to establish an animal research oversight committee, and researchers must justify the need, procedures, and protocols for all studies involving animals. Currently, 95 percent of the animals used in research are rats and mice. Research animals must be used in a responsible manner and under the approval of institutional animal care and use committees.

Animal research is not the only source of data in studies. Research is also conducted with epidemiological studies, computer modeling, tissue and cell cultures, and human trials.

Scientifically valid research designed to reduce, refine, or replace the need for laboratory animals is encouraged.

The Role of the Toxicologist

Toxicology is the study of the adverse effects of chemical, physical, or biological agents on people, animals, and the environment. Toxicologists are scientists trained to investigate, interpret, and communicate the nature of those effects. Toxicologists conduct their work through:

**Basic Research:** Understanding mechanisms of disease and injury to organisms and the environment.

**Environmental Safety:** Hazard identification and determination of health risk due to environmental exposures to toxins.

**Safe Products and Medicines:** Discovery, development, and safety assessment of new products and medicines.

Animal Welfare Oversight

Globally, research using animals is strictly governed by animal welfare laws, policies, and regulations such as the European Animal Welfare Directive (Council Directive 86/609/EEC), the United States Federal Animal Welfare Act (AWA) (P.L. 89-544), and the United States Health Research Extension Act (P.L. 99-158). Many organizations also participate in voluntary accreditation programs, which require adherence to best practice standards based on guidelines published in the National Research Council/Institute of Laboratory Animal Resources (NRC/ILAR) *Guide for the Care and Use of Laboratory Animals.*
SOT’s Educational Activities

Since 1983, SOT has featured sessions at the SOT Annual Meeting to provide education on the use of animals in research and the development of alternatives to the use of animals in research. Sample sessions include:

2010—The Tox21st Community and the Future of Toxicology Testing
2007—Animals Rights Extremism and the Responsible Use of Animals in Research: The Past, Present, and Future
2003—*In Vitro* Toxicity Models to Minimize Animal Use

**The 3Rs: Reduce, Refine, Replace**

Whenever possible toxicologists seek to reduce, refine, and replace animals used in research.

**Reduction:** Minimization of the number of animals used to achieve specific scientific objectives.

**Refinement:** Continual review of improvements in experimental design, techniques, and husbandry to minimize adverse effects and improve welfare.

**Replacement:** Use of absolute replacement techniques that avoid the use of animals; relative techniques include substituting nonvertebrate species.

**The Society of Toxicology’s Position on the Use of Animals in Research**

The SOT has established various committees and task forces since 1981 to ensure that SOT scientists using animals are doing so in accordance with all federal laws. In addition, the Code of Ethics for the Society states that each member shall observe the spirit as well as the letter of the laws, regulations, and ethical standards with regard to the welfare of humans and animals involved in any experimental procedures. In 1999, SOT adopted a position statement to address the use of animals in toxicology:

*The Society of Toxicology is dedicated to the acquisition and dissemination of knowledge that improves the health and safety of humans and animals and the protection of the environment. To fulfill this objective, the Society is committed to:*

- The design and conduct of the best possible scientific research;
- The responsible use of laboratory animals in toxicological research and testing as necessary and vital to ensure and enhance the quality of human, animal health, and the environment;
- The development and use of alternatives to the use of animals;
- The use of research designs that employ less painful or stressful procedures and improve animal care; and
- A reduction in the number of animals used for research and testing when this is scientifically appropriate and valid.
OXFORD UNIVERSITY PRESS CONGRATULATES the Society of Toxicology on its 50TH ANNIVERSARY
Congratulations SOT on 50 successful years of advancing quality education and science in the field of toxicology.
Happy Anniversary SOT!

Congratulations on 50 successful years of leading the science of toxicology.
Our best wishes for the future.
Millions of Transponders Sold. Thousand of Reader Systems Sold. Helping to Validate your research for 25 years.

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The American Academy of Clinical Toxicology (AACT) congratulates the Society of Toxicology on 50 years of excellence and success!
Congratulations on 50 Years

The Hamner supports the Society of Toxicology in its mission and joins in the celebration

Founded in 1974 as The Chemical Industry Institute of Toxicology (CIIT), The Hamner Institutes for Health Sciences in Research Triangle Park, North Carolina, is built upon over 35 years of preeminent research and training in toxicology and human health assessments, and aims to develop and validate new cutting-edge technologies in the safety sciences.

Dr. William F. Greenlee, past president of the Society of Toxicology (2002-03), and The Hamner join SOT in its commitment to creating a safer and healthier world in the 21st century and beyond.

Congratulations on 50 years of advancing the science of toxicology.

www.thehamner.org
Congratulations SOT
On your 50th Anniversary!

From the American Society for Pharmacology and Experimental Therapeutics

www.aspet.org

ASPET has been the premier scientific society for pharmacology since it was founded in 1908. Nearly 5,000 members enjoy Society journals and other publications, and frequent educational opportunities through meetings, colloquia and symposia.
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Congratulation and Appreciation!
The 50th Anniversary of SOT

The Japanese Society of Immunotoxicology (JSIT) was established in 1994 as an independent entity of the Japanese Society of Toxicology. The JSIT now has strong relation with the SOT Immunotoxicology Specialty Section (ISS) running the Researcher Exchange Program to create scientific communication. The JSIT would like to sincerely appreciate the cooperation of the SOT ISS.

Please visit our web-site,
http://www.immunotox.org/english/index.html
Happy 50th Anniversary SOT

Thank you for partnering with us in the search for new therapeutics and vaccines to treat and prevent disease.

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www.SouthernResearch.org
CONGRATULATIONS!

From:
National Institute of Environmental Health Sciences Sponsored
Meharry Medical College-Vanderbilt University
Advanced Research Cooperation in Environmental Health (ARCH) Consortium

Pictured from left: Russell E. Poland, Ph.D., Vice President for Research-MMC and Senior Scientific Advisor-MMC; Aramandla Ramesh, Ph.D., R01 investigator and Director of ARCH Facility Core; Diana Marver, Ph.D., Director of Research for the MMC-VU Alliance; Courtney Starr, MBA, MMC-VU Program Manager; Petra Prins, Research Associate; Uchechukwu Sampson, M.D., Pilot Project Investigator; Robert Matusik, Ph.D., VU Collaborator-Stewart; Darryl B. Hood, Ph.D., Principal Investigator, MMC-VU ARCH Consortium; Michael Aschner, Ph.D., Research Intensive University Leader, MMC-VU ARCH Consortium; David Hachey, Ph.D., VU Collaborator-Stewart; LaMonica Stewart, Ph.D. Pilot Project Investigator and Kevin Osteen, Ph.D., VU Collaborator-Archibong. Not pictured, F. Peter Guengerich, Ph.D. Senior Scientific Advisor-VU
Trusted partner for research and data sharing. Leading in the development of knowledge-based expert in-silico prediction systems and databases.

For predicting toxicity
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- Assists with screening for genotoxic impurities
- Integrate your in-house data
- Linked to Vitic Nexus for enhanced supporting evidence

For predicting metabolic fate
- Link to mass spectrometry software
- Advanced reasoning tools to filter likely metabolites
- Link to Derek Nexus for metabolite toxicity prediction
- Aids identification of toxic intermediates

For predicting chemical degradation pathways
- Degradation behaviour of compounds exposed to different conditions
- Work with structures of degradation products
- Minimise studies for related compounds

Chemical database and management system
- High quality, peer-reviewed data
- Public, regulatory and proprietary data sources (E.g. data obtained under FDA CRADA)
- Web-based user interface

Sending Best Wishes from Lhasa Limited to the Society of Toxicology on its 50 Year Anniversary.

Visit Lhasa Limited at Booth No.904
Global leaders in the field of Safety Pharmacology providing answers to critical questions that matter to patients, regulators and scientists.

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- Training
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Safety Pharmacology Society is an international nonprofit organization that promotes knowledge, development, application, and training in Safety Pharmacology—a distinct scientific discipline that integrates the best practices of pharmacology, physiology and toxicology.

www.safetypharmacology.org
“We celebrate the Society of Toxicology and its 50 years of significant contribution to the study, practice and application of toxicology science for the protection of public health.”

Linda S. Birnbaum, Ph.D., D.A.B.T., A.T.S.
Director, National Institute of Environmental Health Sciences and National Toxicology Program

NIEHS
National Institute of Environmental Health Sciences
Supporting research to understand how the environment influences human health and disease. The NIEHS is part of the National Institutes of Health, U.S. Department of Human Services.
www.niehs.nih.gov

National Toxicology Program
Evaluating chemicals and other agents of public health concern using tools of modern toxicology and molecular biology. The NTP is an interagency program of the U.S. Department of Health and Human Services, located at the NIEHS.
www.ntp.niehs.nih.gov

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ENVIRONMENTAL HEALTH PERSPECTIVES
A monthly, open access, peer-reviewed journal of research and news published by the NIEHS.
www.ehponline.org
The Academy of Toxicological Sciences

November 19, 2010

SOCIETY OF TOXICOLOGY

Congratulations on reaching the milestone of the 50th Anniversary of the Society of Toxicology (SOT). We applaud this achievement and look forward to joining with SOT in celebrating 50 years at the 2011 SOT Annual Meeting in Washington, DC, the city in which SOT was founded in 1961. We also are extending our best wishes and hope for future collaborations and endeavors aligned with SOT’s mission of “Creating and Safer and Healthier World by Advancing the Science of Toxicology.”

Sincerely,

William J Brock, Ph.D., DABT, Fellow ATS
President, Academy of Toxicological Sciences
CONGRATULATIONS FROM THE AFRICAN SOCIETY FOR TOXICOLOGICAL SCIENCES

www.africansocietyfortoxicologicalsciences.org

On behalf of members and Board of the African Society for Toxicological Sciences (ASTS), I congratulate the Society of Toxicology (SOT) as it commemorates its 50th anniversary. This is a great time and a perfect opportunity to acknowledge the impact SOT had in motivating members of ASTS to begin what is now a burgeoning organization.

SOT provided the platform for a group of African scientists to start ASTS 12 years ago. We are proud to be a part of this great organization and are excited at the many new SOT initiatives aimed at increasing global impact and awareness.

Thank you,

Sanmi Areola, PhD
ASTS President
January 7, 2011

Society of Toxicology

Congratulations to the Society of Toxicology on this 50th Anniversary – a landmark achievement in service to the science of toxicology! We applaud SOT’s ongoing commitment to the education of future generations of toxicologists to build and strengthen our profession. The American College of Toxicology is pleased to join the celebration of SOT’s 50th Anniversary and looks forward to another 50 years of complementary missions and professional association.

Best wishes for continued success,

Russette M. Lyons, Ph.D.
President

Secretariat - 9650 Rockville Pike - Bethesda, Maryland 20814
T: (301) 634-7840  F: (301) 634-7852  Email: ekagan@actox.org/clemire@actox.org
www.actox.org
The BRITISH TOXICOLOGY SOCIETY
would like to congratulate the Society of Toxicology on its
50th Anniversary.

We wish you a successful meeting in March 2011
to celebrate the success of the
Society and Toxicology
both in the USA and across the world.

Ruth Roberts, PhD, FBTS, ATS, ERT
President

Heather M Wallace, PhD, FBTS, ERT
General Secretary
Dr. Michael P. Holsapple 06.01.2011
President of SOT

SOT Headquarters Office
1821 Michael Faraday Drive
Suite 300
Reston, Virginia 20190

Dear Dr. Holsapple,

On behalf of the Bulgarian Toxicological Society and all Bulgarian Toxicologists, I would like to extend my very warm congratulations for the 50th Anniversary of the foundation of the Society of Toxicology.

For 50 years, SOT has been caring for the development of the Toxicology in USA and all over the world. It helps for the contacts of toxicologists in all world countries, actively engaged in scientific exchanges in the field of toxicology, facilitating beneficial cooperation, and has received high appreciation and warm gratitude from toxicologists in many countries.

Hereby, the Bulgarian Toxicological Society would like to send the best regards and cordial greetings to all members of SOT, and wish them greater achievements as well as better contribution to development of toxicology in the world.

Sincerely yours

Prof. Christophor Dishovsky, M.D.,Ph.D., D.Sc.
President of Bulgarian Toxicological Society
3,St.G.Sofiiski Str., Military Medical Academy
November 24, 2010

Society of Toxicology
1821 Michael Faraday Drive, Suite 300
Reston, Virginia 20190
United States of America

Greetings!

Congratulations on celebrating your 50th Anniversary from your northern neighbor. The SOT has been a model of success and a leader in advancing the science of toxicology and its service to society. SOT planted many of the seeds which have grown into similar organizations around the world and is highly respected and emulated. Some of the SOT founders and leaders have helped to build our own Society of Toxicology of Canada (STC) now in its 42nd year.

STC sends our very best wishes to SOT in planning for its next golden half century of success.

Sincerely yours,

Roger Keefe
President
On behalf of the Croatian Toxicological Society, I wish the Society of Toxicology (SOT) a happy 50th anniversary.

Since its foundation in 1961, SOT has encouraged the improvement of toxicology, not only in the United States, but all round the globe. Toxicologists worldwide are educated from SOT journals, educational courses, and congresses that always put forward exciting new results in toxicology. For example, one of the most interesting features in the EUROTOX Congress is the EUROTOX-SOT debate on an important issue in toxicology. We appreciate very much the collaboration of American and European societies of toxicology, because SOT, with 50 years of experience, is the leading toxicological society in the world.

All members of the Croatian Toxicological Society unite with me in congratulations on your achievements and best wishes as you enter the next half-century of your work.

Sincerely yours,

Maja Peraica, MD, PhD
President,
Croatian Toxicological Society
Dear Colleagues in SOT

On behalf of German Society of Toxicology it is our pleasure to congratulate SOT for the Golden Jubilee. These past 50 years had many challenges for toxicologists to raise their voices against damage of human health and environment by chemicals. Nowadays Toxicology has become absolutely essential for chemical safety in general. SOT and their members had leadership in this process and on International Toxicology as well.

German Society of Toxicology is happy about the many links to SOT and supportive partnership.

All the best for the future

Ursula Gundert Remy,
Holger Barth,
Heidi Foth,
Peter J Kramer
German Society of Toxicology
Dear Dr Holsapple

Re 50th Anniversary of the Society of Toxicology

The European Association of Poisons Centres and Clinical Toxicologists would like to congratulate the Society of Toxicology on their 50th Anniversary. Since the Society was established in 1961 it has played a major role in research, teaching and training in toxicology, encouraging younger scientists into the discipline and contributing substantially to the advancement of knowledge and public health protection. The Society’s annual meetings are of exceptional quality and valued by toxicologists from across the world. We wish the Society of Toxicology well and hope that the next 50 years will be as successful as the last.

With best wishes

Professor Simon Thomas
President, EAPCCT

Simon.thomas@ncl.ac.uk
Message

The Governing Council and Members of Society of Toxicology (STOX), India has immense pleasure in congratulating the International Scientific Fraternity of the 50th Anniversary Conference of Society of Toxicology (SOT), USA.

The STOX, India a 30-year organization is proud and happy to note that the SOT, USA is implementing its commitment ‘to create a safer and healthier world by advancing the science of toxicology’. STOX, India is confident that the 50th anniversary conference of SOT will strengthen the partnership between academia, R & D institutions and industry for high quality proactive research and training. The scientific deliberations of this conference would certainly enrich the thoughts of toxicology community and the recommendations of the conference would certainly give directions for future research in Toxicology.

The STOX, India extend our warm wishes for the grand success of the 50th anniversary meeting of SOT, USA.

Secretary General, STOX, India

Dr. PV. Mohanan
10th January 2011

Address for Correspondence:
Dr. PV. Mohanan
Secretary General, Society of Toxicology, India
Certified Biological Safety Specialist
Scientist & Head, Toxicology Division,
Biomedical Technology Wing,
Sree Chitra Tirunal Institute for Medical Sciences and Technology (Govt. of India), Poojapura, Thiruvananthapuram 695 012, Kerala, India
Ph: 91-471-2520266, 91-9446542702 (mobile)
Email: mohanpv10@gmail.com, mohanpv@sctimst.ac.in
The International Society of Regulatory Toxicology and Pharmacology (ISRTP) congratulates the Society of Toxicology (SOT) on the 50th anniversary of the founding of the SOT. ISRTP looks forward to continuing collaboration with SOT on topics of mutual interest to our professional societies. ISRTP provides an open public forum for policy makers and scientists promoting sound toxicologic and pharmacologic science as a basis for regulations affecting human safety and health, and the environment.

Gary J. Burin, MPH, Ph.D., DABT
President (2011-2012)
International Society for Regulatory Toxicology and Pharmacology
Washington, DC
Dr. Michael Holsapple  
President  
Society of Toxicology  
1821 Michael Faraday Drive  
Reston, Virginia 20190  

Dear Mike:  

On behalf of the IUTOX Executive Committee and our member societies from around the world, I extend my heartiest congratulations to SOT on the occasion of your 50th anniversary.  

IUTOX has benefited in numerous ways from its long association with SOT. Indeed, SOT helped conceive the original idea to form an international toxicology society and served as one of our nine founding members. Over time, SOT has encouraged the growth of IUTOX programs serving as host of the IUTOX ICTVII meeting in Seattle (July 1995) and providing financial support for many of our activities. We are especially appreciative for SOT’s particular interest in supporting IUTOX programming with and for toxicologists in developing and least developed countries.  

The IUTOX leadership looks forward to collaborating with SOT on many more programs to advance the science of toxicology in all corners of the world—especially in countries where toxicology is underrepresented. IUTOX is grateful for the remarkable partner SOT has been for over thirty years and looks forward to many, many more years of friendship!  

Best regards,  

Daniel Acosta, Jr., Ph.D., ATS
Irish Society of Toxicology
c/o Health and Safety Authority
Hebron House
Hebron Road
Kilkenny
Co. Kilkenny
Ireland
3rd December 2010

Dr. Michael P. Holsapple
President, Society of Toxicology
1821 Michael Faraday Drive
Suite 300
Reston
VA 20190
USA

Dear Sir,

The Irish Society of Toxicology is delighted to extend its congratulations to SOT as they celebrate 50 years promoting the field and study of toxicology. Although a relatively young Society compared to SOT (a mere 26 years as opposed to SOT's 50!), we too share similar ideals and interests with SOT. We consider the achievements and initiatives led by SOT over the past 50 years as a leading example for all other Societies involved in toxicology. We very much look forward to SOT's next 50 years!

Comhsháinte ar do chomóradh órtha.

Is mise le meas,

Dr. Sharon McGuinness
President, Irish Society of Toxicology
The Hague, 4th of January 2011,

To the Society of Toxicology,

On behalf of the Dutch Society of Toxicology I like to congratulate the Society of Toxicology with its 50th anniversary. Throughout the years the activities of the SOT became and remained a global centre point for toxicological activities. Its annual symposium is without any doubt the foremost occasion, where toxicologists from all over the world present their scientific results. In addition, the society its journal – Toxicological Sciences – is now one of the most prominent journals in its field with an all time high impact factor.

On behalf of The Dutch Society of Toxicology I express the hope that SOT will remain to have this high quality symposia and that Toxicological Sciences will continue to lead the way in publishing many and highly significant publications in the field of toxicology.

Congratulations on behalf of all the members of The Dutch Toxicological Society!

Prof. Dr. Martin van den Berg
President of The Dutch Society of Toxicology
January 7, 2011

Dear Dr. Michael P. Holsapple
2010-2011 SOT President

On behalf of the Turkish Society of Toxicology and all Turkish Toxicologists, I would like to extend my heartfelt congratulations to the Society of Toxicology (SOT) on reaching the significant milestone of its 50th Anniversary. During the 50 years of its existence, SOT has successfully served to create a safer and healthier world by advancing the science of toxicology. As a sister society we believe that SOT will continue to be a lighthouse for the development of toxicology in the world.

Yours sincerely,

[Signature]

Prof. Dr. Asuman Karakaya
President of the
Turkish Society of Toxicology
Dear SOT,

Estonian Society of Toxicology (ETS; http://www.kbfi.ee/ets) was created in 1997 and has currently 51 members, mostly scientists and students dealing with chemical safety, occupational health and environmental risk assessment. The number of members in ETS is small compared to SOT but Estonia is a country of 1.3 million people. Analogously to SOT, ETS joins people from academia and government and pays a lot of attention to students.

Please accept warm congratulations for the SOT 50th Anniversary from Estonian toxicologists.

On behalf of the Board,

Anne Kahrnu, Chair-person

Tallinn, Estonia
November 22, 2010

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On behalf of the Australasian College of Toxicology and Risk Assessment Inc (ACTRA), we wish the Society of Toxicology (SOT) a happy 50th anniversary.

Established in 1961 as part of the search of an identity for toxicology, SOT has played a major and leading role in the rapid expansion of toxicology and its sub disciplines in the second half of the twentieth century. SOT has facilitated the growth of toxicology as a proud academic discipline in its own right, with high calibre programmes aimed at producing toxicologists for the future. SOT enjoys a global membership and its annual meetings are major scientific events attracting several thousand delegates.

Congratulations on your achievements and best wishes for continued success.

Brian Priestly
President, ACTRA

Peter Di Marco
Vice President, ACTRA
It is my privilege to send warm congratulations to The Society of Toxicology (SOT) on the occasion of its 50th anniversary celebration.

For half a century, SOT has served a fundamental role for toxicology professionals across the United States and around the world by encouraging and advancing them through education, life-long learning and ethical integrity guidelines.

The relationship between SOT and EUROTOX (formerly ESSDT) across the Atlantic goes back to the late 1960’s. More recently, the debate series established in the 1990’s, as well as the annual congresses held six months apart, have contributed to strengthen our working partnership and commitment to improve human, animal and environmental health.

The EUROTOX Executive Committee, Member Societies, Individual Members and Scientific Partners, all unite with me to send best wishes to SOT members and its dedicated staff for continued success.

With kind regards,
Dr. Nancy Claude

2010-2012 EUROTOX President

The Portuguese Society of Pharmacology

The Portuguese Society of Pharmacology, including its Sections of Clinical Pharmacology and Toxicology, has celebrated its 40th anniversary in 2009, and is proud of being associated to the 50th anniversary of the Society of Toxicology, whose commitment and achievements in creating a safer and healthier world, by advancing the science of Toxicology, has been an example of Excellency and inspiration for scientific societies throughout the world. On the turn of its half-century hallmark, we can only wish the Society of Toxicology a long and prolific scientific life, in which the renewed generations of scientists reaffirm their wealthy legacy.
Dear members of the Society of Toxicology,

It is a great pleasure to know that your Society will commemorate their 50th Anniversary. Throughout your SOT Annual Meetings you have shown a high level of organization, hosted conferences of worldwide renowned researchers, your members have held remarkable oral presentations, and exhibited important posters, as well as having imparted courses and workshops of current topics.

The Mexican Society of Toxicology (SOMTOX) congratulates the Society of Toxicology for the continuous work made to reach this moment, we look forward for the 50th Anniversary celebration at the 2011 SOT Annual Meeting.

Best regards,

Liliana Saldívar Dr. rer. nat.
Past President of the SOMTOX
Sociedad Mexicana de Toxicología
México D.F.
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