

A History of the Teratology Society

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ABSTRACT

Background: The 39-year history of the Teratology Society is reviewed. An abbreviated history is outlined in table form, along with listings of the Warkany Lectures, the postgraduate courses, and officers of the Society.

Methods: A year-by-year description of the events, including the scientific and social content of the annual meetings and changes in the business of the Society, is given, in many cases using comments from the past presidents. The valuable and unique diversity of the members is discussed and illustrated, presenting the disciplines and main research area of the presidents. The number of submitted abstracts and the various categories are tabulated, averaging the number and type over four periods. Within the past 10 years, a significant increase in the number of abstracts dealing with epidemiology and developmental biology is evident. The Society's development is compared with that of a human, and the question is asked: Have we reached the maturational stage of old age or senescence, or is the Society still maturing gracefully? This question needs further discussion by all the members.

Results: During the past 40 years, we have developed the scientific basis to prevent birth defects caused by rubella, alcoholism, and folate deficiency, as well as many other prenatal exposures.

Conclusions: We must now engage in the political battles to obtain the resources needed to conduct further research and to implement the prevention programs, as well as to provide care and rehabilitation for persons with birth defects.

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INTRODUCTION

A history should record and honor the past, help plan for the future, and entertain the reader. In 1998, Philip Mirkes, the president of the Teratology Society, asked the authors to write a history of the Teratology Society to coincide with the year 2000. The content of this publication is summarized as follows. Table 1 presents the Society's presidents, meeting place, and key changes in the Society's function; Table 2 lists all the officers, with their place of work; Table 3 outlines the Warkany Lectures; and Table 4 lists the education courses. A year-by-year description of events detailing the activities for each year is given, but this begins in 1967–1968, since Wilson and Warkany ('85) previously covered the preceding years. In these accounts, we have asked the past presidents to assist and provide interesting and amusing anecdotes. A section on the diversity of the Society has been included, as we believe that one of our unique valuable assets is the contribution from many scientific disciplines from molecular genetics to epidemiology and dysmorphology in the study of teratology. The scientific methods used in the yearly abstracts have been classified and counted in order to give some idea of how the Society's research techniques and approaches have changed over the past 40 years. Lastly, we attempted to compare the Society's life with that of a human and asked the question: Is our Society in its middle age or old age or, worse, senescence? We believe that the Society should be proud of its past, but we should not be mired in nostalgia. In other, simpler, words, it is proper to look back but not to stare.

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TABLE 1. Abbreviated history of Teratology Society

Year of meeting	President	Meeting site	Key topics	Business and administration
1961	J. Warkany	Cincinnati, OH	Organization of society, chromosomal defects	
1962	J.G. Wilson	Gainesville, FL	Chromosomal defects, developmental genetics	
1963	F.C. Fraser	Ste. Adele, Quebec	Thalidomide, cellular basics of development, teratogenic agents	
1964	D.A. Karnofsky and M.M. Nelson	Harriman, NY	Epidemiology, cellular basis of development, teratogenic agents	
1965	I.W. Monie	San Francisco, CA	Viruses, oncogenesis	
1966	S.Q. Cohan	Corpus Christi, TX	Riboflavin deficiency, primate model pesticides	
1967	M.N. Runner	Estes Park, CO	X-irradiation, mechanism of thalidomide, fluid problems in the embryo	
1968	R.L. Brent	Buck Hill Falls, PA	Immunology, Trypan blue	Dr. H. Kalter, first editor of Teratology
1969	T.H. Shepard	Crystal Mountain, WA	Whole embryo culture (Dennis New); thalidomide, isoenzymes	
1970	R.W. Miller	Annapolis, MD	Di George syndrome pharmacokinetics	
1971	J. Langman	Williamsburg, VA		
1972	S. Pruzansky	Brown's Lake, WI	Transplacental carcinogenesis, cartilagenous dwarfism	
1973	D.G. Trasler	St. Jovite, Quebec	Potato blight, male sexual development	
1974	J.R. Miller	Vancouver, BC	Fetal alcohol and other syndromes, placental morphology, animal testing	
1975	E.M. Johnson	Pocono Manor, PA	Developmental pharmacology, preclinical teratology testing	Concurrent sessions at meeting
1976	L.S. Hurley	Carmel, CA	Cleft palate epidemiology, Down syndrome, copper deficiency, and mutant gene quaking mice, immunology and teratogenesis	Poster sessions started
1977	J.L. Sever	Reston, VA	Estrogen and birth defects, mesoderm in polydactyly, terathanasia, preventive methods, teratomas, postnatal defects	R.L. Brent, editor of Teratology
1978	E.V. Perrin	Mackinac Island, MI	Ethical issues, polybrominated biphenyls, molecular biology	
1979	A.R. Beaudoin	Cedar, MI	Biomechanical factors; mutational rates, limb defects	Wilson Young Investigator Award started
1980	R.M. Hoar	Portsmouth, NH	Fetal alcohol syndrome, facial clefts	
1981	C.A. Swinyard	Palo Alto, CA	Ethanol, radiation, workplace hazards, Bendectin trial	Public Affairs Committee initiated
1982	W.J. Scott	French Lick, IN	Developmental neurotoxicology of opiates, receptors, in vitro embryo culture, prevention of congenital defects, drug metabolism	
1983	D.M. Kochhar	Atlantic City, NJ	Neurotoxicity of heavy metals, expert witness, growth factors, gene insertion	
1984	R.E. Staples	Boca Raton, FL	Bendectin	
1985	G.P. Oakley	Pine Mountain, GA	Risk assessment, teratology answering services	
1986	L.B. Holmes	Boston, MA	Hyperthermia, postnatal outcome with lead and cocaine	
1987	A.G. Hendrickx	Rancho Mirage, CA	Diabetic embryopathy, yolk sac, chemical disposition and toxicity, regulation and legislative process	First meeting of Organization of Teratology Information Services (OTIS)
1988	C.T. Grabowski	W. Palm Beach, FL	Teratology in 1990s; advances in morphology	
1989	M.S. Christian	Richmond, VA	Male infertility; retinoids, regulatory issues, lead and behavior, developmental biology, computers and teratology information	Vice-President-elect position initiated; position paper on retinoids, Student Travel Awards started
1990	E.F. Zimmerman	Victoria, BC	Homeotic genes, apoptosis, cocaine	
1991	C.A. Kimmel	Boca Raton, FL	Preimplantation teratology, the war to prevent congenital defects, developmental neurotoxicology, molecular targets in the embryo, Accutane	Business office with executive secretary established
1992	R.K. Miller	Boca Raton, FL	Prevention of neural tube defects, genetic teratology	
1993	M. Barr	Tucson, AZ	Molecular approaches, occupational hazards	T.W. Sadler, editor of Teratology
1994	J.W. Hanson	Puerto Rico		
1995	J.M. Desesso	Newport Beach, CA	Risk assessment, trophoblast cells, folic acid, neural crest, antioxidants	
1996	K.K. Sulik	Keystone, CO	Molecular mechanisms, maternal nutrition, retinoids	
1997	J.F. Cordero	W. Palm Beach, FL	Apoptosis, molecular mechanisms of pharmacology, targeted gene disruption, regulation of apoptosis	L.B. Holmes, editor of Teratology
1998	P.E. Mirkes	San Diego, CA	Genetic susceptibility, gene mapping, legal cases, arsenic, name change for society	F. Clarke Fraser Young Investigator Award initiated; New professional management team (ADG) was hired
1999	A.R. Scialli	Keystone, CO	Apoptosis, oxidative stress, skeletal development, and postmarket surveillance of drugs	
2000	G.P. Daston	W. Palm Beach, FL		

TABLE 2. Alphabetical list of past and present officers of the Teratology Society

Name	Institution	President	Secretary/treasurer	Treasurer	Council member
Barr, M., Jr.	University of Michigan	1992–1993			1986–1988
Beaudoin, A.R.	University of Michigan	1978–1979			1971–1974
Benirschke, K.	University of California, San Diego				1963–1965
Brent, R.L.	du Pont Hospital for Children and Jefferson Medical College	1967–1968			
Brown, K.S.	NIDS				1983–1985
Christian, M.S.	Argus Research Laboratory	1988–1989			1983–1987
Cohlan, S.Q.	New York University	1965–1966	1960–1964		
Cordero, J.F.	Centers for Disease Control	1996–1997			1991–1993
Dagg, C.P.	Jackson Memorial Laboratory			1963–1968	
Daston, G.P.	Procter & Gamble Co.	1999–2000		1991–1994	
DeSesso, J.M.	Mitretek Systems	1994–1995			
Fantel, A.G.	University of Washington				1988–1990
Faustman, E.	University of Washington		1960–1964		
Finnell, R.H.	Texas A&M University				1997–2000
Francis, E.Z.	U.S. EPA			1992–1995	
Fraser, F.C.	McGill University	1962–1963			1960–1961
Friedman, J.	University of British Columbia	(2001–2002)			
Grawbowski, C.T.	University of Miami	1987–1988			1979–1981
Greene, J.A.	CIIT				1984–1986
Gunberg, D.L.	University of Oregon				1960–1962; 1967–1969
Hales, B.	McGill University			1996–1999	1998–1999
Hanson, J.W.	University of Iowa	1993–1994			1990–1991
Hendrickx, A.G.	University of California	1986–1987	1979–1983		
Hoar, R.M.	Roche Pharmaceutical	1979–1980		1974–1978	
Holmes, L.B.	Massachusetts General Hospital	1985–1986			1982–1984
Hook, E.B.	University of California, Berkeley				1987–1989
Hurley, L.S.	University of California, Davis	1975–1976	1968–1972		
Jensh, R.P.	Jefferson Medical College			1990–1992	
Johnson, E.M.	Jefferson Medical College	1974–1975			1967–1970
Jones, K.	University of California			1998–1999	
Kalter, H.	Children's Hospital Research Foundation				1966–1968
Kaplan, S.	University of Wisconsin, Milwaukee				1977–1978
Karnofsky, D.A.	Sloan-Kettering Cancer Institute	1963–1964			1961–1963
Kavlock, R.J.	U.S. EPA	(2000–2001)			1995–1997
Khera, K.S.	Bureau of Chemical Safety, Canada				1980–1982
Kimmel, C.A.	U.S. EPA	1990–1991			
Kochhar, D.M.	Thomas Jefferson Medical College	1982–1983			1971–1973
Langman, J.	University of Virginia	1970–1971			1968–1969
Long, S.Y.	University of Wisconsin, Milwaukee			1978–1979	
Manson, J.M.	Merck Co.		1988–1991		
Miller, J.R.	University of British Columbia	1973–1974			1970–1971
Miller, R.K.	University of Rochester	1991–1992			
Miller, R.W.	National Cancer Institute	1969–1970			
Mirkes, P.E.	University of Washington	1997–1998			
Monie, I.W.	University of California	1964–1965			
Moss, S.	National Institutes of Health		1973–1974	1974–1975	
Murphy, M.L.	Sloan-Kettering Cancer Institute				1960–1961
Nelson, M.M.	University of California, Berkeley	1963–1964	1961–1963		
Oakley, G.P.	Centers for Disease Control	1984–1985			
Perrin, E.V.	Wayne State School of Medicine	1977–1978			1974–1975
Pruzansky, A.	University of Illinois	1971–1972			
Rodier, P.M.	University of Rochester				1993–1996
Rogers, J.M.	U.S. EPA			1998–2001	
Runner, M.N.	University of Colorado	1966–1967			1961–1963
Sadler, T.W.	University of North Carolina				1991–1994
Scialli, A.R.	Georgetown University	1998–1999			
Schardein, J.L.	International Research & Development Corporation				1985–1987
Schwetz, B.A.	Food & Drug Administration		1979–1980	1979–1980	
Scott, W.J., Jr.	University of Cincinnati	1981–1982			1977–1979
Seegmiller, R.E.	Brigham Young University			1999–2000	
Sever, J.L.	NIH, George Washington University	1976–1977			1970–1971
Shepard, T.H.	University of Washington	1968–1969			1966–1967
Slikker, W.	NCTR				1995–1998
Smith, D.W.	University of Washington				1975–1977
Staples, R.E.	Staples Consulting, Inc.	1983–1984	1974–1977		
Steffek, A.J.	University of Illinois				1973–1975
Sulik, K.K.	University of North Carolina	1995–1996			1991–1993
Swinyard, C.A.	Stanford University	1980–1981	1968–1972		
Thiersch, J.B.	University of Washington				1964–1966
Trasler, D.G.	McGill University	1972–1973			
Tyl, R.W.	Center for Life Sciences and Toxicology				1992–1995
Walker, B.E.	Michigan State University				1962–1964
Warkany, J.	Children's Hospital Research Foundation, Cincinnati	1960–1961			
Wilson, J.G.	Children's Hospital Research Foundation, Cincinnati	1961–1962			
Wise, D.	Merck Research Laboratory			1998–2001	
Zimmerman, E.F.	Children's Hospital and Research Foundation, Cincinnati	1989–1990			1981–1983

TABLE 3. Warkany lectures

Year	Speaker	Subject
1985	Bengt Källén	Congenital defect epidemiology
1986	Philip Leder	Insertional mutagenesis
1987	Kurt Benirschke	Borderline of pathology and embryology—the placenta
1988	Thomas Shepard	Borderlines between human embryology, teratology, and medicine
1989	E. Marshall Johnson	Scoring of chemical hazards
1990	Devendra Kochhar	Retinoic acid biology
1991	F. Clarke Fraser	Teratogenic risks; organic solvents
1992	Robert Brent	Radiation effects; the importance of animal research in determining human risks
1993	Heinz Nau	Interspecies pharmacology
1994	John McLachlan	Molecular teratology: diethylstilbestrol
1995	Andrew Hendrickx	Primate models for teratology
1996	William Webster	Rodents, risks, and reactions
1997	Godfrey Oakley	Preventing birth defects
1998	John Gerhardt	Signal transduction during embryogenesis
1999	Carole Kimmel	Improving risk assessment

TABLE 4. Continuing education courses

Year	Title	Organizer
1984	Principles of teratology	Allan R. Beaudoin
1985	Experimental design and data evaluation in teratology	Allan R. Beaudoin
1986	Pharmacokinetics and metabolism	Gary L. Kimmel
1987	Embryology and morphology	Allan R. Beaudoin
1988	Postnatal manifestations of developmental toxicology	Guillermo Millicovsky
1989	Foundations of abnormal development	Ronald P. Jensh
1990	Molecular biology of abnormal development	Richard M. Hoar
1991	Human developmental toxicants	Ronald D. Hood
1992	Pharmacokinetics and developmental toxicology	Robert J. Kavlock
1993	Embryology for teratologists	M.H. Feuston
1994	Molecular and cellular techniques in teratology	George Daston
1995	Principles in teratology	Richard H. Finnell
1996	Risk assessment in developmental toxicology	Thomas B. Knudsen
1997	Approaches for studying mechanisms of abnormal development	Patrick J. Wier
1998	Development and function of the endocrine and immune systems	Craig Harris
1999	Organ system maturation and functional postnatal development	Melissa Tassinari

YEAR-BY-YEAR ACCOUNT OF THE PAST 32 YEARS OF THE TERATOLOGY SOCIETY

The living ex-presidents from 1967 on were asked to contribute scientific and social highlights and other pertinent information about their year in office. Sadly, some did not respond, requiring us to describe their year and, in general, these accounts lack full details as compared with those that were added, with editing, by respondents.

1961–1967

For the period 1961–1967, refer to “The History of Organized Teratology in North America,” by James G. Wilson and Joseph Warkany, *Teratology* 31:285–296, 1985.

1967–1968

The annual meeting was held at The Inn at Buckhill Falls, situated in the Poconos in Pennsylvania, May 15–17, 1969. The Buckhill resort is an elegant old resort, which was frequented by many of the members of Philadelphia high society during the summer months and the spring and fall in the early years of the nineteenth century.

The Society had fewer committees and had not yet attained national recognition. The financial obligations were minuscule compared with the cost of planning a meeting and governing the Society in the 1990s. There were no outside donors who supported the Society or a professional organization that helped administer the Society’s activities and annual meeting.

We believe that the members of the Teratology Society in 1999 would find it humorous to discover the cost of running the meeting in 1968, as well as the cost of attending the meeting. The cost of a room at Buckhill Falls was \$32.50 per day, which included two meals, a very large breakfast, and a banquet-like dinner. The registration fee for the meeting was \$5.00, and the Society Membership dues were in the range of \$15.00–20.00, which included a subscription to the *Journal*. These increased costs, adjusted for a 4–5-fold inflation, may not be excessive.

A trio from the Curtis Institute of Music played chamber music at the banquet meeting. It cost \$50.00 to have these wonderful young students perform at the Buckhill Falls Inn. There were a few symposia and speakers from other countries. Felix Beck and John Lloyd were invited to the meeting and talked about the

TABLE 5. Total submitted abstracts and percentage of different types of four periods

Period	1961–1969	1970–1979	1980–1989	1990–1999
Abstract total number	38.1 ± 3.0	81.8 ± 8.3	175 ± 6.7	171 ± 10.8
Mammalian studies	61.1 ± 4.8	73.8 ± 3.2	64.0 ± 3.0	64.1 ± 1.9
Epidemiology (%)	3.7 ± 1.1	3.2 ± 1.0	5.0 ± 0.9	10.8 ± 2.1
Dysmorphology (%)	4.8 ± 1.0	3.7 ± 0.8	4.0 ± 0.4	3.9 ± 0.6
Developmental biology (%)	3.6 ± 1.3	1.3 ± 0.5	1.5 ± 0.5	13.3 ± 2.7
Embryo culture (%)	0.9 ± 0.6	3.1 ± 0.8	8.1 ± 0.6	11.2 ± 0.7

mechanism of Trypan blue teratogenesis. This was the first time that Bob met Dr. Lloyd in person, and they have been colleagues ever since.

Dr. Warkany chaired the first session. Dr. Wilson also chaired a session and presented some papers. An immunology symposium was held because immunology was exploding during the 1960s. Presenters at that symposium were A.M. Silverstein from Johns Hopkins, who studied fetal immunogenesis and congenital infections, primarily in sheep. Jonathan Lanman, who did some of his work at the Rockefeller Institute, presented his papers on maternal-fetal immunological relationships. Some may recall that these studies demonstrated that immunization of the mother with paternal skin did not harm the fetus. Drs. Jim Wilson, Felix Beck, John Lloyd, Ron Jensh, and David Gunberg participated in a symposium on Trypan blue. Clarke Fraser chaired the last session and the meeting ended at noon on Friday after 3 days.

One of the delightful aspects of the meeting at Buckhill Falls was the manner in which guests were seated for their meals. Most tables were set up for eight people. The seating was based on your position in the dining room waiting line, so there was a great opportunity for the students, the middle-aged faculty members, and the senior faculty members to sit together on a random basis at every meal, which was a very beneficial situation. At many meetings, everybody departs from the meeting site in order to dine, and one never has an opportunity to sit with the likes of Dr. Warkany, Dr. Wilson, or Dr. Fraser, unless the meeting site has a dining room seating arrangement similar to that of the Inn at Buckhill Falls.

One of the momentous occurrences during the year was the fact that the journal *Teratology* was created. In fact, the meeting of the Teratology Society was the first meeting at which the program was recorded for perpetuity in the Journal. Harold Kalter, the first editor is probably one of the most meticulous writers that we have in the Society. He is a stickler for accuracy and clarity and brought those qualities of good writing and good grammar to the Journal that started it on a high road.

From the standpoint of research activities of the membership, it was not difficult to obtain support from the National Institutes of Health. We jested about the fact that in the early days, all you had to do was drop your pen on an National Institutes of Health research application blank, and you had a reasonable chance to have the application approved and funded, a slight

exaggeration, of course. Many projects were funded that would not be approved during the 1990s but that resulted in interesting and important findings. Obviously, times have changed drastically, and it is now extremely difficult to obtain funding for research, especially in the area of teratology. We experienced ups and downs of funding for research. Teratology research suffered during the periods of limited funding, but it was very important to develop a feeling of optimism, namely, that one had to persist in the attempt to obtain research support.

The president, Robert L. Brent, is the distinguished Louis and Bess Stein Professor and Chairman-Emeritus of the Department of Pediatrics at Jefferson Medical College and head of the Laboratory of Clinical and Environmental Teratology at the du Pont Hospital for Children. Among many honors, he was recently elected as a member of the Institute of Medicine of the National Academy of Science.

1968–1969

The annual meeting was held at Crystal Mountain, Washington, a ski resort near Mt. Rainier. The most memorable event of the meeting was a salmon barbecue at the top of the ski lift with Mt. Rainier in its full glory. The after-dinner speaker was the famous salmon biologist, Loren Donaldson. The disadvantages of the site were the travel distance from the airport and mediocre food services.

The program was highlighted by Dennis New's presentation of a whole-embryo culture technique that was eventually taken up by many teratology laboratories (Table 5). J.D. Biggers gave another lecture on isoenzymes. Symposia on thalidomide and cleft lip and palate were held. It is of interest that the same graduate student (Alan Fantel) projected every slide. The council decided to add a second meeting to its activities.

The president, Thomas H. Shepard, is a teratologist in the Department of Pediatrics at the University of Washington. In addition to training many teratologists, his primary research interests are on the effects of nutrients on development, including deficiency of riboflavin, pyridoxine, and iron, as well as retinoic acid excess. The metabolism of glucose by the embryo has also been a subject of his studies with associates. His book "A Catalog of Teratogenic Agents" (Johns Hopkins University Press, 1998) is in its ninth edition.

1969–1970

The meeting was held in late May at the Statler-Hilton Hotel on the bank of the Severn River in Annapolis, Maryland. Room charges were \$16–18 per night, and the facilities were excellent. A small problem developed when we attempted to turn on the slide projector, and “elevator music” filled the meeting room. One of the restaurants in Annapolis featured deli sandwiches named for famous people. The least appetizing was a corned beef on rye called the Spiro Agnew. Invited speakers were Victor McKusick, Philip Fialkow, George Todaro, and Charles Lowe. Bruce Beckwith described what is now known as the Di George syndrome; another paper reported limb defects in the chick after exposure to Texas sand.

The Society hired a lawyer to incorporate the Society to give tax exemption to donors. The key feature of the meeting was the spirit generated by Joe Warkany and Virginia Apgar. They gave a sparkle to the meeting and, as Robert Warwick Miller, the president that year, points out, Virginia Apgar now appears on a postage stamp.

Robert Miller, the president, is a pediatrician who has contributed significant information on the association between congenital defects and various forms of cancer. He works at the National Cancer Institute in Bethesda, Maryland.

1970–1971

The annual meeting was held in historic Williamsburg, Virginia, at the Williamsburg Conference Center. The time of year was early May, which allowed the members to explore the old building and houses without much of a crowd. A symposium was organized by Chester Swinyard on the subject of environmental influences on the development of the central nervous system. Two sessions were devoted to the pathogenesis of cleft palate in animals and humans. Fifty-eight papers were presented from the platform. There were no concurrent meetings and it was necessary to present 10 papers by title only.

Jan Langman, the president, was professor and chairman of anatomy at the University of Virginia, and he died in 1981. His textbook “Medical Embryology” (Williams & Wilkins) is now in its seventh edition, authored by Thomas W. Sadler.

1971–1972

The annual meeting was held at Brown’s Lake Resort in Burlington, Wisconsin. The best remembered aspect of the services was the farmer-sized meals offered. Samuel Pruzansky gave the presidential address on interdisciplinary research, drawing on his experience, using a multifaceted approach to the treatment of craniofacial anomalies at the University of Illinois. The Brown’s Lake Resort was very close to a Playboy Club Resort, but the two facilities could not have been more different. Brown’s Lake was run like a children’s summer camp. Lots of high-starch food and a milk and cookies snack before bedtime.

Dr. Pruzansky died in 1984 (Slavkin, ’84). David W. Smith organized a symposium on osteochondrodysplasia. Invited speakers were Albert Dorfman, Department of Pediatrics, Pritzker School of Medicine, and J.M. Rice from the National Cancer Institute, Bethesda, Maryland. Fifty-five papers were presented from the platform, and 19 papers were read by title. Only two papers dealt with epidemiology of congenital defects.

1972–1973

The meeting took place at Grey Rocks, St. Jovite, Quebec, with more than 400 attending. One symposium addressed the possible role of potato blight as a cause of neural tube defects (a hypothesis well disproved later). A lecture was given on male sexual development. A new rule designating a nonsmoking section in the meeting hall was put into order. An amusing event occurred when the hotel management laid out female nightgowns in the rooms of male members with double gender names. Eugene (Jean) Perrin was disappointed.

Daphne Trasler, the president, is well known for her work in mouse genetics particularly in studying the pathogenesis of inherited defects. She has worked at McGill University until her retirement in 1995.

1973–1974

The annual meeting was held on the campus of the University of British Columbia in Vancouver. The accommodations in dormitories provided a spectacular view of the Strait of Georgia. Many of the tennis players and bathers were disappointed because it rained every day—and we mean rained. Fifty-two papers were presented from the platform and 48 were read by title. There were no concurrent or poster sessions. Guest speakers were Kenneth Jones and Louis Honore, who spoke, respectively, on fetal alcohol syndrome and on placental morphology with spontaneous abortions. A symposium entitled “Have We Forgotten Thalidomide?” was presented.

James Miller, the president, was a geneticist at the University of British Columbia. He contributed substantially to the field of mouse genetic abnormalities. He was retired and died on November 27, 1999, in Vancouver.

1974–1975

The meeting was held in Pocono Manor, Pennsylvania, in a rustic setting. The opening lecture by Joe Warkany was on the first 15 years of the Society. Symposia included developmental pharmacology, organized by Tom Shellenberger, and preclinical testing for teratogenicity, organized by James G. Wilson. The practice of concurrent meeting sessions was initiated.

E. Marshall Johnson, the president, was head of the Department of Anatomy at Jefferson Medical College and has trained many teratologists who are active in the Society. He is especially interested in development of simple teratogen test systems.

1975–1976

The meeting was held at the Highlands Inn, Carmel, California. The location was beautiful but somewhat distant from large airports. Symposia were on the subjects of immunologic aspects of teratology and postnatal manifestations of prenatal or perinatal insult. Papers on facial clefts in domestic animals, the quaking gene and copper, and the parental age of Down syndrome patients were given, among others. The use of poster sessions was initiated. No major changes in the function of the Society were recorded.

Lucille S. Hurley, the president, brought a number of her graduate students, who wore T-shirts, announcing that they were the Hurley's Raiders. Dr. Hurley, who died in 1989, was an internationally known nutritionist, who among other activities was editor of *Journal of Nutrition* (Keen and Finley, '89).

1976–1977

The annual meeting was held at Reston, Virginia, close to the Washington, D.C., airport. Symposia were given on teratogens, perspectives in teratology, and postnatal defects, chaired by Robert W. Miller, Josef Warkany, and Richard Hoar, respectively. Joe Warkany lectured on "terathanasia," the "natural" elimination of congenital defects during prenatal life. An amusing banquet speaker was Father Brian, a Franciscan monk, and there had never been, nor has there been since, such hilarious laughter at a teratology meeting. An art show was held, showing etchings by Joe Warkany and woodcarvings by James Wilson. Robert L. Brent was appointed the second editor-in-chief of the journal *Teratology*.

The president, John L. Sever, was chief, Infectious Disease Branch, National Institutes of Neurological Diseases and Stroke, National Institutes of Health. He is currently professor of pediatrics at the Children's National Medical Center, George Washington University Medical Center, Washington, D.C. He has contributed significantly to the field of infectious diseases, especially during prenatal life and, for the past 10 years, has concentrated on research on human immunodeficiency virus in pregnant women and children.

1977–1978

The annual meeting was held on Mackinac Island, Michigan, in the venerable Grand Hotel. There were many interesting aspects to this meeting. The hotel, which is of wood construction, has the longest veranda in the world—the full width of the hotel. There are two presidential suites, where presidents of the United States have vacationed. You could reach the hotel by several routes, but the most interesting was by hydroplane. It was the only teratology meeting that had a unique odor because there were no motorized vehicles and the horses pulling the carriages were not housebroken. The food delivery was true pageantry with fully uniformed waiters marching into the dining hall in grand style. One hundred and twenty three papers were presented, including 19 by title. Symposia were

given on ethical issues in teratology, molecular teratology, and polybrominated biphenyls. These were among the first symposia, if not the first, on ethics and molecular biology.

Eugene V. Perrin, the president, is a professor of pathology at Wayne State University; his interests lie mainly in the descriptive aspects of human congenital defects and environmental and pharmacological care of families in which there are such damaged children. Among his many interests are birdwatching and unusual hats. The birdwatching has contributed to many early awakenings of other recruited members. His other interests are civil liberties and choral singing and conducting.

1978–1979

The meeting was held at the Sugar Loaf Mountain Resort in Cedar, Michigan. The setting was delightful but difficult to reach. The registration fee was \$15. One hundred twenty-four abstracts were submitted. Four invited speakers were Bruce M. Carlson, University of Michigan (limb anomalies from the perspective of a developmental biologist); Lynnwood B. Clemens, Michigan State University (sex differentiation of behavior in laboratory animals: dysfunction in the absence of congenital malformation); David W. Smith, University of Washington (biomechanical effects in morphogenesis); and K. Lemone Yielding, University of Alabama (DNA repair and co-teratogenic mechanisms). James V. Neel gave an address at the banquet entitled "Is it possible to monitor for changing mutation rates?" The council initiated the Young Investigator Awards.

Allan R. Beaudoin, the president, is now professor emeritus in the Department of Cell and Developmental Biology at the University of Michigan. His major research focus is the study of mechanisms of action of chemical teratogens.

1979–1980

The twentieth annual meeting was held at Wentworth-by-the-Sea in Portsmouth, New Hampshire. One hundred eighty-one papers were submitted, of which 24 were read by title. Four poster sessions were held. A joint session on fetal alcohol syndrome was given by our Society with the Behavioral Teratology Society. Four guest speakers included Paul D. McClean (evolution of brain patterns), John H. Grossman (infections as teratogens), Allen Mitchell (epidemiology), and Peter S. Spencer (neurocellular response to toxins). A New England clam bake was held on the beach.

Richard M. Hoar, the president, trained as an anatomist and has worked in the Department of Anatomy at the University of Cincinnati and at Roche Pharmaceuticals. His research has involved endocrines, pregnancy, and birth defects in guinea pigs, as well as developing the care, maintenance, and reproductive data surrounding the use of ferrets in reproductive toxicology.

1980–1981

The annual meeting took place on the campus of Stanford University. The dormitories proved to be very hot and somewhat inconvenient to the older members, especially at night in the common bathrooms. However, ample ice-cold wine and soft drinks were made available to assuage the discomfort. One hundred seventy papers were given, and 28 were given by title. Four colloquia were given covering the subjects of ethanol, women in the workplace, radiation, and the regulatory aspects of teratology. An interesting visit to the Stanford Linear Accelerator was arranged. A famous lawyer, Mr. Butler presented a ringing accusation of Bendectin as a human teratogen, using his courtroom style. His presentation was followed by stunned silence, with the exception of one commenter, Tom Shepard, who announced that he did not believe a word of it. His comment was encouraged by a jab in the ribs by Joe Warkany who, under his breath, said get up there and say something.

Chester Swinyard, the president, was trained as an anatomist but was noted especially for his major contributions to physical rehabilitation of children with congenital musculoskeletal defects. He formed the first Public Affairs Committee. Dr. Swinyard died in 1997 (Fraser, '98).

1981–1982

The annual meeting was held at the resort in French Lick, Indiana, a long bus ride from the airport in Louisville or Indianapolis. Highlights of the meeting included a symposium chaired by Harold Kalter honoring the eightieth birthday of Dr. Warkany. Speakers included Drs. Wilson, Benirschke, Miller, and a former colleague, Eberhard Passarge, from Essen, Germany. A second symposium, entitled *Prevention of Congenital Malformations. How Are We Doing?*, was chaired by Dr. Warkany. This symposium included a presentation by Richard Smithells of England, describing the preventive effects of maternal vitamin supplementation for neural tube defects, the forerunner of folic acid supplementation to rescue susceptible embryos from this fate. A total of 157 abstracts were submitted. At this meeting, there was a change in the manner of electing officers, with the choice of one candidate from two nominees suggested by a nomination committee.

The president, William J. Scott, Jr., is a professor of pediatrics at the Children's Hospital Research Foundation, Cincinnati, Ohio. He continues a longstanding interest in the mechanisms of limb malformations. He has helped train many of the Society's active members.

1982–1983

The twenty-third annual meeting was held at the Sands Hotel in Atlantic City, New Jersey. The facilities for scientific proceedings and social gathering were elegant and ample. The boardwalk and the casinos provided excellent opportunities for leisure activities, even though a few members found them somewhat distracting. About 100 papers were presented in con-

current sessions, and there were 91 additional presentations as posters; some of those were sponsored by the Behavioral Teratology Society. A symposium on advances in prenatal diagnosis was chaired by Laird Jackson, and another on the role of expert witness chaired by Marshall Johnson. An outstanding talk by Ralph Brinster introduced the members to the relatively new method of inserting foreign genes into mice to generate transgenic animals. For the first time, the Society explored the feasibility of starting a series of educational symposia (courses) under the direction of an Education Committee.

Devendra M. Kochhar is an embryologist at Jefferson Medical College, who initiated and popularized the use of retinoic acid as a teratogen, and has devoted his efforts to understand biological and pharmacological mechanisms of action of retinoids and their nuclear receptors in producing birth defects.

1983–1984

The annual meeting was held at the Boca Raton Hotel in Boca Raton, Florida. A symposium honoring James Wilson was presented by his students. Bob Brent, Jim Wilson's first graduate student, gave Dr. Wilson's biography introducing the symposium. A symposium on postnatal function after prenatal insult was chaired by Casimer Grabowski. A joint symposium sponsored by the Teratology Society and the David Smith Workshop on Malformations and Morphogenesis, chaired by Godfrey Oakley, reviewed the safety of Bendectin. Elements in hazard and risk estimation for Bendectin were given in a session chaired by John L. Sever. The facilities at the Boca Raton Club were superb. It was the last bargain meeting that we had. A room cost \$75 for both occupants. So for \$37.50 you had a room and two banquet-type meals a day.

It is of interest that although the Society sponsored a Bendectin Symposium, and there was no controversy over the lack of teratogenicity Bendectin, the Society has never published a position paper on Bendectin.

Robert E. Staples, the president, has been very active in animal testing of chemicals for teratogenicity and was associated with Merck and the du Pont Company. He also was the first head of teratology at the National Institute of Environmental Health. He now does private consulting.

1984–1985

The annual meeting was held at Callaway Gardens, a country club in Pine Mountain, Georgia, with a humidity of 100%. Callaway Gardens is the United States answer to Puerto Rico's rain forest. Abstracts submitted numbered 142. The first Warkany Lecture was given by Bengt Källén, who talked about malformation registries. Dr. Warkany was there to award one of his etchings to the speaker. The structure for the public affairs committee was revised, and vitamin A and retinoic acid were chosen for the first topic and statement.

A symposium was held on potential developmental toxicants, with a new focus on providing clinical teratology information.

Godfrey Oakley, who trained in pediatrics and epidemiology, played a major role in establishing a congenital defects center at the Centers for Disease Control. He is currently in the Department of Epidemiology at Emory University and is a leading advocate for the consumption of folic acid by women to prevent the occurrence of neural tube defects.

1985–1986

The annual meeting was held at the Boston Park Plaza Hotel. There were several symposia, including one on models of abnormal morphogenesis in honor of Clarke Fraser. Another was held on thalidomide in honor of the twenty-fifth anniversary of the discovery of this tragic human teratogen. The speakers included Joseph Warkany, Widikund Lenz, Frances Kelsey, and a graduate student from McGill who was considered to have limb defects caused by thalidomide. The Public Affairs Committee held a workshop on the new Teratology Information Services in honor of the late Sergio Fabro, who had established the Reprotox information system. A total of 190 abstracts were submitted.

The second annual Warkany Lecture was given on the subject of insertional mutagenesis, by Philip Leder, M.D., chairman of the Department of Genetics at Harvard Medical School.

A harbor cruise was the entertainment one evening. This was the first meeting for which an independent broker had negotiated room rates for the Society. Unfortunately, it was also clear that the apparently “low” rates were higher because of his fee. A full-time fundraiser helped significantly to increase donations.

Lewis B. Holmes, the president that year, is a teratologist and geneticist in the Pediatric Service at the Massachusetts General Hospital in Boston. His interests are in the epidemiology of congenital malformations, limb defects, and identifying human teratogens. He is the current Editor of *Teratology*.

1986–1987

The annual meeting was held at Las Palmas Resort, Rancho Mirage, near Palm Springs, California. The weather was warm even in the evenings, and the support facilities were excellent. The symposia were on diabetic embryopathy, the yolk sac, and the influence on chemical disposition on developmental toxicity. Also addressed was the subject of the influence of scientific societies on regulatory and legislative process. The Warkany Lecture was given on the placenta by Kurt Benirschke, using the title, “You Need a Sympathetic Pathologist, the Borderland of Embryology and Pathology Revisited.” No major changes in policy or procedures were recorded. One member “lost” his trunks in the spa and was awarded them the next day by several ladies as he was presenting a paper from the platform.

The Behavioral Teratology Society held its eleventh annual meeting concurrently and put on a symposium

entitled “Social Behavior as an Endpoint of Toxic Insult.” Carole Kimmel gave an update on federal regulation, and Ken Jones gave a talk on craniofacial malformations as a window to prenatal brain development. The president, Andrew Hendrickx, is an expert in subhuman primate embryology at the University of California at Davis. His laboratory has published many important teratology studies, using subhuman primates as subjects.

1987–1988

The annual meeting was held at the Breakers, Palm Beach, Florida. The hotel staff provided excellent service, and the food was tasty. A total of 201 abstracts were submitted, of which three were read by title. Symposia were held on teratology of the 1990s, developmental biology and teratology, and educational perspectives in clinical teratology.

Casimer T. Grabowski has been a professor emeritus of biology since 1992 at the University of Miami. His work on the physiologic changes in chick embryos after teratogenic exposure led to important concepts of teratogenesis in mammals. Cas is an excellent wood craftsman, and he presented the Society with a gavel, which is handed down each year to the next president.

1988–1989

The annual meeting was held at the Jefferson Sheraton Hotel in Richmond, Virginia. This site was a last-minute choice after plans in Philadelphia were canceled because the costs were too high. The hotel facilities and service were of good quality. An excursion on a dinner boat was memorable for the ferocious thunderstorm that occurred during this trip. The staircase in the hotel had inspired the one featured in the film “Gone with the Wind,” and our president decoratively descended these stairs into the reception meeting.

The International Federation of Teratology Societies presented a draft of the International Conference on Harmonization for Teratology Testing in Animals, which was a benchmark for interaction of regulators, scientists, and the pharmaceuticals industry. Symposia were held on assisted reproduction, regulatory issues, valproic acid, low lead exposure, computer use, biostatistics of segment II studies, threshold concepts in risk evaluation, and regulation of therapeutically useful human teratogens. The Public Affairs Committee presented a draft of a position paper on two retinoids, etretinate and isotretinoin.

The Wilson lunch for students was initiated, and a line item of budget \$10,000 was approved for Student Travel Awards. The Student Affairs Committee was made a standing committee. An agreement was signed by the president, Mildred Christian, for archiving and preserving the Society’s records at the College of Physicians of Philadelphia. A new position, vice-president-elect, was approved in order to give the president a 2-year experience before holding office as president.

Mildred S. Christian, an officer in Primedical-Argus in Horsham, Pennsylvania, has contributed widely to the field of animal testing of drugs and other chemicals.

1989–1990

The annual meeting was held at the majestic Empress Hotel in Victoria, British Columbia. Members were able to whale watch or tour the city in off-hours, but the travel expenses were high for those from the East of the United States. Dave Kochhar gave the Warkany Lecture on the role of retinoic acid as a morphogen and teratogen. Symposia included the role of homeobox genes in normal development and the mimicking of homeobox mutations to produce congenital limb and spinal cord defects. Another subject was the gene regulation of programmed cell death. A review of the effect of cocaine as a human teratogen was presented. The after-dinner speaker was a professional comedian who posed as a soviet bureaucrat with a background in developmental toxicology. The Council met twice at 6-month intervals, and a newsletter was initiated.

Ernest F. Zimmerman, the president, is a pharmacologist at the University of Cincinnati, with special interests in the genesis of facial clefts.

1990–1991

The annual meeting was held in Boca Raton, Florida, and it rained every day. The Wiley-Liss symposium, "Organizational Control in the Embryo: Potential Targets for Developmental Toxicants," gave excellent examples of the importance of molecular and cellular biology to the understanding of birth defects. Two other symposia, sponsored by the Teratology Society, Neurobehavioral Teratology Society, and the International Federation of Teratology Societies, were on improving approaches to the characterization of developmental neurotoxicity and international regulatory concerns. Another symposium was entitled "Where Is the War to Prevent Birth Defects?" Preimplantation factors that lead to birth defects were also addressed. A record number of abstracts (220) was submitted.

During Carole A. Kimmel's presidency, the practice of appointing a separate program chairman and as well as election of both a vice-president and president-elect was initiated. The meeting was held in conjunction with the International Federation of Teratology Societies under the chairmanship of Takashi Tanimura. Society members were active in public meetings regarding Accutane and a campaign to reduce neural tube defects by the use of folic acid was beginning. Richard Miller chaired a group to help make a long-range plan for the Society during the next 10 years.

Dr. Kimmel has had a leadership role in improving regulatory aspects in the government and is a senior scientist at the Environmental Protection Agency.

1991–1992

The annual meeting was held at the Boca Raton Hotel and Club in Florida. The services and hospitality

were appreciated. Symposia were held on newer techniques for measuring development, cardiac development, and Food and Drug Administration classification of drugs. Nicolas Wald from London gave a keynote address on the sentinel study demonstrating that folic acid administration reduced the recurrence of neural tube defects. Mason Barr detailed the syndrome associated with angiotensin-converting enzyme (ACE) inhibitor fetopathology. Keynote speakers were given by Arthur A. Levin and by Robert Areci on retinoid receptors and embryonic signaling, respectively.

Richard K. Miller, the president that year, is a toxicologist at the University of Rochester. His special interest is the role of the placenta in teratogenesis.

1992–1993

The annual meeting was held under bright sun in Tucson, Arizona. You could only use the tennis courts from 5:00 to 6:00 AM or from 9:00 to 11:00 PM; otherwise, you could fry an egg on the court surface. The president, Dr. Barr, introduced the meeting with a short slide show pointing out that teratology is not the study of turtles, terrorists, pterodactyls, or terra firma, but is the study of birth defects, which is also done by the National Enquirer. Use of the word teratology is still being debated by the Society. Symposia were held on women's rights in teratology and genetics, environmental risks, and folic acid in the prevention of neural tube defects. There were 187 (24% of members) abstracts offered by 785 members of the Society.

Mason Barr, Jr., is a pediatrician and perinatal pathologist at the University of Michigan. He continues a long productive experience in detecting, describing, and treating human fetal and infant congenital defects.

1993–1994

The annual meeting was held at the Hotel El Conquistador in Puerto Rico, and the site had spectacular view of the Caribbean. A near-record number of abstracts (204) were submitted. Symposia were held on antisense DNA techniques, endocrine endpoints, dysmorphology and deafness, morphogenesis of the face and brain, the pregastrulation embryo, reproductive testing of biochemical agents, animal care and use, public affairs and the American Medical Association, and an update on hereditary malformations. The banquet was addressed by the Honorable Pedro Rossello, M.D., governor of Puerto Rico. The president, James W. Hanson, a pediatric geneticist with special training in dysmorphology and epidemiology, is active in Washington, D.C., at the clinical epidemiology branch of the National Cancer Institute.

1994–1995

The annual meeting was held at the Marriott Hotel in Newport Beach, California. The support facilities were excellent, and 176 abstracts were submitted. The membership numbered 816. Symposia were held on advances in imaging, interface between research and public education with acquired immunodeficiency syn-

drome as a model and limb dysmorphogenesis. Through the use of concurrent sessions and poster presentation, all abstracts were presented. During this year, a continuing increase in abstracts (24) drawing on molecular genetics was evident.

John DeSesso, the president, works for Mitretek Corporation of McLean, Virginia. His main interests are in the areas of animal models and mechanisms of teratogenicity.

1995–1996

The annual meeting was held at Keystone, Colorado, at more than 10,000 feet in the Rockies, west of Denver. The surroundings were spectacular, but some members had mild altitude illness, while one or two had severe symptoms. Our quota of occupied rooms was missed, and as a result the Society developed a debt that could be paid off only by a return visit, which occurred in 1999. The number of abstracts dropped by 25% to 151. Symposia were held on brain development, molecular teratology, and the therapeutics of teratogens and hormonal effects on development. The Wilson Award dinner was held at Timber Ridge, a gondola ride up from the meeting level.

Kathleen Sulik, the president that year, is a professor in anatomy at the University of North Carolina. She is known especially for her effective scanning electron microscopy to explain pathogenesis of teratogenic events.

1996–1997

The thirty-seventh annual meeting was held in conjunction with the Neurobehavioral Teratology Society, Behavioral Toxicology Society, and the tenth meeting of the Organization of Teratology Information Services at the Breakers in Palm Beach, Florida. The hotel lived up to its expected elegant services and hospitality. Symposia were held on molecular mechanisms of development, heart development, congenital infections and teratogenesis, teratogenic hazards, and risks and dietary prevention of birth defects. Godfrey Oakley gave the Warkany Lecture on preventing birth defects, "Rubella, Alcohol and Folic Acid are Better Models Than Thalidomide, Valproic Acid and Accutane." Of the 145 abstracts submitted, 14 were on epidemiology and 13 dealt with molecular genetics of development. Membership was 798.

Jose F. Cordero, the president, is a pediatrician-epidemiologist who works for the Centers for Disease Control. He is currently leading the program for varicella vaccination in the United States.

1997–1998

The meeting was held on a peninsula projecting into Mission Bay, California, adjacent to San Diego. The site was a virtual botanical garden with numerous lagoons and a variety of birds. The Princess Resort provided excellent meeting facilities. The palm trees wrapped with lights looked like giant banded chromosomes at night. A symposium on thalidomide examined

the pros and cons of its reintroduction for treatment of certain desperate disorders. Other symposia were on genetic susceptibility, gene mapping, arsenic, and the teratologist's role in legal matters.

The Society hired a new professional management group, the Associated Development Group. Twenty members representing different segments of the Society drew up a strategic planning initiative at a separate 3-day meeting. A new mission statement was formulated. The discussion about changing the name of the Society was tabled and referred back to a committee chaired by David Beckman. Topics addressed by the long-range group included financial management, cost of attending the meetings and partnering with other societies. The Clarke Fraser Young Investigator Award was initiated and presented by Clarke to Edward Lammer.

Philip E. Mirkes, the president, was trained in developmental biology and is research professor of pediatrics at the University of Washington, Seattle. His work has been with the metabolism of cyclophosphamide, heat shock proteins, and the cascade of events leading to cell death.

1998–1999

The last years of the century saw the Teratology Society become more modern in the conduct of its business. The 1999 meeting in Keystone, for example, was the first annual meeting for which electronic abstract submission was the norm.

Nancy Dieter, the first executive secretary of the Society under the management with Associated Development Group, left for another position. Nancy had done much of the initial work in transferring the Society from its old self-run business office to a more efficient arrangement at Associated Development Group. Among Nancy's most visible accomplishments was the publication of the newsletter in a more professional format. While this format was very popular, it was costly, due in part to frequent last minute changes and additions. Nancy was replaced by Tonia Masson, who recognized that the Society needed to get costs under control. Tonia put in place a firm schedule for the newsletter, with no tolerance for late submissions or later changes.

In addition, Tonia and the Secretary, Bob Seegmiller, worked on an electronic version of the newsletter, which was planned to replace some or all of the printed newsletters.

Perhaps the greatest challenge for the Society this year was the annual meeting at Keystone Resort in Colorado. The site for the meeting had been forced on the Society in order to fulfill a financial obligation. That financial obligation had been incurred 3 years earlier, when attendance fell short of a guarantee. Some members did not plan to attend because they had been uncomfortable or ill at altitude at the previous Keystone meeting. Finally, the timing of the meeting included the July 4 holiday weekend, another condition forced on the Society. Some members found it unac-

ceptable to be away from home on the holiday. Because the Society still needed to make a guarantee to the resort, there was a possibility of another financial shortfall.

The ending was happy, however. Although the total number of abstracts was 40% lower than usual, skillful management by the program chair, George Daston, and by the meeting planner, Clarissa Russel Wilson, resulted in the meeting at least breaking even and perhaps making a little money. Symposia were held on oxidative stress, apoptosis and abnormal development, skeletal development, and postmarketing surveillance of drugs for teratogenic effects. Of more importance, the scientific sessions were of high quality, and attendees were more than satisfied with their decisions to come to the meeting. As an added bonus, the annual business meeting, for which 90 minutes had been allowed, took only 50 minutes, thanks to the efficient use of time by committee chairs and officers who gave reports. It is likely that this year was the first time in the history of the Society that an Annual Business Meeting took less time than allotted. At the banquet, a slide show of baby pictures of various members entertained the guests.

At the meeting, Mineo Yasuda, co-president of the International Federation of Teratology Societies announced that the 6th meeting of the Organization would be held in Shimane, Japan, from July 12–14, 2000.

The president, Anthony Scialli, is an obstetrician trained in pharmacology. He is editor-in-chief of *Reproductive Toxicology* and an author of *Reproductive Effects of Chemical, Physical and Biologic Agents, Reprotox* (Johns Hopkins Press, 1995). The above book is maintained on an updated database along with TERIS (Teratogenic Information Service) and Shepard's Catalog of Teratogenic Agents by Micromedex, Denver, Colorado.

NUMBER AND TYPE OF ABSTRACTS SUBMITTED TO THE ANNUAL MEETING

A review and classification of all the abstracts submitted to the annual meetings was carried out. The type of abstract for each of 39 years was expressed as the percentage of total annual submissions. In some cases, an abstract was placed in two categories. For instance, an animal study with a null mutation would appear under animal studies and developmental biology and, in the case of an epidemiology paper studying a mutation, it would appear under both epidemiology and developmental biology.

The main body of work, including effects of agents on animals, mechanism studies, and neurobehavioral papers, defied classification. There were many excellent pharmacologic papers. During the early periods, a large number of papers dealing with cleft lip and palate were noted that may have reflected the influence of Clarke Fraser had on his students and associates.

Table 5 gives the mean and standard error for the total number of abstracts and the percentage of types of

abstracts. The average total abstracts increased significantly from 1961–1969 to 1970–1979 and from 1971–1979 to 1980–1989 but remained much the same in 1990–1999 (Table 5). The ratio between abstracts submitted and the total membership ranged between 0.18 to 0.24, with no obvious change over time. Joe Warkany and Clarke Fraser used to tell us that if you have good results you did not need statistics.

The animal studies included mammalian species, while chick and whole-embryo culture studies were excluded in the tabulation. No significant differences were found. The epidemiology studies did not change much until the last period, when a significant increase to 10% was noted. This increase may be explained in part by participation from members of the Organization for Teratology Information Services group, especially the San Diego and Toronto groups. Active participation from the surveillance groups at the Centers for Disease Control and State of California continued to be important. Charlotte Ferencz and her group in Baltimore, contributed valuable papers on the epidemiology of congenital heart disease. The dysmorphology abstracts included new syndromes and case reports with descriptive aspects important for generating epidemiologic studies. No significant changes were noted over the four periods.

The developmental biology abstracts were difficult to count because of changes in the field and especially with increased identification of developmental genes and other products of molecular genetics. What might have been developmental biology during the 1960s could perhaps now be described as descriptive biology, which laid the basics for later discoveries. One might say that the new agents we study now are developmental genes and growth factors, somewhat replacing the prior emphasis on drugs, chemicals, and other environmental agents. The marked increase to 13% for developmental abstracts was seen during the 1990–1999 period; in fact, at the 1998 and 1999 meetings, the percentage of such abstracts was 35% and 20%, respectively.

Whole-embryo culture was introduced during the late 1960s by Dennis New of Cambridge University. Within several years after he developed a method for culturing embryos in rotating gassed bottles ('67), several laboratories began using it to study isolated mouse and rat embryos during active embryogenesis from pre-somite to late somite stages. The main use has been for study of mechanisms including determination of toxic dose levels. Table 5 shows that the percentage of abstracts using the whole embryo culture averaged 3% during the 1970s, rising to 8% in the 1980s and 10% during the 1990s.

DIVERSITY OF MEMBERS

One of the many factors for the success, important contributions, and perpetuation of the Teratology Society is the result of the professional diversity of the membership. The Society could not have achieved a



Fig. 1. Founders in the late 1950s. *From left to right:* James Wilson, F. Clarke Fraser, and Josef Warkany.

more perfect balance than the credentials held by the three senior founding members of the Society (Fig. 1). Josef Warkany was an M.D. He was a superb clinician and a very good basic scientist. James Wilson was an embryologist with a Ph.D. degree, who was an impeccable investigator with unquestionable integrity. Clarke Fraser was a geneticist with both an M.D. and a Ph.D. degree. So, thanks to Clarke, the founding members had two Ph.D. degrees and two M.D. degrees among them.

We were in perfect balance from the inception of the Society, at least with regard to the degrees held by the three senior founding members.

Is this diversity an important part of our Society? Our membership consists of the following:

1. Basic scientists at universities, research institutes, and government laboratories working in the fields of experimental teratology, embryology, toxicology, pharmacology, anatomy, cell biology, physiology, psychology, and molecular biology
2. Basic scientists in industry working in the above-mentioned fields
3. Basic scientists and clinicians working in research, regulatory affairs, or administration at the National Institutes of Health, Environmental Protection Agency, OSHA, Food and Drug Administration, or Centers for Disease Control
4. Physician-scientists, physician-clinicians and adjunct clinicians, which includes pediatricians, obstetricians, pathologists, clinical geneticists, clinical teratologists or dysmorphologists, genetic counselors, and teratology counselors
5. Epidemiologists and statisticians who may be basic scientists or clinically trained. Have we maintained this diversity? It is difficult to say, based on the original earned degree of the members, since medical trainees frequently take up basic science, and sometimes a Ph.D.-trained person deals largely with clinical analysis such as epidemiology. In terms of the interests of the presidents, 23 have been from the basic sciences (Ph.D.), 12 have had medical

TABLE 6. Discipline and main field of research of Teratology Society presidents

Discipline	Field of research
Anatomy, 16	Embryology, 20
Pediatrics, 11	Genetics, 3
Genetics, 2	Epidemiology, 3
Biology, 4	Dysmorphology, 2
Medicine, 2	Carcinogenicity, 2
Nutrition, 1	Toxicology, 2
Dentistry, 1	Pharmacology, 2
Obstetrics, 1	Pathology, 2
Pathology, 1	Radiation, 1
Toxicology, 1	Biology, 1
	Virology, 1
	Nutrition, 1
	Physical medicine, 1

training; 4 have had MD-Ph.D. degrees, and one had dental training. The total number of disciplines and main research areas of the presidents are given in Table 6.

6. Twenty of the 40 presidents were primarily involved in embryology, which is taken to include experimental teratology. Thought has been given to rotating the type of members of the council and officers in hope of increasing versatility. We suggest that this idea be studied. However, classification of individuals may be indistinct and the availability of good candidates in each category might be limited at times.

We doubt that anyone would argue against diversity, which provides a wide range of expertise necessary to carry out the responsibilities of the Teratology Society to the scientific community, and to the public. The interchange between disciplines has been highly educational to the membership. One of the greatest assets of the Teratology Society is the scientific and clinical diversity of its membership. It is in the best interests of the Society to perpetuate this diversity.

ANTHROPOMORPHIC ANALYSIS OF THE SOCIETY

Comparing the progression of the Teratology Society to human developmental stages may be derided by a few members, but it does serve as a framework for discussion. If this section produces controversy, we hope the result will turn into a constructive influence on the Society. Other societies seem to have a birth, childhood, adolescence, young and middle age and old age and senescence. Since we are a society based on the study of growth and development, there is some merit to this approach. Table 5 charts our membership output of abstracts as well as the types of scientific techniques used in the annual meeting abstracts. Conception of the Teratology Society occurred in 1959 during a walk on the beach in Florida. The discussion followed a number of birth defects meetings (?courtship) which were sponsored by the National Institutes of Health, National Foundation (March of Dimes), Association for



Fig. 2. Twenty-one presidents, 1991. Meredith Runner commented that the Society "collects presidents." *Back row from left:* Scott, Hendrickx, Beaudoin, Kochhar, Johnson, Grabowski, Hoar, Swinyard, and Barr. *Middle row:* Zimmerman, Rich Miller, Sever, Shepard, and Holmes. *Front row:* Staples, Christian, Trasler, Fraser, Kimmel, Brent, and Runner. (Photograph by Dr. Fred Biddle.)

Aid to Crippled Children, and Oak Ridge National Laboratory; these are detailed by Wilson and Warkany ('85). The Society founders were Joseph Warkany, a pediatrician trained in Vienna; James G. Wilson, a reproductive biologist and anatomist; and F. Clarke Fraser, a geneticist trained in medicine (Fig. 1). These three young scientists decided that a more organized approach to birth defects was needed and that the best course was to have a society with annual meetings. The first meeting (birth) occurred in 1961 in Cincinnati, Ohio. The first seven meetings have been fully detailed by Wilson and Warkany ('85). Rapid growth and a relatively low profile in facing societal challenges characterized the early years. Guidelines for teratology testing were developed during this time. During the adolescent years, some rebellion was registered such as initiation of a membership vote for officers rather than appointment and some members suggesting that the decision on Bendectin teratogenicity was still in question (Brent, '85; Brown et al., '85; Holmes, '85).

The college or early adult years might be illustrated by the postgraduate educational courses. These began in 1984 and were expansions of earlier workshops that concentrated on animal drug testing (Wilson and Warkany, '85). The courses were organized by the Education Committee and Narsingh Agnish and Hoffman-La

Roche were strong supporters. The list of titles and organizers is given in Table 4.

The early years of adulthood were characterized by the birth of new societies, which might be interpreted as offspring. These affiliated groups include the Neurobehavioral Teratology Society and Organization for Teratology Information Services and, more loosely, the David Smith (Dysmorphology) Workshops. The dates of birth for these three groups were 1977, 1983, and 1987, respectively. One might extend this analogy to include subsequent societies of teratology in Japan, Europe, Australia, and South Korea as cousins to our Society.

The Japanese Teratology Society held its first meeting in 1961 under the management of Hideo Nishimura whose extensive career included many contributions to teratology and our Society. Dr. Nishimura was awarded high honors from the Japanese government, including the Purple Ribbon Prize and the Second Order of Merit with the Sacred Treasure. F. Clarke Fraser, one of the founders of our Society, is an Officer of the Order of Canada, and Marshall Edwards, the first president of the Australian Teratology Society, in 1980, is an officer of the Order of Australia. Both Jim Wilson and Joe Warkany received awards from various societies, but the United States does not bother with very many similar national honors for scientific

achievements. Joe Warkany received the Howland Award, the highest award in Pediatrics. Full details of the accomplishments of Warkany and Wilson have been detailed (Brent, '89, '92). Tuchmann-Duplessis was the first president of the European Teratology Society in 1971 and among other awards is a member of Le College de France. Three members of the Teratology Society have been elected to the Institute of Medicine of the National Academy of Sciences (Drs. M. Bernfield, R.L. Brent, and B.A. Schwetz).

With maturation, our Society took more responsibility for a societal role by formation in 1981 of a public affairs committee which produced statements that had an effect outside the Society itself. This includes repudiation of the Delany Clause, which excluded agents producing animal cancer from human consumption; we voted that no similar application be applied to animal teratogens (Staples, '74). We took stands on vitamin A and retinoic acid (Teratology Society, '87), folic acid (Oakley et al., '83, '95) and on the reintroduction of thalidomide (Friedman, '99). These position papers have been used by other scientific societies and regulatory branches of government. The membership continued to play important roles in federal agencies such as the Food and Drug Administration, Centers for Disease Control, National Institutes of Child and Human Development, Environmental Protection Agency, and National Institute of Environmental Health. Some of the presidents who played an important role in molding the Society are shown in Figure 2.

Over the last several years, the Society has adopted a code of ethics as well as guidelines for ethical publication and presentation of scientific information and data (Teratology Society, '99a). The criteria for membership are also available (Teratology Society, '99b).

Now we face the difficult part of this comparison (Table 7). Are we beyond middle age into old age or, even worse, into senescence? Are we still growing, or is the increase in number of members only an accumulation of middle age fat? Do we have arteriosclerosis of our systems? Ineffective committees? Are we looking (staring) backward as in these very printed words or are we evolving into the future (electronic communications, unraveling the interplay of teratogens on the developmental genome, advanced epidemiology using genetic markers and other techniques). To address these examples, we are communicating by electronic means including web site (URL <http://landaus.com/teratology>) managed by David Wise at Merck and submission of manuscripts to the Journal (Scialli, '99).

Birth defects (errors in prenatal human development) are the leading cause of mortality and a major cause of disabilities in children. We as teratologists, no matter how we practice our discipline, can be proud of our calling and of the progress that has been made toward improving the health of children throughout the world. We have learned that birth defects can be prevented. We have the scientific basis to completely prevent birth defects caused by rubella virus, by in utero exposure to alcohol and by folate deficiency. Con-

TABLE 7. Life of Teratology Society: anthropomorphic comparison

Human	Society
Conception	Walk on Beach, 1959 Wilson, Warkany, Fraser
Birth	First Meeting, 1961 62 charter members
Infancy and childhood	Small meetings 1961-1970 < 200 members
Adolescence	Voting for officers Bendectin controversy, 1985
College years	Postgraduate courses; more symposia
Young life	Offspring Neurobehavioral Teratology Society Organization of Teratogen Information Services Dave Smith Workshops? Cousin societies Japanese Teratology Society, 1961 European Teratology Society, 1971 Australian Teratology Society, 1980
Middle age	Societal activities Delaney clause Retinoic acid Folic acid Thalidomide reintroduction More committees Membership > 800
Old age and senescence	For discussion, year 2000

sider the mortality, morbidity, and disability that just these three etiologic agents have caused mankind. It is a remarkable scientific achievement to have developed, since 1941, the tools by which we can prevent such important and serious defects.

We should not sit on our laurels. We need to be at the forefront in leading the War on Birth Defects. The War on Birth Defects will seek to identify the causes of birth defects and to provide excellent care for persons with birth defects including reducing discrimination against them. We must proceed with wise maturity until this job is done.

We must engage in the political battle to obtain the resources needed to conduct the research, and then to implement the prevention programs and to provide care for persons with birth defects.

In the same way as teratologists, years ago, showed that the mammalian uterus did not protect from environmental insults, we must find ways to use new kinds of information, especially the avalanche of information from the Human Genome Project, to identify the factors that cause birth defects and then to design and implement prevention programs. The first 40 years of modern teratology and the Teratology Society provide us with strong shoulders to stand upon. We, as past presidents of the Society have many mature years before old age and senescence set in. During these years, remarkable improvement will be made for human beings because we worked to solve the birth defects challenge.

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