



ACS NEWS

The biannual newsletter for the American Chemical Society Division of Fluorine Chemistry

MESSAGE FROM THE CHAIR



GREETINGS FROM SOUTHERN CALIFORNIA! The Fluorine Division (FLUO) is off to a great start in 2017. I saw many of you just a few months back at the

Winter Fluorine Conference (WFC). The WFC has seen a change of venue and was held for the first time in Clearwater Beach, FL. The meeting was a great success due in large part to the impressive and timely efforts of **Bob Syvret** (organizer) and **Markus Etzkorn** (co-chair). Thank you both for putting together such an impressive conference! We would also like to thank the multiple organizations who gave financial support, as well as **Brianne Blevins** and **Kimberly Savage** from ACS for helping the meeting to run smoothly. At the conference, the Division of Fluorine Chemistry Distinguished Service Award was presented to **Viacheslav Petrov**. Thank you Slava for your service to our Division.

The Division programming at the 253rd ACS National Meeting in San Francisco included an award symposium for **Antonio Togni**, the awardee of the 2017 **ACS Award for Creative Work in Fluorine Chemistry**. Congratulations Antonio! I like to thank John T. Welch for organizing the symposium.

The Division is continuing its sponsorship of undergraduate research with the

award of two Moissan Summer Undergraduate Research Fellowships (SURF) of \$5,000 each. Several outstanding applications were received and a standing committee had the difficult task of choosing the two winning proposals. Congratulations go out to the successful applicants **Ms. Nicola Breen** at the University of Albany (supervised by John T. Welch) and **Mr. Andrew D. Mills** at UNC Charlotte (supervised by Markus Etzkorn) who will work on "New trifluoromethyl λ^6 -tetrafluorosulfanyl-addition reactions" and "Synthesis and Characterization of Fluorinated Dendralenes: Structures and Reactivity of Cross-Conjugated π -Scaffolds." The deadline for next year's Moissan SURF proposals is January 31st, 2018.

We had a productive meeting of the Executive Committee (EC) right before the start of the Winter Fluorine Conference (WFC) in Florida. On behalf of all members of the Fluorine Division, I would like to thank the Division leadership and express my gratitude for volunteering their time. Please join me in welcoming our newly elected and re-elected Officers and EC members: **David A. Dixon** (Councilor), **Joseph S. Thrasher** (Alternate Councilor), **Andrej V. Matsnev** (Secretary), **Petr Beier**, **Jean-Francois Paquin**, **Olga Boltalina**, and **Thomas Mathew** (Members at Large). Special thanks go to our former EC

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VICE-CHAIR MEMBERSHIP REPORT

As of November 2016 there were 562 members of the Fluorine Division. The breakdown is as follows:

GROUP	COUNT	%
Division Affiliate	13	2.31
Emeritus Member	50	8.90
Regular Member	416	74.02
Regular Student Member	43	7.65
Retired Member	16	2.85
Society Affiliate	8	1.42
Student Member – Undergrad	16	2.85
TOTAL	562	100

Please join me in welcoming the newest members in 2017: **Junichi Aoyama**, **Mark Bortolus**, **Aimée Capellan**, **Ran Cheng**, **Timothy Coggan**, **Justine Fordyce**, **Lukas Goossen**, **Jean-Denys Hamel**, **Edward Helmig**, **Nicholas Heth**, **Nicholas James**, **Khaled Jami**, **Xiaoqing Jia**, **Roger Kardys**, **Kostyantyn Kirichenko**, **Haiming Liu**,

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DAVID VICIC

Siyu Mao, Xiaodan Mao, Dang Nguyen, Tom Morley, Sean Mulcahy, Mihoko Noro, Sensuke Ogoshi, Addison Pasiuk, Connor Rhodes, Yoshinori Sato, Joel Swinson, Ralf Schirmmacher, Peter Scott, Daniel Siegwart.

I hope to encourage you at this time to become a member of the American Chemical Society Division of Fluorine Chemistry. As a member, you have drastically reduced rates at the Winter Fluorine Conferences, as well as eligibility for Division awards and travel reimbursements. We encourage current members to recruit students, postdocs, and early career fluorine chemists to join the Division. To become a member of the Division of Fluorine Chemistry, please navigate to this page: <http://www.acs.org/content/acs/en/membership-and-networks/td/join.html> and complete the application form. To be a full member you also have to be an ACS member. You can be an affiliate of the Division without being a member of the ACS. Please see the ACS website for further details. We welcome any suggestions for activities that will help maintain and expand our membership. ■

VICE-CHAIR **PROGRAM REPORT**



NEIL VASDEV

We jumped into the New Year with the **23rd Winter Fluorine Conference**, held at a new venue in Clearwater, Florida. The meeting ran from January 15-20, 2017 and was chaired by Dr. Bob Syvret and co-chaired by Dr. Markus Etzkorn. Hat's off to Bob and Markus for putting together such a fantastic technical and social program, and also to ACS Planners, specifically Kim Savage and Brianne Blevins. Technical highlights included 14 Fluorine Chemistry sessions over the course of the week. A mix of plenary, invited and contributed lectures as well as a poster session covered all facets of fluorine chemistry from basic science through to applied research. Although the venue was different than previous years, the traditions remained strong with excellent scientific presentations, award presentations, numerous student awards, and with such close proximity to the beach, hospitality room events every evening and a wonderful banquet reception it was guaranteed to be a great meeting. I hope you all mark your calendars for the next WFC and plan to attend in January 2019.

The next major meeting of the year for the Division was the **253rd Spring ACS National Meeting in San Francisco, CA** (April 2-6, 2017). Dr. John Welch organized a Symposium in Honor of **Dr. Antonio Togni** from the Swiss Federal Institute of Technology, ETH Zurich, Switzerland, **Winner of the 2017 ACS Award for Creative Work in Fluorine Chemistry**. In addition to this Award Symposium there was also an open session.

On the behalf of the Division I would like to thank all Symposia Organizers, as well as the Presenters and Chairs for their dedication and hard work in putting together excellent programs!

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MESSAGE FROM THE CHAIR

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members **Michael Brimeyer** and **Sebastian Riedel** who completed their terms of service at the end of 2016.

David Dixon and **Joseph Thrasher** are serving as the Division's councilor and alternate councilor, respectively, ensuring that our voice is heard within the American Chemical Society. In Dave's report, you may read about recent developments in ACS.

Thanks to **Bob Syvret**, the Division's treasurer, we can afford to award two 2017 SURFs and have a stimulating program at meetings. You can find upcoming meetings and symposia of interest in the program chair's report by Neil Vasdev. Please also read the membership report of David Vicic.

I am truly honored to serve the ACS Division of Fluorine Chemistry for a second year. Please do not hesitate to contact me directly (haiges@usc.edu) if you have any comments, concerns or questions. New ideas, improvements or criticism for the Division are also always welcome. I wish all of you on behalf of the Executive Committee a good and successful year 2017! ■

Ralf Haiges
Chair, 2017

FOLLOW US ON TWITTER! AN EASY WAY TO DISCOVER THE LATEST NEWS RELATED TO THE ACS DIVISION OF FLUORINE CHEMISTRY IS TO FOLLOW OUR TWITTER ACCOUNT LOCATED HERE: [HTTPS://TWITTER.COM/FLUORINECHEM](https://twitter.com/fluorinechem).



UPCOMING SYMPOSIA TO NOTE:**100TH CANADIAN CHEMISTRY CONFERENCE AND EXHIBITION, Toronto, Ontario, May 28 - June 1, 2017**

Two noteworthy sessions include: “Fluorinated Molecules: Syntheses, Analyses, and Applications” and “Chemical Biology and Imaging” session which will cover fluorine-18 research. | Conference website: www.csc2017.ca

255TH ACS NATIONAL MEETING & EXPOSITION, New Orleans, Louisiana, March 18-22, 2018

More information on FLUO sponsored symposia will be posted shortly.

22ND INTERNATIONAL SYMPOSIUM ON FLUORINE CHEMISTRY, Oxford, UK, 22-27 July 2018

Chairs: Drs. Veronique Gouverneur, David O'Hagan, and Graham Sandford | More info will be posted as it becomes available. ■

DIVISION COUNCILOR REPORT 2017 Spring National Council Meeting Report

CANDIDATES FOR PRESIDENT-ELECT, 2018 The Committee on Nominations and Elections presented to the Council the following nominees for selection as candidates for President-Elect, 2018: Bonnie A. Charpentier, Mark D. Frishberg, Anne M. Gaffney, and Willie E. May. By electronic ballot, the Council selected **Bonnie A. Charpentier** and **Willie E. May** as candidates for 2018 President-Elect. These two candidates, along with any candidates selected via petitions, will stand for election in the Fall National Election.

CANDIDATES FOR DISTRICTS III AND VI The Committee on Nominations and Elections announced the results of the election held prior to the San Francisco meeting to select *candidates* from the list of *nominees* for Directors from District III and District VI on the Board of Directors for the term 2018-2020. By internet ballot, the Councilors from these districts selected **Alan B. Cooper** and **Teri Quinn Gray** as District III candidates; and **Rita R. Boggs** and **Paul W. Jagodzinski** as District VI candidates. Ballots will be distributed on or before October 1 to all ACS members in District III and District VI for election of a Director from each District.

CANDIDATES FOR DIRECTORS-AT-LARGE The Committee on Nominations and Elections announced the selection of the following candidates for Directors-at-Large for 2018-2020 terms: **Kenneth P. Fivizzani**, **Wayne E. Jones**, **Bonnie A. Lawlor**, and **Barbara A. Sawrey**. The election of two Directors-at-Large from among those candidates and any selected via petition will be conducted in the fall. Ballots will be distributed to the Council on or before October 1, 2017.

2018 MEMBER DUES The Council voted on the recommendation of the Committee on Budget and Finance to set the member dues for 2018 at the fully escalated rate of \$171. This rate is established pursuant to an inflation-adjustment formula in the ACS Constitution and Bylaws.

CONTINUATION OF COMMITTEES The Council approved the recommendation of the Committee on Committees that the Committee on Project SEED be continued; and that the committees on Chemists with Disabilities, on Public Relations and Communications, and on Women Chemists be continued contingent on approval of the Board of Directors.

CHANGE IN LOCAL SECTION NAME On the recommendation of the Committee on Local Section Activities, the Council approved a petition from the Santa Clara Valley Local Section in California to change the name of the section to the Silicon Valley Local Section.

BUDGET AND FINANCE In 2016, ACS generated a Net from Operations of \$23.8 million, which was \$7.2 million higher than 2015. Total revenues were \$526.8 million, increasing 2.9% or \$15 million over 2015. Expenses ended the year at \$503 million, which was \$7.8 million or 1.6% higher than prior year. This was attributable to a continued emphasis on expense management across the organization. The Society's financial position strengthened in 2016, with Unrestricted Net Assets, or reserves, increasing from \$163.3 million at December 31, 2015 to \$206.5 million at year-end 2016.

MEMBERSHIP As of December 31, 2016, the ACS membership was 156,129, which is 0.5% less than on the same date in 2015. The number of new members who joined in 2016 is 23,700. The Society's overall retention rate is 83.5%. The Committee on Membership Affairs also reported that the number of international members has increased to 27,388, exceeding the committee's target by 5%. Retention of graduate students increased by 2% to 76.2%.

SAN FRANCISCO MEETING ATTENDANCE TOTAL 18,850 ■

THE CHEMICAL PROFESSIONAL'S CODE OF CONDUCT

The American Chemical Society expects its members to adhere to the highest ethical and safety standards. Indeed, the Federal Charter of the Society (1937) explicitly lists among its objectives "the improvement of the qualifications and usefulness of chemists through high standards of professional ethics, education and attainments..." The chemical professional has obligations to the public, to colleagues, and to science.

CHEMICAL PROFESSIONALS ACKNOWLEDGE THEIR RESPONSIBILITIES:

TO THE PUBLIC Chemical professionals should actively be concerned with the health and safety of co-workers, consumers and the community. They have a responsibility to serve the public interest and to further advance the knowledge of science. Public comments on scientific matters should be made with care and accuracy, without unsubstantiated, exaggerated, or premature statements.

TO THE SCIENCE OF CHEMISTRY

Chemical professionals should seek to advance chemical science, understand the limitations of their knowledge, and respect the truth. They should ensure that their scientific contributions, and those of their collaborators, are thorough, accurate, and unbiased in design, implementation, and presentation.

TO THE PROFESSION Chemical professionals should strive to remain current with developments in their field, share ideas and information, keep accurate and complete laboratory records, maintain integrity in all conduct and publications, and give due credit to the contributions of others. Conflicts of interest and scientific misconduct, such as fabrication, falsification, and plagiarism, are incompatible with this Code.

TO THEIR EMPLOYER Chemical professionals should promote and protect the legitimate interests of their employers, perform work honestly, competently, comply with safety policies and procedures, fulfill obligations, and safeguard proprietary and confidential business information.

TO THEIR EMPLOYEES OR SUBORDINATES

Chemical professionals, as employers and managers, should respect the professionalism of their subordinates, and have concern for their well-being, without bias. Employers should provide them with a safe, congenial working environment, fair compensation, opportunities for advancement, and properly acknowledge their scientific contributions.

TO STUDENTS Chemical professionals should regard the tutelage of students as a trust conferred by society. They should promote, professional development, learning, and safety, and treat each student fairly, respectfully, and without exploitation.

TO COLLEAGUES Chemical professionals should treat colleagues with respect, encourage them, learn with them, share ideas honestly, and give credit for their contributions. Chemical professionals should carefully avoid any bias based on race, gender, age, religion, ethnicity, nationality, sexual orientation, gender expression, gender identity, presence of disabilities, educational background, or other personal attributes. They should show consistent respect to colleagues, regardless of the level of their formal

education and whether they are from industry, government or academia, or other scientific and engineering disciplines.

TO THEIR CLIENTS Chemical professionals should serve clients faithfully and incorruptibly, respect confidentiality, advise honestly, and charge fairly.

TO THE ENVIRONMENT Chemical professionals should strive to do their work in ways that are safe for the environment. They have a responsibility to understand the total impacts of their work, to recognize the constraints of limited resources, and to develop sustainable products and processes that protect the health, safety, and prosperity of future generations.

TO TEMPORARY EMPLOYEES Chemical professionals should establish clear job descriptions, scope of work, terms of contract, and appropriate compensation prior to start of work by contractors, interns, or consultants. They are also responsible for communicating safety concerns and providing necessary training associated with expected work. ■

**THE CHEMICAL
PROFESSIONAL
HAS OBLIGATIONS
TO THE PUBLIC,
TO COLLEAGUES,
AND TO SCIENCE.**



BOB SYVRET

The Division's total assets have increased approximately 15.2% over the course of the 12 month period ending December 31, 2016. This increase is primarily due to industrial contributions in support of the 23rd Winter Fluorine Conference.

ASSETS (actual as of 31 December 2016)

	(\$ as of 31 December 2015	(\$ as of 31 December 2016
Wells Fargo Bank Account	\$5,662	\$53,523
Ameriprise Financial SPS Advantage Account	\$201,101	\$184,651
TOTAL ASSETS	\$206,763	\$238,174
Percent Change		+ 15.2%

2016 FINANCIAL HIGHLIGHTS:

- > In 2016, the Division provided 2 Moissan Summer Undergraduate Research Fellowships in the amount of **\$5,000 each** to Professors John Welch at the University of Albany and GB Hammond at the University of Louisville.
- > The Division provided **\$6,000** in financial support to the Award Symposium for Steve Strauss at the Spring ACS

- National Meeting in San Diego, March 2016.
- > The Division provided **\$6,000** in financial support for Fluorine Division programming (18F symposium) at the Fall ACS National Meeting in Philadelphia, August 2016.
- > **\$28,000** of industrial sponsorship was raised to support the 23rd WFC.

OUTLOOK FOR 2017:

- > The Division has budgeted to provide **2 Moissan SURF @ \$5,000 each** in 2017.
- > The Division will sponsor the 2017 ACS Award for Creative Work in Fluorine Chemistry at a cost of **\$9,000**.
- > The Division provided **\$3,500** for the ACS Award for

- Creative Work in Fluorine Chemistry symposium in honor of Professor Togni that was held at the 2017 ACS Spring National Meeting in San Francisco.
- > The Division provided financial support for the 23rd Winter Fluorine Conference as customary and as appropriate.

SUPPORT OF FLUORINE DIVISION SYMPOSIA AT ACS NATIONAL MEETINGS

The Division's support is currently at \$3,500 + \$2,500 = \$6,000 for each FLUO Division Symposium held at ACS National Meetings and Pacificchem. Beginning with the ACS National Meeting in Philadelphia (August, 2016), the criteria for providing this support changed as follows:

1. Any Fluorine Division sponsored symposium at an ACS National Meeting or Pacificchem is eligible to receive \$3,500. The \$3,500 must be used to pay for speaker registrations.
2. Only Fluorine Division members with current dues paid in full will be reimbursed. **Non-members of the ACS Division of Fluorine Chemistry will not be reimbursed.**
3. If the symposium organizers raise at least \$3,500, the Division will provide an additional \$2,500 of discretionary funding. ■



**RONALD ERIC
BANKS**
(1932-2017)

Organofluorine chemist and inventor of the electrophilic fluorinating agent Selectfluor®, ERIC BANKS, died February 4 2017, aged 84.

Eric, born in the Midlands in the UK, obtained his BSc and PhD degrees from Durham University. The latter, under the supervision of W. K. R. Musgrave, studying the halogenation of benzene

with chlorine trifluoride. Following his PhD he worked in industry for two years before starting his academic career in 1958, at what was to become UMIST, Manchester, UK, as part of R.N. (Bob) Hazeldine's fluorine team – which became the largest centre for fluorine chemistry in the UK. He rose through the academic grades of Senior Lecturer, Reader and became a full professor in 1989. Eric's research encompassed a wide range of topics, including fluoroaromatic and fluoroheterocyclic chemistry, fluoropolymers and organofluorine nitrogen compounds. It was work in the latter area, and the discovery of perfluoro-N-fluoropiperidine as a powerful electrophilic fluorinating agent that ultimately led to the development of F-TEDA-BF₄ at UMIST by Eric Banks under sponsorship and in collaboration with Guido Pez's team from Air Products Inc. In a short time Air Products took the reagent to full scale industrial preparation. Selectfluor™ is now produced on multi-ton quantities per annum and is the preferred electrophilic fluorinating agent, replacing more expensive and less stable alternatives. Eric officially retired in 1994, but continued his research and fluorine-related activities at UMIST and with the academic-industry fluorine "club" that he and Roger Benn set up, called the Fluorine Technology Bureau, over the next 10 years.

Eric received many awards, including in 1971 a DSc from the University of Manchester for 'original contributions to knowledge of fluorocarbon chemistry' and in 1993 the ACS Award for Creative Work in Fluorine Chemistry. He was involved in the training of over 100 research students and published 260 papers, he also wrote or edited many books on fluorine chemistry, including 'Organofluorine Chemistry', edited with Bruce Smart and Colin Tatlow, 'Fluorine - the first hundred years', 'Organofluorine Chemicals and Their

Industrial Applications' and the delightful 'Fluorine Chemistry at the Millennium, Fascinated by Fluorine', which contained a series of personal accounts of the development of fluorine chemistry from the perspective of a wide range of international practitioners. It is perhaps this book that best encapsulates Eric's interest and enthusiasm for fluorine chemistry coupled with the history, people and stories behind it. He was a supportive, and gifted fluorine chemist, who made a very significant impact on the subject, he was also witty and always enthusiastic, and he will be sadly missed by his family, colleagues and many friends around the world.

—Alan Brisdon



**PAUL
HAGENMULLER**
(1921-2017)

PAUL HAGENMULLER passed away on January 7, 2017; he was 95 years old.

Honorary Professor of the University of Bordeaux, creator and director of the "CNRS Laboratory of Chimie du Solide" until 1985, he is recognized as one of the founders of Solid State Chemistry in Europe, at the interface of Chemistry, Physics and Materials Science. He worked all his

life for the merging of these three fields of research, as well as with the Industry world.

Paul Hagenmuller was a world-renowned scientist, welcoming in his laboratory many young foreign researchers from Russia, USA, China, Korea, Japan, Brazil, Morocco and, obviously, from many European countries. He started exchange programs with German groups as soon as 1960, and such a cooperation should be pointed out, since from 1943 to 1945, P. Hagenmuller had been interned in the Nazi concentration camps of Buchenwald and Dora. He drew from his stay in these camps a legendary fighting force, but also a taste for communication and humanity. It should be noted that he learnt Russian at that time from other Russian and Ukrainian prisoners. The highest honor of Germany, the "Officer's Cross of the Order of Merit" (Bundesverdienstkreuz) was presented to him by the President of the Federal Republic of Germany.

It should be reminded that, among the many scientific

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activities he has carried out throughout his career, Paul Hagenmuller has particularly valued Fluorine chemistry at international level by organizing Symposiums: Aix-en-Provence, 1970; Avignon, 1979; Paris, 1986, by publishing books, and establishing many scientific exchanges. After the 1986 Centennial Symposium, he successfully launched the International Moissan Prize, which is now managed by the Foundation of the “*Maison de la Chimie*”. Among the numerous awards he received, we can quote the first “*Grand Prix International de la Fondation de la Maison de la Chimie*”, the French-German Prize of the A. von Humboldt Foundation, and in 1997 the Henri Moissan International Award.

P. Hagenmuller received the 39-45 War Cross and he was Commander of the “*Legion d’Honneur*”. A dozen Academies worldwide welcomed him as a fellow, and several universities as Doctor Honoris Causa.

The scientific work of P. Hagenmuller is tremendous, including about one thousand papers, well recognized books, and illuminating talks at international conferences.

It is a great scientist, one of the founding fathers of Solid State Chemistry, who just left us.

—Alain Tressaud,
President European Academy of Sciences,
ICMCB-CNRS, Université Bordeaux

the Piarist Fathers (one of the best school in the Roman Catholic religious teaching order) while the World War II was raging. In his autobiography “*A Life of Magic Chemistry*” he describes his horrifying experiences of the time. He and his parents survived, but he lost his older brother, Peter. After the war, he studied chemistry at the Technical University of Budapest and completed his PhD in 1949 under the supervision of Geza Zemplen, a carbohydrate chemist trained under legendary chemist, Emil Fischer. In 1949, he married Judith Lengyel, a technical secretary at the University, who later studied chemistry and became his partner in research and life. He began his academic career as an Assistant Professor in the same department at the Technical University and was promoted in 1954 as the Head of Department of Organic Chemistry and Associate Scientific Director of Central Research Institute of the Hungarian Academy of Sciences. However, these years in Hungary were really tumultuous in his life due to the post-war Soviet rule. Amid the turmoil and aftermath of a failed uprising against Soviet rule in 1956, future seemed bleak and he decided to join the torrent of about 200,000 Hungarian refugees and fled his native Hungary with his wife and two-year old toddler son. With a brief stay in Vienna and England, he moved to Canada.

Olah, was a true legend, a giant of a chemist and a great visionary, who had a prophetic approach for solving challenging problems. In 1957, he joined the Dow Chemicals at Sarnia in Canada and continued his research work. One of the major areas at Dow Chemicals at that time was Friedel-Crafts-type chemistry for the production of ethylbenzene from benzene and ethylene (for the conversion to styrene for polystyrene manufacture), which involves arenium (Wheland) cation intermediates. It was during this period (1957-1964), that his breakthrough work on long-lived carbocations, such as *tert*-butyl and isopropyl cations in superacids was carried out. This work later led to his Nobel Prize in 1994.

In 1965, Olah was recruited to academia as a professor in Western Reserve University, which later became Case Western Reserve University by merging with Case Institute of Technology. Based on the work of Ron Gillespie in Canada, he had realized that fluorinated Bronsted superacids such as HF and FSO₃H in combination with Lewis superacids lead to conjugate Bronsted superacids, which are billions and even trillion times stronger than 100% sulfuric acid. In the late 1950’s he had demonstrated that in such superacid systems at low temperatures long-lived carbocations can be generated. He coined the name “*Magic Acids*” for the ones made from the



**GEORGE ANDREW
OLAH**
(1927-2017)

GEORGE A. OLAH, the recipient of the 1994 Nobel Prize in Chemistry for his groundbreaking work on fluorine containing superacids that led to isolation and observation of long lived carbocations, passed away on March, 8, 2017 at his home in Beverly Hills, California.

Olah was one of the pre-eminent scientists in the second half of the twentieth

century and the early part of the 21st century. His pioneering contributions to Chemistry span through one of the most magnificent era of science. Olah was born on May 22, 1927 in Budapest, Hungary to Julius Olah, a lawyer and Magda Krasznai. He finished his school years in the Gymnasium of

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combination of anhydrous FSO_3H and SbF_5 that cleaved Christmas candle paraffin wax into long lived *tert*-butyl cation (like magic!). Prior to his pioneering work, carbocations were inferred as only fleeting intermediates (with microseconds to nanoseconds life-time) in acid catalyzed hydrocarbon transformations. It was Olah's genius that led to the stabilization of carbocations in superacids and their structural elucidation by low temperature NMR spectroscopy and later on by even X-ray structural analysis. His exhaustive structural studies on long lived carbocations gave rigor and new dimension to hydrocarbon reaction mechanisms under acid catalysis. Olah's studies on carbocations, created clear demarcation between the trivalent *carbenium ions*, planar ions of the CH_3^+ type, and the penta- or higher coordinated *carbonium ions* of the CH_5^+ type, analogous to other onium ions. While trivalent carbenium ions are the key intermediates in electrophilic reactions of π -donor unsaturated hydrocarbons, penta-coordinated carbonium ions are the key to electrophilic reactions of σ -donor saturated hydrocarbons through the ability of C-H or C-C single bonds to participate in 2e-3c bond formations. The non-classical bonding in the 2-norbornyl cation $[\text{C}_7\text{H}_{11}]^+$, suggested by Saul Winstein in the 40's necessitated a higher-coordinate carbon. This was the topic of the so-called classical-nonclassical ion controversy, wherein the late H. C. Brown was the main antagonist, supporting a trivalent carbenium ion structure for the 2-norbornyl cation. The nonclassical structure of the 2-norbornyl cation was finally resolved by Olah's ^{13}C labeling work using low temperature NMR spectroscopy and subsequent solid state NMR at 5 K. The structure of the nonclassical 2-norbornyl cation was later unequivocally established by low temperature X-ray structural analysis in 2013 by German and American groups. His studies on higher-coordinate carbon compounds led to a new area of "Hypercarbon Chemistry". He also showed that in superacids, electrophiles can be further activated to superelectrophiles by protosolvation (superelectrophilic activation) that can initiate electrophilic reactions on weakly basic substrates.

His early work in the 1950s in fluorine chemistry in Hungary helped many researchers in the study and development of many fluorinated drugs in the pharmaceutical arena. He also developed pyridinium polyhydrogen fluoride (known as the Olah's reagent), which is widely used as an ionic liquid substitute for volatile HF, stable at ambient temperature. Many novel and practical fluorination protocols have been developed using the Olah's reagent. The same type of reagent was later (in the 1990s) commercialized to produce

high octane gasoline in an environmentally safe process termed "ALKAD."

In 1977, Olah moved to the University of Southern California, with the author, and founded the Loker Hydrocarbon Research Institute with the generous support of Donald and Katherine Loker, where he stayed rest of his extraordinary life. He continued his research activities in close collaboration with the author that included synthetic methods, catalysis, oxidations, organosilicon and organofluorine chemistry, and computations. He also became impressed with the predictive power of the computational chemistry with the prodding of his theoretician friends and used it to make important discoveries. In 1994, he was bestowed with the solo Nobel Prize in Chemistry for his seminal work on carbocations.

Post Nobel Prize, Olah focused on solving mankind's fossil fuel based greenhouse problem. His solution to the carbon conundrum was a new approach developed with the author known as "The Methanol Economy". The concept is based on the use of liquid methanol as an energy carrier and a convenient substitute fuel for gasoline and diesel. Moreover, it can be used as a feedstock for producing ethylene and propylene leading to all petroleum-derived products. The joint work with NASA-JPL also paved the way for a direct liquid methanol fuel cell (DMFC), a highly efficient portable source of electricity. He also developed new methods for converting existing natural/shale gas (methane) and CO_2 to syngas for making methanol. He also proposed that the renewable methanol can be produced by the reaction of hydrogen (generated from water electrolysis using renewable energy) with carbon dioxide from both anthropogenic and natural sources, liberating mankind from dependence on fossil fuels. Conversion of carbon dioxide to methanol is now commercially practiced in the George Olah Renewable Methanol Plant in Iceland.

More recently, based on reports of astrophysical observations of carbocations and molecules including methanol in space, Olah suggested that methanol could have played a key role in the evolution of complex molecular building blocks that eventually led to life.

Olah's work had a lasting impact on chemistry. His work on carbocations is discussed in all elementary Organic Chemistry textbooks. His hero in chemistry was the late Hans Meerwein of Marburg. He was a friend/collaborator of many notable chemists: M. Saunders, N. Arnett, R. Huisgen, R. Grubbs, K. C. Nicolau, B. Sharpless, K. Houk, H. Schwarz, J. Rabo, G. Somorjai, P. J. Stang, K. Christe, A. de Meijre, R. Gillespie, G. Schrobilgen, the late chemists: H. Prinzbach, R. E. Williams,

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K. Wade, P. Schleyer, I. Ugi, J. Pople, D. J. Cram, J. D. Roberts, J. Kochi, C. Nenitzescu, A. Cotton, and others. The author had the privilege of working with Olah for 43 years, first as a graduate student and subsequently as a colleague, not only on carbocations, and fluorine chemistry but also on the Methanol Economy topics.

Olah was quite prolific with close to 1500 publications, 160 patents and 25 edited books and monographs. He was a kind and generous mentor, who trained more than ~300 graduate students, postdocs and colleagues from many corners of the world, who have done exceptionally well in their chosen careers. He was a highly cited chemist with an h-index of 102! In the course of his career, besides the Nobel Prize, he won innumerable awards, including the ACS Priestley Medal, Cope Award, Roger Adam's Prize, and Eric and Israel's Sheila Samson Prime Minister's Prize for Alternatives to Transportation Fuels. He received more than 15 honorary doctorates. He was a member of many international academies, including the US National Academy of Science and Engineering.

Olah is survived by his wife Judy, two sons, George Jr. and Ronald and three grandchildren. He was a true hero of chemistry, a great role model and a caring human being. He will be deeply missed by the chemistry community.

—G. K. Surya Prakash
Loker Hydrocarbon Research Institute
University of Southern California



**PROFESSOR
VALERY P. KUKHAR**
(1942-2017)

VALERY P. KUKHAR died on March 28, 2017.

This prominent Ukrainian chemist was born on January 26, 1942, in Kyiv. He graduated from Dnepropetrovsk Institute of Chemical Technology in 1963, and obtained his Cand. Chem. Sc. degree (1967) and Doctor Chem. Sc. degree (1974) from Institute of Organic Chemistry of the National

Academy of Sciences of Ukraine under the supervision of Academician Alexander Kirsanov. In 1987, he initiated the creation of the Institute of Bioorganic Chemistry and

Petrochemistry of National Academy of Sciences of Ukraine, and since that time he held the position of Director of the Institute and Head of the Department of Fine Organic Synthesis.

Professor Kukhar started his scientific activity in the field of organophosphorus chemistry. Using halogenated alkylamines, he was able to synthesize the first representatives of geminal polyphosphonates bearing three phosphonate groups at the bridged carbon atom (Kukhar's phosphonates). His further work was devoted to the chemistry of aminophosphonates, bisphosphonates, and fluorinated amino acids. Professor Kukhar also performed creative investigations connected with asymmetric synthesis of various fluorine-containing amino acids. Since the Chernobyl incident, he has devoted his time to examining ways of minimizing its harmful effects. He has also continued to apply his knowledge in chemistry to conduct research in the conservation of natural resources, the use of agricultural chemicals, and well-water retaining capacities. During 50 years of research, the scientific achievements of Professor Kukhar are notable. They comprise more than 650 papers and 30 review articles published in world-recognized journals. He is also the author and editor of 6 books, including *Chemistry of Fluorine-Containing Amino Acids* (1994) and *Aminophosphonic and Aminophosphinic Acids. Chemistry and Biological Activity* (2000). His activities also included numerous national and international collaborations, among others with research groups in Germany, France, Poland, Italy, Russia, and USA.

Professor Kukhar scientific work has been honored both at home and abroad. He was a member of National Academy of Sciences of Ukraine and Head of State Fund for fundamental research of Ukraine. He was recipient of the GLOBAL-500 Prize (UNEP, 1993), San-Valentino Award (World Federation of Scientists, 1999), Ukrainian State Award in Science & Technology (1999), and the International Arbusov Award for research in organophosphorus chemistry. Valery Kukhar was a member of the OPCW Scientific Advisory Board and International Advisory Group for Chernobyl Shelter Fund, EBRD.

—Friends and Colleagues:
Prof. Dr. Vadim D. Romanenko,
Dr. Alexander E. Sorochinsky, Dr. Igor I. Gerus,
National Academy of Science of Ukraine ■

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