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PRIESTLEY MEDALIST

A LOVE AFFAIR WITH CHEMISTRY

Nobel Laureate George A. Olah has spent nearly six decades in the service of chemistry

GEORGE A. OLAH

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TOWERING FIGURES IN CHEMISTRY SOMETIMES SAY they knew since childhood that they wanted to become chemists. But not George A. Olah. "I was mainly interested in history, languages, even philosophy," recalls Olah, winner of the 2005 Priestley Medal, the American Chemical Society's highest honor. "And until I started university, I never really thought about science, much less chemistry."

Of course, like many world-class chemists, Olah—who, at age 77, still towers over most of his colleagues, despite having shrunk a bit with advancing years to 6 feet 4 inches—has a story to tell about tinkering with a chemistry set as a boy. Long before he was appointed director of the Loker Hydrocarbon Research Institute at the University of Southern California and won

the 1994 Nobel Prize in Chemistry, Olah and a boyhood friend experimented with a chemistry set in the basement of the friend's home in Budapest, Hungary.

At first, the boys followed the experiments laid out in the manual that came with the chemistry set. But then, "we boldly advanced to more 'interesting' experiments," Olah recalls, "until one day, things got a little noisy and smelly." Olah no longer remembers what caused the small explosion and accompanying fire and stench. But the incident destroyed the chemistry set and put an end to his science experiments for several years.

PHOTOS COURTESY OF GEORGE OLAH

SUPERACID TO SUPER PRIZE **Olah's novel use of extremely powerful acids (such as those shown above) to prepare long-lived carbocations from a variety of organic compounds contributed to his receipt of the 1994 Chemistry Nobel Prize, which is shown here being presented by King Carl Gustav XVI of Sweden.**

The experiment-gone-awry hardly dampened the young boy's love of learning. "Schoolwork came easily to me, and I enjoyed studying," Olah says. "Back then, we didn't have all the distractions that are around today—like television." As a result, Olah was an avid reader of all sorts of material. "I still am," he says. "You pick up those habits early in life."

Clearly, those habits served Olah well. Throughout elementary and high school, Olah was a top student. The school he attended provided "a very good general education with a heavy emphasis on the humanities," he notes. All students studied Latin, German, and some French, in addition to history, literature, and other subjects. And as if that weren't enough, Olah supplemented his education with private lessons in English and French.

"In retrospect, I'm very grateful for the well-rounded education I received," Olah says, thinking back to his youth. The demanding work schedule and lifestyle typical of research scientists often leave little time for pursuing nonscientific interests. "So I'm fortunate to have studied those subjects when I was young."

Furthermore, a rigorous general education is beneficial all around because "it teaches you how to organize your thoughts," Olah asserts. Studying languages and grammar, for example, forces you to think clearly and methodically, he continues.

Although his heart was in the humanities, Olah remembers that some of his high school science teachers were "inspiring." For example, his physics teacher, who later introduced televised science programming to Hungary, made a lasting impression on Olah. Apparently, the school's chemistry teacher made no such impression—seeing as how Olah doesn't remember who taught the class. Just the same, Olah made excellent grades in all subjects. "Except in physical education," he acknowledges.

The image of a star pupil—the class valedictorian—who was lacking somewhat in athletic ability hasn't been forgotten yet by Judy, Olah's wife of some 55 years. "My wife still teases me that I was a 'nerd,' " Olah says with the warm smile and thick Hungarian accent that are his trademarks. Olah counters that he wasn't a total bookworm with no interest in sports. In fact, "I was reasonably good" at soccer, rowing, and a couple of other activities. But reading and studying were always high on the list.

In the spring of 1945, when Olah graduated from high school and deliberated about a field of study for his university education, he decided to follow his head, not his heart. "As much as I was interested in literature and history, it didn't seem to me that there were many job opportunities in those areas, especially not in Hungary just after the war." Instead, he was forced to consider "more practical" subjects. And chemistry seemed like a good choice, he explains.

"The thing that attracted me to chemistry is its wide scope," Olah says. "It was clear that with a good background in chemistry, even in a small, poor country, I would be able to find opportunities for the future." Olah's attitudes about chemistry may have been a bit dispassionate as he set out for the university, but they changed quickly.

"Once I started taking chemistry courses, I fell in love with chemistry," Olah declares. "I can't explain why people fall in love—it's not very logical—but chemistry quickly became part of my life."

YEARS LATER, Olah came to learn that his line of reasoning regarding "practical" fields of study and career choices was followed by other notable Hungarians. For example, Eugene P. Wigner, who won the Nobel Prize in Physics in 1963, was persuaded by his father to major in chemical engineering because theoretical physics—Wigner's real interest—seemed to the father like a dead-end choice. Eventually, Wigner returned to theoretical physics.

Likewise, the mathematician John von Neumann also studied chemistry for the same reasons—and even graduated with a degree in chemistry from the Swiss Federal Institute of Technology (ETH), Zurich. But he, too, left chemistry. Olah, on the other hand, stuck with it for a lifetime.

At the Technical University of Budapest, Olah became a student of Geza Zemplen's, which quickly established his lineage in the chemistry world. Zemplen was a well-

Within a short while after fleeing his troubled homeland and familiar university life, Olah was up and running again.

known carbohydrate chemist who directed the university's Organic Chemistry Institute and was instrumental in developing Hungary's pharmaceutical industry.

As a young man, Zemplen worked with Emil Fischer, the influential natural products chemist in Berlin who trained a generation of chemists across Europe and laid the groundwork for the field that would eventually become biochemistry. As such, Olah is proud to point out that he is a "scientific grandson" of Fischer's, who was honored with the second-ever Nobel Prize in Chemistry, which was awarded in 1902.

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As Olah recalls, he started the chemistry curriculum with about 80 students. But the number was cut in half quickly during his first year, he says, "by do-or-die examinations." Zemplen was a particularly tough examiner. Once during an oral exam, one of Olah's friends, who must not have been on the professor's good side, was asked to describe the structure of some complex natural product. "But he didn't have the foggiest idea what the substance was, so he certainly couldn't have known its structure," Olah says. Zemplen continued to question the student: How is the compound synthesized? Again, no answer. Finally: What is the material used for? Olah's friend failed the exam and was dropped from the program.

The weeding-out process was harsh and sometimes unfair, Olah remarks. Laboratory facilities were so limited at that time that only a small number of students could be accommodated, he explains. As a result, many students were failed. But the students who succeeded were motivated by the professors and imbued with "a real fascination and love for chemistry," Olah notes. That love "is the most important heritage of my university days."

In the span of just a few weeks in the summer of 1949, Olah graduated from the Technical University, began his first academic position as an assistant professor in Zemplen's institute, and married Judy Lengyel. Olah tells of how six years earlier, as a 16-year-old, he met "a shy girl not much interested in boys" while vacationing with his family at a summer resort near Budapest.

"I didn't realize at the time that this would become the most significant and happiest event of my life," he says. After more than 55 years of living in a "fairytale" with his "boyhood love," Olah proclaims fondly, "If anyone is blessed with a happy marriage and life partnership, I am."

As it happens, Judy Olah was working as a secretary at the university at the time they got married. She, too, ended up studying chemistry—although not entirely by choice. Olah explains that he "took advantage" of his faculty status to enroll his new bride in his field of study without receiving her full consent. He insists his heart was in the right place, however, explaining that their mutual interest in a single profession—chemistry—would strengthen their marriage. After graduating, Judy joined her husband in research and has maintained a presence in the Olah research group ever since. Asked whether his wife has forgiven him after all these years, Olah answers without hesitation, "I'm not entirely sure."

COURTESY OF GEORGE OLAH

A TIME FOR SPORT **Standing almost a head taller than his teammates, Olah played goalie for the Technical University of Budapest's 1952 chemistry faculty soccer team.**

FOR A WHILE, Olah's research at the Organic Chemistry Institute focused on digitalis heart glycosides: plant-derived compounds used in heart medications. But soon he struck out on his own in a new area that piqued his curiosity: organofluorine chemistry. The going was tough at first, he explains, because Zemplen thought the idea was "foolish" in postwar Hungary, where hydrogen fluoride, boron trifluoride, and other "outrageous" reagents, as Zemplen referred to them, were unavailable, yet needed to be prepared to conduct research.

Nonetheless, Olah persisted and in time built up a small but productive research group that developed methods for preparing fluorinated organic compounds and using them in subsequent reactions. Fascinated by their potential pharmaceutical applications and driven to learn more about biology and medicine, the young chemistry professor went so far as to enroll in medical school in Budapest. "I passed all preclinical courses," Olah says, "but never really intended to obtain an M.D."

Life changed abruptly for Olah and his fellow countrymen in 1956 when the country revolted against the Communist regime. The Hungarian Revolution was crushed quickly by Soviet forces, and a large number of Hungarians, including the Olah family and most of the members of the research group, fled the country. After a few months' stay in England, Olah moved to Canada, where he had accepted a position at a Dow Chemical research facility.

"As a chemist, it was easy for me to fit into the new environment," Olah says. The usual sorts of language difficulties often experienced by immigrants didn't cause Olah much trouble in the new workplace, not because he disguised his thick accent, but rather "because science is international and has its own language," Olah explains. So, within a short while after fleeing his troubled homeland and familiar university life, Olah was up and running again—this time in an industrial setting.

In all, he published some 100 papers and obtained 30 patents during an eight-year stint at Dow in Sarnia, Ontario, and later in Wayland, Mass., that he describes as "a productive and rewarding period." Olah points out that it was during the same period that he made important breakthroughs in superacid chemistry, in which antimony pentafluoride (SbF_5), fluorosulfonic acid (FSO_3H), and other highly acidic systems were used to prepare long-lived carbocations. That work eventually led to his receiving the 1994 Nobel Prize in Chemistry.

Over the years, Olah would come to be honored with many awards and recognitions. But other than the Nobel Prize, he

says that no award meant more to him than the ACS Award in Petroleum Chemistry, which he received in 1963 for his work on Friedel-Crafts chemistry.

"I was an unknown immigrant at that time," Olah says, referring to the years he worked in industry. "And for a young guy who came from a faraway country and started all over with nothing, it really was a significant honor. I still feel that way." Some years ago, in Olah's honor, ACS renamed the award the "George A. Olah Award in Hydrocarbon or Petroleum Chemistry."

By the summer of 1965, George and Judy Olah and their two young sons were on the move again—this time to Cleveland. Since leaving Hungary, Olah had wanted to return to his academic research career, and so he accepted a position as chemistry professor and department chairman at Western Reserve University.

ONCE AGAIN, within a relatively short period, Olah succeeded in re-establishing himself in a new setting. As chairman, he attracted new talent that strengthened the department. In addition, Olah was instrumental in merging Western Reserve's chemistry department with that of neighboring Case Institute of Technology, which soon paved the way for the larger merger that formed Case Western Reserve University. As professor, he quickly built up a research group with 15 to 20 graduate students and postdoctoral researchers whom he describes as "dedicated and enthusiastic."

Talk to John T. Welch, and it becomes clear immediately that nearly 30 years after graduating from Olah's group at Case Western, he's still dedicated and enthusiastic about his mentor. "Working with Professor Olah was absolutely terrific—just super," says Welch, who continues to address his teacher formally after all those years. "For me, he was the perfect research adviser."

Welch, professor and chair of the chemistry department at the State University of New York, Albany, says that during his graduate school days, "research papers were just pouring out of the Olah group. There was a flood of ideas and a terrific enthusiasm about working in the lab."

In addition to other research, at that time the Olah group was building upon its discoveries in superacid and carbocation chemistry and working with colleagues to develop vibrational and electron spectroscopy methods to learn about the nature and electronic structure of persistent carbocations. "We were really happy to be part of it," Welch recalls, "because we all knew this was really hot stuff."

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Graduate students and postdocs weren't the only ones full of enthusiasm, according to Welch. "As a group member, you knew that the Olahs took an interest in you personally—not just as a student." To underscore the point that both Olahs cared about the welfare of group members, Welch adds that "people were always going to Mrs. Olah to talk about their marriage or divorce or their children."

Other coworkers also respond fondly when asked about Olah. "He's not just a great chemist with a lot of really original ideas, he's also a really nice person," says G. K. Surya Prakash. Prakash, who is a chemistry professor at the University of Southern California, moved in the late 1970s with Olah and other members of the group to USC. He completed his Ph.D. studies there and then started his own research group, which continues to work closely with Olah's group.

Prakash tells a story that while he was a graduate student, his father underwent major surgery in India. The young student wanted to be with his father but could not afford to pay for airfare. "George just gave me the money and didn't want to be repaid," Prakash says. "He said, 'Go stay with your father for a month and make sure he's okay.' That's the kind of man he is."

The warmth that was felt by Olah's students and the camaraderie it fostered live on for some students long after leaving the group. In Japan, for example, some 25 former associates get together annually for an Olah group reunion. And it's not just research associates who appreciate what Olah has done for them. In recognition of Olah's efforts in mentoring so many Japanese scientists, last year the Japanese emperor honored Olah with a national decoration.

COURTESY OF GEORGE OLAH

IN SOUTHERN CALIFORNIA **Olah with benefactors Katherine and Donald Loker, in whose honor USC's Hydrocarbon Research Institute is named, in 1985.**

For some leading scientists, after conducting nearly 60 years of distinguished research, guiding more than 200 research associates, and winning a Nobel Prize, it might be time to sit back and take it easy. But Olah doesn't see it that way. He remains active in research and teaching. These days at USC, he focuses on the fundamental advances and chemical transformations needed to convert natural gas—and eventually carbon dioxide—to methanol to drive a future "methanol economy."

"The work I'm doing now may be some of the most interesting and perhaps most significant work I've ever done," Olah says. No small claim for a scientist working in his sixth decade of research. Then again, no surprise coming from a man with an ongoing love affair with chemistry. ■