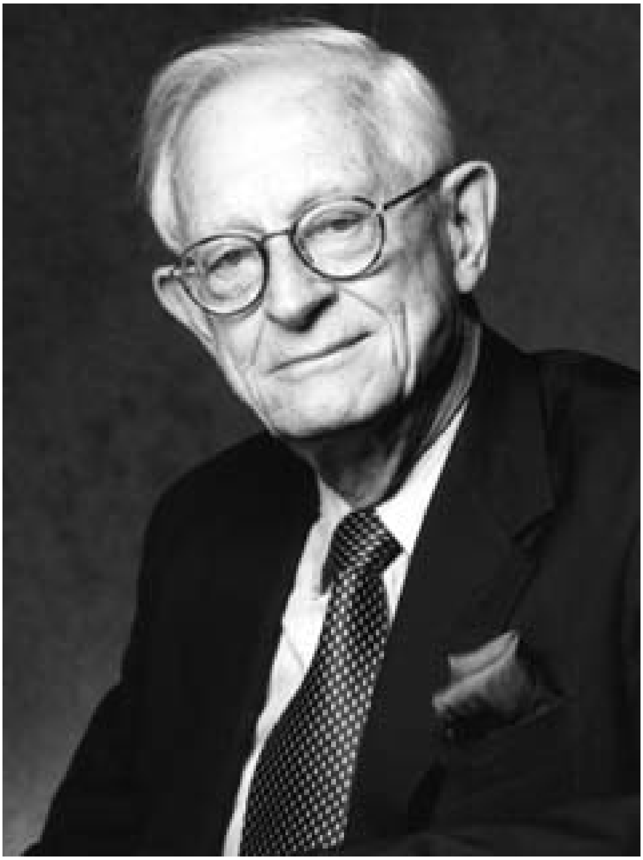

ALAN G. MACDIARMID

1927–2007

Elected in 2002

"For the co-discovery and development of conductive polymers."

BY RAY H. BAUGHMAN

ALAN GRAHAM MACDIARMID, who shared the 2000 Nobel Prize in Chemistry with Alan Heeger and Hideki Shirakawa, died on February 7, 2007, at age 79.

His fundamental and applied discoveries ushered in the second age of polymers, in which organic polymers became fully functional electronic materials. His mentorship and encouragement inspired generations of students. He taught them that "theories come and go, but the facts go on forever, so you have to get the facts correct."

Alan was born in New Zealand on April 14, 1927, to loving parents and a supportive family impoverished by the Great Depression. Though getting food on the table was difficult, they shared what little they had with friends and neighbors. This tradition of giving even when it was very difficult was in Alan's makeup, and he believed that winning the Nobel Prize gave him a special obligation to advance humankind. While suffering from frequent skin cancer, a broken hip, and a blood disease that was expected to soon end his life, he nonetheless struggled ahead on the day of his death to begin a 10-day trip to New Zealand for keynote lectures, governmental meetings, a television interview, and a likely last farewell to family.

Alan never forgot his origins; he went barefoot to primary school in a two-room schoolhouse, where he reported, "Most of my school chums were Maori boys and girls from whom I learned so much."* In their honor and in the celebration of life, Alan danced the spirited Maori *haka* at the all-night student celebration ending the Nobel Prize ceremonies and at many other celebrations until he died.

Alan's love of chemistry began because of his thirst for knowledge and understanding, which lasted a lifetime and enabled him to do pioneering research in diverse fields of chemistry, physics, biology, materials science, and engineering. At the age of 10, he began reading his father's chemistry textbook from the late 1800s and performing experiments from *The Boy Chemist,* which he discovered in a library.

When he had to leave high school at 16 to help support his family, he found a part-time job as a lab assistant and janitor in the chemistry department of Victoria University College in New Zealand. Alan began his academic career there, earning a bachelor's degree and a master's degree. He earned doctorates from the University of Wisconsin and Cambridge University and subsequently became a professor at the University of Pennsylvania. His initial pioneering breakthroughs in Cambridge and Philadelphia were in silicon chemistry, which earned him the 1971 Frederic Stanley Kipping Award of the American Chemical Society. He became professor of chemistry and James Von Ehr Distinguished Chair in Science and Technology at the University of Texas at Dallas in 2002. The same year he became a member of the National Academy of Engineering and the National Academy of Sciences and was inducted into the Order of New Zealand, the highest honor bestowed by his country of birth.

The voyage that led to the Nobel Prize for the discovery of conducting organic polymers began long ago. While at Victoria University College and just starting his career, Alan MacDiarmid published his first paper in 1949, which was on the cyclic monomer S_4N_4. Much later, in 1973, Mort Labes's team at Temple University showed that an inorganic polymer derived from S_4N_4, called $(SN)_x$, is metallic down to 4 K. Alan MacDiarmid and Alan Heeger subsequently reported in 1977 that bromine doping increased the room temperature electrical conductivity of $(SN)_x$ 10-fold.

* From *nobelprize.org/nobel_prizes/chemistry/laureates/2000/macdiarmid autobio.html.*

Then came the famous meeting in Japan, over cups of green tea, between Alan MacDiarmid and Hideki Shirakawa. Both had metallic-looking polymers; Alan's was an inorganic polymeric metal—$(SN)_x$—that looked like gold, and Hideki's was a poor conductor that looked like aluminum foil but was the organic polymer polyacetylene— $(CH)_x$. They developed a joint goal of understanding why $(CH)_x$ is such a poor conductor and of using this understanding to transform this beautiful organic polymer into a metallic conductor.

Money was needed to bring Shirakawa together with MacDiarmid and Heeger at the University of Pennsylvania. Alan MacDiarmid has remarked, "Vision without funding is hallucination." Fortunately, program manager Ken Wynne from the Office of Naval Research happened to have $21,650 left in his program account, which he gave to support Hideki Shirakawa's visit. Once together, Heeger's deep insights into the physics of molecular charge-transfer complexes could be combined with MacDiarmid's and Shirakawa's seminal chemical insights to make, characterize, understand, and exploit the first highly conducting organic polymer.

In the early days of the conducting polymer field, Alan MacDiarmid was frequently asked, "What use are these metallic organic polymers?"—to which he would respond, "Of what use is a beautiful poem?" or "Of what use is a newborn baby?" Yet Alan was already translating the pure poetry of science into the demonstratively useful language that enabled companies around the world to begin developing new products. Realized or proposed products resulting from his work with colleagues include, for example, antistatic and corrosion protection materials, electromagnetic shields, light-emitting devices, solar cells, sensors, artificial muscles, transistors, supercapacitors, batteries, electrochromic displays, and fuel cells. Alan often brought demonstrations of his newest invention to lectures, such as a fan powered by the first conducting polymer battery.

Rising up and down like a wild stallion, Alan carried my three-year-old son, Alex, on his back a decade ago. In much the same way, Alan carried his students through early learning experiences, bringing them to the point where they could ride the wild bronco of discovery on their own. His former students are leaders in science and technology around the world, and in his honor Alan G. MacDiarmid institutes have been started in China, India, New Zealand, South Korea, Taiwan, and Brazil. After his death, we renamed our NanoTech Institute at the University of Texas at Dallas in his memory. Because of Alan, we now have more Nobel Prize "holders" in Texas than anywhere else in the world—Alan always passed his Nobel Prize medallion among the many high school students that he lectured.

Alan was a hero in so many ways. He often said that "Science is people," and he lived his conviction by inspiring generations of scientists and technologists. Students at poster sessions always found him ready to listen. After asking them penetrating questions he would usually say, "Ah, this is so interesting!" This response from a Nobel Prize winner deeply inspired young scientists and engineers.

When there was the possibility of a catastrophic explosion, Alan was the one ready to risk his life to save others. An excited student once ran into Alan's office saying that he might have condensed acetylene into the liquid state, thereby possibly creating a powerful bomb. The fire department cleared the building, and Alan volunteered to go into harm's way to eliminate the risk. With others safely distant, Alan donned bomb disposal clothing and used a fishing rod to open a valve to avert a potential catastrophe.

Despite the many arrows in his body, no one could stop Alan from always climbing back into the saddle, from which he finally fell only as he was dying. Alan was a man for all seasons, so very exuberant, loving, sensitive, and active in responding to individual human needs and those of humankind. The institutes he founded and nourished with his scientific insights and support span the world, and there would have been others and many more breakthroughs if he had lived just a little longer.

He is survived by his loving wife, sister, four children, nine grandchildren, and friends too numerous to count.