

Mario J. Molina

Atmospheric chemist Mario J. Molina died on 7 October 2020 in Mexico City. He was the first to demonstrate that industrially produced chlorofluorocarbons (CFCs) decompose and release chlorine atoms in the stratosphere, which lead to catalytic ozone destruction. His research was instrumental to the establishment of the 1987 Montreal Protocol to ban ozone-depleting substances worldwide. Additionally, Molina made contributions to science policy issues related to urban, regional, and global air pollution and climate, and he promoted environmental protection and awareness on climate change. He was a corecipient of the Nobel Prize in Chemistry in 1995 and received the Presidential Medal of Freedom in 2013.

Born in Mexico City on 19 March 1943, Molina earned an undergraduate degree in chemical engineering in 1965 from the National Autonomous University of Mexico, a graduate degree in 1967 from the University of Freiburg in Germany, and a PhD in physical chemistry in 1972 from the University of California, Berkeley. He was an MIT Institute Professor between 1989 and 2003 and a Distinguished Professor at the University of California, San Diego, between 2003 and 2020. In Mexico City in 2003, he established the Mario Molina Center for Strategic Studies on Energy and the Environment to conduct research and advocate for public policy; he headed it until his death. Under Presidents Bill Clinton and Barack Obama, he served on the President's Council of Advisors on Science and Technology.

In a landmark 1974 publication, Molina and F. Sherwood Rowland reported their discovery of the ozone-depletion potential of CFCs. The paper showed that when chemically inert CFCs, once considered miracle compounds because of their versatile industrial applications, reach the stratosphere, the intense solar UV radiation causes them to dissociate, producing chlorine atoms that consequently and efficiently destroy ozone through catalytic reactions. Their results, which predicted that if CFC release into the atmosphere was unchecked then significant depletion of the ozone layer could be possible, were later verified by the discovery of the Antarctic ozone hole.

Molina continued his research on stratospheric chemistry between 1974 and 1995, during which time he published a series of articles that elucidated the chemical properties and the fundamental mechanisms that lead to the breakdown of the stratospheric ozone layer. His foundational research on the CFC–ozone issue demonstrated the vulnerability of the natural environment and promoted public awareness of the potential harmful consequences of anthropogenic activities. His research and effort in galvanizing public opinion led to the negotiation and establishment of the Montreal Protocol to protect the ozone layer by prohibiting the release of gases that destroy it. Nearly 200 countries, including every member of the United Nations, have ratified the protocol, and signs of ozone-layer recovery have recently been documented. The protocol's importance in protecting climate has also been firmly established, since CFCs not only cause ozone depletion but also are key greenhouse gases.

Molina later shifted his research to the chemistry of air pollution in the lower atmosphere. He participated in interdisciplinary collaborations to confront the problem of air-quality deterioration and to advance the knowledge of and solutions for air pollution in urban areas. His latest work was also dedicated to science policy issues related to climate change, and he promoted global actions for sustainable development inclusive of economic growth.

My first encounter with Molina occurred in spring 1990 at MIT, as he patiently explained to me, a first-year graduate student in meteorology, the importance of clouds in the depletion of stratospheric ozone over the Antarctic. That meeting inspired me to pursue a career in atmospheric chemistry and initiated a long-lasting collaboration between us. He was a remarkable mentor to his graduate students, postdocs, and research scientists. I was particularly intrigued by his unique manner of scientific thinking—exploring not only the obvious but also the invisible. I was also fortunate to inherit several instruments from him after his departure from MIT in 2003.

Our collaboration continued until last summer, as he held numerous virtual meetings with my students and me concerning the COVID-19 pandemic. He



Mario J. Molina

wrote personal letters to the head of the World Health Organization and the director of the US Centers for Disease Control and Prevention to communicate our scientific findings on the importance of airborne transmission in spreading the disease and of face coverings in preventing interhuman transmission of it. His last public appearance was on 15 August 2020, when, with allusions to Mexican president Andrés Manuel López Obrador and US president Donald Trump, he insisted that high-level politicians should set an example in the use of masks.

Molina believed that scientists should not claim their authority by labeling their specialty but should make convincing arguments by presenting their evidence. A favorite quotation from him was that “scientists may depict the problems that will affect the environment based on available evidence, but their solution is not the responsibility of scientists but of society as a whole.”

Renyi Zhang

Texas A&M University
College Station **PT**

**TO NOTIFY THE COMMUNITY
about a colleague's death, visit
<https://contact.physicstoday.org>
and send us a remembrance to post.
Select submissions and, space permitting,
a list of recent postings will appear in print.**