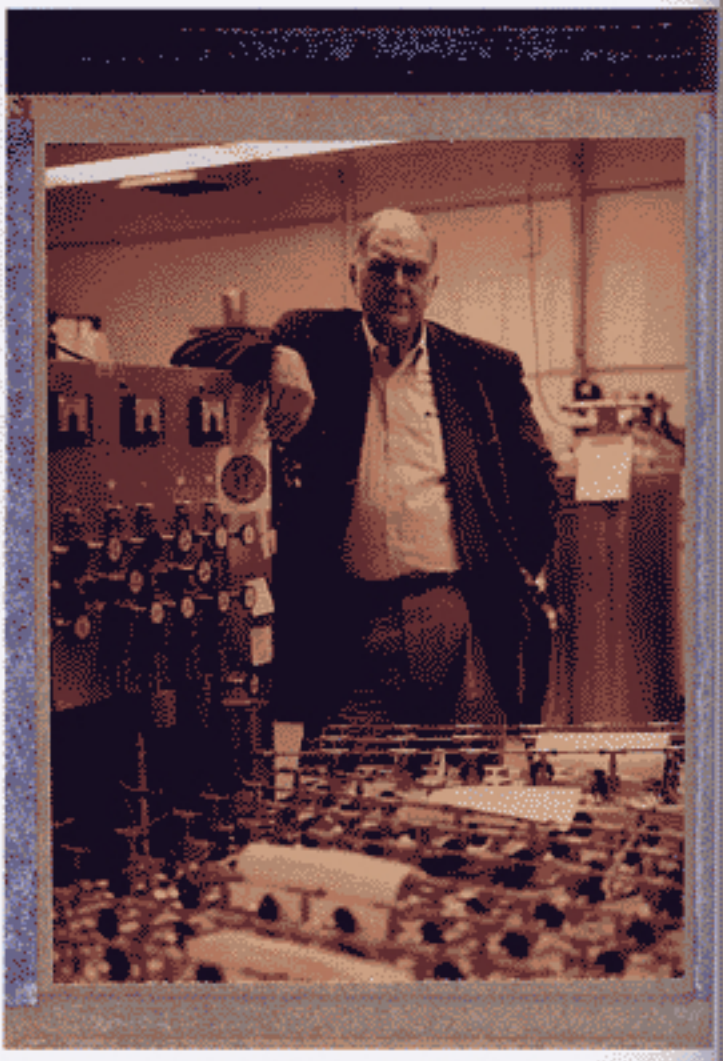

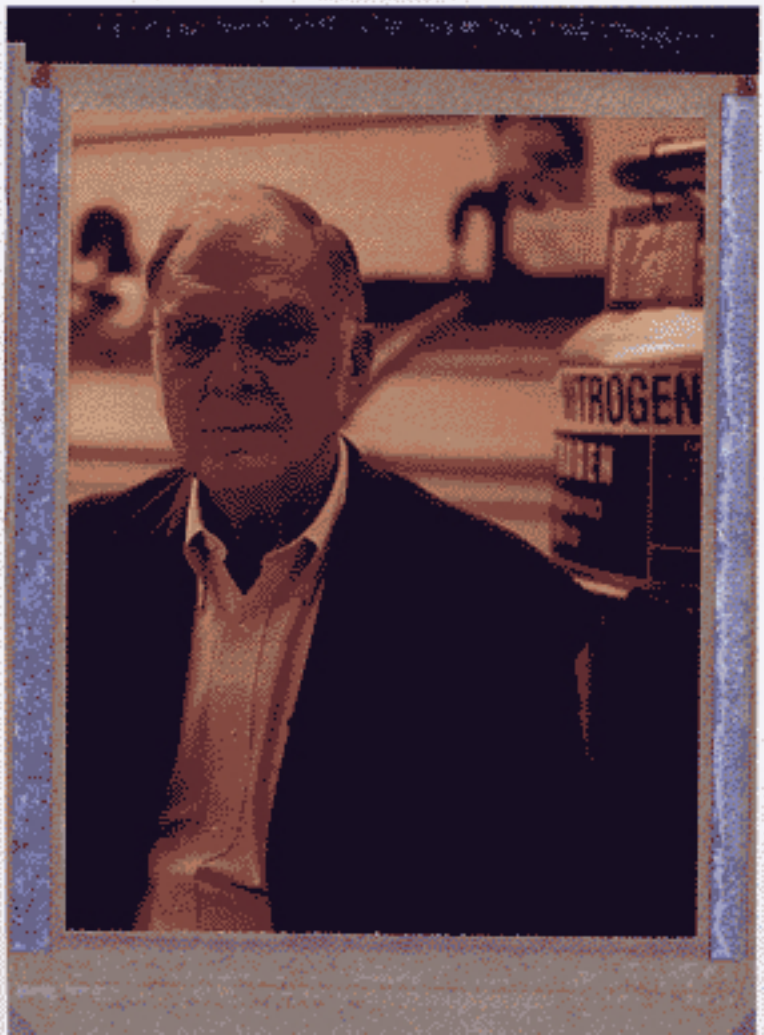
NITROGEN

The Man Who Saved The World

He didn't discover a subatomic particle. He didn't locate some mysterious galaxy in a faraway corner of the universe. All UCI's Sherry Rowland did to win his Nobel Prize was stop a planet's suicide

By Edward Humes • Photography by Sari Makki

"HAVE YOU HEARD THE NEWS?" F. SHERWOOD Rowland asked in his deep, calm voice. It was a little before 7 a.m. on October 11. Professor Hal Moore had just returned home from the gym, and here was his eminent colleague from the chemistry department, a friend of 30 years, on the phone. • "You bet I heard, Sherry!" Moore shouted into the receiver. "Isn't it great for Fred?" Moore was almost giddy at the news: Fred Reines, who revolutionized theoretical physics 40 years earlier by discovering a new and mysterious particle called the neutrino, had finally been recognized with a Nobel Prize, science's greatest honor. The news had been on the radio a few minutes earlier and had swept across the University of California's Irvine campus like brush fire. • "Yes, it is wonderful for Fred," Rowland agreed. And he and Moore talked together excitedly for a good five min-

utes more about Reines' much-deserved award, how it had taken so long for it to come, and how they hoped the 77-year-old physicist's frail health would improve so that he could fly to Stockholm to accept the honor.

"But you know, there's more to the story," Rowland finally said in his martini-dry, understated way. Then, after a tiny, self-conscious pause that told Moore all he needed to know, Rowland explained, "I got a call from the Swedes, too."

That's just the way he talks about it, even now. As if he were saying, oh yeah, my wife, Joan, called and reminded me to pick up a carton of milk at the market, and the cable guy called and said he'd be late, and, by the way, those pesky Swedes called and gave me a Nobel Prize.

You wouldn't guess it from the pages of accolades contained in his resume—the Albert Einstein World Award, the Japan Prize, the Charles Dana Award for Pioneering Achievements in Health, a host of others—but it simply would have been too embarrassing for the self-effacing Rowland to have cut off his friend's discussion of Reines and neutrinos by blurting that he won the Nobel, too. Had he done so, Moore might not have believed him. These two highly respected scientists are known for their elaborate practical jokes on one another, and a phony Nobel wouldn't have been out of the question. But that small, self-conscious hesitation, and Rowland's use of such a humble euphemism for the most wonderful award a scientist could ever get, convinced Moore.

"That's just the kind of guy Sherry is. He's one of a kind," Moore says. "He's made what I think is the most important contribution to science in the last decade, if not more. Not that he would ever say that...And there he was, just a few minutes after getting the news, going on and on about the award someone else had received."

SHERRY ROWLAND—THE BOSS, AS HE is known at UCI, having founded the school's chemistry department and just about the entire science of atmospheric chemistry—is the fellow who discovered the silent time bomb hidden inside each can of Right Guard, in every refrigerator and air conditioner, in each spritz of hair spray, shaving cream and oven cleaner. He's the fellow who, working back in 1973 with a postdoctoral researcher named Mario Molina, discovered the grim truth about chlorofluorocarbons, or CFCs, the aerosol compounds and refrigerants most commonly known by the trademark Freon: They were inexorably destroying Earth's protective ozone layer high in the stratosphere, baring us to ever-increasing doses of cancer-causing ultraviolet rays.

In short, Sherry Rowland is the fellow who, quite arguably, saved the planet.

Not that he was always seen in such heroic terms. Now, of course, the Royal Swedish Academy of Sciences has anointed him and Molina (along with a Dutch scientific collaborator, Paul Crutzen) with the Nobel Prize in chemistry for this vital discovery. Now the U.S. government and most other nations of the world accept the validity of his work and have greatly curtailed production of CFCs. Now, thanks to Rowland's tireless efforts, we have blunted the ozone layer depletion that causes skin cancer, injures the immune system, damages other forms of life from plankton to sheep, perhaps even contributes to global warming and other changes in climate. Now we know the 68-year-old Rowland was right, and have taken steps to save ourselves.

Twenty years ago, though, every medicine cabinet, kitchen, garage, business and factory had CFCs on the shelves and in the machinery. We wanted them, relied on them, they were everywhere. A $2 billion-a-year industry was at stake, with mighty Du Pont, the corporate giant that invented CFCs, at the forefront.

Then along came Rowland. When the scientist stepped up with proof that an omnipresent chemical widely regarded since the 1930s as universally safe and useful was about to kill us all, you can guess how Du Pont, the government and the scientific community reacted. They set out to prove Rowland wrong. He was an alarmist charlatan, they said, an eco-extremist. They ignored the fact that just two years earlier he had angered environmentalists and become the darling of industry by debunking and defusing a na-

tional panic over mercury levels in tuna (turned out there wasn't any more of the toxic metal in fish than in the past). But after he and Molina published their findings on CFCs, Rowland was likened publicly to Henny Penny shouting about the sky falling. Ronald Reagan's first Environmental Protection Agency chief, Anne Burford, dismissed Rowland's work as a scare tactic worthy only of scorn.

This is not the sort of attention scientists crave. Indeed, the potential for vilification over unpopular findings is one reason so many of them avoid publicly announcing their findings, preferring the sanctity of the lab and bench. And it is the main reason so many of Rowland's colleagues admire him for his clout, class and his willingness to put himself on the line for what he believes until others believe, too.

"We're all very lucky it was Sherry Rowland who made this discovery," says his research partner at UCI, Don Blake. "He's a strong enough personality to pull it off. Though he was chastised by industry, he persevered. Someone else might have turned around, gone back to the lab and, even though we eventually would have gotten where we are now, it would have been later, not sooner. We would all be paying the price...Sherry and Mario changed things. The idea that a little hair spray and a little deodorant in the morning could affect our children's children changed everything. When it comes to the atmosphere, there are no longer any geological or political boundaries."

IT'S JUST A FEW DAYS BEFORE THE BIG trip to Stockholm. Rowland, his wife, his two adult children, and a group of friends and fellow researchers at UCI are scrambling to prepare for the long flight, wrapping up loose ends. Or rather, everyone is scrambling except Rowland, the ever-calm, always-imposing pillar of the university's chemistry department. You could never tell that his schedule is booked for the next year and that there are constant demands for speeches, testimonials and testimony from the Nobel Laureate (including a plea, which he's refused, to be an expert witness in a breast-implantlike class-action lawsuit on behalf of skin cancer victims against CFC makers). Yet he still takes time out to go to the usual campus wine-and-cheese functions, to chat with and advise students as always, and to plot his experiments.

His gift is to find the unasked questions that lead to scientific discovery. For example, he tackled the question, what is the source of the smog that envelops Mexico City in a brown fist? For decades, everyone assumed the pollution was caused by cars, and the government went so far as to limit driving privileges. Rowland, however, learned that the real source of most of the smog was the leaking tanks of cooking gas outside nearly every home. In one startling repudiation of conventional wisdom, Rowland and his team gave Mexicans a way to cure pollution that had seemed incurable: Fix the leaks.

Today, with chaos all around him, his office door partially obscured by a large yellow banner that reads "Congratulations Boss," he leans back in his office chair and takes calls from CNN and ABC News, answering questions about complex chemical reactions in the atmosphere in one breath, reviewing his career as a semipro baseball player in the next. ("One of the things you learn in graduate school is how to analyze a situation," he tells one interviewer with a mixed expression of longing and amusement on his face. "I came to the realization that I was not a prospect, so I returned to graduate school.")

Down the hall in the physical sciences building, Blake, his partner, is fuming in his office, having just spoken by phone with a member of their research team in Tasmania. The team members are half a world away and unable to conduct tests of the atmosphere because they used up all their air bottles. The tests are crucial to experiments Rowland and Blake have designed to measure chemicals in the air linked to global warming and ozone depletion. The problem must be resolved before Rowland, Blake, and their entourage board the plane to Sweden. Blake is spinning in his chair like a top, racing between computer, phone and desktop, glowering and muttering. Rowland leans his 6-foot-5-inch frame against a spare

desk in the younger scientist's office, rubs his big hands together, and deftly calms Blake down.

"It's just one of those things," Rowland soothes. "We just need to get someone out there with more cans." A few minutes later, Blake is notably calmer: A grad student has a ticket to Tasmania in his back pocket and a load of atmospheric sample containers in the trunk of his car. The problem has been solved, and you can see why Rowland and Blake have become the nucleus of one of the nation's foremost teams of atmospheric chemists. Blake is the drill sergeant, hammering things through, chasing down details, keeping things moving forward. Rowland is the policy maker, the healer, the calming influence who assesses the big picture and keeps the team from flying apart.

Rowland's calm in the face of crisis and criticism has become his trademark, along with his basketball player's gangly-yet-graceful physique (he played that in college, too, as well as baseball), his intense interest in opera (opera posters adorn his office walls and he has been known to duck out of scientific conferences abroad to rush to a performance), and his one concession to professorial eccentricity: big, bushy sideburns.

His stoicism reveals itself in a number of ways. When Rowland was awarded the Daniel Aldrich Chair in chemistry, an academic honor at UCI, his buddy Hal Moore decided a more concrete symbol was required. He found an old wooden chair in his garage that he had used for years as a step ladder for paint jobs. It was encrusted with old splotches of paint, dented and lumpy, its back missing. He put a sign on it—"The Aldrich Chair"—and exchanged it for Rowland's comfortably padded office seat late one night, then waited for the fireworks.

The fireworks never came. Rowland's revenge was to ignore Moore's practical joke. He sat in the ridiculous chair for days—without complaint, without even mentioning it to anyone—taking calls, advising students, meeting with professors and deans. Defeated, Moore (who, during an earlier hospital stay, received a dead plant from Rowland, offered without comment as if it were the most natural thing in the world) finally slunk back into Rowland's office and replaced the chair.

That trademark calm carries over into the most serious aspects of Rowland's work as well. He describes a conversation with his wife on that day, 22 years ago this month, when he and Molina discovered what CFCs were doing to the planet in the most pragmatic of terms.

"How's work going?" Joan asked him when he came home looking dejected one night.

"Very, very well," he replied. "But it looks like the end of the world."

ROWLAND DOES ALLOW THAT HE'S experienced two events in which there was no way he could remain calm. Both involved phone calls in the early hours before dawn. "At that time, you know it's one of two things: a mistake, someone calling from another time zone who has forgotten to account for the time change. Or it's bad news."

The first of those calls was years ago. Joan, barely roused by the ringing, had muttered from her side of the bed, "Are you going to get it?" Rowland did.

On the other end of the phone was a brain surgeon, Rowland recalls now. "He said we could be cautiously optimistic, but that our son had been in a terrible accident."

Within hours, Rowland and his wife were at their son's bedside in San Diego, where they remained for five months, abandoning school, research and all other concerns until their son, Jeff, was healed and his hospital stay ended. Rowland even worked as an orderly during those five long months. (Jeff, now a businessman in San Diego County, recovered fully.)

The second call came early in the morning, too. Rowland, standing barefoot in his pajamas in his Irvine home, couldn't help feeling an old dread well up in him, the fear that something just as terrible as that accident years ago—or worse—was waiting for him on the phone. And there was that awful *dejà vu* when his wife said, "Are you going to get it?" When he picked it up, the voice on the other end had a Swedish accent. Then, even Sherry Rowland could be

forgiven for losing his composure.

LIKE SO MANY OTHER GREAT SCIENtific discoveries, this one started with a simple question. Simple, except for the fact that no one had ever thought to ask it before: What happens to all those CFCs we keep spraying on ourselves? We produce nearly a million tons of the stuff every year. Where, Rowland wondered, does it all go? And what happens to it once it gets there?

You'd think such a simple question would have been resolved years before. CFCs were discovered in 1928 by a Du Pont chemist searching for chemicals that could replace the flammable and toxic substances then used for refrigeration. CFCs seemed to fit the bill—nontoxic, inflammable and among the most chemically stable compounds ever found. They were inert, meaning they stubbornly refused to dissolve in or combine with anything, which is what makes them such a great propellant in spray cans. Refrigerator manufacturers seized on the wonder substance, and it didn't take long for a new industry to be born, or for Du Pont to adopt its now-famous slogan, "Better Living Through Chemistry." The invention of the spray-can top after World War II—the little plastic valve that releases or restrains a pressurized aerosol with such elegant and inexpensive simplicity—sealed the deal on CFCs, creating a huge new market. Soon everyone in America had cans full of the chemicals under the kitchen sink and in the medicine cabinet.

It was always assumed that the chemical stability of CFCs rendered them harmless to the environment. But at a scientific conference in 1972, Rowland learned of some atmospheric tests that showed CFCs lingering for years in the atmosphere, something that wasn't supposed to happen. Most pollutants man and nature create are quickly removed from the lower atmosphere by rain, sunlight or oxidation, powerful forces that can break down almost any substance. What happened, Rowland wondered, when a chemical like CFCs could resist that process?

Back at UCI, he suggested to postdoctoral student Molina that this would be an interesting problem to investigate. "It was just an academic exercise," Rowland recalls. "We had no idea what was awaiting us."

They discovered that CFCs, which could not dissolve in rain or combine with other chemicals, slowly drifted up into the stratosphere. There, the thin but crucial ozone layer absorbs the ultraviolet light that, in its mildest form, causes sunburn. At its most intense levels, it's incompatible with earthly life. Once the CFCs get to the outer stratosphere, the far more intense sunlight finally breaks them down. Among the chemicals released into the stratosphere is free chlorine.

Having figured that out, the two scientists almost stopped there, concluding what would have been a mildly interesting research project. They could have published a paper and that would have been that. There would have been no outcry; no one would have noticed outside the small community of scientists interested in such things. But then Rowland suggested they figure out what happens to all that chlorine.

Thus were borne the calculations that predicted the end of the world. It turns out that each chlorine atom would set up a chain reaction that destroyed thousands of molecules of ozone, a horrific multiplying effect. One molecule of CFC could take out a hundred thousand molecules of ozone. The CFCs weren't just bullets cutting holes in the ozone. They were shrapnel from a chemical grenade, shredding whole swaths of the vital layer high above us. At the time, 40 year's worth of CFCs were slowly drifting upward, 40 years worth of grenades. CFCs released during World War II were just arriving to do their dirty work. The world was only just beginning to see the results of this snail-paced folly, Rowland and Molina realized, and it would keep getting worse.

"It was a long and difficult process that followed," Rowland says now. "Every time you find out something...it means that either somebody made a mistake earlier, or hadn't thought about it...People who make errors don't much like having them pointed out."

After the discovery, Rowland began a long battle—writing papers, contacting legislators, and spreading the word to other scientists. Slow progress was made in the Seventies, only to be undone in the early Eighties, then resurrected by the timely discovery of the ozone hole over Antarctica in 1984. Unequivocal proof linking the hole to CFCs in the upper atmosphere quickly followed.

Still, all those years of aerosol use continue to exact a price. The released CFCs still are drifting upward, a journey that can take half a century. Rowland calculates that ozone has been depleted by 10 percent worldwide so far, with an inevitable effect on cancer rates and other health and environmental problems. Another five percent loss is likely, he says, then, after another decade, the damage slowly will begin to heal, thanks to the reductions in CFC production Rowland helped initiate. "The crisis is over for now," he says. "But it's going to get worse before it gets better."

ROWLAND KNOWS BETTER THAN TO consider the matter settled; his fight is not over. A new wave of opposition to banning the chemicals is gathering force, despite the Nobel Prize and other awards, physical evidence that proves his calculations on ozone depletion, and despite the chemical industry's happy discovery of new compounds that work just as well as CFCs without nearly the harm to our atmosphere. Now Rush Limbaugh, relying on dubious research funded by supporters of conspiracy theorist cum imprisoned tax evader Lyndon LaRouche, regularly attacks the CFC ban and scientists such as Rowland who support it. Orange County's own U.S. Rep. Dana Rohrabacher wants to ease restrictions.

The critics keep raising old issues, saying volcanic eruptions and evaporating seawater dump far more chlorine into the atmosphere than CFCs without harming the ozone layer. They cite old and discredited but official-sounding studies, red-herring arguments long ago dismissed by reputable scientists. In fact, no significant amount of chlorine from volcanoes or seawater rises high enough to harm the ozone layer. A similar group of critics is trying to debunk evidence of global warming with scientific studies backed by the fossil fuels industry—the main contributor to global warming. Rowland gets letters every week from dittoheads asking why he is taking part in a conspiracy to destroy business and industry with hysterical doomsday pronouncements. Even his Nobel ceremony was picketed in Sweden. "The level of civility is constantly declining," he laments. "There seems to be a growing sentiment to have scientific questions decided without much input from scientists."

Taking the heat doesn't pain him—he's used to that—it's what this hostile and angry refusal to accept solid scientific evidence implies about society that troubles him most. In a speech to the American Association for the Advancement of Science, Rowland, then the group's president, spoke of a study that found a majority of Harvard University graduates could not provide a knowledgeable answer to the question, Why is summer warmer than winter? His own survey of students at UCI showed similar results. If you agree with the most common answer—that the earth is closer to the sun in summer— shame on you! Go buy a book and recall that when it's summer in Orange, it's winter in Buenos Aires. If even our most prestigious places of higher learning churn out scientific illiterates, Rowland says, how can we expect society as a whole to accept difficult and unpopular scientific discoveries such as the danger of CFCs?

Rowland's calm, simple answer, the one that changed our world for the better, is to keep pounding away, educating the public, the government, and industry. "We must be prepared to do it over and over again," he told his fellow scientists. "And it's still the most exciting game in town." OC

Orange Coast *contributing writer Edward Humes won a Pulitzer Prize for specialized reporting in 1989. His fourth book,* No Matter How Loud I Shout: A Year in the Life of Juvenile Court, *will be published next month by Simon & Schuster.*