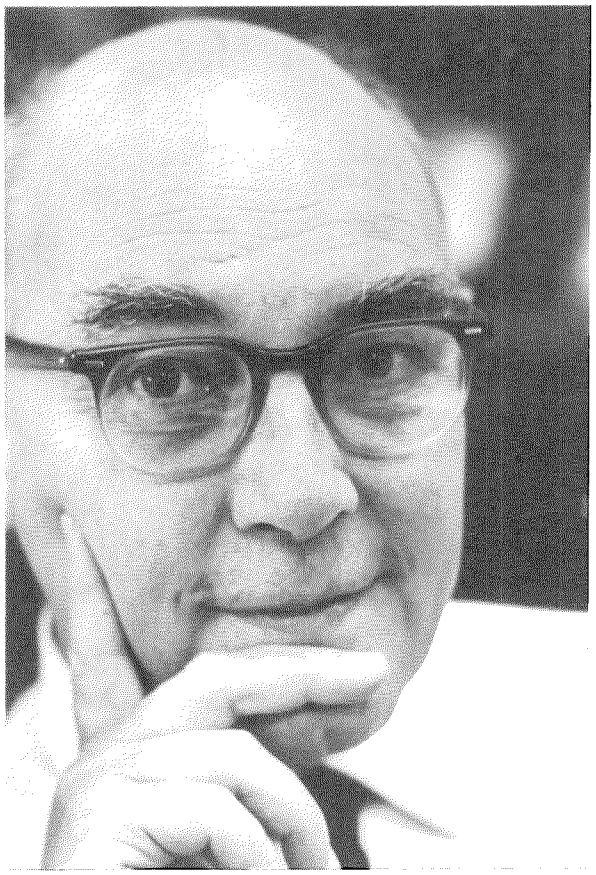


A Man Who Speaks Swedish

STANDING on the Stockholm docks on a summer day in 1926, a 21-year-old American college student was surprised to find himself speaking Swedish with a local fisherman. He didn't know he could speak the language. Just over ten years later, that latent ability once more stood him in good stead. He received the Nobel Prize in physics from King Gustav and was able to converse with the king in his native tongue.

The young man was Carl Anderson and, of course, he didn't acquire such linguistic capability completely out of the blue. Both of his parents came to the United States in their late teens, and though they spoke English in their home, Swedish was always part of the background.

Carl was born in New York in 1905, and when he was about seven, the Andersons moved to Los Angeles. He attended grade school and then Los Angeles Polytechnic High School, from which he graduated in 1923. His chief extracurricular interest in those years was electrical engineering, and he was able to get material for a lot of experimenting by making the rounds of nearby garage repair shops where he picked up discarded but still serviceable batteries.

With hope for an electrical engineering career motivating him, Carl applied for admission to Caltech. This step was against the advice of almost everyone he talked to except his physics teacher, but he went ahead anyway and stayed firmly committed to his engineering goals — until the third term of his sophomore year. He was then among the select few students whose grades warranted their being put in "Section A," where sophomore physics was covered in the first two terms, and Ira Bowen's course in modern physics was offered in the third term. That course converted engineer Anderson to physicist Anderson.

After Carl received his BS in 1927, he stayed on as a graduate student working on X-ray photoelectrons under the supervision of Robert Millikan — at least officially. For several months, actually, he didn't have a research adviser, but when he mentioned this to Millikan, Millikan volunteered his own services. Anderson does not recall that the Nobel Prizewinning physicist and head of the Institute ever entered his laboratory or discussed his research with him. Nevertheless, there must have been considerable interaction and mutual respect because after Carl received his PhD, *magna cum laude*, he became a research fellow at the Institute, working with Millikan on cosmic ray studies.

Millikan was a pioneer in cosmic ray research, and he had already measured their enormous penetrating power. What he wanted Anderson to do was to measure the energy of the electrons they produced, and the best way to do that at the time was in a cloud chamber. After conferring with Millikan, Anderson designed and built an apparatus consisting of a giant electromagnet wrapped around a cloud chamber. An arc lighted camera was focused on the window of the chamber to record the visible vapor trail of electrons or other charged particles passing though the chamber.

This was in the early 1930s, a time when scientists had identified two elementary particles of matter — the electron, with its negative charge, and the positively charged nucleus of the hydrogen atom, the proton. Anderson realized that he had found something new when his photographs showed what appeared to be a positively charged electron. This particle was eventually named the positron, and its discovery brought Anderson the 1936 Nobel Prize in physics.

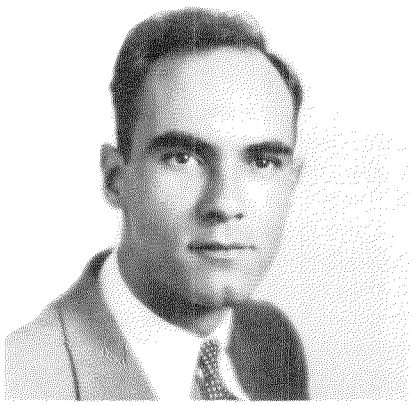
Acceptance of the reality of the positron did not come easily to Anderson or to Millikan — or to physicists in general. But when it became clear that no other explanation of the observed phenomenon made sense, the concept of matter and antimatter enunciated by Dirac was confirmed. Since then research in this field has led to the discovery of so many elementary particles, each with its antiparticle, that physicist Enrico Fermi is said to have remarked that if he could remember all of their names he would have been a botanist.

By the time Anderson received his Nobel Prize — at the age of 31 — he and his first graduate student, Seth Neddermeyer (now professor of physics emeritus at the University of Washington), had identified two more of the fundamental particles of matter, the positive and negative meson, or muon. Nothing of that discovery came about by chance; it was the result of four years of careful, systematic investigation. Part of it was done at the summit of Pikes Peak in Colorado because the intensity of cosmic radiation is greater at high elevations than it is at sea level. Later, Anderson also conducted research in Panama, in the White Mountains of California and in a B-29 airplane that operated at altitudes up to 40,000 feet.

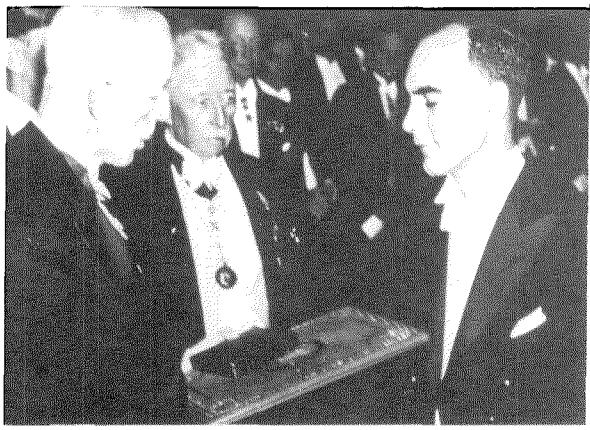
In 1933 Anderson was promoted from research fellow to assistant professor, a step that improved both his academic standing and his financial situation. The award of the Nobel Prize had similar beneficial effects, though Carl had to borrow $500 from Millikan to pay for his ticket to Stockholm to receive the award. In 1937 he was promoted to associate professor, and in 1939 he became professor.

The outbreak of World War II changed the activities of both Caltech and Anderson. Teaching and peacetime research had to take a back seat to war-related efforts. Arthur Compton of the University of Chicago offered Carl the directorship of the bomb-development laboratory, and Anderson visited Chicago in early 1942 to look the situation over. He turned the job down because, in the first place, he felt he did not have the necessary administrative skills and, in the second, he did not have the resources to support himself in Chicago and his semi-invalid mother in Califor-

Carl Anderson's 1926 Junior Travel Prize of $900 gave him nearly six months in Europe during which he climbed its second highest peak, Monte Rosa. At the left above is the Swiss guide for the climb.

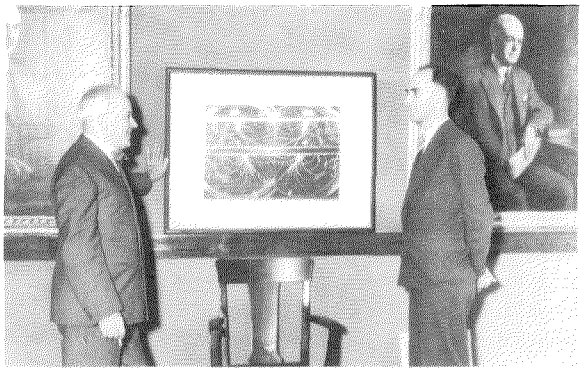


Graduating in 1927, Anderson was a member of both the campus scholastic honor societies, Tau Beta Pi and Sigma Xi.

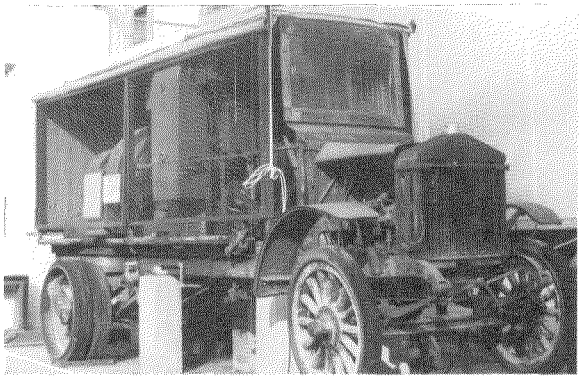


In 1936 King Gustav of Sweden presents Anderson with the Nobel Prize in physics in recognition of his discovery of the positron.

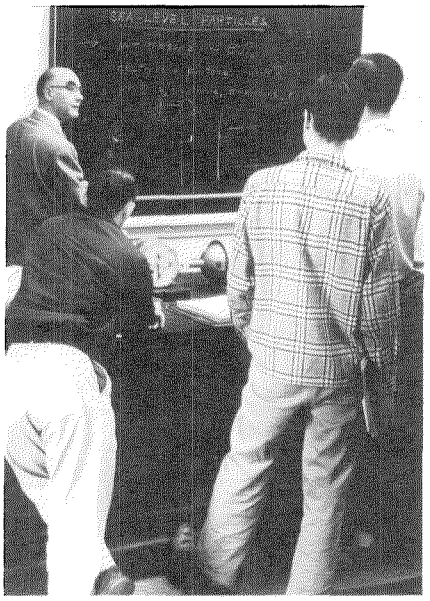
Four cheers instead of three is an old Swedish custom, and in 1965 Anderson was proud to lead them in honor of Richard Feynman, whose Nobel Prize award had just been announced. Unfortunately, Feynman himself is mostly hidden in the crowd.



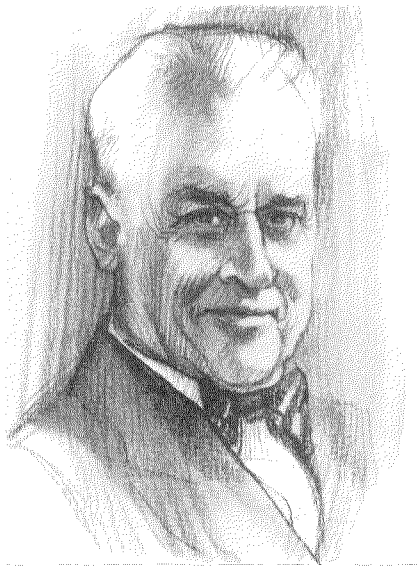
Robert Millikan and Carl Anderson with cloud chamber photographs of the positron.



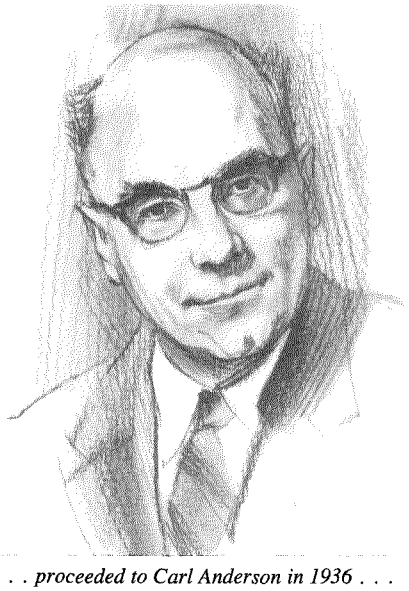
This motor generator mounted on a 1911 Pierce Arrow was given to Anderson by film director and Caltech alumnus Frank Capra. Towed to Caltech and parked in the alley beside the aeronautics building, it provided power for the cloud chamber magnet.



Teaching is a part of the life of most professors, including Nobel Laureates. Here Anderson is explaining something about the particle content of the cosmic radiation to a group of students.



A Nobel Prizewinning teacher-to-student cycle began with Robert Millikan in 1923 . . .



. . . proceeded to Carl Anderson in 1936 . . .

. . . and went on to Donald Glaser in 1960.

nia. Instead, he spent a good deal of time during the war years working on the solid-propellant rocket project headed by Caltech physicist Charles Lauritsen. Specifically, his work dealt with how to fire these rockets from aircraft, and this effort was successful enough that he was flown to Europe in 1944 to supervise the installation of the first aircraft rockets on Allied fighter planes.

One of the first things that happened to Anderson after the war was giving up being a bachelor. After an eight-month-long engagement, he and Lorraine Bergman drove off to Santa Barbara one Sunday in 1946 to find an open church and get married. That turned out to be more difficult than expected, but a few telephone calls located a Seventh Day Adventist minister who was willing to perform the ceremony. Entirely coincidentally, the bride and groom encountered James Page, chairman of the Caltech Board of Trustees, with his wife and a friend, and invited them to the wedding. The Pages reciprocated by taking the newlyweds to their home in Montecito for a champagne wedding reception. For most of the ensuing 36 years the Andersons have lived in San Marino, California. They have two sons — Marshall, who is a mathematician and computer analyst, and David, a physicist.

After the war Anderson returned to studies of cosmic radiation. His research group included Robert Leighton and Eugene Cowan, both now professors of physics at Caltech. It also included Donald Glaser, who received the 1950 Nobel Prize in physics for his invention of the bubble chamber, another device for detecting atomic particles. Anderson still hopes that Glaser will have a Nobel Prizewinning student to continue the professor-to-student cycle that began with Millikan.

In the course of their research Anderson and his group took literally tens of thousands of pictures, each of which was methodically examined in the hope of seeing interesting particle tracks. More than a little tedium was involved in this process, but it paid off for Anderson's research group as they accumulated photographic evidence of many examples of new fundamental particles that came to be known as "strange particles."

By the late 1950s Anderson's kind of cosmic ray studies was beginning to be replaced by work done on huge high-energy accelerators, and he was willing to take on administrative work in addition to the committee service he was accustomed to giving to the Caltech community. He became chairman of the Division of Physics, Mathematics and Astronomy in January 1962, and he held the job until 1970. While he was in office, two physicists at the Institute received Nobel Prizes — Richard Feynman in 1965 and Murray Gell-Mann in 1969 — two events in which Anderson took great pleasure but for which he claims absolutely no credit. Carl Anderson is, in fact, a modest man. When Caltech feted him with an Athenaeum dinner after he had received the Nobel Prize, he responded to the highly laudatory speeches by recalling the first medal he ever won.

"I won it for improvement in physical achievement when I was a Caltech freshman," he explained. "To begin with, I was among the poorer runners, broad-jumpers, and high-jumpers, but at the end of the term I finished ahead of several of them, so they gave me second prize — a silver medal."

He then went on to admit that the reason for the improvement was simple — he changed his shoes. Originally he had thought that the test had something to do with ROTC, so he wore his heavy Army shoes. For the later test he wore sneakers.

Neither that prize nor the Nobel Prize was the last of his honors. He has, for example, been awarded three honorary doctorates, and he has received the Gold Medal of the American Institute of the City of New York, the Presidential Certificate of Merit, the Elliott Cresson Medal of the Franklin Institute, and the John Ericksson Medal of the American Society of Swedish Engineers.

In retirement now (he has been Board of Trustees Professor Emeritus since 1976) Anderson has been doing quite a lot of writing, and in 1979 he recorded an oral history for the Caltech Archives, in which the interviewer asked him if he felt that society should spend huge sums on scientific projects. Carl Anderson replied: "If you ask how many millions or billions of dollars a fundamental particle is worth, the answer is that I don't know. Doing science is a matter of faith. You just have to explore the physical world. Curiosity is a part of human nature, and there will always be science for the sake of science — for the sake of pure understanding."

The young man who was able to speak Swedish to a fisherman and to converse with a king, is also obviously a competent spokesman in English in behalf of science. □ *–JB*