

proteins and nucleic acids. But which was the active ingredient: the protein or the nucleic acid?

Cohen went to see Arthur Kornberg, an enzyme biochemist who was working at Washington University at the time and who later also won a Nobel Prize. Kornberg had a suggestion. Snake venom contains enzymes that break down nucleic acids but leave protein untouched. Try snake venom, he said, referring him to a colleague, Osamu Hayaishi, who was purifying enzymes from snake venom.

When Levi-Montalcini tested the snake venom on a bit of nerve tissue, she was amazed. The venom produced a stupendous halo—a much bigger halo of nerve fibers than the mouse tumor had. Compared to mouse tumors, the snake venom proved to have three thousand times more growth factor. After purifying the factor from commercially available venoms, Cohen figured that mouse tumors and snake venom could not be the only two natural sources of the growth factor; mouse tumors and snake venom had too little in common. Then he made an inspired guess. The venom-producing snake gland has a mammalian equivalent: the salivary gland. Testing various animals, he discovered that the salivary gland of a male mouse is phenomenally rich in nerve growth factor. One drop of a male mouse gland in fifty liters of solution produced a spectacular halo. With a cheap and ready source of the nerve growth factor, Cohen was able to purify it.

The team of Cohen and Levi-Montalcini was fabulously successful, but it broke up in 1959. Calling Levi-Montalcini into his office, Hamburger told her that Cohen had to go. As chair of the university's zoology department, Hamburger had pushed Levi-Montalcini's promotion to full professor through the university the year before. But he could no longer justify keeping a biochemist in a zoology department. Today science is interdisciplinary, and zoology departments routinely hire biochemists. But the practice was uncommon in 1959, and Hamburger said he could not pay a professor who could not teach zoology courses.

Cohen moved to Vanderbilt University in Nashville and continued working on another substance, the epidermal growth factor, which he had discovered in St. Louis as part of the NGF project. EGF stimulates the growth of cells in the skin, cornea, liver, and other organs.

Once more, Levi-Montalcini plunged into despair. Her six years with Cohen had been her most creative period, and his departure felt like the tolling of a funeral bell. Unsettled and dissatisfied, she was unsure of what to do next. She knew that many neurologists still did not believe in NGF. Both NGF and EGF were completely novel biological phenomena and hard to incorporate into existing know-

edge. For a time, she took up a different research problem, the nervous system of cockroaches. Then she realized that she could not give up or abandon NGF.

Some colleagues contend that Levi-Montalcini overdramatized the scientific community's lack of interest in NGF. After all, they note, she was elected to the prestigious National Academy of Sciences in 1968. Nevertheless, she began to promote her discovery persistently and doggedly.

To illustrate the vital importance of NGF for the development of the nervous system, Levi-Montalcini developed a series of elegant proofs with the help of Cohen and graduate student Barbara Booker. When nerve growth factor was injected into newborn rodents, they developed an excessive number of neurons. Then, injecting antibodies to the nerve growth factor into newborn rodents, she showed that their developing nerves virtually disappear.

Further research on antibodies against NGF, conducted with a young Italian biochemist, Piero Angeletti, resulted in a classic, frequently cited review article. And in 1972, Levi-Montalcini's postdoctoral fellow Ruth Hogue Angeletti and a young Washington University biochemist, Ralph Bradshaw, identified the precise sequence of NGF's amino acids. So NGF was definitely real and important.

Armed with her evidence, Levi-Montalcini was unstoppable. Her carefully developed talks were famous for extending far beyond the usual fifty minutes. Deep into one talk, a renowned neuroscientist started grabbing her slides out of the projector, hoping to cut her off; Levi-Montalcini just filled in the blanks as if nothing had happened.

Traveling to a French scientific conference, she found herself without a reservation for the flight she wanted; every seat was filled. A colleague inside the plane watched as the pilot was summoned back into the terminal; then, suddenly, the scientist saw two figures crossing the tarmac toward the plane. They were Levi-Montalcini and the pilot—carrying her luggage. Levi-Montalcini climbed regally into the copilot's seat, and the plane took off. Her colleague never figured out whether she had used her charm or her temper—or a combination of both—to hitch a ride.

She acquired an entirely new image to sell NGF. Old-fashioned elegance gave way to an aristocratic, womanly chic. The transformation made her feel good and was good salesmanship. Her bun became a dramatic swoop, and an elegant uniform satisfied her own finishing-school standards and her busy schedule. Still slim as a fashion model and straight-backed, she designed a basic high-necked, sleeveless dress with a matching jacket. She had them made in Italy in silk and brocade. And she wore them every day summer

and winter with four-inch-heeled shoes, her mother's single strand of pearls, a magnificent gold bracelet, and an antique brooch. Arriving at work each morning, she put a lab coat over the silk for dissecting mice. Before teaching her large and popular lecture course, she stopped by her office to dab a bit of perfume behind each ear. At the end of a day, she was still spotless. According to a particularly persistent story, an airline lost her luggage on her way to speak at Harvard University. Refusing to appear in her wrinkled traveling outfit, she lectured in an evening gown—the only fresh dress she had with her.

She enjoyed entertaining and became famous for her elegant dinner parties. Alone, she ate yogurt with plain rice and steamed vegetables. But for guests, she jettied in fresh truffles and developed a basic banquet, with fabulous variations. For appetizers, chicken liver pâté with raw pistachios and Marsala wine; cheese curls; and Belgian endive leaves stuffed with caviar and sour cream. For the main dish, a beef *filet en chemise* with cheese puffs and vegetables. Then a salad and frozen zabaglione for dessert. Levi-Montalcini always makes an impressive show. In Italy, she has a full-time cook, and friends cannot believe that she can prepare a meal. She does not dissuade them.

Cooking, she emphasizes, was only a hobby.

As always, she lived intensely, with style and verve. Her St. Louis secretary served afternoon espresso on a tray to lab workers each day as they reported on their work. A paper she gave her postdoctoral fellow Robert Provine to edit was filled with flamboyant, sweeping statements. When Provine pruned out the flourishes, she complained mournfully, "You took my beautiful prose, and you turned it into boiled spinach." Her dry humor has a touch of aristocratic understatement. She was discussing a complicated point with Provine when two streakers raced by—a naked bicyclist with an equally nude girl perched on his handlebars. Levi-Montalcini turned regally to Provine and deadpanned in her rich Italian accent, "Bob, do they do this often here?" A friend calls her "La Regina"—in Italian, "The Queen."

She moves mountains to help people in need. She gave a technician's family a new refrigerator and arranged a job for a poor youth. She brought the daughter of a tyrannical Italian professor and her fiancé to the United States so that they could marry. She was kind and supportive to the undergraduates in her lecture class. Her secretaries remained her friends for decades, remembering how she helped them with mailings, French lessons, and the like.

With her peers and competitors, on the other hand, she could conjure up tempestuous visions of her father and Giuseppe Levi. "She places a great importance on intelligence, and she couldn't

tolerate stupidity very well," Cohen learned. "If somebody said something that she thought was stupid, she'd tell him it was stupid." Levi-Montalcini speaks her mind, whether she is talking to an eminent professor or a street cleaner, a friend said.

"She had a lot of fights with a lot of people, myself included," admitted Ralph Bradshaw, who became chair of the biochemistry department at the University of California at Irvine. "Rita was extremely possessive of NGF. She viewed it as her private property. It became her child.... There's almost no one in NGF at one time or another who hasn't been at odds with her."

Referring to Levi-Montalcini's tumultuous emotions, a colleague asked Provine how he liked the "Levi-Montalcini Roller Coaster." Provine replied, "Overall, it was a good ride. But sometimes it felt like working for Maria Callas and Marie Curie." But then he added, "Great ideas are a dime a dozen. The great scientist is one who delivers. And Rita delivered."

When a student inadvertently hurt Levi-Montalcini's feelings, she screamed at the student—at length and in front of colleagues. Then the mood passed, and it was over. "Her temper doesn't last. She doesn't hold a grudge," according to her former secretary and longtime friend, Martha Fuermann. "Two things are very important to her: her work and her twin, almost in that order.... Her research has to go right. She's so wrapped up in her work, it's her life."

"Now she accepts her position as the originator of a large field, but in the [beginning], you had to wear your asbestos suit if she got your paper or grant to review," explained Ruth Hogue Angeletti. "It's a classic problem. You find something really exciting. You're the mother of the field." **↓ STOP**

Levi-Montalcini was homesick for her family, too, especially her twin Paola. Securing a National Science Foundation grant in 1961, she started a small research unit in Rome. Soon she was spending six months of the year in Rome and six in St. Louis. Italian university positions are doled out by seniority, not merit, and Levi-Montalcini had lost her place in line when she went to St. Louis and became a United States citizen. The Italian biochemist Piero Angeletti, who alternated places with her during her traveling years, helped get funding from the Italian government for an independent research institute for Levi-Montalcini to direct. The institute became the vehicle for her return home. She and Angeletti planned to run the institute together; then, at the last minute, he pulled out to accept a more lucrative position with a pharmaceutical company. Their friendship did not survive the blow.

Running the institute was not easy, given Italy's bureaucracy. Her researchers sometimes worked for months without pay because of