Jumping the Gun

It is toward the end of a cold January day in 1948 at the huge, modern complex that is Lederle Laboratories in Pearl River, New York. Winter darkness has fallen beyond the windows of the lab where research scientist Dr. Hilary Koprowski and his assistant, Thomas Norton, are at work. The night turns the big windows into mirrors that multiply a glittering confusion of chemical glassware, colorful fluids, powerful microscopes, and the assorted exotic trappings of scientific research. But it is a simple Waring blender over which Koprowski and Norton are bending, measuring out the ingredients of a very special cocktail.

And a gruesome cocktail it promises to be. The two men spoon bits of grisly cotton rat spinal cord and brain tissue into the blender—cold, greasy stuff that has been infected with a particular strain of poliomyelitis virus. It is a "live attenuated" mixture, one that contains polio virus diluted to the exclusion of its virulence. Almost.

Thomas Norton, a tall, stooped man, flips on the blender. He and Koprowski frown at the machine as it whirs with a shrill scream, clunking now and then as the blades reduce chunks of solid matter to puree. Norton reaches out a hand to steady the blender so it won't vibrate its way off the stainless table. After it has run smoothly for a moment, he switches it off.

Koprowski carefully pours one cubic centimeter of the cold, grayish suspension into each of two small graduated glass beakers. It is an oily glop. Brains are full of fat. The two men

pick up the beakers and for a brief moment study the contents. It makes cold lamb gravy look appetizing. The material has been filtered for bacteria, but that is all. Heating it would have destroyed the virus.

Norton and Koprowski regard each other over the rims of the beakers. They drink, tipping their heads back for a long moment until the thick stuff flows sluggishly across their tongues. They make bad faces as they suck the greasy soup out of the corners of their mouths and swallow repeatedly. Koprowski notes that the raw vaccine tastes like cod liver oil. When he can speak, Norton asks, "Have another?"

"Better not," Koprowski says. "I'm driving."

~

As the year 1950 began, Harry Truman was president. *South Pacific* was playing on Broadway. A U.S. guided missile had been propelled to a record altitude of 250 miles. Senator Joseph McCarthy was about to begin a witch hunt for communists in the State Department. George Orwell's *1984* was in the bookstores. The United Nations building in Manhattan was nearing completion. And a virus called poliomyelitis was running rampant in the land. Polio was putting people (primarily children) into iron lungs, braces, or coffins at astonishing rate.

For thirty-five years (since 1915) the invisible crippler had been spreading panic and paralysis. It waxed and waned in a maddening, random cycle that confounded those who would conquer it. In the United States, there were 1,639 cases (661 deaths) documented in 1915, the first year it gained notoriety; a whopping 27,363 cases (7,179 deaths) in 1916; 4,174 cases (1,451 deaths) in 1917; and so on. Researchers continued to rack their brains trying to find a formula that would arrest the disease. Two notable attempts at vaccines proved as deadly as the disease itself, creating an ominous double edge to the quest.

In 1924 one of the 6,301 polio victims was a man who would become president of the United States. Since the inauguration of wheelchair-bound Franklin Delano Roosevelt in 1933, money

flowed like water out of Washington, D.C., to support work aimed at finding a cure for polio. And still there was nothing.

Beginning in the 1940s polio had established a steadier foothold. From 1945 on, it had reached epidemic proportions with 13,500 cases that year; 25,600 in 1946; 27,700 in 1948. In 1949 there had been a record 42,033 cases. The hot summer months when the virus flourished had become a nightmare, especially in the cities. Crowded public facilities such as newly established community swimming pools and amusement parks had become havens for the extremely contagious polio germs. Anywhere people gathered in close proximity—ballparks, race tracks, department stores, company outings, even the streets—were considered polio risks. Frantic parents who could afford it sent their children out of the cities for summer vacations. While that was a psychological placebo, it was by no means a fail-safe move. Roosevelt was said to have contracted the polio virus while visiting a boys' camp in upper New York State. Some beleaguered town fathers went as far as to barricade the roads to their municipalities, turning away summer visitors who could have been carrying the crippling virus. The specter of polio had the entire country in its clutches. Parents could only wonder if their children would be next, and whether death or a life in braces would be the result.

It was amid such pervasive anxiety in the late fall of 1949 that Hilary Koprowski bid farewell to a visitor to Lederle Laboratories. He then turned and walked in his square-shouldered, stiff manner to his private office. He was so preoccupied by the conversation just completed with his visitor that he didn't hear a question posed by one of his lab technicians as he passed by.

Hands clasped behind his back, Koprowski stared out the window of his office at the stark winter landscape. A light snow was falling, blowing in dusty swirls at the whim of a biting north wind. He watched his visitor cross the parking lot below, bent against the elements. In his thirties, Koprowski was compact, stocky. His looks were intriguing. His close-cropped hair was combed back from a determined, full face with strong cheekbones. Even today he appears habitually cocked, like a runner in the blocks awaiting the starter's pistol.

Deep in thought, energy radiated from the purposeful set of Koprowski's shoulders beneath the white lab coat, and from his gray eyes, which peered through the snow beyond the glass with the intensity of an explorer looking for sign. Koprowski was born and educated in Warsaw, Poland, graduating from medical school and the conservatory of music in Rome the same year. For pragmatic reasons, he chose medicine over a career as a concert pianist. He didn't think he was a good enough pianist to make it to the top. Anything less would have been unacceptable to him. And he was born to explore.

Koprowski's field became virology, the study of viruses, an occupation that would bring him to Lederle in 1944. To this day he uses virology as a wide-angle lens to take in a broad range of medical science. From childhood his intellectual thirst has proved insatiable. A comprehensive study of world history has been one of his hobbies since grammar school. His command of literature exceeds that of many specialists. His scientific papers achieve relevance with quotes from Russian, Polish, French, Italian, English, and American writers and poets. He has good command of those languages, in addition to Latin. His speeches are spiced with humor. And while his intellect, in combination with a thick accent, is often intimidating, his charm can be irresistibly seductive.

But intuitiveness and boldness are what truly set Koprowski apart from his contemporaries. He has an uncanny feel for what is relevant. Dr. David Kritchevsky, who made a name for himself with his early discoveries about the nature of cholesterol, joined Lederle not long after Koprowski arrived in 1944. Another soul of broad interests, and a glib man, Kritchevsky will not know true happiness until he becomes offensive coordinator of the Philadelphia Eagles football team. "We were two of a kind," Kritchevsky says of himself and Koprowski. "Young iconoclasts. Sick of the chicken shit, to put it in scientific terms. If you can scare people, you will. Koprowski could scare people.

"The day I was being interviewed for my job as a researcher, I was taken to lunch in the cafeteria. At the table were Koprowski, his lab boss, Herald Cox, a visiting director of some sort from Scotland, and some others. Cox and the Scot were trading fishing stories. When the bosses were speaking, everyone shut up in those

days. But I had to say something. So I said there was a lot of good trout fishing in California. Cox asked, 'Do they use wet or dry flies?' I said I didn't know how far they went into the water. Koprowski laughed like hell. The others didn't dare. I liked him immediately."

Among his contemporaries at Lederle, Koprowski was regarded as impatient, impulsive, determined. Dr. Edwin Lennette, an early mentor of Koprowski's in Brazil, recalls his aggressiveness. Though he is more than ninety years old, Lennette has the lucid delivery of a far younger man, coupled with a phenomenal memory. "Unless you defend yourself, he'll run over you," Lennette says. "Some people are born that way. Hilary had a penchant for roughing up people. He acquired that reputation in a hurry." But all agree that in the late 1940s, Koprowski was an adventurous scientist, one who damned the torpedoes and proceeded full ahead, confident that the facts would eventually catch up with where he was bound. That they often did served to reinforce his credibility, brightened his rapidly ascending young star, and added depth to an already lush patina of self-confidence.

~

In the poker game of medical research, that confidence had just been challenged by Koprowski's visitor to Lederle. He was a man named George A. Jervis, an MD and neuropathologist who was director of research at Letchworth Village, a home for severely and profoundly disturbed children located in nearby Nyack, New York. Koprowski respected Jervis. Three years before, in 1947, he was so drawn to Jervis's work on allergic encephalitis (a disease that causes an immune system to destroy its own brain tissue) that he coauthored a paper with Jervis on the subject. Koprowski also admired Jervis's studies of the genetically all-white Great Pyrenees dog, many of which become paralyzed after rabies injections. Rabies was another of Koprowski's consuming interests.

Because of their close professional association, Jervis knew that chief among Koprowski's priorities at Lederle was the development of a polio vaccine. He also knew that Koprowski's Type II polio vaccine (there are three distinct strains of polio virus) had successfully immunized hundreds of monkeys.

It was this knowledge that brought Jervis to Koprowski's office at Lederle. He came to plead for the vaccine. At Letchworth, he supervised a group of young boys who were regularly pelting each other with their own feces in the midst of a polio epidemic. To a virologist, that is like playing with live hand grenades. Jervis was terrified that Letchworth would soon be wiped out by polio if something wasn't done.

Jervis was one of the few who knew about Koprowski's and Norton's private little cocktail party that had been held a few months back. He also knew that neither man had suffered any ill effects from the live polio vaccine they had imbibed.

Koprowski allowed himself the slightest flicker of private satisfaction as he recalled that scientific toast with Tom Norton. Norton was a godsend. Every hard-charging scientist like Koprowski wishes he had several Nortons. Norton had no academic degrees. The lab was his only school of advanced studies. There he learned the science, mastered the details, became committed to thoroughness. His methodology engendered the trust that allowed Koprowski to take the high road with increased confidence. For relaxation, Norton wrote detective stories. Most important, he knew the attenuation process like the back of his hand.

The theory of attenuation is based on the principle that through various laboratory manipulations, microorganisms (viruses or bacteria) lose their ability to cause disease, but not their ability to stimulate the body's immune system to manufacture antibodies against the disease. Once antibodies are produced, they fortunately remain dormant in the immune system for life, ready to rise up and attack if that virus should ever reinvade the body. Live attenuated vaccines (rubella, measles, chicken pox) are commonplace in the modern medical community. Today, attenuation is an approach reinforced by years of success. But in 1950 the process remained hotly debated. It was thought to be potentially dangerous. This was especially true with polio because of the disease's paralyzing effect. It was widely feared that an attenuated virus could regain its virulence (poisonous nature) with time.

A man named Edward Jenner is credited with being among the first to use a natural attenuation process. Jenner diluted a cowpox virus to successfully vaccinate human beings against smallpox

in 1789. France's famed Louis Pasteur established the principles of attenuation of virulent microorganisms in a scientific paper published in 1880. Yet Pasteur's own rabies vaccine was not really attenuated. He simply dried spinal cords from rabid rabbits in germproof jars for up to fourteen days. On July 6, 1885, after hundreds of successful tests with dogs, Pasteur injected the first human being with his rabies vaccine made from the spinal cords. His patient, a young boy who had been slashed in many places by a mad dog, never showed a sign of the hydrophobic disease that assures a prolonged, agonizing death. In the 1930s, a Rockefeller Foundation scientist named Max Theiler further advanced attenuation methods to produce a successful vaccine against yellow fever.

"Pasteur's vaccine was man-made," Koprowski says today, "but he did not intentionally give living virus. The first series of inoculations were dead virus. Only the last inoculation consisted of live rabies virus. Theiler, on the other hand, really began the era of man-made live virus vaccines." Theiler received a Nobel Prize for his work.

Koprowski worked with live yellow fever vaccines during a four-year stay in Brazil after fleeing Poland when war broke out in 1939. At the Rockefeller Foundation in Rio de Janeiro, he was in charge of monitoring tests conducted during mass yellow fever vaccination trials. "All the sera I collected," he says, "was evaluated to find out whether or not the vaccine protected, and for how long."

In the 1940s, because of his work with yellow fever in Brazil, Koprowski and Max Theiler had become acquaintances. Thomas Norton had previously worked in Theiler's lab and had come to Koprowski through Theiler's generosity. "Theiler attenuated yellow fever virus to produce immunity," Koprowski says today. "For me, his work provided a most encouraging model." Koprowski was certain that the process of attenuation brought about a permanent, genetic change in the structure of the virus in the vaccines.

Theiler used many generations of chick embryos to attenuate the yellow fever virus. Koprowski used mice and cotton rats for testing his poliomyelitis vaccine, unnatural hosts in that neither animal naturally contracts the disease. But cotton rats were re-

puted to be susceptible to the introduction of the disease. It was a long and painstaking process. Simply put, a group of rats would be injected with the polio virus. Once the animals showed the disease, their brains would provide the basis for a new batch of virus that was diluted with a saline solution or other inert media. A new group of rats would be injected, and so on until Koprowski and Norton thought the virus was sufficiently diluted. Then it was time to try the evolving vaccine on monkeys. When monkeys began producing antibodies, but no disease, there was hope.

Of more than 850 papers Koprowski has published in his lifetime, Number 25 records the first sign of significant progress on the polio project "Isolation of the Poliomyelitis Virus from Human Serum by Direct Inoculation into a Laboratory Mouse." It is dated 1947 and signed by Koprowski, T.W. Norton, and W. McDermott, the doctor who provided the polio strain. But many scoffed at the paper, calling the results impossible, insisting there had to be contamination during the experiment. Other scientists simply refused to believe that polio virus was viremic (carried in the blood). "Even today," Koprowski says, "people would take issue with that experiment." Nonetheless, the experiment served to isolate the "TN" polio strain (named for Tom Norton).

After five years of testing and modification, by 1950 Koprowski's vaccine had succeeded in immunizing hundreds of monkeys against polio while causing no discernable ill effects. But the most difficult and perilous step in the development of any vaccine was at hand: application to human subjects.

Koprowski has always maintained that taking the vaccine was no big deal. Mad scientist cartoons notwithstanding, the self-administered dose of new, curative substances by inventors is a distinguished, often heroic, and sometimes fatal tradition. Medical history is full of frightening tales, from doctors passing wires through the marrow of their own bones without anesthesia, to practitioners purposely infecting themselves to more intimately understand certain diseases and the effectiveness of treatments, to the young Peruvian medical student, Daniel Carrion, who died a painful death in 1885 after injecting himself with blood from a diseased wart (verruga). But Carrion's death proved that the skin disease (verruga peruana) and the blood disease called oroya fever

were one and the same. Max von Pettenkofer, the public health pioneer of the late 1800s, drank water laced with cholera bacilli to prove that the bacteria alone would not cause cholera. Pettenkofer did not contract cholera (today most physicians would agree that he in fact suffered a mild case of the disease), but he was ready to die in the service of science. "If he will rise above the animals," Pettenkofer wrote, "[man] must sacrifice both life and health for the higher ideals."

Both Koprowski and Norton had determined that they, like most adults, had polio antibodies in their systems. Mature immune systems usually develop antibodies to a cornucopia of viruses the body encounters in the course of daily life. That's why children, in the sanitized world parents prepare for them in the United States, are particularly at risk. Children in less sanitary countries where a large variety of germs are part of daily existence have a much lower chance of contracting polio. Koprowski and Norton were not likely to contract the virus. But when pressed about the potential toxicity of the cocktail, Koprowski now admits there was a possibility. "If it were toxic, we would have found out quickly."

When Koprowski and Norton drank their attenuated cocktail, it was a historic occasion, an important step toward the proof that a live virus vaccine against polio was possible.

~

After work the day of Jervis's visit, Koprowski drove his recently acquired, two-tone brown Nash Ambassador a half hour through falling snow to his house in Englewood, New Jersey. The Koprowskis had moved there from Pearl River in 1948 to shorten Dr. (Mrs.) Irena Koprowska's ninety-minute commute by bus and subway to Manhattan, where she worked as assistant pathologist at Cornell Medical College at New York Hospital. From Englewood, the commute was about the same for both doctors, until Irena switched jobs to the Downstate Medical College in Brooklyn. Her commute increased again to ninety minutes, but this time it was by car.

A double-career family was unusual in the 1950s, but for Hilary Koprowski, it was an extension of how his parents had lived

in Poland. His father, who was separated from Hilary's mother, was a textile manufacturer who lived most of the time in England. His mother, Sonia, was a dentist who maintained an office in their home in Warsaw.

Sonia had lived with Hilary and Irena since the family had fled from Poland to Brazil. Hilary was devoted to her. While her son and daughter-in-law pursued their careers, Sonia ran the family house and cared for her grandson, Claude. Always a demanding woman about life's details, Sonia was obsessed with her health to the point of hypochondria. Before she reached fifty-five, she'd had two serious bouts with cancer that not only took a physical toll, but also escalated and reinforced her preoccupation with illness. When Hilary arrived home in the snowstorm, Sonia was busy in the kitchen supervising the preparation of dinner by Claude, now nine. Under her guidance—often dispensed from a sick bed—Claude was already a promising cook. The two got along famously. Once his grandmother asked Claude what he would like for dinner. He named ten different dishes. The next day, she cooked all ten.

It was a different story with Sonia and Irena. The old adage about any house being too small for more than one matriarch was proved at the Koprowskis'. Sonia was a strong, opinionated mother-in-law, a troublesome, abrasive presence for Irena from the time Hilary began courting her. It didn't help that Sonia spoke little English. Friends were few and far between for her in the Englewood area. She relied heavily on both Claude and her son for companionship and attention.

To this day Irena is soft-spoken, but direct and strong-willed. In the 1950s, she was a smart young doctor with considerable charm and a promising career of her own. She was working on diagnosing cancer in women. She has a natural penchant for languages, learning mainly by ear. In Brazil, she quickly picked up Portuguese. While living in Englewood, her self-taught English that she articulates to this day with studied care in her low, quiet voice, improved daily. The fact that her husband, an only child, was still so dependent on his mother's approbation was annoying. She could count on Hilary resolving any conflict between her and his mother in Sonia's favor. It was ever thus. But the extended family is the Polish way, and Irena's career required a caregiver

for her son. Hiring one was out of the question for the Koprowskis at this stage. Sonia was both a responsibility and a help, a virtue and a thorn. The situation could be explosive. Claude can remember times when the two women ended disagreements with hair-pulling. It was best, Hilary often thought, that Irena usually arrived home after the evening meal was prepared.

Arriving in Englewood, Hilary greeted Sonia and Claude with his usual exuberance. For all Hilary's seriousness at work, an approach that still ranges from demanding to disparaging, Claude remembers his father as habitually lighthearted, humorous, even whimsical at home. Hilary glanced through the mail on the desk in the living room, then went to the piano and played with such gusto that Sonia stopped to listen. It was Sonia who had directed Hilary toward both music and medicine. Now she closed her eyes and frowned as the notes cascaded about her too fast, too jumbled, an exercise for nimble fingers while the mind was otherwise engaged. She'd heard it before, this musical release of emotion from her son. Distressing as it was musically, she was glad for it. Without it, she might never know how he felt.

After ten minutes the music ended abruptly in mid-phrase. There was the sound of the piano bench being pushed back, the living room telephone being dialed, Hilary speaking rapidly, quietly in his rough English. The word *Jervis* was overheard. Moments later Hilary appeared in the kitchen, a smile on his face, rubbing his hands together. "Would you be so kind," he said in Polish, "as to tell me what is for dinner?"

~

On February 27, 1948, a week after Jervis's visit to Lederle, Hilary Koprowski and Tom Norton arrived at Letchworth Village around 10 A.M. Dr. Jervis greeted them. Norton carried a small cooler containing another batch of the polio vaccine he and Koprowski had made in the Waring blender earlier that morning. In Jervis's lab, a boy of six waited. Jervis had tested twenty "volunteer" children for polio antibodies. Seventeen of them had none. This boy was one of them. His extreme handicap included an inability to feed himself.

A cubic centimeter of the gray vaccine was measured out. Jervis fed it to the boy. Koprowski recalls that the boy reacted badly to the taste, and was given a chocolate milk chaser, which he liked. It formed a moustache on his upper lip. It is typical of Koprowski to remember such a detail. The boy was, as Koprowski wrote later, "the first human subject anywhere in the world to be fed live attenuated polio virus for immunization purposes."

Blood drawn from this subject after fourteen days indicated that he had developed polio antibodies. After forty-four days of close observation that proved uneventful, another boy was selected to sample the vaccine. Again, his blood tested positive for antibodies, and after another forty-four-day observation period that revealed no complications or illness, the remaining boys were fed the vaccine. All seventeen boys who had previously tested negative for antibodies developed them after being given the vaccine. No cases of polio occurred at Letchworth Village.

It wasn't for almost a year that anyone but Jervis, Norton, and Koprowski knew of the immunization of human subjects at Letchworth. Then, when formal observation of all twenty subjects was nearing completion, Koprowski briefed his lab director, Dr. Herald Cox, about the event. A conservative, yarn-spinning midwesterner, Cox was very different from Koprowski. Cox had been traveling during February 1950. When told about the Letchworth Village trial, he was nonplussed, according to Koprowski.

Cox hadn't sought the position at Lederle. He had been content with his job at the Rocky Mountain Laboratory in Hamilton, Montana, where he could freely indulge his passion for hunting and fishing. So when Lederle asked him to set up a department of virology for them, he made a huge salary demand he thought would discourage the offer. Instead, Lederle accepted his terms.

Cox's work in virology included developing vaccines against Rocky Mountain spotted fever and typhus. He isolated a rickettsial disease called Q fever, a respiratory illness spread through contact with infected animals. He was also the codiscoverer (with Australian Nobel prize–winner Macfarland Burnet) of an organism called Coxiella, named for him. Cox also developed methods of growing viruses in egg yolk.

David Kritchevsky says Cox was an unstable, even a tragic figure. At the Rocky Mountain Lab, Cox worked on his own, at his own pace. Lederle was an industry front-runner, a more pressured environment. "He was out of his depth, and he knew it," Kritchevsky says. "He was very insecure. But management loved him. He was a good old boy. Certainly they could relate to him better than a stout, aggressive little guy with a foreign accent."

When Koprowski arrived on the scene, Cox put him to work on the polio project. Having such a free spirit in his charge was upsetting to Cox, who approached his newly attained role as benevolent dictator. "Cox liked to pretend he'd stuck his neck out to get you a raise that you knew was automatic," Kritchevsky says. "He liked to have his ring kissed. He didn't exactly insist on having his name on every paper that came out of his lab, like some directors in those days, but he subtly badgered or nagged people into it. He was a pathologically jealous man."

Cox was smart enough to recognize Koprowski as someone who would not respond well to micromanagement, however. He handed him a broad assignment and left him alone. He went even further. In 1947 Herald Cox named Hilary Koprowski assistant director of the virology section at Lederle. Lederle was putting pressure on Cox to name an assistant, but Cox's choice came as a surprise to Koprowski, and it stunned a much more senior scientist who was considered a shoe-in for the appointment. Kritchevsky says that many at Lederle thought Koprowski somehow engineered the selection, but Koprowski denies having anything to do with it. Kritchevsky, the observer of Cox, believes Koprowski. "Cox would get furious about something, then think it over and go off in a different direction, or disregard it. You must understand, Cox sought approbation from the janitor. Truth is, he started trying to fire Hilary an hour after he appointed him."

Several times Herald Cox took leave of Lederle for treatment of mental problems, leaving Koprowski in control. "Hilary never took advantage of him," Kritchevsky says, "never knifed him in the back, which would have been standard corporate behavior in those career-minded days. In the organizational sense, he always remained loyal to Cox."

When it came to research, however, Koprowski believed it was every man for himself. Koprowski's Letchworth Village gambit was as politically incorrect a move as one could have made in his situation. "He jumped the gun," Kritchevsky says. "While the concept was still under discussion, he went out and did the test." The paper that resulted from the Letchworth immunization was titled "Immune Responses in Volunteers upon Oral Administration of a Rodent-Adapted Strain of Poliomyelitis Virus." It was published in the *American Journal of Hygiene* in January 1952 and signed by Koprowski, Jervis, and Norton. The signatories made sense. Scientific papers are signed first by the principal investigator, then by other investigators who have contributed to the project. Technicians who assisted are usually thanked by name within the paper. But leaving Cox's name off the paper was an insult. And Koprowski knew it.

"It was a cruel thing to do," Koprowski says today. "But as a young man, I didn't want to share credit for what was my work. I wanted the control. As a courtesy I should have put Cox's name on the paper. But in that stage of my career I was not gentle or tolerant. I felt I had to be hard and tough."

~

A few months after the Letchworth immunization, Koprowski tested the waters by paying a visit to Dr. Thomas Rivers, a laboratory chief at the Rockefeller Institute and an insider at the National Foundation for Infantile Paralysis. The foundation, which President Roosevelt helped establish, monopolized all polio research. Administered by Basil O'Conner, a powerful attorney and personal friend of FDR's, the foundation was promoting the work of Dr. Jonas Salk and his "killed" virus vaccine. As one can imagine, the situation was rife with politics. For more than fifteen years the heavily government-funded foundation had poured hundreds of millions of dollars into the fight against polio with little to show for it. The notion that Koprowski, a commercially employed outsider, might have the gall to one-up this major, presidentially blessed, publicly funded effort was unthinkable.

Dr. Rivers expressed shock when Koprowski broached the concept of a live attenuated vaccine. He said he would never approve of such a course. A live vaccine was much too dangerous.

With this as prevailing scientific sentiment, the public disclosure of the Letchworth Village immunization predictably generated considerable heat in the research community. It began at the Round Table Conference on Immunization in Poliomyelitis, held in Hershey, Pennsylvania, in March 1951. Among those at this exclusive gathering in the town that literally smells like chocolate were Doctors Jonas Salk and Albert Sabin.

Koprowski, who was scheduled to present a technical paper on the modification of rabies virus, asked for additional time to present new information on polio. Because of the tight schedule of the symposium, he was given a ten-minute slot immediately following a presentation by Jonas Salk. Salk spoke about the immunization of monkeys with his polio vaccine. The discussion that followed focused on a variety of immunization experiments with monkeys and chimpanzees.

Koprowski began his presentation to the drowsy postlunch audience, replete with charts and graphs showing data about the twenty boys immunized at Letchworth. A doctor sitting next to Salk at the round table, who had nodded off, awoke, looked at the chart on the screen, and asked Salk, "What sort of monkeys are these?"

"They are not monkeys," Salk told him, "They are children." Suddenly the drowsy doctor was wide awake.

Koprowski's Letchworth presentation was greeted by stony silence. Among those who later sought Koprowski out in private was Dr. Albert Sabin, a well-regarded scientist with a brusk, harsh demeanor. Koprowski still recalls the force of Sabin's remarks to him that day in Hershey. " 'How do you dare feed live polio virus to children,' he scolded me," Koprowski says. But Sabin was a savvy pragmatist. Less than a year later, after initiating an exchange of virus strains with Koprowski that was never reciprocated, Sabin would begin his own work on a live attenuated polio vaccine at his lab at the University of Cincinnati.

One doctor at the conference asked Koprowski if he had checked the possibility that the Society for the Prevention of Cru-

elty to Children would sue him for what he had done. But the overall reaction was one of silence. "Only one man at the meeting was supportive," Koprowski says. "Jules Freund, a great immunologist, told me that mine was the only approach he had seen that would protect against polio. Not one other person at the meeting went home and discussed what we had done, or tried to expand on the work," Koprowski says. "But then I was an upstart. I did not belong to the National Foundation club. Of those at the meeting, I was one of only two doctors whose research was not supported by the National Foundation."

Looking back, Koprowski understands the consternation Letchworth caused. "If we did such a thing now, Norton, Jervis, and I would be in jail and the company would be sued. If Jenner or Pasteur or Theiler or myself had to repeat and test our past discoveries in the 1990s, there would be no smallpox vaccine, no rabies vaccine, no yellow fever vaccine, and no live oral polio vaccine.

"Over the past fifteen years my rabies group has developed a vaccine for raccoons. Before it was authorized, we were required to test it on sixty difference species, including bears and vultures. Fifteen years of field trials were required for authorization of an animal vaccine. Imagine how long it would have taken if it had been for humans."

~