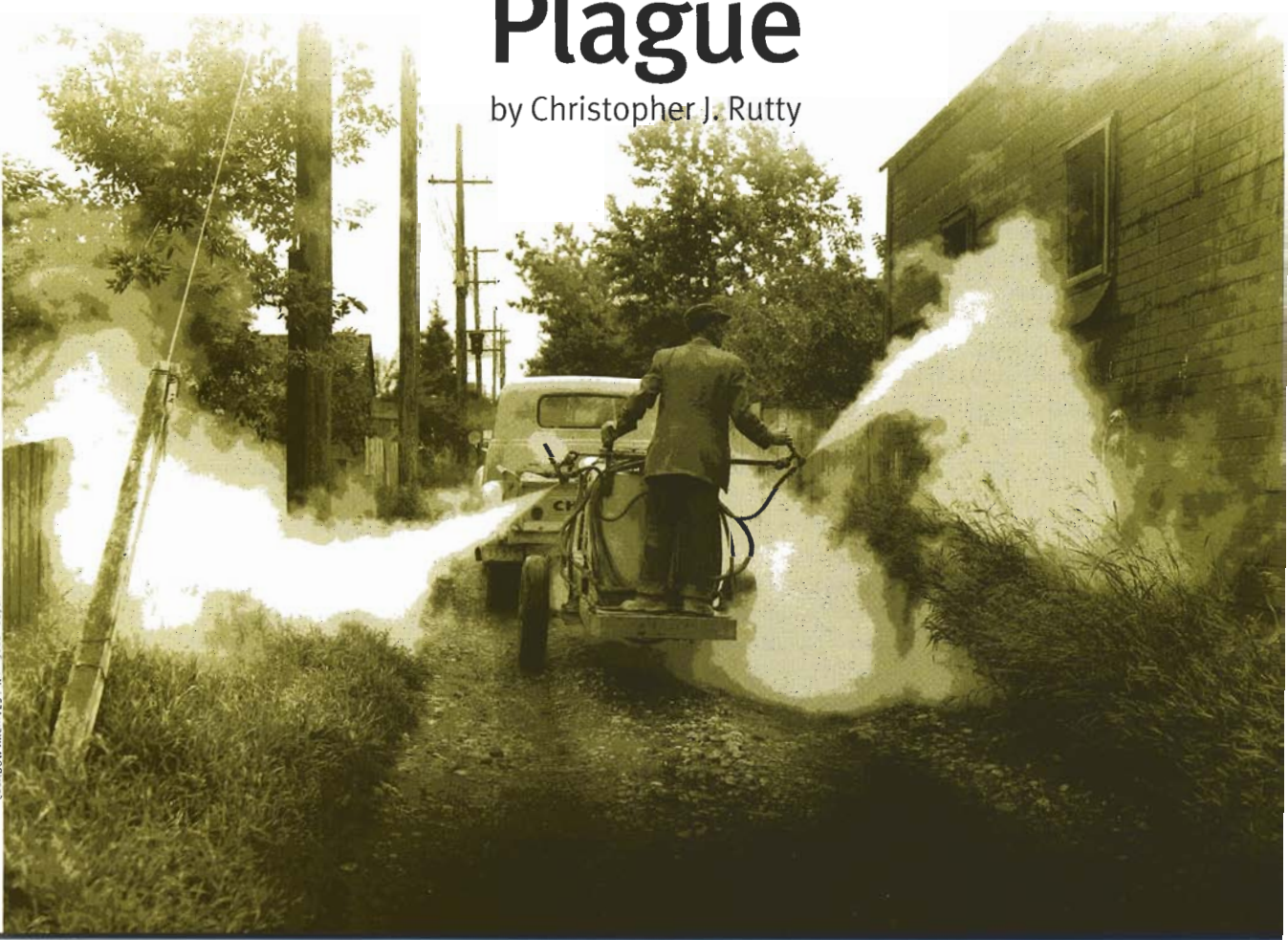


# The Twentieth-Century Plague

by Christopher J. Rutt



**Long one of the most feared diseases, polio paralyzed or killed more than a half million people a year worldwide. Then, fifty years ago, a new vaccine promised hope. If not for the Herculean efforts of a Canadian laboratory, many more might have died.**

## CHILDREN ARE ATTACKED BY STRANGE EPIDEMIC

### Twenty Cases of Fever and Infantile Paralysis

— Once Swept Over the States.

Hamilton, Ont., Aug. 17. — *An epidemic of poliomyelitis, or infantile paralysis, a comparatively new disease, which is attracting much interest among medical men the world over, has broken out here.* — *Toronto Star*, August 17, 1910

**A**lmost a century after this news item appeared, very similar newspaper headlines heralded the arrival in Canada of SARS, or Severe Acute Respiratory Syndrome. The sudden emergence early in 2003 in China and swift global spread of this new and perplexing infectious disease had a dramatic impact on the countries and cities it hit, particularly Toronto, not to mention the people affected. The SARS crisis of 2003 focused sharp attention on Canada's public health infrastructure. In a desperate search for useful lessons, it also prompted many to wonder how epidemic diseases, particularly "new" diseases, were experienced and managed in the past.

Canadians last faced a major public health crisis during the summer of 1953 when most of the country suffered the worst epidemic of paralytic poliomyelitis in its history—a national emergency that followed over forty years of worsening epidemics. While Canadians have faced other infectious disease threats since 1953, none have been as publicly and politically prominent or emotionally challenging as polio. Nor have they been as dramatically brought under control: the development and supply of polio vaccines was very much a Canadian success story.

While epidemic polio was frustrating and frightening for physicians and parents, its escalating public health and financial threat, particularly to middle-class families, catalyzed and galvanized a broad range of creative Canadian responses towards understanding this disease, treating its paralytic effects, controlling epidemics, managing aftercare, and ultimately preventing and eradicating it. Yet for more than forty years, it took its toll.

**T**he first North American outbreaks of paralytic polio were reported in the 1890s, but by 1910, polio incidence levels reached a new threshold, striking many parts of Canada and the United States. The first polio cases in Canada that year appeared in Hamilton, Ontario, when a little girl, thought to be suffering from hydrophobia, was taken to the

hospital, where she died. The *Toronto Star* reported that she was a victim of "infantile paralysis." Canadian medical authorities of the day recognized that infantile paralysis was not a new disease. Medical journals often quoted descriptions of cases from ancient Egyptian tablets and eighteenth- and nineteenth-century doctors. But what could not be denied was that polio was now a new epidemic disease.

The 1910 Ontario paralysis outbreak continued through the late summer and fall of 1910, with cases soon appearing in Toronto, Windsor, and Niagara Falls. One of the more disturbing elements was the number of adults struck by the disease who died due to chest muscle or throat paralysis. (Little could be done; iron lungs, machines that took over the breathing function, were not introduced until the late 1920s.) It was also clear that the victims of polio were not among the poor or delicate. Often attacked were the vigorous and healthy who lived in comfortable middle-class homes. Local and provincial public health officials, experienced with the dominant "dirt and disease" model of infectious diseases, had trouble reconciling this. And children weren't the only victims. Among those stricken in 1910, for example, was the head of one of the largest industrial corporations in the country, as well as a professor at Queen's University.

The financial impact of paralysis was soon apparent to officials of the Hamilton Board of Health. While they had quickly posted placards on affected homes warning of the presence of the disease, the members went further to manage the effects of paralytic polio than they had done with any other infectious disease. They recommended that city council provide a special fund to pay for the massaging of polio victims who couldn't afford to pay for it themselves. It was primarily intended for middle-class families too rich for charity, but not rich enough to pay for private nursing and otherwise vulnerable to financial hardship and sudden poverty, particularly if the family breadwinner fell victim. Though it's unclear whether the City of Hamilton implemented the plan, provincial health departments across the country took up the idea to varying degrees as the epidemics worsened, developing special polio treatment, hospitalization, and after-care policies.

Six years later, one of the worst polio epidemics in history struck. In the United States through the summer and fall, some 27,000 paralytic cases and 6,000 deaths were counted, mostly in the northeast. New York City bore the brunt with 9,000 cases. This epidemic soon spilled across the Canadian border. In mid-July, alarmed at the mounting polio epidemic in New York, the minister of agriculture<sup>1</sup> amended the federal quarantine regulations to include infantile paralysis under "graver quarantinable diseases." By early August, the federal government required that "children under sixteen years produce a medical certificate dated within twenty-four

Young polio patients (above, left) convalescing at Princess Elizabeth Hospital in Winnipeg in the early 1950s. Note the leg braces on some of the children.

Spraying alleys (near left) in Calgary in 1954. In the late 1940's and early 1950's, before the discovery of a vaccine, DDT was used to control the housefly population, which was thought to be a carrier of the disease. Most uses of the pesticide were banned in Canada in 1974.

<sup>1</sup>The federal government did not establish a formal department of health until 1919, after the great influenza pandemic of 1918–1919.



## NEW DISEASE A NATIONAL PERIL

Hundreds of Cases of Infantile  
Paralysis Reported From  
Different States.

MANY CASES IN CANADA, TOO

Large Number of Deaths Followed  
the Attack of the  
Disease.

### What is polio?

Poliomyelitis is a highly infectious disease caused by three distinct types of polioviruses, of which humans are the only natural host. Almost all poliovirus infections are mild, invisible, and immunizing, confined to the gastrointestinal tract and spread primarily via fecal-oral contact. But if the poliovirus invades the nervous system and damages the motor neurons of the spinal cord, weakness or paralysis can result, usually affecting voluntary muscles. Five to ten percent of cases die because of paralysis of breathing and/or swallowing muscles.

After centuries as an invisible, harmless, and endemic virus, with only rare, isolated cases of "infantile paralysis" reported, outbreaks of paralytic polio rose as sanitation and public health standards improved. Ironically, as parents tried to keep their infants and toddlers clean and isolated from the "dirt" and other young children, paralytic polio became more of a threat. Lessened exposure to germs meant immune systems that couldn't fight the virus. This left growing numbers of children (and their older siblings and parents) susceptible to nervous system infection when they were inevitably exposed to the poliovirus at a later age – particularly when they first entered school – when their immune systems were less able to respond as effectively. Rapidly growing in numbers and increasingly obsessed with personal hygiene, middle-class families in northern Europe, Australia, and particularly in the new suburban areas of North America, thus became most vulnerable to paralytic polio, especially during the post-World War II baby boom.

— C.J.R.



Earliest evidence of paralytic polio is seen in this Egyptian stele dating from between 1580 to 2350 B.C.

hours of departure that they have had no contact with cases of poliomyelitis."

While the situation seemed to be under control along the Ontario–New York border, alarm grew in Nova Scotia, a destination for Americans feeling the scourge in their own country. Travel restrictions were imposed, but public pressure on the Canadian government to do more grew, though other than applying strict quarantine of paralytic cases – a measure designed more to soothe public anxiety than have any real effect – there was little authorities could do. During the second week of October, an alarming polio outbreak began in Montreal's Westmount district, but by late November, following the Canadian late summer–early fall polio-season pattern, the level of new cases in Montreal and south of the border dropped. Canadian travel restrictions against the U.S. were lifted.

In 1927, when polio once again took on epidemic form in Canada, it was British Columbia and Alberta that were hit first. The disease then seemed to march eastward each year, striking Manitoba in 1928, Ontario in 1929 and 1930, and Quebec in 1931 and 1932. In these years, management of the disease was conducted with an immune serum, known as "convalescent serum," which was prepared from the blood of recovered cases. While people were comforted with articles in popular publications like *Canadian Magazine* that declared convalescent serum a "sure, safe, and widespread means" to combat poliomyelitis, doctors and public health authorities were less assured. Though many provinces in this period fought polio with the serum, providing it free of charge, the value of the serum remained unclear. There was no properly controlled evaluation of its effectiveness because no doctor was willing to withhold it from a child and face the wrath of parents.

The second worst polio year in Canadian history was 1937. Almost four thousand cases were reported across the country, with Ontario – officially reporting 2,546 cases and 119 dead – the most seriously hit. The size, severity, and dramatic intensity of the epidemic came as a major shock to the province. News reports and human-interest stories filled the province's newspapers, especially in Toronto, detailing school closings, convalescent serum, and other dramatic public health measures imposed by the local and provincial health departments. The press coverage also underscored the debates that persisted among doctors, public health authorities, and politicians over the effectiveness of strict quarantines, school closings, and other measures such as keeping children from such public places as pools, movie theatres, and the Canadian National Exhibition.

With polio prevention uncertain and no vaccine foreseen, pressure grew on provincial governments to take a leading role in responding to the disease. Following the 1927 epidemic, the Alberta government built a fully equipped sixty-bed hospital to provide adequate "after-treatment" for polio victims. In Ontario, faced with an unprecedented



number of disabled children in the wake of the 1937 epidemic, the provincial government established a program of free standardized treatment and hospitalization for all paralytic cases for a three-week period. Because strict immobilization was thought to prevent “unnecessary deformities,” the province freely supplied standardized splints, braces, and Bradford frames, which ensured the complete immobilization of patients for long periods so motor neurons damaged by the poliovirus could recover. At the end of the period of free hospitalization, parents were instructed on caring for their polio children at home. Other provinces responded similarly when polio incidences became acute.

Meanwhile, the search for a cure continued. The Ontario government sponsored an experiment on five thousand children of a nasal spray thought to block the poliovirus from entering the nervous system. It not only failed to prevent the disease, in some cases it caused children to temporarily lose their sense of smell, while others lost it permanently.

Treatment, too, advanced. The 1937 epidemic brought alarming numbers of bulbar polio<sup>2</sup> cases in which breathing

Some of the twenty-seven iron lungs (top) manufactured in the basement of the Hospital for Sick Children in Toronto during the 1937 polio epidemic.

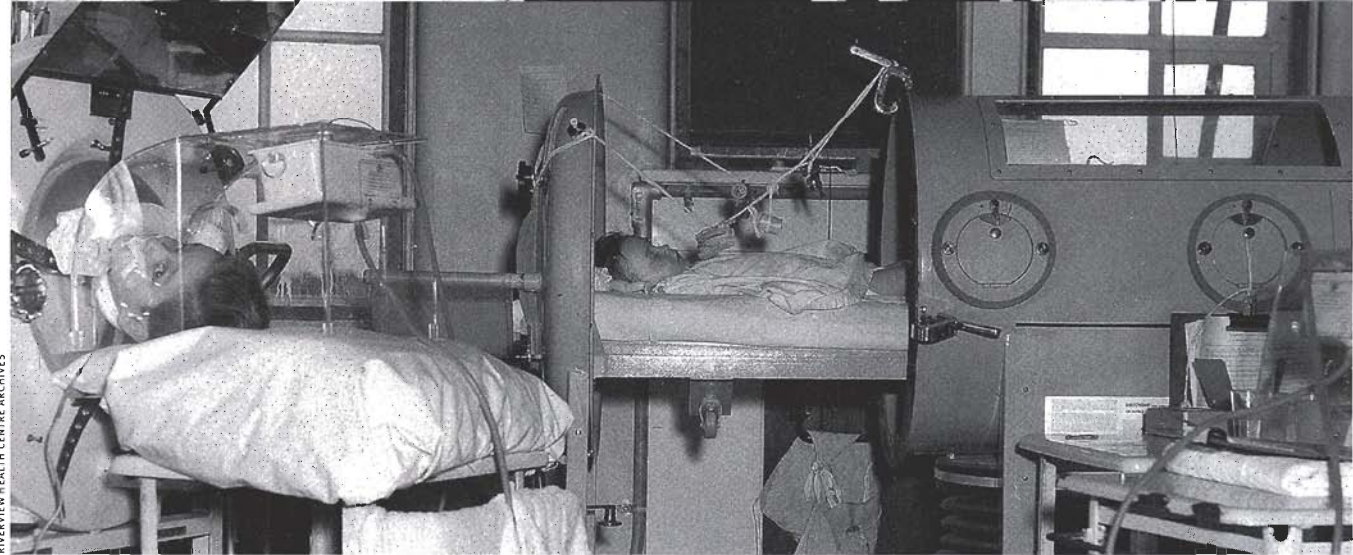
Elizabeth Kenny demonstrating her revolutionary polio treatment methods in Montreal in 1942. Born in Australia in 1880, Sister Kenny, as she was known, (“sister” being the British designation for “nurse”) developed the theory of muscle reeducation – retraining of muscles so they could function again. This was contrary to the conventions of the day, which promoted the immobilization of affected muscles with splints.

was impaired, requiring the use of an iron lung. As the epidemic began, only one iron lung existed in Canada, located in the Hospital for Sick Children in Toronto, and it was in use. When a boy was admitted with trouble breathing, the doctors and engineers at the hospital sprang into action and built a wooden lung out of plywood and an experimental respirator for premature infants. While this homemade lung saved the boy’s life, it provided no solution to the growing demand. Commercial iron lungs were available, but they couldn’t be delivered in time. Instead, over six weeks, the hospital assembled in its basement twenty-seven iron lungs, paid for by the Ontario government, and rush shipped to wherever they were needed.

The strict-immobilization approach to polio treatment

<sup>2</sup>A type of polio that affects nerve centres in the brain stem that control swallowing and talking.





**Preparation (top) at Connaught Medical Research Laboratories, University of Toronto, of bulk poliovirus fluids used for the U.S. field trial of the Salk polio vaccine, 1954.**

**Children in iron lungs at Winnipeg's King George Hospital in Winnipeg during the 1953 epidemic.**

was also changed in these later years. Under the leadership of Australian nurse Sister Elizabeth Kenny, heat to relieve pain and passive movement to reeducate the affected limbs became the preferred therapy. In doing so, she revolutionized polio treatment, in part because she and other nurses took much of the pressure and frustrations of therapy away from the medical profession.

**P**olio incidences fell during World War II, but between 1946 and 1953 they struck again, more severely, and in more parts of the world than ever before, including, during the winter of 1948–1949, the Canadian Arctic. Improved hygienic standards, more rapid international travel, a sharply higher birth rate—especially in North America—led to the sharply rising incidence, which reached a crescendo from the summer of 1953 into early 1954. Most disturbing were the high numbers of bulbar cases among young adults. Many hospitals filled rooms with iron lungs. In

October, at the King George Hospital in Winnipeg, ninety-two people were dependent on the machines. The Royal Canadian Air Force was dispatched to Boston to pick up respirators. When a thunderstorm knocked out power at Edmonton's Royal Alexandra Hospital, nurses were forced to manually pump each iron lung until power was restored.

### **SYNTHETIC POLIO VACCINE PREDICTED BY RESEARCHER**

Within a few years it is likely an anti-polio vaccine may be produced synthetically, said Dr A.J. Rhodes, of Toronto, addressing doctors from Western Ontario yesterday.

—*London Free Press*, October 2, 1947

Andrew J. Rhodes's prediction was made shortly after he was appointed to the University of Toronto's Connaught Medical Research Laboratories to lead an expanded polio research program. Rhodes, a leading virologist from England, arrived in Toronto at a time when there was a substantial postwar renewal of scientific energies towards solving the enigma of polio. However, progress remained stymied until 1949, when a way was finally found to grow the poliovirus in a test tube, instead of having to rely on mon-

keys for research. Still, not enough vaccine could be produced to be practical until a member of Rhodes's research team tried a new method that involved the synthetic nutrient base known as "Medium 199"—first developed at Connaught for cancer research. The substance provided a chemically pure basis for a safe vaccine that could be produced in sufficient quantity for the millions clamouring for protection from the dreaded disease.

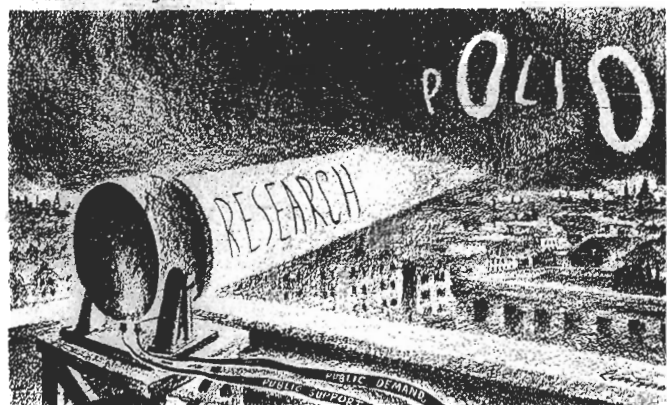
This advance proved crucial to the University of Pittsburgh's Dr. Jonas Salk, who was confident that an inactivated vaccine could stimulate the immune system enough to prevent polio in children if the twin issues of safety and mass production could be solved. In late 1952, residents of a disabled children's residence near Pittsburgh were the first to get Salk's vaccine. The National Foundation for Infantile Paralysis (U.S. March of Dimes) poured money into Connaught to expand its methods of growing the virus in a large field trial. In July 1953, the NFIP asked Connaught to provide all the poliovirus fluids required for a U.S. national vaccine field trial set to begin in the spring of 1954.

Through the fall and winter of 1953–1954, large bottles full of poliovirus, totaling 3,000 litres, were sent from Toronto in station wagons over the border to Parke, Davis in Detroit and Eli Lilly in Indianapolis, where the virus fluids were inactivated and processed into a finished vaccine. Salk described Connaught's efforts in this project as "Herculean" in magnitude, and without its collaboration there could never have been a trial, since no American commercial laboratory had the experience or facilities to undertake such a financially risky project.

**T**he first news of a polio vaccine—or renewed hopes that such a vaccine was possible—emerged in 1953 in the middle of Canada's worst polio epidemic year, generating intense public interest in the vaccine. The next spring, the NFIP began its mammoth field trial in the U.S., involving the elaborate tracking of some 1.8 million children who were either given the polio vaccine or a harmless placebo. The results of the trial were announced April 12, 1955 to great fanfare. Washington immediately licensed the vaccine and manufacturers rushed it into production.

In the meantime, Connaught had been preparing and testing a finished vaccine of its own for use in Canada. The trial was about to begin when, at the end of April, public euphoria over the Salk vaccine was shattered: seventy-nine children given the vaccine prepared by Cutter Laboratories in California contracted polio, resulting in the cancellation of the entire American vaccine program. In Canada, Paul Martin, the minister of National Health and Welfare, faced one of his most difficult political decisions: what should Canada do? The prime minister did not want the Canadian trial to continue, but based on Connaught's long experience with the development of the vaccine, and his personal experience with polio—he was stricken in 1907, as was his son, Paul Jr.

Let There Be Light!



From the *Montreal Daily Star*, August 12, 1946.

in 1946—Martin maintained his confidence. The Canadian immunization campaign continued with no problems.

Canadian trust in the vaccine bolstered Jonas Salk's bruised resolve and attracted considerable American press and political attention, sharply highlighting, among other things, the differing approaches to public health in the two countries.

The Salk vaccine struck a crippling blow to paralytic polio, but it was not the final answer to bringing the disease under control. Once the great publicity over the vaccine eased, ensuring high immunization rates among schoolchildren became more challenging. An unexpected post-vaccine wave of epidemics hit several provinces between 1958 and 1960, prompting renewed vaccination campaigns, especially among adults, who remained vulnerable to polio during this period. This induced Connaught to develop, mass produce, and test the live Sabin polio vaccine, which, given on a spoon or a sugar cube, was cheaper and easier to administer. (The Sabin vaccine was licensed in Canada in 1962.) Meanwhile, the Salk vaccine became an important international prestige item for Connaught, which soon exported it to countries that would otherwise be without any protection against polio's growing worldwide threat. In Canada, the spectre of polio galvanized a broad range of creative interventions from governments, both provincially and federally, to control and ultimately prevent the disease and provide a variety of free health care services to those stricken by it, regardless of income. As such, it is an important milestone in the evolution of Canada's universal health care system. ■

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#### ET CETERA

*A Summer Plague: Polio and its Survivors* by Tony Gould. Yale University Press, New Haven and London, 1995.

*Patenting the Sun: Polio and the Salk Vaccine* by Jane S. Smith. Anchor Books, New York, 1991.

*Dirt and Disease: Polio Before FDR* by Naomi Rogers. Rutgers University Press, New Brunswick, New Jersey, 1990.

A history of polio prepared by Christopher J. Rutty may be found at <[www.polio-vaccine.com](http://www.polio-vaccine.com)>.