Collapse and Expand

Architecture and Tuberculosis Therapy in Montreal, 1909, 1933, 1954

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During the mid-twentieth century, Montreal's Royal Edward Laurentian Hospital (now known as the Montreal Chest Institute) enjoyed a reputation as the major tuberculosis referral hospital in Canada's largest city (fig. 1). Montreal's notoriety in the campaign against the disease came from having one of the highest mortality rates of large North American cities.[1] An important center for innovative medical research and training, Montreal was the site of pioneering developments in tuberculosis surgery, while at the same time maintaining strong links with the sanatorium movement. Montreal surgeon Edward Archibald, for instance, performed the first thoracoplasty in North America in 1911 at the Royal Edward's sister institution, the Royal Victoria Hospital. Outspoken surgeon, inventor of modern surgical instruments, and tuberculosis activist Norman Bethune called Montreal his home from 1929 to 1936.[2]

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1. See Terry Copp, *The Anatomy of Poverty: The Condition of the Working Class in Montreal, 1897–1929* (Toronto, 1974), 100–102.

2. Edward Archibald, "The Development of Surgical Methods in Treatment," in *The*

FIG. 1 Royal Edward Laurentian Hospital (Montreal division), shortly after the 1957 expansion that added three floors to the surgical towers. (Reproduced courtesy of the Montreal Chest Institute.)

Studying the Royal Edward's history allows us to juxtapose medical and architectural expertise and technologies. Two ritual ribbon-cutting ceremonies illustrate this intersection. The 1909 opening of the first Royal Edward Institute on Belmont Park, a renovated house, showcased technological prowess. King Edward presided over the opening remotely from England. A transatlantic telegraph (fig. 2) sent from his library in Colchester caused the lights in the hospital that bore his name to illuminate, the door to swing open, and a flag to ascend.[3] "We do not know that any Imperial episode has made a finer appeal to the imagination," remarked the *London Observer*.[4]

Forty-five years later, the institute's surgical and laboratory building opened with a very different presentation of technological know-how.

Story of Clinical Pulmonary Tuberculosis, ed. Lawrason Brown (Baltimore, 1941), 281–323. On Archibald, see Lloyd D. MacLean and Martin A. Entin, "Norman Bethune and Edward Archibald: Sung and Unsung Heroes," *Annals of Thoracic Surgery* 70 (2000): 1746–52.

3. "Tuberculosis Institute," *Gazette*, 21 October 1909, 1, 6. The best technical description is "Royal Edward Opened by King," *Gazette*, 22 October 1909, 7. See also "King's Hand Opens Doors of New Home," *Montreal Daily Star*, 21 October 1909, 7.

4. *London Observer*, 24 October 1909, quoted in Royal Edward Chest Hospital, *Sixty Years into the Future* (Montreal, 1969).

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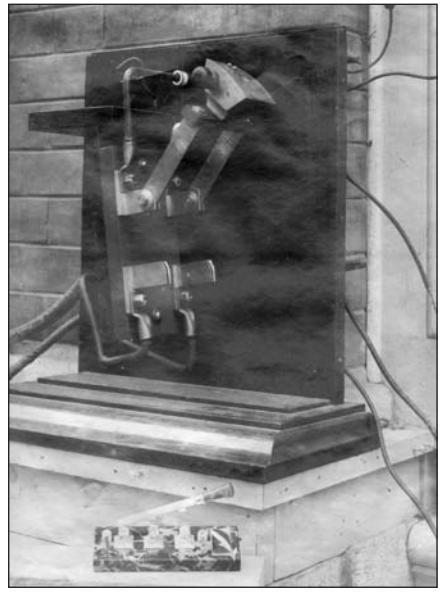

FIG. 2 Telegraph switch wired to open doors with a transatlantic signal at the Royal Edward Institute, 1909. (Reproduced courtesy of the Montreal Chest Institute.)

Whereas in 1909 the opening was an international social occasion with a climax of nonmedical, technological pomp, the 1954 opening showcased medical knowledge in a deliberately stark container—the hospital. Newspaper coverage highlighted the public interiors of the hospital, especially its modern lecture hall and entry lobby, rather than spaces for patients or surgery. Tuberculosis experts from across North America arrived in Montreal for a symposium to discuss current approaches to the disease. The transatlantic remote-response spectacle of 1909, celebrating philanthropy and charity, was thus displaced by an in-person ceremony that showcased medical knowledge and research. Attendees of the 1954 opening swapped patient statistics and diagnostic techniques in an atmosphere of both competition and collegiality, like an academic conference today. Royal representation, however, was still important: Vincent Massey, governor general of Canada, toured the building on 15 April 1955. The sharp change and subtle overlap in emphasis in these two opening events nearly five decades apart is a lucid indicator of both the continuous cultural value of tuberculosis therapy and the rapid rate of change in tuberculosis technologies.

This article examines the complex history of an urban, specialized hospital as a way to explore the relationship of medicine and architecture, the disciplinary backgrounds of the three co-authors. Our combined perspectives, we think, shed new light on how buildings serve as medical technolo-

gies and, conversely, on how technology adjusts and adapts to different architectural settings. Our innovative methodology posits hospital architecture as a form of medical technology, a position rarely adopted by historians of technology and medicine, who tend instead to imagine buildings as neutral, nontechnological settings for smaller-scale artifacts. Even scholars who insist on the social construction of medical technology typically overlook the role of the hospital building itself.[5] Moreover, using the history of medicine to investigate hospital architecture as a technology allows us to study the Royal Edward as a cultural landscape. This approach, a subfield of mainstream architectural history, emphasizes the need to engage places over an extended lifecycle and to substantiate how the context, use, and experience of buildings contribute to architectural meaning.[6]

Approaching hospital environments as cultural landscapes requires engagement with an extraordinarily wide range of primary sources. These include traditional, architect-produced documents like measured drawings, photographs (construction and interiors), building specifications, zoning diagrams, and professional correspondence, as well as sources commonly used by scholars studying vernacular architecture: amateur photography and ephemera like posters and postcards. Juxtaposing this visual evidence with sources in the history of medicine, such as annual reports, medical textbooks, journal articles, doctors' correspondence, conference proceedings, statistics regarding the spread of tuberculosis, patient records, the personal reminiscences of physicians and nurses, and medical technologies, we believe, provides a new and nuanced look at spatial responses to disease. What role has architecture, as a technology, played in the fight against tuberculosis?

The Technologies of Tuberculosis Therapy

Our aim is to understand how new technologies overlap, displace, and parallel existing ones. More specifically, we look at the relationships between twentieth-century technologies associated with the care and treat-

5. Scholars of medical technology rarely discuss the hospital itself as a technology. See, for example, Pascale Lehoux, *The Problem of Health Technology: Implications for Modern Health Care Systems* (New York, 2006), and Joel D. Howell, *Technology in the Hospital: Transforming Patient Care in the Early Twentieth Century* (Baltimore, 1995). An exception is Peter Keating and Alberto Cambrosio, *Biomedical Platforms: Realigning the Normal and the Pathological in Late-Twentieth-Century Medicine* (Cambridge, Mass., 2003).

6. Dell Upton, *Architecture in the United States* (Oxford, 1998), 12. On understanding architecture as cultural landscape, see Upton, "Architectural History or Landscape History?" *Journal of Architectural Education* 44, no. 4 (1991): 195–99; "The Power of Things: Recent Studies in American Vernacular Architecture," *American Quarterly* 35, no. 3 (1983): 262–79; Paul Groth and Chris Wilson, eds., *Everyday America: J. B. Jackson and Recent Cultural Landscape Studies* (Berkeley, Calif., 2003); and Todd Bressi and Paul Groth, eds., *Understanding Ordinary Landscapes* (New Haven, Conn., 1997).

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ment of tuberculosis: the fresh-air cure, collapse therapy, surgical therapy, chemotherapy, and hospital architecture.[7] Tuberculosis technologies—in this sense, sets of resource-using practices marshaled to eradicate the disease—did not efficiently replace each other (one by one) in response to medical innovation; but neither did contradictory tuberculosis technologies simply co-exist as an aggregate of possible alternatives. Rather, the technologies developed in a complex, dynamic interaction with one another and within their cultural landscapes. Indeed, seemingly outdated technology often survived, providing underlying continuity, as newer ones induced major changes to the overall interplay of hospital organization, medical care, and social doctrine.[8]

Our argument that architecture serves as a medical technology is inspired by a remarkable line in the 1949 *Montreal Star* suggesting the interchangeability of architecture and drugs. Explaining how streptomycin, an expensive medicine, would be given at no cost to tuberculosis patients in Quebec, a journalist wrote that the "costs of the drug will be charged against the $1,069,564 allotted to Quebec in 1948–49 for the extension of tuberculosis control facilities."[9] Engaging contemporary textual sources like these, we argue that architecture is more than the background context for these medical debates: it is itself one of the technological alternatives whose role reciprocally destabilizes and shapes the others.[10] The rest cure for tuberculosis prevalent at the beginning of the twentieth century started a tradition, lasting until the age of antibiotics, where architecture (or more generally the patient's immediate environment) served explicitly as an active physical agent in tuberculosis treatment.[11] Tuberculosis architecture,

7. Other tuberculosis therapies included such "quack" remedies as gold treatment, inhalations, and exposing patients to X-rays; see Thomas Dormandy, *The White Death: A History of Tuberculosis* (New York, 1999), 273–83. Linda Bryder emphasizes the importance of prevention also: "isolation of tuberculous patients, preventing people with tuberculosis from working in food trades, the control of milk supplies, vaccination [BCG (Bacillus Calmette-Guérin) vaccine], education, the provision of open-air schools, and the boarding out of susceptible children"; see Bryder, *Below the Magic Mountain: A Social History of Tuberculosis in Twentieth-Century Britain* (Oxford, 1988), 130–56.

8. For a similar argument about the engagement of experimental physics and everyday life, see Peter Galison, *Image and Logic: A Material Culture of Microphysics* (Chicago, 1997), 46–63.

9. James A. Oastler, "Streptomycin To Be Given Free To Quebec T.B. Patients," *Montreal Daily Star*, 10 February 1949, 1.

10. On technology and culture as mutually constitutive, see Lehoux, xiii.

11. On the history of the rest cure, see Frank Ryan, *The Forgotten Plague: How the Battle against Tuberculosis Was Won and Lost* (Boston, 1993); R. Y. Keers, *Pulmonary Tuberculosis: A Journey Down the Centuries* (London, 1978); and Dormandy. The history of tuberculosis therapy was often recounted during the time period under study; see P. D. Hart, "Chemotherapy of Tuberculosis: Research during the Past 100 Years," *British Medical Journal* 2 (1946): 805–10, 849–55; G. M. Balboni, "The Development in the Treatment of Pulmonary Tuberculosis from 1696 to the Present Time," *New England Journal of Medicine* 212 (1935): 1020–27; and Brown (n. 2 above).

first with its "low-tech" porches, balconies, sunning galleries, and occupied rooftops, then later juxtaposed with "high-tech" operating rooms and surgical suites, provided crucial physical and spatial stability. This architecture proved a lasting symbolic presence for physicians, surgeons, public health officials, and patients—even after the successes of chemotherapy, the first therapy to directly and specifically target the tubercle bacillus, augured the end of specialized tuberculosis-treatment settings.

Perhaps our most unexpected finding is that the architecture of the Royal Edward expresses in spatial terms a hesitation or even pessimism about the importance and efficacy of antibiotics—surprising because retrospectively, the introduction of drug therapy at the close of World War II made a dramatic break with established traditions. By the 1960s, antimicrobial treatment had rendered sanatoria, the rest cure, and collapse therapy obsolete in North America.[12] Tuberculosis deaths in Canada dropped from 7,698 in 1921 to 1,403 in 1955 (in Quebec from 2,909 to 608).[13] Likewise, tuberculosis mortality rates decreased from 87.7 (per 100,000) in 1921 to only 8.9 in 1955 (from 123.2 to 13.5 in Quebec).[14] The progressive decline in tuberculosis morbidity and mortality continued through the late 1980s. How much did this discrepancy between design and practice, the overlapping though distinct histories of architectural modernization and scientific innovation, reflect differences of opinion between surgeons and nonsurgeon physicians about tuberculosis care?

This article scrutinizes the architectural and medical evidence for the interplay of design with established and new therapies in three historical moments: 1909, 1933, and 1954. Overall, our story is straightforward. The increasing use of collapse therapies—beginning with pneumothorax (the injection of air into the pleural cavity to collapse the lung inward), followed by more aggressive thoracoplasties (surgical removal of ribs to produce collapse of the chest wall and underlying lung tissue), and finally surgical resection of the diseased lung—did not displace the material culture of the rest cure. Instead, the established architectural setting expanded to include spaces for surgery.[15] Conversely, the surgical interventions were in one sense continuous with earlier ideas about rest as an aspect of tuberculosis stabilization and cure, but here applied locally to diseased lung tissue: surgical removal was a way of permanently "resting" affected lung tissue.

12. Katherine McCuaig questions the efficacy of medical intervention in the fight against tuberculosis; see McCuaig, *The Weariness, the Fever, and the Fret: The Campaign against Tuberculosis in Canada, 1900–1950* (Montreal, 1999), 3–8. In *Below the Magic Mountain*, Bryder states that there is "no evidence that collapse therapy had any effect on the course of the disease" (p. 259).

13. From George J. Wherrett, *The Miracle of the Empty Beds: A History of Tuberculosis in Canada* (Toronto, 1977), quoted in McCuaig, p. 291, table A13.

14. Ibid., p. 292, table A14.

15. For a contemporary illustrated survey of collapse techniques, see John Alexander, *The Collapse Theory of Pulmonary Tuberculosis* (Springfield, Ill., 1937).

Tuberculosis History

In the timeframe under study, the role of technology is vital to understanding tuberculosis history because of the complicated entanglement of therapy, medicine, prevention, and social conceptions. We follow medical historian Joel Howell's definition of "technology" as including physical artifacts, goal-oriented activities, and social knowledge.[16] Studying tuberculosis technology through the interplay of architecture and therapy is especially germane because of the sanatorium movement. In 1854, Swiss physician Hermann Brehmer instituted a program of fresh air and rest in a settlement at Göbersdorf in the Alps, a romantic, mountainous terrain.[17] Edward Trudeau imported the sanatorium idea to the United States at Saranac Lake in New York.[18] Canada's National Sanitarium [*sic*] Association formed in 1896 and opened its first sanatorium at Muskoka, Ontario, ninety kilometers north of Toronto, in 1897.[19] Sanatoria were intertwined with the clean, linear, functionalist buildings associated with modern architecture, especially in Europe. Celebrated European sanatoria include those by well-known architects such as Alvar Aalto at Paimio, Finland, Johannes Duiker at Hilversum, the Netherlands, and Otto Wagner and Josef Hoffman near Vienna. Such buildings, especially at Paimio, attracted attention because pioneering architectural historians such as Sigfried Giedion used the clean, white, undecorated architecture of the modern hospital to explain what they understood as the relationship of form and function: that the distinct parts and functions of a building are integrated into a bold, pure conceptual whole, like the organs within the body.[20] The architects whose mission it was to effect social change (to cure the sick) exploited modern materials and construction techniques, just as they did in the architecture of social housing, the centerpiece of European international-style

16. Howell, *Technology in the Hospital* (n. 5 above), 8–9. Howell's work is significant for us because he aims to "make it clear what choices were available to those who wished to use new technology without assuming that the choices that were made were somehow natural or inevitable" (p. 11).

17. Brehmer believed that tuberculosis patients had weak hearts that could be aided by the low pressures at high altitudes; see Dormandy (n. 7 above), 150–53. By 1911, there were important how-to books on sanatorium architecture, such as Thomas Spees Carrington's *Tuberculosis Hospital and Sanatorium Construction* (New York, 1911).

18. On Trudeau and medical life at Saranac Lake, see David L. Ellison, *Healing Tuberculosis in the Woods: Medicine and Science at the End of the Nineteenth Century* (Westport, Conn., 1994).

19. On the architectural history of the Muskoka sanatorium, see Annmarie Adams and Stacie Burke, "'Not a shack in the woods': Architecture for Tuberculosis in Muskoka and Toronto," *Canadian Bulletin of Medical History* 23, no. 2 (2006): 429–55. Sanatorium ideals also extended to home situations, as illustrated in Thomas Spees Carrington, *Fresh Air and How to Use It* (New York, 1912).

20. See Sigfried Giedion, *Space, Time, and Architecture: The Growth of a New Tradition*, 5th ed. (Cambridge, Mass., 1967), 629–32.

modernism.[21] Architects specified expansive areas of glass in order to maximize sunlight and views; structural steel frames meant that building plans could be open and thus more flexible than ever before. The absence of interior, structural supports also meant that fresh air could more easily circulate between the functional zones of hospitals. Nevertheless, because tuberculosis was highly contagious, even institutions that showcased modern architecture, such as Aalto's hospital at Paimio, included separate rooms for patients.

By 1909, bacteriological research had firmly attached the disease to a single agent—a bacterium—and the scientificization of tuberculosis treatment was well under way: doctors, if not the general public, believed individuals caught the disease because of a germ, rather than because of a moral failing or through heredity.[22] German physician Robert Koch isolated the rod-shaped tubercle bacillus (*Mycobacterium tuberculosis*) in 1882. Tuberculosis was diagnosed using technologies such as chest X-rays, tuberculin tests, and microbiologic cultures of sputum—which reciprocally emphasized the presence of science.[23] In 1926, for instance, the Royal Edward *Annual Report* states: "Sputum from 392 [patients] was examined and positive results were obtained in 56% of those diagnosed tubercular."

Nevertheless, tuberculosis remained overwhelmingly a social problem precisely because there was no effective, scientifically established medical therapy.[24] Clearly, prevailing cultural and lay beliefs about modern medical care inspired and conditioned the adoption of leading-edge therapeutic advances. Tuberculosis had been linked to poverty and poor living conditions, and thus it was a privileged vehicle for private and state reformers, philanthropists, public health professionals, and educators, a conglomeration of players often categorized as the "anti-tuberculosis movement." For our story, a crucial manifestation of the antituberculosis movement is the 1908 Montreal Tuberculosis Exhibition, which targeted the home as the main vehicle of disease transmission. The exhibition's design urged visitors to

21. See Margaret Campbell, "What Tuberculosis Did for Modernism: The Influence of a Curative Environment on Modernist Design and Architecture," *Medical History* 49 (2005): 463–88; Leslie Topp, "An Architecture for Modern Nerves: Josef Hoffmann's Purkersdorf Sanatorium," *Journal of the Society of Architectural Historians* 56, no. 4 (1997): 414–37; "Otto Wagner and the Steinhof Psychiatric Hospital: Architecture as Misunderstanding," *Art Bulletin* 87, no. 1 (2005): 130–56; Beatriz Colomina, "The Medical Body in Modern Architecture," *Daidalos* 64 (1997): 60–71.

22. Barbara Bates, *Bargaining for Life: A Social History of Tuberculosis, 1876–1938* (Philadelphia, 1992).

23. Moreover, Katherine Ott writes that the process of scientificization is material and technological, as it entails the new notion of "apprehension of disease through the mediation of instruments"; see Ott, *Fevered Lives: Tuberculosis in American Culture since 1870* (Cambridge, Mass., 1996), 66.

24. Writing as a trained doctor during the 1990s, Frank Ryan (n. 11 above) is incredulous that "the great sanatorium movement . . . with its massive utilization of public and private funding, was never subjected to a scientific trial of its effectiveness" (p. 26).

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transform their daily practices into action by emulating the demonstrations and models presented at the exhibition and by heeding the advice of the reformers, social gospelers, philanthropists, and health professionals.[25] As historian Katherine Ott shows, the disease itself thus has a history and can be conceived in part as a culturally produced, rather than a trans-historically stable, condition.[26] We argue that tuberculosis culture always includes material culture, complete with instruments derived for and from therapy and technology: inhaler, stethoscope, sputum cup, X-ray, spirometer—and hospital architecture.

Part 1, 1909: Establishment of the Royal Edward Institute in Montreal

The Montreal Chest Institute began in October 1909 as a tuberculosis dispensary in a three-story renovated house.[27] The Royal Edward Institute (fig. 3), as it was then known, was centrally located at 47 Belmont Park, a two-block, mixed-use street near the downtown commercial core. A map in the institution's first annual report showed that the institute was tightly integrated with the city's transportation system, taking advantage of the new electric streetcar technology (adopted by Montreal in 1892); it was a three-to-five-minute walk from the Beaver Hall, Windsor, and St. Catherine Street streetcar stops. Edinburgh-born financier and industrialist Sir George Drummond was first president of the Royal Edward's management board. The institute had grown from the work of the Montreal League for the Prevention of Tuberculosis (founded 1 June 1903) and housed a shelter and a dispensary in its early years.[28] Funds for the charitable clinic, "with its

25. The impact of antituberculosis thinking on Montreal home life is explored in Valerie Minnett, "Inside and Outside: Pathology, Architecture, and the Domestic Environment at the Montreal Tuberculosis Exhibition, 1908" (M.Arch. thesis, McGill University, 2004). On how notions of tuberculosis contagion affected everyday practices, see Nancy Tomes, *The Gospel of Germs: Men, Women, and the Microbe in American Life* (Cambridge, Mass., 1998), 113–34. *The Annual Report of the Royal Edward Institute for the Study, Prevention, and Cure of Tuberculosis* 2 (1911) features photographs showing "spread of TB in Montreal" that illustrate a few somewhat dilapidated streets and alleys, but most impressively one labeled "The Cure of Tuberculosis in Montreal." It shows a jerry-built shack described as being twelve feet aboveground, which the caption calls the dweller's "private sanatorium"; it contains windows described as being adjustable depending on wind direction, as well as a few basic furnishings.

26. Ott, 1.

27. On the history of the Montreal Chest Institute, see Norman C. Delarve, *Thoracic Surgery in Canada: A Story of People, Places, and Events—the Evolution of a Surgical Specialty* (Toronto, 1989), 21–49; Royal Edward Chest Hospital (n. 4 above); H. E. MacDermot, *A Short History of the Royal Edward Institute [presented to the] Royal Edward Chest Convention in Honour of Hugh Edmund Burke . . . and Clarence Alexander McIntosh . . . May 18, 1965* (Montreal, 1965).

28. E. S. Harding, "The Royal Edward Institute, Affiliated with McGill University," *McGill News* 14, no. 3 (1933): 18; Delarve, 36. The league's work culminated in a 1908

FIG. 3 Royal Edward Institute (1909) on Belmont Park, Montreal, as shown in the pre–World War I annual reports. (Reproduced courtesy of the Montreal Chest Institute.)

bright sun parlours and large roof garden," came from Lieutenant Colonel Jeffrey Hale Burland (1861–1914), who also oversaw "with much judgment and care" the alterations to the former residence.[29] From March 1910 to September 1912, 1,756 new patients sought care at the Royal Edward.[30]

The institute followed the "dispensary method for reaching the tuberculous poor"; it was an outpatient clinic only (there were no inpatient rooms), which treated early-stage patients in their own homes and emphasized education.[31] The dispensary model had been inaugurated in Edin-

educational exhibition on the dangers of tuberculosis, directed toward the general public; see "All Is Now Ready," and "Exhibition Opened," *Gazette*, 18 November 1908, 8–9; and Minnett.

29. On Burland's life, see C. W. Parker, ed., *Who's Who and Why* (Vancouver, 1914), 153. The quotes on the building are from William Henry Atherton, *Montreal under British Rule* (Montreal, 1914), 446–47. Burland chose Belmont Park as the location and procured options on a property there in 1908; see "Meeting of the General Committee for Exhibition," 15 October 1908. He subsequently purchased 45 Belmont Park for the institute: see entry for 16 December 1913, Minutes of Board of Management, Royal Edward Institute, Vol. 5 (11 June 1909 to 14 November 1922), MCI Library Collection.

30. The patient population was mixed. The four most frequent ethnic classifications listed were: French Canadians, 1,201 (68 percent); English, 138 (8 percent); Canadians, 87 (5 percent); and Jews, 77 (4 percent). Another branch of our larger research project looks at the different approaches to tuberculosis treatment accorded these groups.

31. See Atherton, 447.

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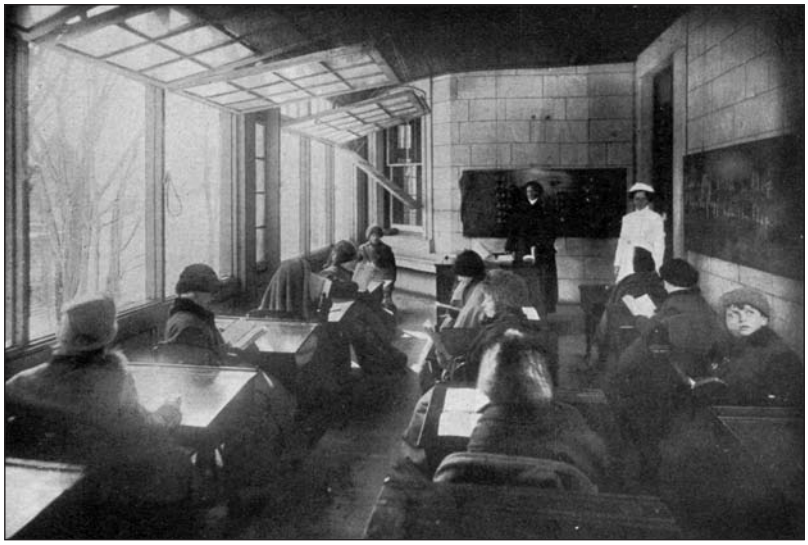

FIG. 4 Open-air school on the Royal Edward Institute veranda. (Reproduced courtesy of the Montreal Chest Institute.)

burgh's Victoria Dispensary for Consumption in 1882. Photographic evidence in the annual reports, however, shows that soon after its opening, the Royal Edward Institute began to offer in-house rest therapy as a remedy for tuberculosis. In 1911, a "limited number of patients" began treatment by the "open air method on the galleries of the Institute": ten patients received treatment during both day and night on the galleries, while sixteen came to the galleries during the day but returned home every evening.[32]

In December 1912, an associated "open-air" school for students between the ages of seven and fifteen opened on the veranda.[33] The 1913 *Annual Report* includes photographs of children in the back garden of the institute, surrounded by light canvas and wooden cots, and of children having lessons on a veranda in February (fig. 4). The photographs depict the teacher and a dozen or so students wearing hats and coats, or wrapped in blankets, even though they are inside. In the same photo, the angelic figure of a uniformed nurse, who appears to have arrived from inside the building, contrasts starkly with their dark and heavy clothing.

Some patients at the hospital have left accounts that tell us about the routine in the 1909 building. Frederick Lear (1909–1999), the son of an upholsterer in Montreal's working-class Pointe-Saint-Charles district, recalled

32. *The Annual Report of the Royal Edward Institute for the Study, Prevention, and Cure of Tuberculosis* 2 (1911).

33. According to Harding (p. 18), it was later relocated to a small structure behind the main house.

in a 1990 letter the daily routine he had experienced while attending the school in 1917: "We had lessons in the morning, a midday meal at noon, and then had to lie down for a period, before being sent home," he writes.[34] New technologies arrived only slowly. The hospital installed an X-ray machine at Belmont at the end of 1923, and a quartz lamp in 1926. The *Annual Report* for that year states: "Pulmonary cases do not show great improvement under the Lamp [*sic*], but it has been found very beneficial in cases of enlarged glands of the neck and tuberculosis of the peritoneum." The quartz lamp room apparently opened in the last five months of 1926, during which time "79 cases have been under treatment, with a total of 1,033 exposures." To sum up: by the interwar period, many experts believed that the patient's material setting could effectively treat the disease. State-of-the-art tuberculosis therapy—education, good food, and rest—was organized and implemented through an architecture whose imagery was primarily domestic.

Part 2, 1933: Changes in Site and Services

Our second moment shows a different configuration of technologies, as buildings began to support and accommodate new tuberculosis therapies. Displaced by the construction of Montreal's new central train station in 1933, the institute moved north of the downtown commercial core to its present location on St. Urbain Street, just south of Pine Avenue, near McGill University and the Royal Victoria Hospital, one of McGill's internationally renowned teaching hospitals. This relocation saw the construction of a purpose-built hospital. It included rooms and areas for the tuberculosis cure of sunlight and fresh air. But it also saw a new role as a dedicated container for diagnostic medical technologies like X-rays and growing importance as a headquarters for broader social technologies, including patient isolation and preventive diagnosis.[35] The expanded hospital was a vital place for tuberculosis treatment in Montreal: of 546 deaths from pulmonary tuberculosis in Montreal in 1935, 137 (25 percent) involved patients who had received care at the Royal Edward Institute.[36]

Scottish-born Montrealer John Smith Archibald (1872–1934), who designed the 1933 facility, provides an important link between the hospital and other Montreal institutions. It is important to note also that his design

34. Letter from Frederick Lear to Duncan Campbell, 23 November 1990, 2. He also remembers a yard with apple trees. See his more detailed "For Family and the Royal Edward Chest Hospital," a fascinating firsthand account of his time at the school, 1 November 1993. Both letters are in the MCI Library Collection.

35. Harding (n. 28 above) noted that the death rate from tuberculosis in Montreal dropped from 210 to 100 per 100,000 over the thirty-year period from 1903 to 1933. "This indicates a healthier and more sanitary city," he wrote, "but we like to think that part of the result is due to the dreams of . . . Col. Burland" (p. 20).

36. *The Annual Report of the Royal Edward Institute for the Study, Prevention, and Cure of Tuberculosis* 25 (1935).

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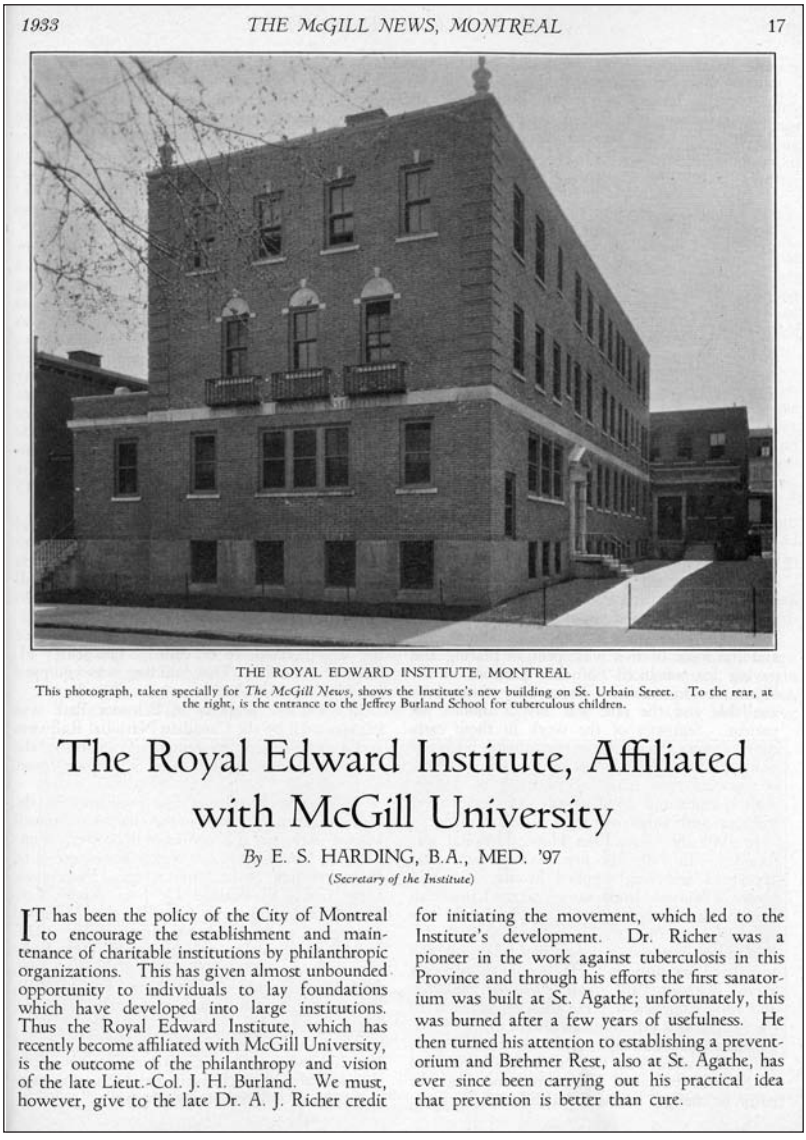
was not simply for a hospital, but also included a clinic and the Jeffrey Burland School.[37] Like the hybrid combination of functions that comprised the Royal Edward, Archibald's reputation rested on both hospital and school commissions: Baron Byng High School (1921), Elizabeth Ballantyne School, Notre-Dame de Grâce (1921), the Connaught School (1923), the Woodlands School in Verdun (1931), the Montreal Convalescent Hospital (1931), and St. Mary's Hospital (1931).[38]

The combined hospital and clinic building was a long, narrow, four-story brick structure set perpendicular to the street (fig. 5). Its rectangular mass was broken only by a one-story entry pavilion protruding from the building's northeast elevation. Three taller, arched windows on the second floor contrasted with the pattern of four rectangular windows on the ground and third floors. Brick quoins emphasized the corners of the hospital block. In terms of architectural style, the 1933 hospital shared a subtle neoclassicism with other Archibald designs, visible in its symmetry (except for the entry) and in details like the quoins, as well as the handsome pair of probably-concrete urns marking the corners of the main block at the level of the roof.

Unlike the 1909 institution, the squarish school building of 1933 was intended for children living in the homes of tuberculosis patients, rather than for children with tuberculosis themselves. It was and still is visible from the street to the north of the hospital building. It had a much simpler plan (fig. 6) than the double-loaded corridor arrangement of the adjacent hospital. The main floor included an L-shaped room for girls and a rectangular space for boys. These two rooms were disconnected, accessible only through doorways located on the landing of a central stairway, which also accommodated small closets. As expected in school buildings of the time, the walls incorporated large windows mandated for tuberculosis treatment,

37. The two buildings were separated at the request of Isabel May Megarry Burland (Royal Edward Institute, "Board of Directors Meeting Minutes, 14 July 1931," MCI Library Collection). For the life and work of Archibald, see Irena Murray, ed., *John S. Archibald and His Associates: A Guide to the Archive* (Montreal, 1990); Irene Puchalski, "An Analysis of Four Building Types by John S. Archibald, Architect (1872–1934)" (M.A. thesis, Concordia University, 1991); "John S. Archibald Dies in 63rd Year," *Montreal Daily Star*, 2 March 1934, 1, 3; "John Archibald Funeral Service Set For Tuesday," *Montreal Daily Herald*, 3 March 1934, 1. W. S. Maxwell wrote a moving tribute to his colleague: "John S. Archibald 1872–1934," *Journal of the Royal Architectural Institute of Canada* 11 (March 1934): 44.

38. On school architecture, particularly the techniques of fireproofing, see E. B. Palmer, "Typical Schools of the Province of Quebec," *Journal of the Royal Architectural Institute of Canada* 4 (September 1927): 327–36. Archibald also worked on a number of prominent hotels, including the Manoir Richelieu in Murray Bay, Quebec, and alterations to the Hotel Vancouver, the Château Laurier, and the Windsor Hotel. For discussions concerning the settling of his bill for services rendered, see the Royal Edward Institute Board of Directors meeting minutes of 27 April and 22 June 1934 in the MCI Library Collection.



1933 THE McGILL NEWS, MONTREAL 17

THE ROYAL EDWARD INSTITUTE, MONTREAL

This photograph, taken specially for *The McGill News*, shows the Institute's new building on St. Urbain Street. To the rear, at the right, is the entrance to the Jeffrey Burland School for tuberculous children.

The Royal Edward Institute, Affiliated with McGill University

By E. S. HARDING, B.A., MED. '97

(*Secretary of the Institute*)

IT has been the policy of the City of Montreal to encourage the establishment and maintenance of charitable institutions by philanthropic organizations. This has given almost unbounded opportunity to individuals to lay foundations which have developed into large institutions. Thus the Royal Edward Institute, which has recently become affiliated with McGill University, is the outcome of the philanthropy and vision of the late Lieut.-Col. J. H. Burland. We must, however, give to the late Dr. A. J. Richer credit for initiating the movement, which led to the Institute's development. Dr. Richer was a pioneer in the work against tuberculosis in this Province and through his efforts the first sanatorium was built at St. Agathe; unfortunately, this was burned after a few years of usefulness. He then turned his attention to establishing a preventorium and Brehmer Rest, also at St. Agathe, has ever since been carrying out his practical idea that prevention is better than cure.

FIG. 5 The new Royal Edward Institute, designed by John S. Archibald, was featured in *McGill News* in 1933, soon after its opening. (Reproduced courtesy of *McGill News*.)

for which there are carefully drawn details on the left of Archibald's extant plan; Archibald indicated six to eight openings on each wall, four feet wide and six-and-a-half feet high. Not surprisingly, the 1934 *Annual Report* referred to it as the "open window" school.

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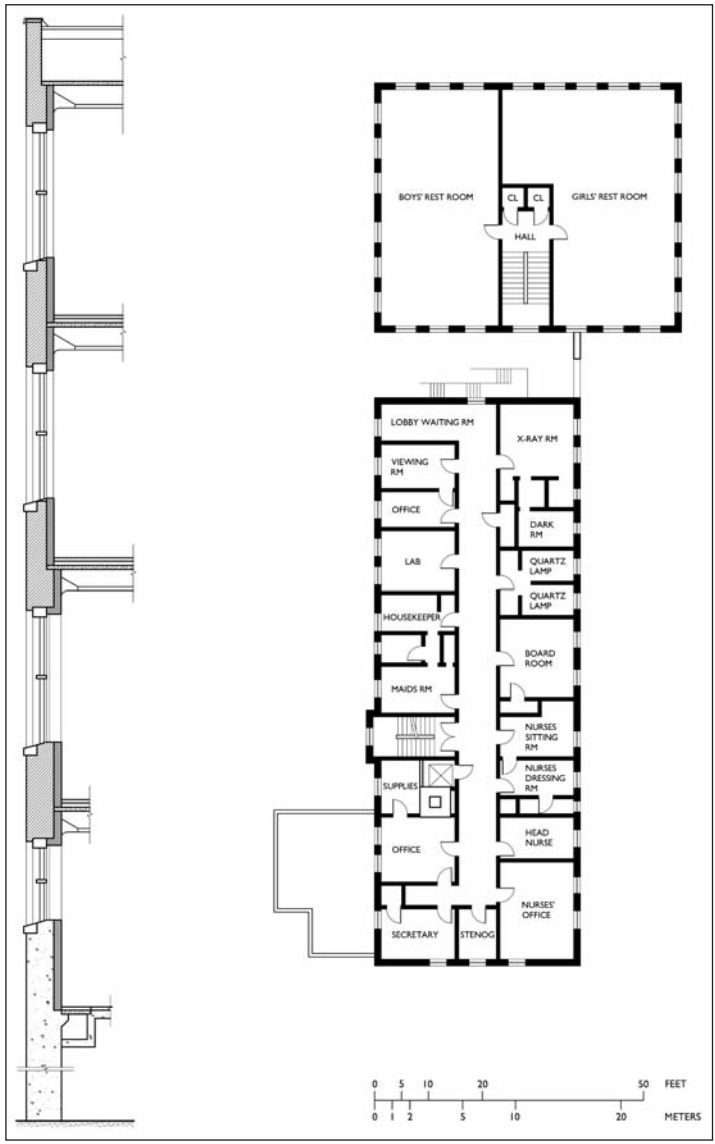

FIG. 6 John S. Archibald's plan of the second floor of the 1933 Royal Edward Institute. (Redrawn by Clara Shipman; courtesy of the Montreal Chest Institute.)

A detailed description of the new buildings appeared in the 1933 *McGill News*. According to author E. S. Harding (and confirmed by Archibald's plan), the ground floor accommodated the patients' waiting room, consulting and examination rooms, nose and throat departments, and the dis-

pensary.[39] For the first time, the Royal Edward offered permanent inpatient beds. Harding noted that the four wards on the third floor contained twenty-two beds; the second floor held the offices, common room and offices for visiting nurses, X-ray and quartz light departments, laboratory, and boardroom. In other words, the new building accommodated medical technologies like X-rays; was a headquarters for broader social technologies, including patient diagnosis and isolation; and served as a technology itself with its inclusion of rooms and dedicated areas for the tuberculosis prescription of sunlight and fresh air. The architecture, with its huge windows, treated patients directly, but now functioned simultaneously as a warehouse for specialized technological objects. It was also a burgeoning bureaucratic space for broader social technologies that surveyed a much larger geographical area; visiting nurses, for example, set out from the building as agents, fanning out through the city to locate suspected tuberculosis patients and their families.[40] Technology involved a combination of spatial conditions a healthy citizen might encounter across the city: school, hospital, and home.

EXPANSION AND THE SURGICAL MISSION OF THE ROYAL EDWARD LAURENTIAN HOSPITAL

Four interlocked situations developed within a dozen years of the opening of the Archibald building, forcing rapid and dynamic institutional and architectural changes: 1) the preeminence of collapse therapy, including an emphasis on increasingly invasive surgical collapse treatments; 2) the development of successful procedures for lung-tissue resection, which then eclipsed collapse therapies as the preferred surgical intervention; 3) an institutional alignment in the Royal Edward's role as a teaching hospital; and, finally, 4) the advent of antibiotics.

While earlier medical thinking about tuberculosis had emphasized the rest cure—rest, hygiene, diet, and fresh air—the interwar period witnessed the rise of collapse therapy for tuberculosis in the United States and Canada.[41] From the turn of the twentieth century through the 1940s, practitioners increasingly promulgated procedures that collapsed affected lung

39. Harding, 19. Harding was secretary of the Royal Edward Institute.

40. The 1924 *Annual Report of the Royal Edward Institute for the Study, Prevention, and Cure of Tuberculosis* (vol. 14), for instance, lists six "visiting nurses," including their "lady superintendent." The 1937 *Annual Report* (vol. 27) has a table showing annual statistics about consultations, nurse visits, and so on from 1909 to 1937.

41. For an outline of collapse therapy in the broader history of tuberculosis, see H. Herzog, "History of Tuberculosis," *Respiration* 65 (1998): 5–15, esp. 11–12; and Dormandy (n. 7 above), 249–63. For a Canadian focus, see Stefan Grzybowski and Edward A. Allen, "Tuberculosis: 2. History of the Disease in Canada," *Canadian Medical Association Journal* 160 (1999): 1025–28.

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tissue. They believed that such procedures deprived *M. tuberculosis* bacilli of oxygen and hence killed them.[42]

James Carson first attempted artificial pneumothorax in Liverpool in 1822. The treatment became widespread during the closing years of the nineteenth century and the first years of the twentieth.[43] The twin-bottle pneumothorax machine used in Canada included a water manometer, allowing the operator to accurately gauge the amount of air pumped into the cavity surrounding the patient's lungs via a hose and a long needle. Surgeons experimented with the design. Most famously, Norman Bethune invented one bearing his name that actively pumped air into the cavity (fig. 7), which may have been used at the Royal Edward. Doctors and nurses used flow sheets (fig. 8) to document the pleural pressures of pneumothorax procedures.[44] The sheet shown here indicates that the patient received the treatment twenty-two times between May and October 1948.

Although the annual reports from the first building do not mention pneumothorax at all, at the Archibald-designed building pneumothorax treatment was relatively common.[45] The earliest available medical charts, from 1938–39, highlight repeated treatments; for example, a twenty-two-year-old woman with "bilateral tuberculosis" who was admitted for six months during 1939 underwent thirty left-sided pneumothorax treatments, as well as phrenic nerve crush.[46] Phrenic nerve crush refers to a surgical procedure whereby the phrenic nerve was crushed through a small incision just above the collarbone. This led to temporary paralysis of the diaphragm on that side, resulting in reduced expansion of that lung for three to six months. Phrenic nerve crush was therefore another type of collapse therapy; it differed from phrenicectomy, which involved surgical removal of a segment of the phrenic nerve, causing permanent diaphragmatic paralysis on that side. The 1935 *Annual Report* shows that collapse therapies were a major activity for the inpatient service, including 88 new pneumothoraces and 900 "refills" (of previously created pneumothoraces), as well as 30 pneumolyses (lysis of pleural adhesions), 15 phrenicectomies (phrenic nerve interruption), and 3 "phrenic crushes." The report also doc-

42. However, Bryder (n. 7 above) cautions that "the rise of surgical interventions in the 1930s . . . had more to do with professional interests, and economic and social pressures than with any inherent superiority of surgery over conservative treatment" (p. 157).

43. The traditional account of the history of artificial pneumothorax is in Brown (n. 2 above), 235–80.

44. On the material culture of pneumothorax, see Annmarie Adams and Kevin Schwartzman, "Pneumothorax Then and Now," *Space and Culture* 8, no. 4 (2005): 435–48.

45. The Belmont Park site produced annual reports until 1929. The Royal Edward Institute vacated the Belmont house in 1930 and occupied temporary quarters until the Archibald-designed hospital was ready.

46. Unfortunately, the lack of patient records from earlier years makes it impossible to clarify what treatments did or did not exist at the first facility on the Belmont Park site.

FIG. 7 Pneumothorax machine designed by Norman Bethune. (Reproduced courtesy of the Osler Library of the History of Medicine, McGill University.)

uments 144 persons who received 865 pneumothorax treatments as outpatients—largely refills. Later surgical interventions included thoracoplasty (fig. 9), in which the surgeon partially removed ribs in order to reduce the volume of the thoracic cavity and create inward collapse of both the chest wall and underlying lung (first performed in 1885), and sometimes obliterated the pleural space with a foreign material such as wax or oil (oleothorax, plombage). By 1927, thoracoplasty, which as we mentioned was introduced to North America by Montreal surgeon Edward Archibald, was in widespread use, standardized in a three- to four-stage technique for progressive rib resection.[47]

Although doctors initially carried out the pneumothorax procedures in generic, sometimes office-like spaces, the increasing use of thoracoplasty and related interventions eventually created a new kind of tuberculosis patient—the surgical inpatient—who in turn prompted changes in tuberculosis hospital planning and design. Simultaneously, the use of diagnostic technology, likewise initially pushed into nonspecialized rooms, began to be housed in dedicated areas. The two trends mutually reinforced each other. By the open-

47. Archibald (n. 2 above).

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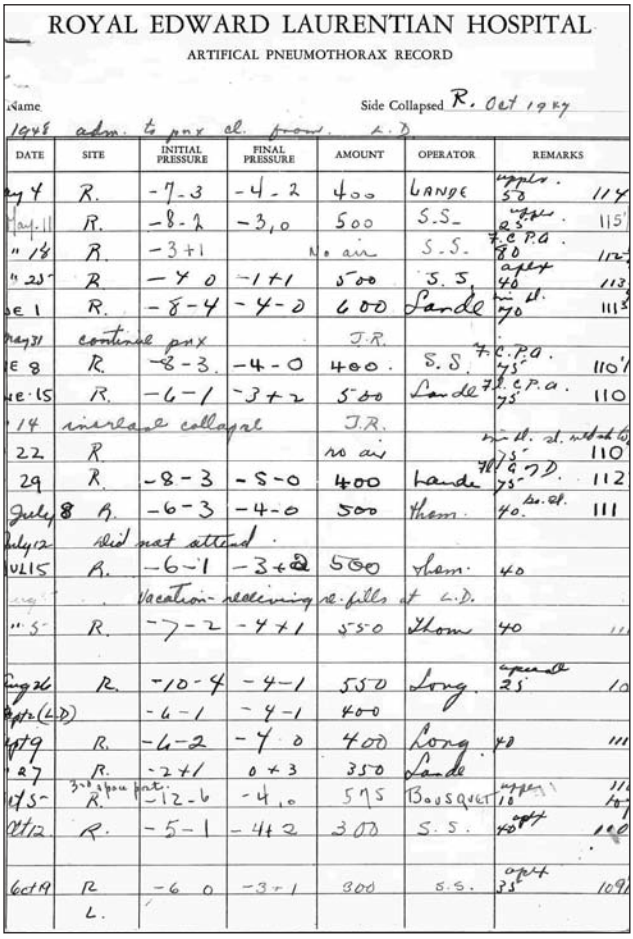

ROYAL EDWARD LAURENTIAN HOSPITAL

ARTIFICAL PNEUMOTHORAX RECORD

Name

Side Collapsed R. Oct 1948

1948 adm. to pnx cl. from L.D.

DATE	SITE	INITIAL PRESSURE	FINAL PRESSURE	AMOUNT	OPERATOR	REMARKS
ay 4	R.	-7-3	-4-2	400	LANGE	upper. 53 114
May 11	R.	-8-2	-3,0	500	S.S.	115
" 18	R.	-3+1	No air		S.S.	7. C.P.A. 80 112
" 25	R.	-4 0	-1+1	500	S. S.	apex 40 113
ne 1	R.	-8-4	-4-2	600	Lande	in U. 70 111
May 31	continue pnx			J.R.		
E 8	R.	-8-3	-4-0	400	S. S.	7. C.P.A. 75 110
ne 15	R.	-6-1	-3+2	500	Lande	7. C.P.A. 75 110
14	increase collapse			J.R.		
22	R			no air		in U. st. with adh 75 110
29	R.	-8-3	-5-0	400	Lande	7. C.P.A. 75 112
July 8	R.	-6-3	-4-0	500	Thom.	Lo. Ap. 40. 111
July 12	did not attend.					
ULY 15	R.	-6-1	-3+2	500	Thom.	40
	Vacation - receiving re-fills at L.D.					
" 5	R.	-7-2	-4+1	550	Thom	40
ug 26	R.	-10-4	-4-1	550	Long.	upper 35 10
pt 2 (L.D)		-6-1	-4-1	400		
pt 9	R.	-6-2	-4 0	400	Long	40 111
" 27	R.	-2+1	0+3	350	Lande	
ct 5	3rd refill pnx R.	-12-6	-4,0	575	Boisquet	upper 10
Oct 12	R.	-5-1	-4+2	300	S. S.	40 apex 100
Oct 19	R L.	-6 0	-3+1	300	S.S.	apex 35 109

FIG. 8 Record of treatment with artificial pneumothorax notations for a patient admitted in 1948. (Reproduced courtesy of the Montreal Chest Institute.)

ing of the Royal Edward on St. Urbain Street in 1933, chest radiography was obtained before, during (fluoroscopy), and after pneumothorax treatment to characterize tuberculous lesions and estimate the degree of lung collapse achieved.[48] The Montreal Anti-Tuberculosis League poster featured in the daily Montreal *Gazette* on 18 November 1955 displays a graph that showed a steady increase in the number of X-rays since 1943 and advocates: "Have a

48. The utility of X-rays for tuberculosis diagnosis was noted almost immediately; see the essay by Francis H. Williams, "The X-rays in Medicine," *International Monthly* 3 (1901): 42–56, reprinted in *From Consumption to Tuberculosis: A Documentary History*, ed. Barbara Gutmann Rosenkranz (New York, 1994), 551–61.

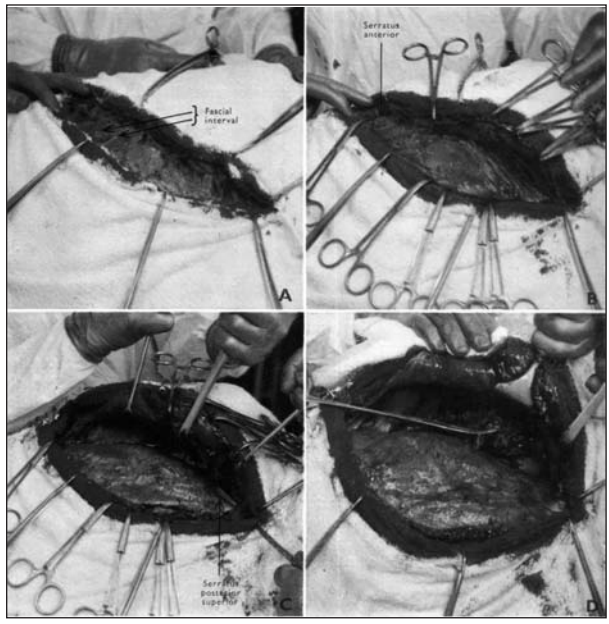

FIG. 9 Images of thoracoplasty from a 1961 textbook by B. T. Le Roux, *Techniques of Thoracotomy* (London: E. & S. Livingstone).

Chest X-ray at least Once a Year" (fig. 10).[49] Thus the hospital design was itself therapeutic, but it also expanded and transformed its spaces in order to house and cultivate other diagnostic and therapeutic tools.

An additional influence on the institution's reaction to emerging therapeutic technology came from a realignment in Montreal's hospital network. In 1933, the Royal Edward contracted with McGill University to become an affiliated teaching hospital. In 1941, McGill's major research and teaching hospitals, the Royal Victoria and Montreal General, stopped admitting tuberculosis patients for surgical treatment. The Royal Edward therefore closed the Burland School and called on hospital-specialist architect J. Cecil McDougall to renovate part of the 1933 hospital building and modify the former school so as to create an addition that included an operating room and surgical ward.[50] The operating room opened on 30 Sep-

49. The Montreal Anti-Tuberculosis League was a benevolent organization unrelated to the Prevention League that founded the Royal Edward. On the incorporation of X-ray and other diagnostic technology into the hospital, see Joel D. Howell, "Machines and Medicine: Technology Transforms the American Hospital," in *The American General Hospital: Communities and Social Contexts*, ed. D. E. Long and J. Golden (Ithaca, N.Y., 1989), 109–34.

50. See Howard Murray, "Royal Edward Laurentian Hospital: Its History; an Aide-Memoire," typescript, p. 8, in the MCI Library Collection.

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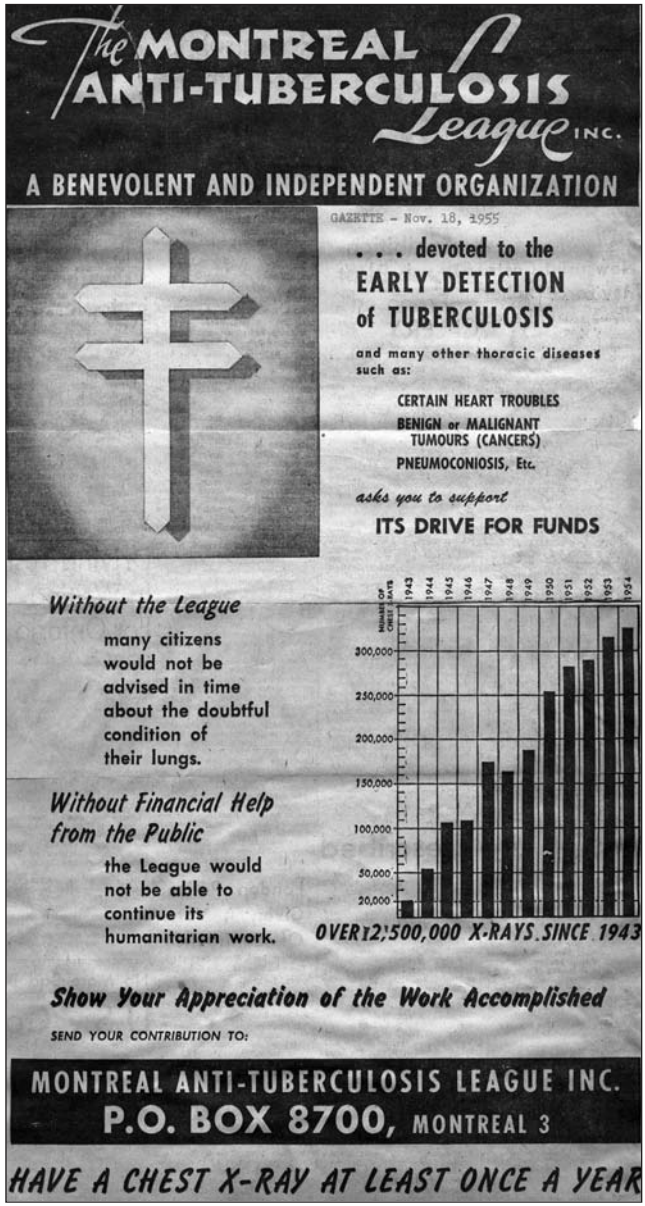

FIG. 10 Montreal Anti-Tuberculosis League advertisement in the Gazette, 18 November 1955. (Reproduced courtesy of the Montreal Chest Institute.)

tember 1942, in which year there were eleven "major operations" performed.[51] During the next five years, surgery—usually thoracoplasty—became a common treatment.[52]

STREPTOMYCIN

The most famous innovation in tuberculosis treatment was the introduction of streptomycin and other chemotherapeutic agents.[53] Antibiotic medicine—the first therapy to directly and specifically target the tubercle bacillus—augured the end of specialized tuberculosis-treatment settings. Streptomycin was first isolated in the laboratory of Selman Abraham Waksman at Rutgers University in 1943 and was first administered for human tuberculosis treatment in Minnesota in November 1944.[54] It was tested in Canada as early as 1945.[55] Three of thirty consecutive Royal Edward patient files reviewed from 1947 mention its use. In 1949, sanatorium patients in Quebec could receive antibiotic treatment free of charge.[56] Top federal officials cautiously endorsed the new therapy: "Streptomycin is not a cure-all for tuberculosis, Mr. Martin [Canada's Minister of National Health and Welfare] emphasized, but in certain cases it has proven effective not only in arresting the disease but also in reducing the time in hospital and in hastening the patient's return to normal activity."[57]

As the Royal Edward Laurentian Hospital (a 350-bed sanatorium division in Ste-Agathe, ninety kilometers north of Montreal, discussed below) sought to expand its surgical services, the development and production of antituberculous drugs were reshaping the approach to tuberculosis treatment and care. Nurses administered streptomycin bedside, in the hospital room, or at home. Royal Edward nurses kept track of the procedure on the

51. By 1946, there were sixty-four first-stage thoracoplasties, ninety-three "other-stage" thoracoplasties, and two pneumonectomies performed at the Montreal hospital. Our review of thirty consecutive patient medical charts from 1947 also highlighted the growing use of thoracoplasty, which was documented for ten of these patients, while not even being mentioned in the 1938–39 case files.

52. On the history of thoracic surgery and surgeons in Montreal, see Delarve (n. 27 above), 21–49.

53. Ryan (n. 11 above) recounts the history of the "intimate details of how the cure was found" (p. xvii).

54. On this treatment in Minnesota, see K. H. Pfuetze et al., "The First Clinical Trial of Streptomycin in Human Tuberculosis," *American Review of Tuberculosis* 71 (1955): 752–54; on Selman Abraham Waksman, see Alex Sakula, "Selman Waksman (1888–1973), Discoverer of Streptomycin: A Centenary Review," *British Journal of Diseases of the Chest* 82 (1988): 23–31.

55. "Streptomycin Being Tested As a Cure for Tuberculosis," *Montreal Star*, 10 July 1945, 3–4.

56. Oastler (n. 9 above), 1.

57. Ibid.

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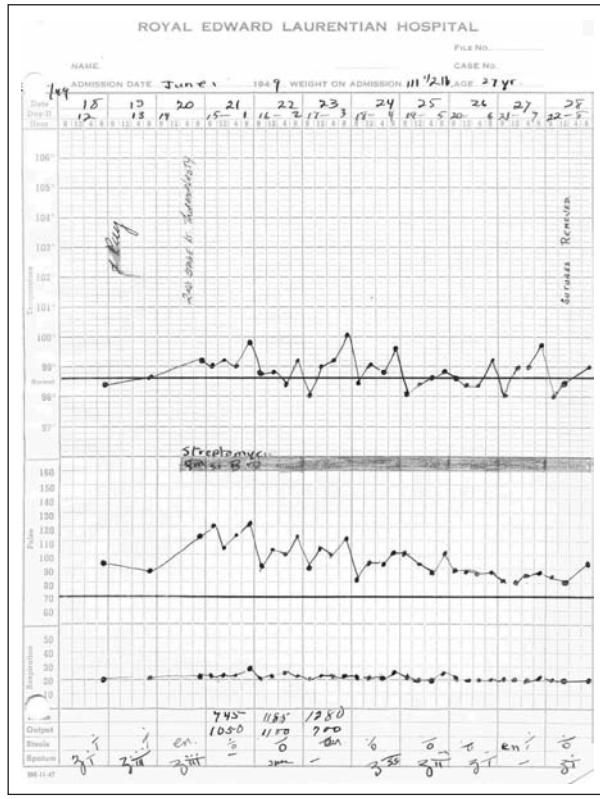

FIG. 11 Chart showing administration of streptomycin immediately after a second-stage thoracoplasty, 1949. (Reproduced courtesy of the Montreal Chest Institute.)

vital sign (fever) chart; the use of medications is color coded (fig. 11), namely, there is a red bar used to shade a box under the vital signs for every day that streptomycin was given. In October 1949, the *Montreal Star* reported that "in the highly fatal types of generalized tuberculosis streptomycin frequently brings about a striking clinical remission."[58] In 1951, the *Gazette* reported that the combination of streptomycin and para-amino-salicylic acid had led to "moderate" or "marked" improvement in thirty-five patients.[59]

58. *Montreal Star*, 25 October 1949.

59. Brian Cahill, "Combination of 2 Drugs Reported Best T.B. Control of Treatment Yet," *Gazette*, 9 August 1951, 13; N. Lewin and M. Aronovitch, "Para-amino-salicylic Acid with Streptomycin in Pulmonary Tuberculosis," *Canadian Medical Association Journal* 65 (1951): 140–44. Our review of thirty Royal Edward patient files from 1951 yielded thirteen in which streptomycin was administered, sometimes in combination with para-amino-salicylic acid.

FIG. 12 Hugh Burke, director of the Royal Edward, pictured with Edith Mankiewicz in 1955 in press coverage of her work on diagnostic techniques for tuberculosis. (Reproduced courtesy of the Montreal Chest Institute.)

SURGICAL THERAPY

Rapid changes followed streptomycin. By the 1940s, hospital leaders in Montreal perceived that demand for inpatient tuberculosis care greatly outstripped available resources. In August 1945, at the close of World War II, Hugh Burke (fig. 12), medical director of the Royal Edward's Montreal division, indicated that the Montreal hospital was supervising 3,002 persons with tuberculosis, including 1,214 persons with "moderately far-advanced" and 290 with "far-advanced" tuberculosis. On 1 August 1945, 530 of these 3,002 were hospitalized at the Montreal or Laurentian divisions or at the Grace Dart Home Hospital in Montreal; 70 percent of these individuals were sputum culture–positive. An additional 243 patients were described as "anxiously awaiting beds in hospital at this moment. . . . 90% of these 243 patients had tubercle bacilli in their sputum at the time of their last examination."[60]

In a 1945 postwar memorandum, Burke maintained that

> it has become clear, with the development of surgical procedures for the control of tuberculosis . . . that the Hospital does not have adequate facilities for the active treatment of this disease . . . 54 of the 87

60. Hugh E. Burke, "Memorandum Regarding Post-war Expansion of the Royal Edward Laurentian Hospital," memorandum dated 14 June 1945, MCI Library Collection.

> patients whose names are on the admission list of the Hospital's Montreal unit at this moment are awaiting surgical procedures.[61]

The hospital therefore proposed to nearly quadruple its bed capacity—from 52 ("taxed to capacity") to 200, including six 30-bed wards and one 20-bed ward (with one ward reserved for children)—to add a second operating room, and, finally, to construct accommodation for a hundred nurses and sixty other staff.[62] This last category, "other staff," included X-ray technicians, dietitians, and social workers. Annual reports distinguish among medical staff responsible for inpatients, surgical staff, and "dispensary staff" physicians who were responsible for outpatient care. For example, the 1945 report for the Montreal division (i.e., the Royal Edward) cites both a medical director (Burke) for the Montreal site and an assistant medical director. It lists a surgeon-in-chief, two additional surgeons, four associate surgeons, one assistant to the surgeon-in-chief, and one "assistant in surgery." For the dispensary, it notes eight physicians, twelve associate physicians, and three "voluntary assistants." There was also a medical microbiologist. Surprisingly, documentation as to the number of inpatient nursing positions on St. Urbain is consistently absent from the annual reports. There were fifteen full-time and one part-time public health nurses, with their own superintendent.

Part 3, 1954: The Surgical and Laboratory Building

Despite the growing use of both antimicrobials and resectional surgery, Burke continued to promote rest therapy—and thus inpatient-treatment facilities that included balconies, galleries, and extensive glazing. As medical historian Julius Comroe Jr. puts it, doctors were "reluctant to let patients get out of bed."[63] In 1956, Burke delivered a scientific paper at the Canadian Medical Association's annual meeting citing evidence from guinea pig experiments that treadmill exercise was associated with shortened survival after intrapleural inoculation of *M. tuberculosis* bacilli: "rest favours the healing of areas of tuberculous infection, as demonstrated in the survival of three of the group of 'resting' animals."[64] This echoed a 1954 official statement from the American Trudeau Society that emphasized the continued role of rest therapy. The American Trudeau Society's Committee on Therapy acknowledged "continuing reports showing the increased effectiveness of

61. Ibid.

62. Ibid.

63. Comroe reviews the evolution of treatment through published textbooks; see "T.B. or not T.B.? Part II. The Treatment of Tuberculosis," *American Review of Respiratory Disease* 117 (1978): 379–89, quote on 387.

64. Burke, address to the Canadian Medical Association's 89th Annual Meeting, Quebec City, 11–15 June 1956, reported in the *Gazette*, 15 June 1956.

FIG. 13 The Royal Edward Surgical Tower, designed by the architectural firm McDougall, Smith, & Fleming, under construction in 1953. (Reproduced courtesy of the Montreal Chest Institute.)

antimicrobial therapy in the treatment of pulmonary tuberculosis have caused many physicians to question the necessity or advisability of prolonged bed rest." However, it concluded that "from the facts now available, there is no evidence to support a reduction in the amount of rest therapy from that of past practices except as this may be justified by an earlier attainment of an inactive status of the disease."[65] The new therapies were superimposed on the conceptual and material infrastructure of the old.

Even with the advent of isoniazid—the most powerful antituberculous agent yet developed—medical authorities remained skeptical. George Wherrett, executive secretary of the Canadian Tuberculosis Association, wrote in 1952 that despite the development of chemotherapies, "There will be no reduction in the need for hospital beds. . . . It cannot be too strongly emphasized that neither streptomycin nor isoniazid replace the well-tried methods of treatment by bed rest in the sanatorium and surgery in selected cases." Therefore, in 1952, the Royal Edward's Montreal site saw the construction of a sleek modern tower dedicated to surgical procedures, by the architectural firm of McDougall, Smith, & Fleming (fig. 13).[66] Located just south of the 1933 Archibald-designed hospital on St. Urbain and connected

65. *American Review of Tuberculosis* 69 (1954): 1069–70.

66. The construction process is comprehensively recorded in an outstanding numbered series of eight photographs taken between January 1952 and January 1953. These photographs are in the MCI Library Collection.

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to its older neighbor by an overhead bridge on the second floor, the new long, narrow surgical tower stretched approximately 180 feet from St. Urbain to an alley in the rear. The main portion of the building was six stories high (two additional stories were added in 1957). The overhead bridge from the older building joined the tower's second floor through an L-shaped wing, just behind the main entry. During 1956, bed capacity there increased from 81 to 131 patients with the completion of three additional floors.[67] The new building, however, was not designed to accommodate patients for the rest cure, but worked in conjunction with the other (Laurentian) arm of the institution, which was located in a picturesque rural setting.

Inside, the architect's design of the new hospital showcased four-bed wards and private rooms along a double-loaded corridor (fig. 14). McDougall, Smith, & Fleming's plan shows accommodation on a typical floor for twenty-five patients: twenty in the wards, and five in private rooms. At the end of the long building, a gallery next to the smokestack faced the alleyway; near the center, public waiting rooms, flanked by offices for the head nurse and medical personnel, protruded from the building's south face. The section of the tower directly above the attractive entry, projecting north, held the elevator banks and large ward kitchens. From the exterior, however, these spaces appeared identical in elevation to the patient rooms. In terms of general appearance, the new hospital building resembled a high-rise office tower, with its crisp edges and windows forming bands or ribbons. Unlike the 1933 building, the new one even turned a relatively blank façade to the street (fig. 15); indeed, the most interesting architectural feature of the tower was the bold, protruding double-height entrance, set back forty-five feet from St. Urbain and constructed of Queenston limestone like the ground story of the tower section nearest the street.

How did the architecture of a chest hospital differ from a general hospital? Not radically. Postwar chest hospitals look like other postwar hospitals. McDougall, Smith, & Fleming designed several other remarkably similar institutions, especially the 1956 Montreal Children's Hospital. Both the Royal Edward and the Children's Hospital are high-rise brick blocks with rectangular footprints, ziggurat-like silhouettes, window configurations stressing horizontal movement, and iconic chimneys. As hospitals became less like civic monuments or large houses and more like urban office towers, however, the interior arrangement remained obsessively specialized. In McDougall, Smith, & Fleming's Montreal General, for example, different types of patients are stacked in a complicated nosological and social diagram, which is only connected by vertical circulation through disconnected stair towers and elevators (fig. 16).

67. However, on 31 December 1956, 96 of the 131 beds were occupied, as compared with 72 of 81 beds on 1 January of the same year (*Report—Royal Edward Laurentian Hospital* 16 [1957]).

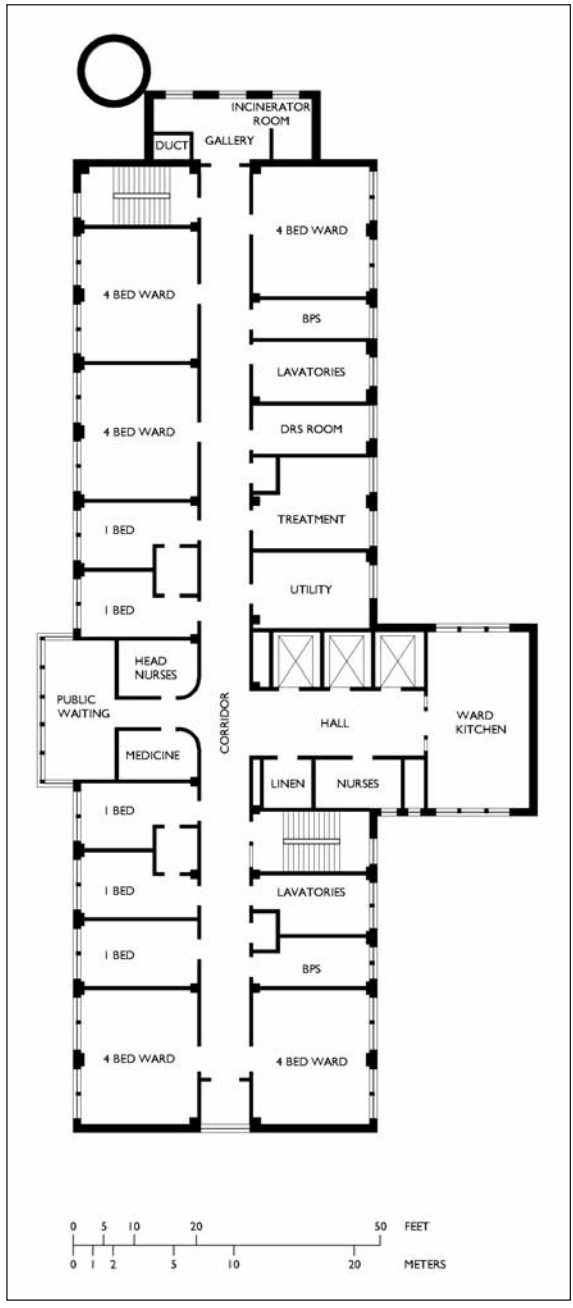

FIG. 14 The plan of the Royal Edward Surgical Tower, 1954. (Redrawn by Clara Shipman; courtesy of the Montreal Chest Institute.)

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FIG. 15 The Royal Edward Surgical Tower pictured soon after the opening of the first six floors in 1954. (Reproduced courtesy of the Montreal Chest Institute.)

Postwar towers of all types (medical and nonmedical) are distinguished by an absence of any spatial hierarchies. Despite the functionalistic rhetoric of form following function, discrete functional zones are not apparent: corridors, lobbies, living rooms, offices, and even lavatories might all sport the same floor-to-ceiling heights and fenestration. A comprehensive survey of chest hospitals in North America may show, in fact, that the broadening of tuberculosis hospitals' vocation at this time to include patients with other chest problems paralleled the move to a more standardized hospital building. Still, the vertical separation of patients by nature of their condition remained. Once the Royal Edward began to accept patients with conditions other than tuberculosis, for example, tuberculosis patients were housed on the top floor of the older building, clearly separated from the others with nontuberculosis ailments.[68]

After Chemotherapy

With these changes in architectural planning and imagery, the building helped determine the unfolding changes in treatment. In the 1953 *Annual*

68. Personal interview with Mary Phung, 20 July 2007; Phung began working at the MCI in 1965 and retired in 1991.

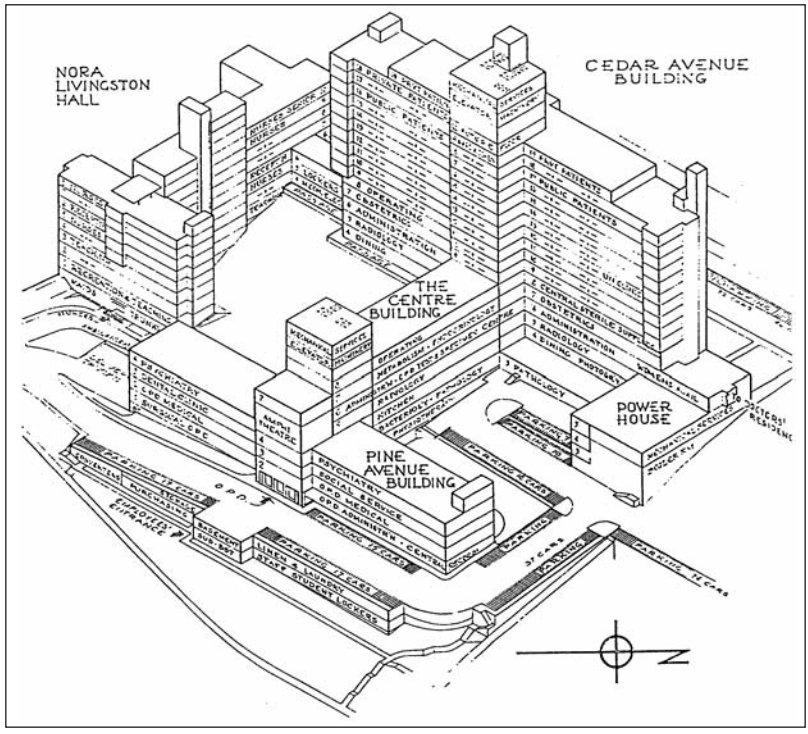

FIG. 16 Axonometric diagram of zoned areas at the Montreal General Hospital (from *Journal of the Royal Architectural Institute of Canada* 32 [September 1955]: 314). (Reproduced courtesy of the Royal Architectural Institute of Canada.)

Report, immediately before the opening of the new surgical and laboratory building, Burke stated:

> The numbers of minor operations carried out for the purpose of permitting better collapse of an area of disease in a lung have dwindled almost to the vanishing point. This turn of events is a direct result of the fact that, due to an upsurge in interest in pneumoperitoneum therapy [an alternate form of collapse therapy], the advent of effective anti-tuberculous [*sic*] chemotherapeutic agents, and a growing interest in resection surgery, few attempts have been made to institute pneumothorax therapy. . . . Growing appreciation of the fact that recently developed forms of treatment—i.e.: chemotherapy and resection surgery—have more to offer many patients who in the past almost certainly would have been considered suitable candidates for collapse therapy, is largely responsible for the decline in the numbers of thoracoplasty operations from 136 in 1948 to 25 last year. . . .

> Ten resection operations were carried out in 1948 . . . forty-two this past year.[69]

From the surgical standpoint, interest in collapse therapies had waned in favor of resection of diseased lung tissue, first conducted successfully in 1934 in Montreal by surgeon Edward Archibald (hence the larger numbers of resections as compared with thoracoplasties).[70] In 1941, just three years before streptomycin was tested on human patients, Archibald used an unusual architectural metaphor to express his belief in the efficacy of surgical treatment for tuberculosis: "The foundations have been well and truly laid. Most of the superstructure has already been added. What remains to be done cannot be much more than detail work."[71]

Once chemotherapy was part of the treatment armamentarium, the typical patient actually received three very different therapies, recapitulating the development of therapeutic technology since the beginning of the century: the rest cure, surgical intervention, and chemotherapy. In 1942, the Royal Edward Institute had merged with the Laurentian Sanatorium Association (fig. 17) to form the Royal Edward Laurentian Hospital, composed of Montreal and Laurentian divisions.[72] The newly merged hospital instituted a network of facilities between which patients traveled for different types of treatment. As Royal Edward director F. Learn Phelps recounted in 1957, there was no need for a single massive, centralized facility supporting surgery, rest, and drug therapy:

> As in previous years the drug treatment of our cases has been concentrated on any two of the three drugs, streptomycin, P.A.S. and I.N.H. When possible the length of treatment has been set at one year in the sanitarium [*sic*]. The results have been most amazing in some early cases. However the older or chronic cases can be helped only. Destroyed tissue is hard to replace. Surgery in some form has been used in the eighty-two cases referred to our Montreal Division. Most of these cases returned to Ste-Agathe for post surgical care of some months.[73]

69. *Report—Royal Edward Laurentian Hospital* 12 (1953).

70. Archibald (n. 2 above), 319. During 1953, 159 patients were admitted to the Montreal hospital's surgical unit. The 1953 *Annual Report* documents 247 "minor operations," primarily diagnostic bronchoscopies and related procedures. There were 82 "major operations," including 25 thoracoplasties, 9 pneumonectomies, and 31 lobectomies and/or wedge resections of lung tissue.

71. Archibald, 323.

72. These two sites continued to operate as a merged institution until 1963, when the Quebec Hospitals Act mandated their separation. The Montreal site was then renamed the Royal Edward Chest Hospital.

73. F. Learn Phelps, *Report—Royal Edward Laurentian Hospital* 16 (1957): 16.

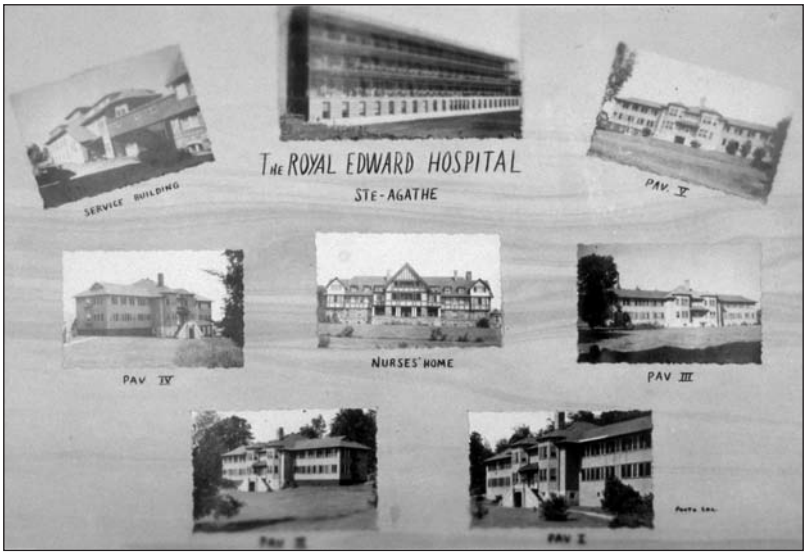

FIG. 17 Postcard showing pavilions of the Royal Edward Laurentian Hospital, Ste-Agathe division. (Reproduced courtesy of the Bibliothèque et Archives nationales du Québec.)

Rest could be managed in the sanatorium at Ste-Agathe; drug therapy at home; and surgery in Montreal.[74] Patients could travel between facilities. So even though antibiotics were transportable, the patient was passed from building to building—as if the distinct architecture of each location continued to contribute to and influence the course of treatment. Architecture housed rooms and installations for specialized therapies (rest cure) and machines (X-rays), and, in turn, changes in technology initiated changes in building programs (operating rooms for surgery). Even as treatment seemed to be less intricate because of the efficacy of drugs, therapy had in fact become more complex, involving multiple, overlapping technologies and procedures, carried out in multiple therapeutic settings.

74. Ronald Bayne recounts his experience at the sanatorium in Ste-Agathe during 1948–49, at the end of which he received an experimental trial of streptomycin; he was at the time a resident in pediatrics at the Children's Memorial Hospital in Montreal. See "Ascending the Magic Mountain," *Canadian Medical Association Journal* 159 (1998): 258, 517–18.

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Conclusion: From Tuberculosis to Lung Disease

The tuberculosis hospital was adjusted to become the center of a different institution. Specialized architecture was reconceived and repurposed from tuberculosis treatment only to a more general thoracic hospital. On 1 January 1956, a change in hospital policy allowed for the admission of persons with nonpulmonary tuberculosis, while on 19 September it became possible "for members of this Hospital's staff to arrange to have patients who have chest conditions of uncertain etiology admitted for investigation and, if indicated, treatment."[75] In 1957, the first patients with chest conditions of uncertain etiology were admitted: 40 of them that year, as opposed to over 300 with tuberculosis, of which 286 were pulmonary or pleural.[76] Prior to these developments, on 24 January 1955 the first baby was born onsite, to a mother with tuberculosis, in the hospital's obstetrical unit, which was on the third floor of the old building.[77]

Not only was there insufficient room in the expanded building for patients diagnosed with tuberculosis, but the institute also needed to provide services for tuberculosis patients who developed other conditions. This need was exacerbated by the fact that the general hospitals no longer wished to provide any tuberculosis care.[78] The Royal Edward began to move away, then, from caring only for persons who had tuberculosis (in some instances with additional, coexisting conditions) toward treating those with undifferentiated and ultimately nontuberculous chest problems. The 1960 *Annual Report* is the first to mention lung cancer: sixty patients "proved to have lung cancer," and there were eleven major operations for it. In that year, 582 nontuberculous patients were admitted (including 78 with lung cancer), double that of 1959. Likewise, outpatient drug therapy had risen from 381 at the end of 1959 to 560 two years later. In 1961, there were 195 major operations, including 57 nontuberculous-related lung resections. In other words, antibiotics affected tuberculosis care on many fronts, for not only were they important therapeutic agents themselves, but they also improved outcomes after surgical operations, including thoracoplasty and lung resection.[79] By 1963, the pulmonary tuberculosis service reduced to twenty-five beds, while nontuberculosis treatment included over a hundred.

What then does hospital architecture tell us about the reception of

75. *Report—Royal Edward Laurentian Hospital* 15 (1956): 21.

76. *Report—Royal Edward Laurentian Hospital* 16 (1957).

77. The baby's name featured the initials R. E. L., after the hospital. This was reported in *Report—Royal Edward Laurentian Hospital* 14 (1955).

78. In his memorandum dated 14 June 1945 (n. 60 above), Burke wrote explicitly that "It seems clear that this Hospital must, in its plans for expansion, make provision for a limited number of beds for the treatment of patients with infectious tuberculosis in whom non-tuberculous conditions requiring attention develop."

79. Herzog (n. 41 above), 12.

streptomycin? An earlier hypothesis presented by one of us (Adams) in 2002 by means of a timeline pointed out the difficulty of reconciling the drug treatment and tuberculosis architecture.[80] As an architectural historian, Adams speculated that the absence of direct links between tuberculosis architecture and the use of therapies indicated that medical architecture was shaped by other, nonmedical forces. This suggestion contests the assumption in classic histories of hospital architecture that hospital design illustrates medical theories. Adams showed how the advent of antibiotics actually lagged behind major developments in tuberculosis-related design, rather than driving architectural innovation.

In many ways, this case study of the Royal Edward tests and confirms the incongruities noted in that initial speculative survey of building design for tuberculous treatment. In particular, the next architectural stage of our case study suggests surprising doubts about the effectiveness of antibiotics, expressed in the ways medical spaces were used; surprising because the introduction of drug therapy seemed to promise the large-scale elimination of tuberculosis, especially when considered in conjunction with the treatments of other bacterial infections at the end of World War II.[81] The hospital shifted from being primarily concerned with a particular disease, tuberculosis, to broadening that concern to an entire organ, the lung. A similar process of generalization took place in another free-standing tuberculosis hospital, Denver's National Jewish Hospital, which is now a leading respiratory research and care center.

Traditional architectural history suggests that buildings should be studied through the ideas of those who commission and conceive them—in this case, doctors and architects. Medical histories typically claim that buildings illustrate medical progress. This case study instead shows that architecture, studied through its changing uses, actually slowed medical innovation. The story of tuberculosis therapy at the Royal Edward is a superb example of the notion that buildings are more than reflections of societal values; rath-

80. The timeline was presented by Adams in "Porches and Pills: The Architecture of Postwar Tuberculosis," Society for the Social History of Medicine, Sheffield, UK, 23–25 March 2002. A book of papers from the conference is under review: Flurin Condrau and Michael Worboys, eds., *From Urban Penalty to Global Emergency: Current Issues in the History of Tuberculosis*.

81. In some ways, the switch away from tuberculosis was probably easiest for thoracic surgeons. Having established techniques for lung resection and postoperative care, these could be immediately extended to lung resection for other pathologies. If the Royal Edward was the "market leader" in thoracic surgery (and thoracic surgery was localized there), it was not much of a stretch to shift to other pathologies, as the need for nontuberculosis surgery increased and that for tuberculosis surgery disappeared. It was probably more difficult for medical (nonsurgeon) chest specialists, in the sense that the spectrum of disease and treatment was quite different for nontuberculosis conditions: a mixture of acute infections—namely, pneumonia—with chronic noninfectious conditions such as asthma or emphysema.

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er, the context, use, and histories of buildings contribute to architectural meaning. The Royal Edward (and especially Burke) backed surgery treatments when antituberculous drugs appeared on the scene as a seemingly miraculous cure. The surgeons were wrong. This is a rare instance of architecture as evidence of what doctors wanted but patients didn't need.

Using architectural and material evidence to gauge physicians' initial responses to chemotherapy opens the door to myriad studies. The interaction of architecture and medicine is crucial here. When we study the overlaps between tuberculosis and technology by charting the rise and fall of tuberculosis collapse therapies against the Royal Edward's architectural expansions, it becomes clear that pneumothorax therapy began to decline once operating rooms were available for major surgery. New and old technologies—the various realms of clinical practice, medical innovation, machines, and buildings—interact and develop in only partial autonomy; both surgery *and* surgical space are necessary components of the medical practices that linked environment-based cures and the full deployment of chemotherapies. The lesson here is to study the progress and adaptation of new technologies as a nonlinear, multifactorial process in which architecture is both a technological support and is itself a significant technology. Form does not simply follow function. Like other medical technologies, architecture can impose constraints when it comes to deciding which treatments are feasible or not or which are to be used in a particular setting; architecture embodies choices about health care, imposing consequences on these choices. Place—the material environment and its symbolic cultural meanings—must be integrated into any understanding of tuberculosis technologies, no matter how portable, ephemeral, or intangible. Architecture matters.