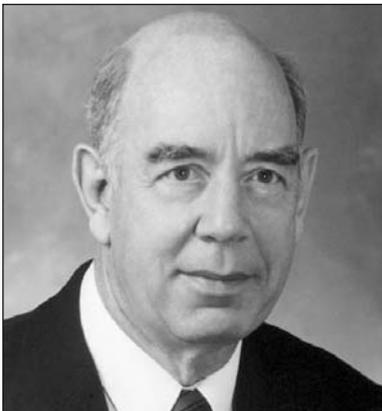


## Origins of the Canadian school of surgery

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**Background:** Since its inception 50 years ago, the *Canadian Journal of Surgery* has published articles under the banner “History of Canadian Surgery.” Because no comprehensive history of surgery in this country has yet been written, these articles may provide its basis. **Method:** The *Canadian Journal of Surgery* was searched from October 1957 to August 2007 for articles on the practice of surgery in Canada before 1957. Articles regarding the development of surgery in provinces, universities, hospitals and surgical specialty societies were included, as well as biographies and obituaries of surgeons. **Results:** Thirty-six articles dealing with the lives of 57 Canadian surgeons were located. Three periods of Canadian surgery were covered: the French regime (1535–1759), the transition period (1759–1870) and the early modern period (1870–1945). The review shows that persistent efforts were made in Canada to develop surgical education and to regulate the practice of surgery. Isolation forced a spirit of adaptability that led to innovation and progress. **Conclusion:** The practice of surgery in Canada today can be traced back to contributions made by pioneering surgeons over the entire history of modern Canada. An archive of materials related to the history of surgery in Canada is being created at [www.historyofsurgery.ca](http://www.historyofsurgery.ca) to facilitate further research.

**Contexte :** Depuis sa création il y a 50 ans, le *Journal canadien de chirurgie* publie des articles dans une chronique intitulée Histoire de la chirurgie canadienne. Comme on n’a pas encore écrit d’histoire détaillée de la chirurgie au Canada, ces articles pourraient servir de base. **Méthode :** On a cherché, dans le *Journal canadien de chirurgie* d’octobre 1957 à août 2007, des articles sur la pratique de la chirurgie au Canada avant 1957. On a inclus les articles portant sur l’évolution de la chirurgie dans les provinces, les universités, les hôpitaux et les sociétés de spécialistes en chirurgie, ainsi que des biographies et des notices nécrologiques de chirurgiens. **Résultats :** On a trouvé 36 articles sur la vie de 57 chirurgiens canadiens. Les articles couvraient trois périodes de la chirurgie au Canada : le régime français (1535–1759), la période de transition (1759–1870) et le début de l’ère moderne (1870–1945). L’étude montre que l’on a fait des efforts persistants au Canada pour faire progresser la formation en chirurgie et en réglementer la pratique. L’isolement a imposé un esprit d’adaptabilité à l’origine de l’innovation et du progrès. **Conclusion :** La pratique de la chirurgie moderne au Canada remonte aux contributions des pionniers de la discipline pendant toute l’histoire du Canada moderne. On s’emploie à créer une archive documentaire sur l’histoire de la chirurgie au Canada à [www.historyofsurgery.ca](http://www.historyofsurgery.ca) afin de faciliter d’autres recherches.



Tom Williams, 1925–2006.

The modern period of surgery might be said to have started after World War II. Veterans who returned to Canada with extensive experience in trauma surgery were eager to apply their skills to a variety of clinical problems in civilian hospitals. Senior surgeons, many themselves veterans of World War I, had prepared a sound foundation upon which their younger colleagues built a unique school of surgery. Orientation of the search for postgraduate training changed from Britain to-

ward the United States. Access to surgical services became universal with the development of Medicare. Surgical standards were unified with the strengthening of residency programs and the development of specialty committees at the Royal College of Physicians and Surgeons of Canada. Canadian surgery often adopted what was considered the “mid-Atlantic position,” defined by its rational implementation of a bewildering array of technical innovations. Publication of the *Canadian*

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*Journal of Surgery (CJS)* gave expression to this independence. From the start, contributors to the journal recognized the debt owed to those who went before them. A series of articles, often published under the banner, “History of Canadian Surgery,” documented the lives of significant surgeons from the past. These articles show that the pioneering spirit, which marked the development of the country as a whole, also found expression among surgeons. They suggest that the Canadian school of surgery is not derived from a compromise between practice of surgery in Britain and the United States, but that it might have begun with the “make-do” ethic of Canada in the 19th and early 20th centuries.

### Method

A systematic search for articles published in the *CJS* between October 1957 and June 2007 was undertaken for articles about the development of surgery in Canada before 1957. These articles included biographies and obituaries of prominent figures, recollections of the founding of specialty surgical societies and discussions regarding the development of surgery in provinces, hospitals and universities. This review provides a framework for understanding the practice of surgery in Canada as an evolving enterprise within the context of its time.

### Results

The search yielded 36 articles con-

cerning the history of surgery in Canada; most of the papers dealt with the lives of individual surgeons.<sup>1-36</sup> Several authors attempted to deal systematically with either distinct time periods<sup>1</sup> or locations.<sup>2,3,36</sup> Other authors documented the development of specialty surgery.<sup>34,36</sup> In all, lives or vignettes of 57 surgeons are available in the *CJS*, with tantalizing glimpses of several others who are not sufficiently featured to be included in this review (Table 1,<sup>1,3</sup> Table 2,<sup>3-6</sup> Table 3<sup>7-35</sup>). Inevitably, some important individuals were missed. For example, Wilder Penfield contributed an article to the series “History of Canadian Surgery,” but no article about this important surgeon was included.<sup>21</sup> Its absence probably reflects a perception of

**Table 1**

Prominent Canadian surgeons featured in the *Canadian Journal of Surgery*; period of the French regime (1535-1759)

Name	Dates	City	Narrative
Bonnerme <sup>1</sup>	Died 1608	Habitation de Québec	Surgeon in Champlain's Québec settlement; accused, but exonerated, of participation in mutiny; died of scurvy
Adrien Duchesne <sup>3</sup>		Habitation de Québec	Surgeon of the Habitation (1618); first extant “coroner's report” (1639)
Robert Giffard <sup>1</sup>	1587-1668	Québec	Very successful surgeon and colonizer; appointed King's Physician and the colony's senior medical officer; first seigneur in Canada
René Goupil <sup>1,3</sup>	1608-1642	Québec and Huronia	A Parisian surgeon who joined the Jesuits; martyred in Huron Country; canonized (1930)
Jean Madry <sup>3</sup>		Québec	“Lieutenant in New France of the King's chief barber-surgeon” charged with starting a school for barber-surgeons
Michel de Sirsée, René Saugageau and Jean Rouxcel <sup>3</sup>		Montréal	Barber-surgeons mentioned in archives of Montréal
Jean Desmony, père et fils <sup>3</sup>		Québec	Father and son were surgeons-major of Hôtel-Dieu
Timotheé Roussel <sup>3</sup>		Québec	Surgeon-major of Hôtel-Dieu
Etienne Boucharde <sup>1</sup>	1622-1676	Montréal	Introduced first prepaid medical plan in Canada
Michel Sarrazin <sup>1,3</sup>	1659-1734	Québec	First scientist (botanist) in America; excellent surgical reputation; King's Physician
Hubert-Joseph de la Croix <sup>3</sup>		Montmagny, Que; Québec	Local surgeon influenced by Sarrazin, passed over in favour of Gauthier
Jean Francois Gauthier <sup>1,3</sup>	1708-1756	Québec	Excellent surgeon; botanical and meteorological pioneer; discovered oil of wintergreen and recommended spruce tree tea for scurvy; King's Physician
André Arnoux <sup>3</sup>	Died 1760	Québec	Surgeon-major of army in New France and friend of Montcalm who died in his house
Antoine Briault <sup>3</sup>		Québec	Doctor of medicine, surgeon-major of the Marine and of Hôpital Général 1759-1760
Philippe-Louis Badelart <sup>3</sup>	1728-1802	Québec	Military surgeon; first medical publication in North America (about <i>la Maladie de la Baie Saint Paul</i> , which he thought to be syphilis).
Jacques Dénéchaud <sup>3</sup>		Québec	Last physician from Old France in charge of Hôtel-Dieu

surgery in the age of subspecialties that was not shared by Penfield himself. There are, however, no temporal gaps in the story.

In a 1977 *CJS* article, Dr. Robert Macbeth summarized the traditional 4-period division of Canadian history: the discovery period (1497–1608), the settlement period (French regime; 1608–1763), the transition period (British regime; 1763–1867) and the modern period (Confederation; 1867–present).<sup>1</sup> He suggested landmarks by which we might modify these divisions to consider eras of surgical development in Canada. Boundaries between periods are, of necessity, blurred, but the characteristics of each era are relatively clear. The eras of discovery and settlement might be combined as surgery during the French regime, in which renaissance surgery and a fusion of European and Aboriginal empirical medicine predominated. The period of transition saw the development of medical education and licensure in Canada, commencing with the foundation of the Montréal General Hospital in 1822.<sup>2</sup> The third period began with the widespread use of

anesthesia and surgical antisepsis around 1870 and might be called the early modern surgical era. In this review, commencement of the modern surgical age is proposed to occur after World War II, in 1945. Although virtually every surgical technique used in the modern period had been invented before, it was during this age that discoveries and inventions combined with experience to promote expertise and to develop rational applications of surgical therapies. This review focuses on the first 3 periods of surgery in Canada as featured in the *CJS*.

## Discussion

### French regime 1535–1759

Surgeons were essential members of the expeditions of Jacques Cartier (1535) and Samuel de Champlain (1604). At the time of contact, Aboriginal medicine was strikingly similar to the European version — essentially the empirical application of herbal remedies. The situation for surgery was very different. European surgery was anatomically-based trauma care,

consisting mainly of incision and abscess drainage and limb amputation, whereas no system of Aboriginal surgery existed. Phlebotomy, which was still practised in Europe for various ailments, probably had Aboriginal equivalents involving incisions and poultices. No physicians accompanied the early explorers, possibly to the detriment of each expedition. Surgeons were expected to provide medical care but might not have been sufficiently skilled in the remedies of the day to have had an open mind about Aboriginal innovations.

Both Cartier and Champlain ordered their surgeons to perform autopsies in an effort to understand why so many men died during the long winter months. Although the surgeons failed to find a cure for scurvy, they did provide both Cartier and Champlain with some of the earliest descriptions of the disease. Cartier's mission was rescued by native medicine. Two sons of Donnacona, chief of the native peoples in the area of present-day Montréal, offered Cartier the local cure for scurvy — a tea made from Annedda, thought today

**Table 2**

Prominent Canadian surgeons featured in the <i>Canadian Journal of Surgery</i> : transition period (1759–1870)			
Name	Dates	City	Narrative
Adam Mabane <sup>3</sup>	Died 1791	Québec	First British surgeon in Québec, founded Québec Library Association
James Bowman <sup>3</sup>		Québec	Established a registry of patients suffering from Baie Saint Paul disease
Mervin Nooth <sup>3</sup>		Halifax; Québec	Continued investigations of Baie Saint Paul disease
John Gould <sup>3</sup>		Québec	Published, in the <i>Quebec Gazette</i> , a petition to Lord Dorchester that University medical school be established in Canada (1790)
James Fisher <sup>3</sup>		Québec	Early proponent of medical legislation; teacher of francophone physicians, Fortier and Blanchet
Francois Fortier <sup>3</sup>		Québec	First Canadian-born physician to become member of Royal College of Surgeons of England (1813)
Francois Blanchet <sup>3</sup>		Québec	First Canadian-born medical author; pioneer of medical research and education; founder of the Québec Medical Society; foundation dean of Université Laval (1854–1856)
James Douglas <sup>3</sup>	1800–1886	Québec	Taught anatomy (from 1826) and “principles and practice of surgery” (from 1837), progenitors of Québec School of Medicine (1847) and later, Université Laval (1854)
John Mackieson <sup>4,5</sup>	1795–1885	Charlottetown	Casebook provides excellent account of practising surgeon
John Rolph <sup>6</sup>	1793–1870	Toronto	Dedicated teacher; contentious politician; founder of the first medical school in Toronto (1834)
William Thomas Aikins <sup>6</sup>	1827–1897	Toronto	First professor of surgery in Toronto; North American trained; pioneering orthopedic surgeon; medical politician

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to be the white cedar tree, *Thuja occidentalis*. Many of Cartier's crew refused the medicine for fear it was a poison, and they died; those who accepted it made a rapid recovery.

History repeated itself 69 years later, when Champlain wintered on

Île Sainte Croix between present-day Maine and New Brunswick. Fifteen men died in the winter of 1604. Their graves were explored in the 1960s and their bones x-rayed. They were recently reinterred as part of the 400th anniversary celebrations.

When spring arrived in 1605, Champlain searched the coast for a new haven and for the Annedda described in Cartier's journals. The settlers were saved in Port Royal by an abundant local supply of cranberries, but scurvy struck again in 1608, killing

**Table 3**

Prominent Canadian surgeons featured in the *Canadian Journal of Surgery*; early modern period (1870–1945)

Name	Dates	Place	Narrative
George Edgeworth Fenwick <sup>7</sup>	1825–1894	Montréal	Surgical pioneer; educator; medical journalist
Louis Edouard Desjardins <sup>8</sup>	1837–1919	Montréal	Pioneer ophthalmologist
John Harrison O'Donnell <sup>9</sup>	1838–1912	Winnipeg	Surgeon; educator; politician in Red River Colony and in early Manitoba
John Stewart <sup>10</sup>	1847–1833	Halifax	Professor of surgery and dean of medicine at Dalhousie University; Officer Commanding, No.7 Field Hospital (WWI)
Abraham Groves <sup>11,12</sup>	1847–1935	Fergus, Ont.	Surgical innovator; first to use aseptic technique; entrepreneur; local politician
James Kerr <sup>13</sup>	1848–1911	Halifax; Winnipeg; Montréal; Washington	Prominent surgeon; professor of surgery at Georgetown University and George Washington University
Francis J. Shepherd <sup>14</sup>	1851–1929	Montréal	Chief, Montréal General Hospital; professor, McGill University
Irving H. Cameron <sup>15</sup>	1855–1933	Toronto	Professor of surgery, University of Toronto
George A. Kennedy <sup>16</sup>	1858–1913	Fort Walsh, Sask.; Fort Macleod, NWT	Surgeon to North West Mounted Police; pioneer prairie surgeon
George A. Peters <sup>17</sup>	1860–1907	Toronto	Innovative surgeon; professor of surgery, University of Toronto
Alexander Primrose <sup>18</sup>	1861–1944	Toronto	Distinguished Service Order (WWI); professor of surgery and dean of medicine, University of Toronto; President, American Surgical Association
John C. Webster <sup>19</sup>	1863–1950	Chicago; Shediac, NB	Professor of obstetrics and gynecology; Canadian historian
Wilfred T. Grenfell <sup>20</sup>	1865–1941	Newfoundland and Labrador out-ports	Innovative remote-area surgeon; first recipient of honorary MD from Oxford University; knighthood
Edward Archibald <sup>21</sup>	1872–1945	Montréal	First in America to perform thoracoplasty for tuberculosis; pioneer in many surgical fields; teacher; author
Frederick Marlow <sup>22</sup>	1877–1936	Toronto	Pioneer of surgery for cancer of the cervix
Benjamin-Georges Bourgeois <sup>23</sup>	1877–1943	Montréal	Leading francophone surgeon who sought to bridge the divide through alliances with Penfield and Galle
Alexander R. Munroe <sup>24</sup>	1879–1965	Edmonton	Served in No. 7 Canadian Field Hospital (WWI); professor of surgery, University of Edmonton; medical historian
Lorimer J. Austin <sup>25</sup>	1880–1945	Kingston, Ont.	British Red Cross surgeon; Commanding Officer, No.1 Field Ambulance (WWI); teacher
Harry H. Kerr <sup>13</sup>	1881–1963	Winnipeg; Washington	Assisted Harvey Cushing during WWI; professor of surgery, George Washington University
William Edward Galle <sup>26</sup>	1882–1959	Toronto	Innovative surgeon; pioneer of pediatric surgery; educational philosopher
George Elias Darby <sup>27</sup>	1889–1962	Bella Bella, BC	Dedicated surgeon, missionary and anthropologist
Amédée Marien <sup>28</sup>		Montréal	Chief surgeon, Hôtel Dieu; teacher
Armand Paré <sup>28</sup>	1889–1956	Montréal	Surgeon at Hôtel Dieu, Military Cross and la Croix de Guerre (WWI)
Norman Bethune <sup>29,32</sup>	1890–1939	Montréal; Spain; China	Pioneer of international surgery; battlefield transfusion
Frederick Banting <sup>31,32</sup>	1891–1941	Toronto	Experimental surgeon; Military Cross (WWI); Nobel Prize winner for insulin research; Order of the British Empire, Knighthood
Kenneth G. McKenzie <sup>33</sup>	1891–1963	Toronto	Neurosurgeon
Pierre Z. Rhéaume <sup>28</sup>		Montréal	Chief surgeon, Saint Luc Hospital and No. 6 Canadian Field Hospital (WWI)
Gordon Murray <sup>34</sup>	1894–1976	Toronto	First clinical application of heparin therapy; pioneer of cardiac and vascular surgery; inventor of techniques for dialysis and renal transplantation
Robert M. Janes <sup>35</sup>	1894–1964	Toronto	Proponent of the modern academic department of surgery
Merier Fauteux <sup>28</sup>	1898–1950	Montréal	Coronary artery surgery pioneer

18 people in the settlement of Québec. The surgeon Bonnerme was among the fatalities. He might have been weakened by his imprisonment on suspicion of participating in an abortive coup against Champlain. He died soon after his exoneration.<sup>1</sup>

Wilfred Caron<sup>1</sup> and Robert Macbeth<sup>3</sup> reviewed the practice of surgery during the period of settlement under the French regime. Eighteen surgeons were portrayed, along with Bonnerme (Table 1). Caron categorized them into 4 successive groups: surgeon-colonists, barber-surgeons, surgeon-scientists and military surgeons. Several contracts were made to replace Bonnerme, but all of them fell through until Adrien Duchesne arrived in the colony in 1618. He was determined to make a life in the new country and stayed during the 2-year English occupation by the Kirke brothers. His services were rewarded by a grant of land just outside Québec city. It was on this land, which he had sold to Abraham Martin, that Britain regained control of the colony a century later. A report made by Duchesne in 1639 regarding the drowning of a man in the St. Charles River is considered to be the first medicolegal report written in North America. Surgeon Robert Giffard was a successful colonizer and became Québec's first seigneur in 1634. He was well respected for his surgical and medical skills. He was given the title of "King's Physician," an unfamiliar honour in France at this time, and he became the colony's chief medical officer.

The next physician portrayed in this journal came to Canada on a different mission. Paris surgeon René Goupil joined the Jesuits and ministered to the Huron. He had hoped to provide both surgical and spiritual care, but he was rejected. In 1642, he became the first Jesuit martyr and was canonized in 1930. Surgeon Etienne Bouchard arrived in Montréal under contract to La Société Notre Dame de Montréal in 1653. He is remembered because he was the first, possibly in the world, to de-

vised a form of medical insurance. For the price of 100 *sous* per person, he agreed to care for a family for 1 year. Clearly, he had found his contract with Notre Dame to be insufficient. By 1655, Etienne Bouchard had terminated the contract and signed 24 families to his novel scheme. There were 2 other surgeons working in Montréal at the time. Macbeth believed that the competition between surgeons and Bouchard's insurance scheme, complete with its exclusion clauses, resonated remarkably with practice 3 centuries later.

The archives of Montréal contain records of several commercial deals involving barber-surgeons, usually the trade of land for a period of free shaving and phlebotomy, as required. In 1651, Jean Madry arrived in Québec armed with a certificate of qualification as a barber-surgeon. He succeeded Giffard as the chief of Hôtel-Dieu. By 1658, he had received a commission as deputy of the King's chief barber-surgeon. His task was to regulate practice and to provide education for barber-surgeons.<sup>3</sup>

Natural philosophers of the Enlightenment were greatly attracted by the New World. Michel Sarrazin and Jean Francois Gauthier were renowned scientists who combined busy surgical practices in Québec with descriptions of new discoveries. They were university educated and were members of the Royal Academy of Sciences. Their superiority as surgeons was quickly recognized. They gained the direction of Hôtel-Dieu and were honoured with the title, King's Physician. The annals of the Hôtel-Dieu contain details of operations performed by these surgeons, including a mastectomy performed by Sarrazin in 1700.<sup>1,3</sup>

Continuous warfare with Britain resulted in several military surgeons practising in Québec. Montcalm died in the house of his friend, Surgeon Arnoux. After the defeat on the Plains of Abraham, several French military surgeons remained in Québec, including Philippe Bardelart, who is remem-

bered for his report on the mysterious contagious disease that occurred sporadically in Baie Saint Paul. This 1785 report is considered the first medical publication in Canada.<sup>3</sup> In summary, surgery under the French regime in Canada progressed from its medieval roots to set the stage for its modern incarnation.

### Transition period 1759-1870

Efforts to regulate the practice of surgery and to provide local education continued during the transition period after the fall of the French regime. Eleven surgeons from this period are portrayed in the *CJS* (Table 2). French military surgeons were replaced by their English counterparts. In 1790 in the *Quebec Gazette*, surgeon John Gould published a petition to Lord Dorchester that a university medical school be established in Canada.<sup>3</sup> Canadian surgeons, most of whom were immigrants, all trained abroad. Several left detailed records of their practice, including Dr. John Mackieson of Prince Edward Island.<sup>4,5</sup> John Rolph first came to Canada in the war of 1812. Courteous treatment at the hands of his American captors might have coloured his character — in later life, he became an ardent supporter of William Lyon Mackenzie's reformers. Prior to this, he returned to Cambridge to study medicine and law. After Rolph returned to Toronto, he established the city's first medical school in 1834.<sup>5</sup> Prominent students of Rolph's included W.T. Aikins and J.H. Richardson. In writing about these students in this journal, Charles Harris outlined the internecine warfare between Toronto's three 19th-century schools of medicine, and he supplied excellent sources of a future historian wishing to complete the story.<sup>5</sup> Richardson set up a superb anatomy laboratory and might have been responsible for the success of his students, William Osler and Abraham Groves. Rolph took Aikins as a partner. Aikins became Toronto's first professor of surgery, developing an ex-

cellent reputation as a cancer and orthopedic surgeon. A description of excision of the elbow performed in the patient's home demonstrates how advanced his skills were.<sup>5</sup>

While the Toronto General Hospital continued to suffer from feuding between groups of physicians, the Montréal General Hospital (established in 1822) had become, along with the Massachusetts General Hospital, the premier teaching hospital in North America.<sup>2</sup> In Québec city, Scottish surgeon James Douglas set up a medical school in 1837. It eventually became the University of Laval in 1854, with his student Jean Blanchet as the university's first professor of surgery and its first dean of faculty.<sup>3</sup>

In 1870, Ontario became the first jurisdiction, possibly in the world, to examine candidates for licensure using anatomical specimens. Kingston professor of surgery, Michael Sullivan, was responsible for this innovation, which markedly raised the bar for qualification. Excellent teaching in Toronto, Montréal and Winnipeg met the demands of the new strict standards and set the scene for an explosion of innovative surgery that occurred in Canada after the introduction of anesthesia and of techniques to reduce surgical infection.<sup>36</sup>

#### **Early modern surgical period, 1870–1945**

Thirty surgeons from the early modern period are featured in the *CJS* (Table 3). Canada was well placed to embrace Lister's concepts of antiseptics. Stewart of Halifax,<sup>10</sup> Kerr of Winnipeg,<sup>13</sup> Archibald Malloch of Hamilton and Thomas Roddick of Montréal all had direct experience of Listerism. Even older surgeons, such as Professor Aikins of Toronto, embraced antiseptics, even though he was not above occasionally "parking" his knife in his mouth.<sup>6</sup> Abraham Groves, a student of Aikins and a classmate of Osler, independently developed the aseptic technique that

we use today.<sup>11</sup> This remarkable surgeon practised in the small town of Fergus, Ontario. Operating often in his patients' kitchens, he was the first in North America, or in Canada, to perform a series of operations, including suprapubic lithotomy, appendectomy, vaginal hysterectomy and prostaticectomy.<sup>11</sup> He used rubber gloves 5 years before Halsted to prevent transmission of infection, unlike Halsted who used gloves to lessen the irritation of carbolic antiseptic solution. His innovative tendencies were derived from a need to "make-do." He converted a local mill into a hydroelectric power station and became the first to transmit electricity between towns (Fergus to Elora). When Roentgen described x-rays, Groves bought a tube and became the first in Canada to treat cancer with x-rays. Groves was involved in several local controversies regarding grave robbing, indicating that, like his classmate Osler, he based his innovations on sound anatomic principles, learned from their master, J.H. Richardson.

The early modern period of Canadian surgery was marked by several wars. No mention of the Boer Wars is contained in the portraits published in this journal, even though it saw the birth of the Canadian Army Medical Corps. Virtually all of the able-bodied surgeons portrayed here volunteered for service in the First World War. Canadian universities each manned complete field hospitals in France with faculty volunteers. John Stewart, the professor of surgery in Halifax who led No. 7 Canadian Field Hospital, refrained from telling the King that it was his 70th birthday on the day of the King's visit to the hospital. Several surgeons were decorated, including Alexander Primrose (Distinguished Service Order), Frederick Banting (Military Cross) and Armand Paré (Military Cross and Croix de Guerre). Norman Bethune used advances in blood typing to set up the first mass blood donation campaign and battlefield transfusion unit during

the Spanish Civil War.<sup>29–32</sup> Always a controversial figure, Bethune was sufficiently driven by the Canadian pioneer spirit of making-do to invent a series of surgical instruments, such as rib shears (which were adapted from pruning shears) and the fixed retractor (nicknamed the iron intern) from a need to relieve his aching arms while he assisted Edward Archibald. Bethune died from septicemia caused by an injury received while operating in the service of Mao's Chinese army. The Second World War is rarely mentioned in the "History of Canadian Surgery" series, likely because it was a relatively recent event. Unfortunately, the deficit has not yet been remedied.

Systematic surgical research was developed during the early modern Period. The case report approach to medical innovation that characterized the late 19th century was dramatically replaced by Banting and Best's surgical experiments, which led to the development of insulin. The frenzy that followed the discovery and the honours, which included a knighthood and the Nobel Prize, undoubtedly inspired others. WWI veteran Gordon Murray was approached by Charles Best to join the team that developed heparin. Using surgical models, Murray demonstrated heparin's ability to prevent clotting in tubes and in transplants. These observations and a wonderful talent for surgery permitted Murray to pioneer closed cardiac surgery, peripheral vascular surgery and thrombosis-embolism therapy and to invent techniques for dialysis and transplantation.<sup>34</sup> Several surgeons chose to meet the challenges of providing modern care in remote areas, including George Elias Darby in Bella Bella, British Columbia,<sup>27</sup> and Wilfred Grenfell in the out-ports of Newfoundland and Labrador.<sup>20</sup> With Norman Bethune, these surgeons might be considered forerunners of the modern global or international surgery movement.

This period of Canadian surgery is

notable for the progress made by innovative surgeons working as individuals. Isolation acted as a stimulus for these exceptional surgeons; however, the groundwork was laid for the development of academic departments of surgery that came to predominate in the current period. Portraits of surgeons in the *CJS* include successive professors of surgery in Toronto, including Aikins,<sup>6</sup> Peters,<sup>17</sup> Cameron,<sup>15</sup> Gallie<sup>26</sup> and Janes.<sup>35</sup> Aikins and Peters inspired their students through sheer skill, while Gallie enjoyed father-like devotion due to his unwavering loyalty to colleagues and students. Cameron and Janes controlled their departments by imposing discipline and respect. The tug-of-war between personal freedom and corporate responsibility came to head with a dispute between Janes and his most gifted surgeon, Gordon Murray. As a result, Canada failed to exploit Murray's success in a way that American institutions might have. It did, however, set the scene for the growth of disciplined academic surgery that became the hallmark of the Canadian school of surgery.

The papers quoted in this article and other materials related to the history of Canadian surgery have been collected at [www.historyofsurgery.ca](http://www.historyofsurgery.ca), where they will be openly available for further study.

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