

The Proceedings of the 19th Annual History of Medicine Days Conference 2010

The Proceedings of the 19th Annual History
of Medicine Days Conference 2010:
The University of Calgary Faculty of Medicine,
Alberta, Canada

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The Proceedings of the 19th Annual History of Medicine Days Conference 2010:
The University of Calgary Faculty of Medicine, Alberta, Canada,
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Leslie Baker.....	University of Saskatchewan
Allison Barr	University of Alberta
Brydon Blacklaws	Dalhousie University
Curtis Budden.....	Memorial University of Newfoundland & Labrador
Anna Davies	Memorial University of Newfoundland & Labrador
Riana Downs	University of Calgary
Caitlin Dyer	McMaster University
Adam Fowler.....	University of Saskatchewan
Holly Ann Garnett	Nipissing University
Shaina Goudie.....	Memorial University of Newfoundland & Labrador
Christiane Grieb.....	University of Calgary
David Zhifei Han	University of Manitoba
David Harnett	Memorial University of Newfoundland & Labrador
Charles Ho.....	University of Western Ontario
Sanjna Miriam John.....	Queen's University
Ashley Kim.....	University of Western Ontario
Esther Kim.....	University of Calgary
Erin Knight	University of Manitoba
Jacinda Larson	University of Calgary
Clinton Lewis	University of Calgary
Angelique Myles	Memorial University of Newfoundland & Labrador
Matthew Mossey	University of Saskatchewan
Vanessa Nelson	University of Calgary
Chris Noss	Queen's University
Boluwaji Ogunyemi.....	Memorial University of Newfoundland & Labrador
Tyler Peikes.....	University of Manitoba
Ian Pereira.....	University of Western Ontario
Stephen Pow	University of Calgary
John Doan Ali Qazalbash	Queen's University
Lucas Richert.....	University of London
Charlene Ronquillo.....	University of British Columbia at Vancouver
Amy Samson	University of Saskatchewan

Tashia Scott	Oxford Brookes University
Carly Scramstad.....	University of Manitoba
Davinder Singh.....	University of Manitoba
Christopher Anthony Smith.....	Memorial University
Heather Stanley	University of Saskatchewan
Helen Vradelis	McGill University
Andrew Weiss	University of Calgary
Jacqueline Willinsky	Queen's University

PREFACE AND ACKNOWLEDGEMENTS

This book is the second volume in a new, peer-reviewed series of Proceedings Volumes from the Calgary History of Medicine Days conferences with Cambridge Scholars Publishing. The History of Medicine Days are two-day Nation-wide conferences held annually each spring at the University of Calgary in Alberta (Canada), where undergraduate and early graduate students from across Canada, the United States, United Kingdom and Europe give paper and poster presentations on a wide variety of topics from the history of medicine and health care. The selected 2010 conference papers, which are assembled in this volume, particularly comprise Applications of Science to Medicine, the History of Nursing, and essays on the History of Public Health along with topics from Illness and Disease in History. Further content areas such as Stigma and Gender and the History of Neurological Theory, include papers with interdisciplinary perspectives on history, such as anthropology and medicine, from two extended summer research projects from a medical student (Chris Noss, Queens) and a health sciences student (Riana Downs, Calgary), as well as from four history graduate students, Allison Barr (Edmonton), Caitlin Dyer (McMaster), Holly Garnett (Nipissing), and Tashia Scott (Oxford-Brookes) from the United Kingdom.

Professor Geertje Boschma, a renowned nursing and public health historian at the University of British Columbia at Vancouver (UBC) and past President of the Canadian Association for the History of Nursing, gave the 2010 keynote address at the conference. Her topic “From a Family and Community Point of View: Rethinking Institutional Mental Health Care in Alberta, 1905-1975” was based principally on an earlier article published in the *Canadian Bulletin of Medical History* (CBMH).¹ With the permission of the author and editors-in-chief of *CBMH*, this article appears as a full reprint in this volume, to represent the 2010 keynote address. In 2010, the invited keynote lecture was given as a co-sponsored event together with the Calgary Institute for Population and Public Health (CIPPH) and the Calgary History of Medicine Society (CHOMS), for which the organizers of this event had been very grateful.

¹ Geertje Boschma, “A Family Point of View: Negotiating Asylum Care in Alberta, 1905-1930,” *Canadian Bulletin of Medical History* 25 (2008): 367-389.

This volume also includes the abstracts of all 2010 conference presentations and has further been illustrated with diagrams and images pertaining to the various topics from the history of medicine as they are assembled here.

The development and fruition of this series, as in the past, has depended strongly also on the editorial and review involvement as well as the volunteering work of the eight advisors to the editors as well. Very unfortunately and sadly, however, during the production process to these 19th HMDs Proceedings, a very important member of the advisory board passed away after a short but serious period of illness. Dr. Margaret (“Maggie”) J. Osler (1942-2010) was a Full Professor in the Department of History and an Adjunct Professor in the Department of Philosophy at the University of Calgary, as well as an Adjunct Professor in the Department of History and Classics at the University of Alberta. She was sixty-seven years old when she passed away on September 15, 2010, and for everyone in her vicinity her passing came all too soon.

The tragedy of her death, of a leading historian of the ‘Scientific Revolution’ and the relationship of ‘Science and Religion,’ has been a great loss to the local community in the History and Philosophy of Science at the University of Calgary, as well as for the work with the HMDs Proceedings series. Her erudite and stimulating work counts among the best of scholarship in her field, seeing that it had evolved and continued to explore the works of I. Bernard Cohen (1914-2003) and Thomas S. Kuhn (1922-1996). Both had eroded the fundamental assumptions of a history-of-ideas-style historiography of science and medicine in the vein of Russian-French philosopher and historian of science, Alexandre Koyré (1892-1964). Moving the picture of the scientific revolution further towards illuminating the underlying irrational, metaphysical and even mystical presuppositions that ground the Renaissance and the Early Modern Period in non-negligible forms, Maggie Osler’s publications represent a most important step with regard to the bigger picture of the advancement of science. She was a highly productive scholar and effective teacher, and will be remembered by her colleagues and students as such.

Born December 1942 in New York, Osler attended Swarthmore College in Pennsylvania where she received her B.A. degree in Philosophy in 1963. She then moved to Indiana University for her graduate studies where she earned her M.A. degree in History and Philosophy of Science in 1966—during the turmoil of the Civil Rights Era. In the midst of the enthusiastic learning environment fostered by the faculty and graduate students at Bloomington, Osler perfected her historical skills. Amongst many future student generations she would become known for her broad

understanding of scientific content and social context. Probably the most decisive period was marked by her PhD work entitled *John Locke and Some Philosophical Problems in the Science of Boyle and Newton* with the late historian of science Richard S. Westfall (1924-1996).

In an almost seamless transition, after receiving her PhD, Maggie assumed a position in History and Philosophy of Science at Oregon State University. Quite determined, she drove to the other side of the continent with her car filled with just the necessary boxes of clothing and books. In 1970, she then acquired a continuing position in History at Harvey Mudd College, California, and has since had her primary affiliation with departments of history at Wake Forest University, North Carolina (1974-1975) and the University of Calgary (1975-2010). For thirty-five years she stayed there, rising through the ranks of Assistant to Full Professor. She also assumed an Adjunct Professorship in the Philosophy Department (1998) and in History and Classics at the University of Alberta (2002).

Over the many decades of service to the University of Calgary, Osler taught countless undergraduate students from very diverse fields. She is remembered as a generous preceptor to undergraduates and also a demanding supervisor to the graduate students, both in her home department as well as in other university settings. Quite a number of her supervisees continued on at other colleges and became academic teachers in History, Philosophy and History and Philosophy of Science programs. Counted among her most outstanding local contributions are the launch of the History and Philosophy of Science Program and the Program for Science, Technology and Society at the University of Calgary; she took great pride in these, and we must hope that this institution continues their support in the future. Her research particularly comprised the history of the scientific revolution, such as: magic, science and religion; science in the 17th century and the mechanical philosophy from the 17th to the early 19th century. In addition to her book *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (1994),² she published as co-editor (with John Hedley Brooke) a themed-issue on *Science in Theistic Contexts in Osiris* (2001).³ As a single editor, she produced *Rethinking the Scientific Revolution*

² Margaret J. Osler, *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingency and Necessity in the Created World* (Cambridge: Cambridge University Press, 1994).

³ John Hedley Brooke, Margaret J. Osler, and Jitse M. van der Meer (eds.), *Science in Theistic Contexts: Cognitive Dimensions*, vol. 16 *Osiris* (Chicago: University of Chicago Press, 2001).

(2000),⁴ and recently another monograph with Johns Hopkins University Press: *Reconfiguring the World: Nature, God, and Human Understanding from the Middle Ages to Early Modern Europe* (2010).⁵ This book has been printed in Baltimore, Maryland, the city of her childhood that she had loved so much.

Amongst her many other distinctions, Osler received the Science and Religion Course Prize from the Center for Theology and the Natural Sciences at the University of Berkeley (1999), was invited to give the Stillman Drake Lecture of the Canadian Society for the History and Philosophy of Science (1996), and the Richard S. Westfall Lecture at Indiana University (1999). She served as the Secretary and a Member of the Council for the History of Science Society (HSS), as well as on the advisory boards of *Isis*, the *Journal of the History of Philosophy and Science and Religion around the World* (eds. John Hedley Brooke & Ronald L. Numbers). She joined HSS early in her career and became a member of the British Society for the History of Science, the Canadian Society for the History and Philosophy of Science, the International Society for Science and Religion, and the American Society for Eighteenth-Century Studies. Her numerous scholarly involvements in societies, programs and institutions throughout North America and Europe demonstrate deep engagement in her field and a great capacity to make scholarly friends worldwide. In recent years, Osler was also closely involved with an early modern philosophy group at the Dipartimento di Filosofia dell'Università di Lecce. Upon her return to Calgary, she frequently spoke of the warm and studious atmosphere in Italy. In the middle of the many plans that Professor Osler had was the idea to bring more international scholars to the University of Calgary, and see a comprehensive graduate program emerge in the History and Philosophy of Science, Medicine and Technology. In concord with her local colleagues and friends, we hope that these plans will rise to life in future decades.⁶ During the month after her death, the idea has emerged in the University of Calgary Department of History to create an endowed undergraduate scholarship in support of a student in European History and the History of Science in honour of her name and lasting contributions to the History and

⁴ Margaret J. Osler (ed.), *Rethinking the Scientific Revolution* (Cambridge: Cambridge University Press, 2000).

⁵ Margaret J. Osler, *Reconfiguring the World: Nature, God, and Human Understanding from Middle Ages to Early Modern Europe* (Baltimore: Johns Hopkins University Press, 2010).

⁶ Cf. Frank W. Stahnisch, "Professor Margaret J. Osler (1942-2010)," *The British Journal for the History of Science* 44 (2011): 115-118.

Philosophy of Science community in Calgary. It is with great coincidence and pleasure that the work of Dr. Osler's last supervised student was published in the previous edition of this volume, *The Proceedings of the 18th Annual History of Medicine Days Conference, 2009* (2012). Lina Roa, an undergraduate student from the Bachelor of Health Sciences Program, who has gone on to pursue her medical studies at McGill University in Montreal, researched an historical topic on William Harvey (1578-1657) and produced a paper that she contributed to this 2010 volume (published in 2012), entitled "Aristotle's Influence on Harvey's Discovery of the Circulation of the Blood.

In the current Proceedings Volume (from the 2010 conference), the abstracts from all presenters at the conference are included in a special Appendix, so as to comprehensively document the activities, discussions, oral and poster presentations at the Calgary History of Medicine Days. This year, 41 students from thirteen universities—University of Saskatchewan, Queen's University, University of Alberta, Memorial University of Newfoundland, University of Calgary, University of Western Ontario, Dalhousie University, McMaster's University, University of Manitoba, University of British Columbia, McGill University, University of London, and Oxford Brookes University—gave oral or poster presentations during the two-day event held on March 12-13, 2010. We are very grateful that following to the peer review process the number of 10 manuscript contributions could be included in this volume.⁷ Throughout the 2010 conference, research enthusiasm, oratory and A/V competence of the speakers were of a very high quality. The conference audience was not only magnificently entertained, but the local and national delegates contributed to a highly stimulating and engaging discussion throughout the whole event.

The proceedings editors are grateful to all participants for their active contributions and support, which helped to make this academic conference a great success. Both the publication of the Proceedings Volumes and the organization of the Calgary History of Medicine Days would not have been possible without the continued substantial financial support from Associated Medical Services in Toronto and the Alberta Medical Foundation in Edmonton.

⁷ All of the contributions in these proceedings, for which the volume editors have received explicit *Copyright Transfer Forms* and *Author Consent Forms*, will also be made available online through the University of Calgary Internet Repository *dSpace*: History of Medicine Days Community Homepage: <https://dspace.ucalgary.ca/handle/1880/47439>.

In addition, we want to thank Vitaid Ltd. for their donation to the conference, the Calgary Institute for Population and Public Health, and the Faculty of Medicine at the University of Calgary for their continued support. We also extend our warm thanks to Beth Cusitar for her important additional editorial help before the manuscript was finalized.

Frank W. Stahnisch
Lisa Petermann
Kelsey Lucyk

(University of Calgary, November 13, 2012)

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APPLICATIONS OF SCIENCE TO MEDICINE

A POISONED SLEEP: HOW CURARE REVOLUTIONIZED ANESTHESIOLOGY

ESTHER KIM

SUMMARY: The discovery of modern anesthetics in the 1840's revolutionized surgery and gave birth to the new specialty of anesthesiology. The single greatest advancement in the specialty since its beginnings is the introduction of muscle relaxants. The first important muscle relaxant used as an adjuvant to anesthesia was curare. It was first used by Canadian anesthesiologist Dr. Harold Randall Griffith (1894-1985) and his resident in anesthesiology, Enid Johnson Macleod (1909-2001), on January 23, 1942 in Montreal, Quebec. Dr. Griffith's experiment was especially interesting and controversial because he applied a substance that had up until that time been considered a poison. Curare was used by the indigenous people of South America as a deadly arrow poison for centuries before it was first encountered by European explorers to the Americas starting in the 1500's. Although curare initially assumed a notorious reputation for its deadliness, its application to anesthesia gave it a more noble purpose. As a muscle relaxant, curare helped to reduce the amount of anesthetic needed for procedures, and it rendered patients immobile, making them easier to operate on.

Curare was the first in a long line of muscle relaxants that revolutionized anesthesiology and led to improvements in surgery and decreases in surgical mortality. However, along with the benefits, physicians soon discovered some negative side effects of muscle relaxants that continue to be an issue today. Such disadvantages of muscle relaxants include allergic reactions to the drugs and an increased risk of anesthesia awareness in the patients, as well as a traumatic state where a patient is awake during the procedure but cannot communicate this fact to the medical staff due to paralysis. This paper explores the history behind the discovery of curare, and it also traces the development of anesthesiology from its origins until today, while maintaining a focus on the impact of curare and other muscle relaxants on this particular specialty discipline in medicine.

KEYWORDS: Anesthesiology; Anesthesia; Anesthetics; Curare; Muscle Relaxant; Harold Griffith; Anesthesia Awareness

PRECEPTOR: Dr. Frank W. Stahnisch
INSTITUTION: University of Calgary

Introduction

In today's era of painless and everyday medical procedures, anesthesia during surgery is often taken for granted. However, modern anesthetics have only been used for a little under two centuries. Prior to their discovery in the 1840's, surgery was a tortuous ordeal for both patients and surgeons. Sir Benjamin Ward Richardson (1826-1896), a prominent British physician from the nineteenth century, once described surgery without anesthesia by saying,

I have heard many [patients] express that if they had known beforehand what the suffering was, and the effects subsequently endured, they would rather have faced death than such a fearful struggle for continued existence.”¹

Surgery was done quickly and only as a last resort. The mark of a good surgeon in those times was the ability to complete the procedure as swiftly as possible. British physician Sir Thomas Clifford Allbutt (1836-1925) recalled that during his childhood, “He was the best surgeon, both for a patient and onlooker, who broke the three-minute record in an amputation or a lithotomy.”²

Everything changed with the advent of modern anesthetics in the mid-nineteenth century. The anesthetic properties of the first three inhalant anesthetics, nitrous oxide, ether and chloroform, were discovered during this time. Nitrous oxide was first used in 1844 as a dental anesthetic in Hartford, Connecticut. A local dentist named Horace Wells (1815-1848) had nitrous oxide administered to him when he underwent a tooth extraction. He was so pleased with the painless procedure that after he had recovered from the anesthetic, he proclaimed “a new era in tooth-pulling!”³

Ether soon followed nitrous oxide with the first public demonstration in Boston, Massachusetts in 1846 by William Thomas Green Morton (1819-1868). The story of ether is shrouded in controversy. Three other individuals, Horace Wells, Crawford Williamson Long (1815-1878), and Charles Thomas Jackson (1805-1880) also claimed the credit for this discovery. Long, a physician from Georgia, had privately used ether in a surgical excision several years before Morton in 1842, but he did not

¹ Victor Robinson, *Victory Over Pain: A History of Anesthesia* (New York: Henry Schuman, 1946), 78.

² *Ibid.*, 79.

³ Geoffrey B. Rushman, Nicholas J.H. Davies, and Richard Stewart Atkinson, *A Short History of Anaesthesia* (Oxford: Butterworth-Heinemann, 1996), 10.

publish his results until 1849 after Morton had already convinced the world of ether's usefulness. Jackson was a chemist and geologist who taught Morton and gave him chemical advice during Morton's initial experiments with ether. This later led to disputes between the two men regarding who deserved credit for the introduction of ether.⁴ Wells had also been a teacher to Morton at one time, and they ran a dental practice together briefly. Wells always believed that he should be credited with the discovery of anesthesia, since he used nitrous oxide before Morton used ether, and he also claimed to have used ether for anesthesia first.⁵ Interestingly, all four men met tragic fates and did not obtain much benefit, financial or otherwise, for the discovery of ether.

The third anesthetic, chloroform, was introduced in 1847 by Scottish obstetrician James Young Simpson (1811-1870). Simpson greatly advocated chloroform for use in obstetrics. His work was controversial at the time, because religious institutions claimed that women were ordained by God to experience pain during childbirth. To provide relief from pain would be to go against God's will. Simpson countered this argument with his own religious beliefs and theological reasoning. He said, for example, that in the Bible in the book of Genesis, "God caused a deep sleep to fall upon Adam, and he slept: and he took one of his ribs, and closed up the flesh instead thereof." Thus, Simpson claimed that God was the first anesthetist, so therefore the deliverance of pain for mothers in labour could not be morally wrong.⁶ Later, the arguments against using anesthetics in childbirth were laid to rest when Queen Victoria of England (1819-1901) used chloroform during the births of two of her children.

These initial three inhalant anesthetics forever changed surgery into a safer and more effective practice. They paved the way for other better anesthetics to follow, and they led to the birth of the specialty of anesthesiology.

Anaesthesiology's Early Days

In its early years, anesthesiology was far from being an exact science. Nitrous oxide, ether and chloroform were all administered by inhalation, and the manner in which they were given was also not pharmacologically standardized. Practitioners would dab some liquid anesthetic onto a

⁴ *Ibid.*, 14.

⁵ Robinson, *Victory Over Pain*, 105.

⁶ *Ibid.*, 204.

handkerchief and hold it over the patient's nose so that the patient would breathe in the fumes and be rendered unconscious. Due to the inexact nature of this method, however, terrible side effects and even death could result in such medical settings, if a practitioner happened to administer a dose incorrectly.⁷

The first physician to specialize in anesthesiology was English physician Dr. John Snow (1813-1858). He likewise was the first to standardize the use of the anesthetic substances and calculate exact doses that were required for safe and effective anesthesia. Snow thus emerged as one of England's leading anesthesiologists in the late 1840's and 1850's, a position which found him administering chloroform to Queen Victoria at the birth of her son Prince Leopold (1853-1884) on April 7, 1853 and her daughter Princess Beatrice (1857-1944) on April 14, 1857. These medical treatments forever settled the controversy over whether obstetrical anesthesia was morally acceptable in Victorian society. Dr. Snow was a remarkable man who made great advancements in two budding specialties. In addition to laying the foundations of anesthesiology, Snow also carried out extensive research into the cholera epidemics of the time, and he established epidemiologically that cholera was transmitted through contaminated water. Snow's work with cholera sparked the development of the early field of social medicine (public health) and medical epidemiology.⁸

Snow's research in anesthesiology mainly focused on how anesthetics affect the body and how to administer them safely and effectively. He was also very interested in why chloroform caused death and how this could be prevented. In his last book *On Chloroform and Other Anaesthetics*, which was published posthumously in 1858, Snow described all of the fatal cases involving chloroform that had been documented up until then. He thereby noted that in most cases, "death took place by cardiac syncope, or arrest of the action of the heart," while in the rest of the cases; death was attributable to respiratory arrest.⁹ Snow's careful research in calculating safe doses of anesthetics proved to be invaluable to improving patient safety under anesthesia. Snow also wrote numerous casebooks in which he

⁷ Rushman, Davies, and Atkinson, *A Short History of Anaesthesia*, 20.

⁸ David A. E. Shephard, *John Snow: Anesthetist to a Queen and Epidemiologist to a Nation* (Cornwall, Canada: York Point Publishing, 1995), 10.

⁹ John Snow, *On Chloroform and Other Anaesthetics: Their Action and Administration* (Tokyo: Iwanami Book Service Center, 1997; original edition London: John Churchill, New Burlington Street, 1858), 217.

meticulously recorded all the details of every anesthetic administration that he oversaw. He left a legacy emphasizing the importance of pharmacological standardization and patient safety which many anesthesiologists after him would follow. Dr. Victor Robinson (1866-1947), a physician and medical journalist, eloquently summarized Snow's anesthetic accomplishments when he wrote, "It is justly said of him [John Snow] that he made the art of anesthesia a science."¹⁰

Chloroform and ether remained the mainstays of anesthesia for decades after John Snow's era. Despite the fact that very few new anesthetic agents were discovered for a time, much progress was made during the early twentieth century in the more technical areas of the specialty. Anesthesiologists became more skilled at controlling patients' respiration during surgery by using endotracheal intubation and ventilator machines in intensive care units and operation theatres. Some new agents were also discovered during this time. Ethylene and cyclopropane gradually became more popular than the older drugs due to better safety profiles.¹¹ By the 1940's anesthesiology had come a long way from its origins in the previous century.

Despite anesthesiology's positive impact on surgery and its progress in the early twentieth century, using anesthetics during operations was still not without its problems. Although patients would be unconscious and free from pain during procedures, their muscles would continue to twitch and move involuntarily, creating many difficulties for surgeons performing delicate operations such as abdominal and thoracic procedures. The only way to induce muscle paralysis at the time was to increase the concentration of the anesthetics administered, but this had negative effects on patient safety, since at high doses the inhalant anesthetics could become cardiac as well as respiratory depressants.¹² Even at high doses of the anesthetic, an adequate level of muscle relaxation could not always be achieved for the more delicate procedures. This is where a notorious poison called curare made its mark on medicine through a Canadian anesthesiologist, Dr. Harold Randall Griffith (1894-1985). Griffith was the first to successfully use curare in anesthesia, which he did in Montreal in 1942. This display of medical and scientific ingenuity revolutionized the practice of

¹⁰ Robinson, *Victory Over Pain*, 219.

¹¹ Richard Bodman and Deirdre Gillies, *Harold Griffith: The Evolution of Modern Anaesthesia* (Toronto: Hannah Institute & Dundurn Press, 1992), 10.

¹² Archibald Ross McIntyre, *Curare: Its History, Nature, and Clinical Use* (Chicago: The University of Chicago Press, 1947), 193.

anesthesiology, and in fact many historians, such as Dr. J. Earl Wynands (b. 1930?) of the Canadian Anesthesiologists Society, divide the history of the specialty into “before and after Griffith.”¹³ To gain an appreciation for the significance of Griffith’s contribution to anesthesiology and surgery, one first needs to understand the history of curare a bit better, along with the events leading up to Griffith’s landmark experiment.

Curare’s Background and History

Curare is a poison grown from several different plants in the jungles of Central and South America. It has been known to the native peoples of these areas for centuries as an arrow poison, which they used to hunt and kill their prey and enemies. The word curare actually does not describe one specific compound, but it is a term used by the natives to designate a varied group of arrow poisons. These include extracts from the vine-like plants *Strychnos toxifera* and *Chondodendron tomentosum*.¹⁴ Curare can be prepared by combining young bark of curare-vine with crushed roots and stems and mixing them with snake venom. The principle chemicals in curare are the alkaloids curarine and tubocurarine.¹⁵

The first documented European contact with the poison occurred in 1595 during English explorer Sir Walter Raleigh’s (1552-1618) expedition to the Orinoco River in the Amazon. Raleigh later wrote a book in 1596 called *Discovery of the Large, Rich, and Beautiful Empire of Guiana* where he detailed his experiences in the Amazon region.¹⁶ European explorers quickly learned that a mere scratch with a poisoned arrow could kill a person within minutes by paralyzing all of their muscles, most importantly the muscles of respiration. The cruelest thing about the poison – since the times of its discovery – was that victims remained completely conscious during the phase of agony, as they died from respiratory paralysis, since curare does not cross the blood-brain barrier.¹⁷

¹³ J. Earl Wynands, “Anesthesia Greats: Harold Randall Griffith,” *Canadian Anesthesiologists’ Society* (June 1998): <http://www.cas.ca/>. (Accessed December 31, 2009).

¹⁴ Cf. Frank W. Stahnisch, *Ideas in Action. Der Funktionsbegriff und seine methodologische Rolle im Forschungsprogramm des Experimentalphysiologen François Magendie (1783-1855)* (Muenster: LIT Press, 2003), 158-215.

¹⁵ Charles Czarnowski, “Curare and a Canadian Connection,” *Canadian Family Physician* 53 (September 2007): 1531.

¹⁶ McIntyre, “Curare: Its History, Nature, and Clinical Use,” 13.

¹⁷ Czarnowski, *Curare and a Canadian Connection*, 1531.