

# **The Birth and Evolution of Trauma Systems in the 20<sup>th</sup> Century: from World War I to the Nova Scotia Experience**

By

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One hundred years ago, the world witnessed casualty numbers of epic proportions during The Great War. Out of necessity, a coordinated casualty evacuation chain was developed to improve trauma care. This analysis will focus on key developments of systems of casualty care in WWI and how they have been applied to a modern regionalized trauma system, introduced to the province of Nova Scotia in 1994.

In the early years of WWI, the massive numbers of casualties forced the medical response to be redesigned. The first day of the "Battle of the Somme" (July 1, 2016) produced nearly 60,000 casualties, of whom 30% died. The casualty evacuation chain at the time was greatly overwhelmed. As a result, a comprehensive and coordinated transportation network evolved to evacuate injured soldiers from the medical stations in the trenches (regimental aid posts) to more distant receiving mobile hospitals (casualty clearing stations). Sorting or 'triage' methods, advanced operating stations, and transportation networks were developed to optimize care, resources, treatment time, and to return more soldiers to the front. The evolution of the battlefield casualty care that took place in WW1 is reflected in the modern trauma systems of today.

Twenty years ago, in 1994, the Nova Scotia Legislature passed the "Emergency Health Services (EHS) Act", which included the design of a province-wide trauma system. Building first on the casualty care experience gained in WWI and other wars of the 20<sup>th</sup> century, civilian regionalized systems were designed in the United States offering a comprehensive and coordinated. approach to optimize casualty care, resources, and treatment time. This presentation will highlight key advances and lessons learned 100 years ago in WWI and how they have been adapted to construct a model modern 21<sup>st</sup> century trauma system in the province of Nova Scotia.

# **The Rise of Nuclear Medicine: Ernest Rutherford and World War I**

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From diagnosis to treatment of disease, nuclear medicine has revolutionized the care and health of individuals around the world. Although now thoroughly established, the field of nuclear medicine has emerged from rather humble and mysterious beginnings.

Antoine-Henri Becquerel's 1896 observations of uranium identified for the first time radioactivity. In 1898, the young physicist Ernest Rutherford established a laboratory at McGill to explore this new field. A prominent career ensued that saw Rutherford significantly advance knowledge of radioactivity and for which he received the 1908 Noble Prize in Chemistry. However, arguably Rutherford's greatest achievement would arise from a simple experiment nearly a decade later.

World War I plunged nations everywhere into a conflict unlike any other. Manpower and resources were depleted, leading to the slowing of advances in fields such as radioactivity. However, shortly before World War I, Rutherford's student Ernest Marsden had begun an experiment in advance of serving in the war. Rutherford, although occupied with wartime research, sporadically continued this experiment which inexplicably produced hydrogen in the presence of radioactivity. Further experimentation revealed that nitrogen in air was absorbing radioactivity and disintegrating into this other element. Thus in 1919, radioactivity, a field previously dominated by observation of radiations, was now set on a path of experimentation. Transmutation, a process where elements could be created and destroyed and had been predicted and sought for centuries, was finally realized through this work.

Rutherford's results in 1919 quickly exploded into the production of novel radioactive elements. Uses were found for these elements such as tracers that could detail biological functions and diagnose diseases. Furthermore, the terrible effects of radiation exposure were harnessed for treatment, in particular of cancers. Rutherford's simple experiment and unexpected results during World War I opened the way to undreamt possibilities that cemented the foundations of modern nuclear medicine.

**Oral Presentation Preferred**

# **Over the Top or Not; the Ethical Dilemma of Wartime Triage**

**By**

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Preceptor: Ronald D. Stewart, M.D.

Front-line physicians during The Great War faced overwhelming casualties with limited resources. The order in which casualties received medical attention and treatment, or not at all, was decided under strict military regulation. The “walking wounded” were given a higher priority than those more gravely wounded, the goal being to return them to the front as quickly as possible. Contrary to current military triage protocol, this utilitarian approach to treatment was the accepted paradigm.

Front-line physicians during World War I were constrained in their clinical and ethical decisions by strict military code. The strategic mission at any particular time could influence the objective of a medical officer. The loss of a physician’s autonomy allowed for standardized care and objective triage based on physical injuries.

In addition to the unfathomable physical injuries sustained by military personnel throughout the War, this period saw the emergence and drastic influence of severe psychological trauma among casualties on both sides. Early in the War, British soldiers on the Western Front began to refer to an unknown and debilitating condition they collectively termed “Shell Shock”. While the underlying etiology of the condition was debated among psychologists, a more practical debate occurred among military physicians in the casualty clearing stations. This bizarre constellation of signs and symptoms did not fit into the front-line triage spectrum, which was entirely based entirely around assessment of physical wounds. Physicians were challenged intellectually and ethically in regards to triage and treatment of this completely unknown ailment. The triage requirements of maintaining a fighting force amid the horrors of trench warfare compounded the ethical dilemma physicians faced with the emergence of psychologically debilitated soldiers. Improvements in casualty management over the past century have eased the ethical challenge to triage decisions for 21<sup>st</sup> century front-line physicians.

# **Blood will have blood: Lawrence Bruce Robertson's campaign for blood transfusion in the Great War**

By

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Preceptor: Judith Tulloch

In 1818, British obstetrician James Blundell began replacing blood lost during post-partum hemorrhage with human blood, thus beginning the modern era of blood transfusion. During the ensuing 50 years, blood transfusions were used regularly in cases of extensive blood loss. Difficulties with the procedure, however, were abundant, prompting physiologists and surgeons to search for an alternative to human blood. The result was the use of saline solution as an alternative to blood as a transfusion fluid in the 1880s.

Saline infusion also became widespread in America, although its popularity was short-lived. American surgeon George Washington Crile revived American interest in human blood transfusion in the 1890s after arriving at different physiological conclusions from his British counterparts. Despite Crile's work and contemporaneous scientific advances which alleviated some of the difficulties of blood transfusion, British surgeons and physiologists remained enamored with saline as an alternative to human blood.

Finally, during the First World War, Canadian surgeon Major Lawrence Bruce Robertson, brought about a return to human blood transfusion within the British military system through direct demonstrations of the efficacy of blood transfusion and academic publications in British medical journals. The conversion back to blood transfusion saved thousands of lives over the course of the war and also laid the foundation for further American advances upon their entry into the war in 1917. This presentation will analyze why and how Robertson was able to convert British medicine from saline infusion to blood transfusion during World War I. His success, however, was not the result of simply "being in the right place at the right time", as illustrated by the stories of two British physiologists, Edward Schaefer and Ernest Starling who seemed to be poised to effect a return to blood transfusion in Britain prior to the war.

# **Life-Saving Medicine: The Transition from the “Dying Tent” Into the “Resuscitation Ward” As Technical Advancements Proceeded Since World War I**

By

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Preceptor: Dr. Ronald Stewart, OC, MD, FRCPC, DSc

During World War I (WWI), the use of medical tents near the battle front was responsible for saving the lives of many wounded soldiers in part by shortening the travel time needed to reach a hospital and thereby allowing for medical treatment to be initiated sooner. Despite this benefit, medical tools, equipment, treatment techniques, and medications were limited leading to varying survival outcomes. As a result, these establishments were often viewed as a “dying tent” rather than a “resuscitation ward.”

Over the last 100 years, there have been numerous technological and medical advances including the use of splints, introduction of blood transfusions, development of new wound treatment methods, and the implementation of motorized transport to carry persons to and from the battlefield. Indeed, the mortality rate due to femur fractures in one British camp during WWI decreased from 80% to 20% once the action of immediately immobilizing this bone using a splint became standard practice.

These advancements significantly improved the survival outcomes and wellbeing of wounded soldiers, despite the fact that more severe injuries were being sustained as a result of increasingly sophisticated weapons and ammunition being used. In addition, the average ward stay became shorter which helped to solve the overflow problem where the sheer number of wounded soldiers needing medical attention was often overwhelming. Such numbers resulted in prioritizing treatment to those with critical but less complicated wounds over those with more time-consuming medical needs.

Using a combination of scientific journal articles, historical memoirs, and first-hand accounts, this presentation will highlight some of the key medical advancements that helped transform the “dying tent” into a “resuscitation ward.” In particular, it will attempt to highlight Canadian involvement be they soldiers or medical personnel where possible.

**Poster presentation preferred.**

# **Medicine at a Time of Louisbourg: Cultural Influences on Colonial Medicine**

By

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Preceptor: Dr. Ron Stewart, M.D.

In Europe in the early 1700s, surgery and medicine were considered separate professions. The scientific method, at the time being applied to chemistry and physics, was not used initially in medicine. Major advances in military combat medicine led to changes in civilian medicine in areas such as trauma, surgery, and prosthetics, as well as system practices such as the establishment of neutral territory between battle lines and the use of ambulances to carry wounded soldiers to behind the lines for treatment. Non-military advancements were also made, such as the first known clinical trial using the scientific method, and the first paper about infectious disease transmission.

Meanwhile, across the Atlantic, French explorers had been in contact with the Mi'kmaq and related tribes (Maliseet, Abenaki) in the area to be known as Nova Scotia since the 1500s through at least the 18<sup>th</sup> century. Relationships were generally amicable, with trading, military alliances, and examples of intermarriage. Annual gift exchanges occurred between the Mi'kmaq and French, which exposed the Mi'kmaq to European diseases such as smallpox. Accounts showed that the Mi'kmaq and French colonists relied on each for certain aspects of health care. In 1713, the Fortress of Louisbourg was established on Cape Breton Island following the Treaty of Utrecht between the French and British. A formal health care system was developed at the fort that was influenced by both the cultures surrounding the fort (natives, colonists) and French-trained surgeons and other health workers.

Using primary sources, published data from the Government in Canada, and historical journal articles, this project will explore the structure of the medical system at Louisbourg between 1713 and 1758 in the context of cultural influences and how these services paralleled those in France.

# **Medicine at a Time of Louisbourg: Trauma, Disease, and Techniques of Care**

By

Carly Langley and Jeannette Verleun  
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Preceptor: Dr. Ron Stewart, M.D.

As a bustling French colony between 1713 and 1758, the Fortress of Louisbourg on Cape Breton Island, Nova Scotia, had a sophisticated and well-organized medical system. Despite the absence of physicians, citizens of the Fortress had access to a wide range of services, including a hierarchy of surgeons, midwives, and a hospital operated by the Brothers of the Church. The majority of these medical professionals were trained in France, which was considered a leading country in surgical technique and midwifery at the beginning of the eighteenth century.

While war trauma, battery, disease and crisis in childbirth plagued the Fortress, these professionals used a variety of techniques such as bleeding, surgery, potions and infusions to treat the ill. Injuries from battery were surprisingly common among men and women, and were treated by resident surgeons using interesting protocol. As an active port in Colonial France, the Fortress was often affected by infectious disease, including typhus and a smallpox epidemic, despite precautions taken to prevent their spread.

The Fortress of Louisbourg is the largest historical reconstruction in North America, and this project aims to aid in the restoration the Surgeon's house as an exhibit of Medicine at a time of Louisbourg. Using historical journal articles, primary literature pieces and published data from the Government of Canada, this presentation will discuss the most common medical issues facing the citizens of the Fortress and explore the ways they were treated.

**Giants come to the rescue of a giant's son: The lives and contributions of those who gallantly tried to revive Revere Osler, the Fallen Soldier.**

*"Revere claimed my attention twice, first at his birth and now at his death" -George Crile (1864-1943)*

By

Basavaraj Shettar

Department of Anatomy and Neurobiology, Dalhousie University, Halifax

Preceptor: Dr. Ronald Stewart

Sir William Osler, "Father of Modern Medicine" and a founding professor of Johns Hopkins Hospital was an indisputable giant in the field of medicine. During World War I, his son, Edward Revere Osler, was commissioned into the Royal Artillery, where he was wounded by a German shell and eventually succumbed to his injuries. Using memoirs, journal articles, and well documented autobiographies this presentations looks into the lives and the contributions of the five key members who attempted to save Revere Osler's life.

These five members, giants in their own fields, were George Crile, Harvey Cushing, William Darrach, George Brewer and Anne Penlad. The high level of respect and close proximity that many on this team shared with the Osler family resonates in the words of Crile, "Revere claimed my attention twice, first at his birth and now at his death". This presentation weaves the biographies and contributions of these five great individuals around the unfortunate death of Revere Osler.

Revere's injuries included damage to liver, kidneys and shredding of a major portion of his colon leading to massive bleeding. Anesthesia was given by Anne Penland, the first nurse anesthetist on the British front whose remarkable work paved way to development of nurse anesthetist programs. Harvey Cushing, "Father of Modern Neurosurgery", one of whose major contributions included studying importance of intraoperative blood pressure monitoring, watched the pulse. The scientifically oriented surgeon and a founder of the Cleveland clinic, George Crile, who pioneered the management of surgical shock, and was the first to perform a direct blood transfusion, was the one who transfused blood to the injured Revere who was in hemorrhagic shock. The hemorrhage was arrested and wound closed. Prominent surgeon and author of Textbook on Surgery, George Brewer assisted William Darrach, the chief of surgical staff in this operation.



# **Changing Attitudes: Antisepsis and the Franco-Prussian War**

By

Apiraami Thana

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Although the importance of antisepsis is exemplified in today's many universal sterilization measures, antiseptic techniques were not always accepted. In the 19<sup>th</sup> century, the medical world was reluctant to accept the notion of microorganisms as the causal agent of infections. However, the Franco-Prussian War of 1870-1871 proved to be the first major event that would see the advent of changing attitudes towards antisepsis, ultimately propelling further developments to this fundamental aspect of medical care. This presentation will describe how the Franco-Prussian War served as a turning-point in the history of antisepsis by examining its role in medical care before, during and after the war.

Prior to the Franco-Prussian war, Joseph Lister described his use of carbolic acid as an antiseptic in a series of publications in 1867. However, his work was received with skepticism, because the infection of wounds was regarded as an unavoidable outcome.

During the war, German surgeon Friedrich von Esmarch played a key role in convincing the Prussian military surgeons of the efficacy of antisepsis, due to his appreciation of the potential of Lister's methods to reduce infection. Consequently, care of the wounded was far more successful on the Prussian side than on the French side, who remained skeptical of Lister's methods. The British would eventually concede the efficacy of carbolic acid for wound treatment and supplied both sides with necessary materials to employ Lister's methods.

Finally, the war experience provided surgeons with the opportunity to try Lister's techniques, and they were brimming with ideas upon returning home. One of those surgeons was Ernst von Bergmann, who realized that while killing bacteria in an open wound was important, preventing contamination in the first place was also essential. In sterilizing instruments and ensuring the maintenance of a clean working environment, Bergmann catalyzed the transition from antisepsis to asepsis.

# **The story of a Jewish refugee's influence on modern hospice**

By

Ciaran Lane

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Preceptor: Dr. Matthew Cwinn, MSc, MD

In 1939 Hitler's invasion of Poland led to the development of the Warsaw Ghetto and some of the greatest human rights violations in modern history. David (Ela) Tasma, a Polish Jew, escaped Poland and fled to France. He left behind a family who would be captured by the Germans and killed in the Holocaust. In France he found work as a waiter until the invasion of France in 1940. Again, David fled Nazi rule and escaped to England where he would spend the final years of his life. Here, David was diagnosed with inoperable colon cancer.

In the busy hospitals of London soon after the end of the war, David would meet Cicely Saunders. Cicely Saunders was a nurse recovering from a back injury and preparing for a qualifying exam to become a social worker. At this time, David was an inoperable cancer patient living out the final days of his life, and Cicely would spend hours with David sharing common interests, during which time their friendship flourished into a romance. In turn, David would leave 500 British pounds to Cicely and this would allow Cicely to pursue her passion to study medicine, and eventually lay the groundwork for the hospice movement.

This presentation will focus on Cicely Saunders and David Tasma as key influences in the development of the hospice movement. Using primary documents, medical literature, and biographies, I will trace the development of the idea of palliative medicine from the founding of the London Medical Group to the international lecture series given by Cicely Saunders in 1963 to the current state of modern medical ethics including the development of the Journal of Medical Ethics.

# **Medicine following the Halifax Explosion: A Close Look at Ophthalmologic History**

By

Laura Schep  
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Preceptor: Dr. Allan Marble, PhD

On December 6<sup>th</sup>, 1917, in the midst of the first Great War, the Halifax explosion- the most powerful and largest unintended event of its kind in history- took place in the Narrows, a straight connecting the Bedford Basin to the upper Halifax harbor in Halifax, Nova Scotia, Canada.

At 8:48am on this fateful day, the SS Mont-Blanc, a French cargo ship loaded with explosives for the war, collided with the SS Imo, a Norwegian vessel not carrying cargo at the time, but set to pick up relief supplies in New York. About 25 minutes after the collision, the Mont Blanc exploded and nearly vaporized, leaving instantly catastrophic and tragic results. Approximately 2,000 people were killed, and thousands more had severe injuries. A large number of people were attracted to approach their windows to view the spectacular event, and as a result, a prominent injury that occurred to survivors of the Halifax explosion was severe damage to the eyes from flying shards of glass.

592 people with eye injuries were treated by twelve ophthalmologists, with 249 enucleations being performed in total. As a result of the high number of optic injuries caused by the Halifax explosion, a Blind Relief Fund was also established after this historical tragedy, to aid those affected by eye damage and blindness. Using journal articles, non-fiction books, interviews and data from the Nova Scotia Archives, this presentation will explore eye injuries suffered during the Halifax explosion, the response by ophthalmologists, and the effects that the Halifax explosion had on this surgical specialty.

## **The Misogyny of History; an Unsung Heroine of World War 1 – Marie Marvingt**

Dax Bourcier

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Dalhousie University, Halifax, Nova Scotia, Canada

Preceptor: Dr. Ronald D. Stewart

If celebrity contributes to one's place in history and legacy is measured against the background of culture and social norms, the story of Mademoiselle Marie Marvingt illustrates the truth in this premise. By the age of five, Marie Marvingt was already showing her unique talents and interests. Motivated by her father, she excelled in sports such as swimming and canoeing. These quickly escalated towards risk-taking and male-dominated endeavors such as mountaineering, shooting, ballooning, aviation, and even martial arts. During "Les Années folles," in which women filled many of the jobs vacated by soldiers, Mlle Marvingt, disguised as a man, took to the trenches to fight as a French soldier. Having studied medicine, she became a certified nurse and a surgical assistant, careers that, combined with her love of aviation, led her to promote aeromedical transport and its potential in the Great War. Truly visionary, she conceived the use of aeroplanes for battlefield aerial searches, for communication with field hospitals, and for the supply of ambulance stations. She designed and ordered the first air ambulance in 1912, provoking distain among civilians who perceived aviation as a dangerous recreation for men. But she proved through the achievements of her long life the inadequacies of such societal norms.

Mlle Marie Marvingt was unmistakably one of the most influential and effective proponents of the development of aeromedical evacuation. Cultural norms, gender inequality and misogyny, have contributed to her lack of deserved acknowledgment in general and even in the history of aeromedical transport, her greatest passion. As the most decorated French woman, she has largely been confined by the obstacle of misogyny, an injustice so often confounding the accuracy of history. Her legacy rests in France; her gifts beyond its borders

# **Response and Relief to the Halifax Explosion: The Bellevue House as a Temporary Hospital of the Massachusetts State Guard**

By

Devin Stephanian  
Faculty of Science, Dalhousie University

Preceptor: Dr. Allan Marble, MD

The Halifax explosion of 1917 left more than 1500 dead and many more wounded. The first response to the devastation came from Massachusetts. At the time of the explosion Halifax had four public hospitals, four military hospitals, and seven private hospitals that were immediately inundated with wounded Halifaxians. The arrival of physicians and nurses from Massachusetts created a need for more hospitals to provide medical aid. Relief came from the Massachusetts State Guard who set up in the Bellevue House on Halifax's Spring Garden Road.

Originally built in 1801 the Bellevue House was initially used to house the commander of the British regiment in Halifax. During 1917 the house was the officers quarters. Due to the explosion the building lost all of its windows but the structure remained sound allowing it to be converted into a temporary hospital manned by the Surgeons and Doctors of the Massachusetts State Guard.

Using historical research papers, archeological research, and archival evidence this presentation will examine the Surgeons and Doctors who treated the wounded in Bellevue House. Also of interest will be the medical practices used in the temporary hospital, the patients treated, and the overall implications of how the hospital helped with relief efforts. The selfless actions of the men and women of Massachusetts who helped after the Halifax explosion saved many lives and gratitude of the people of Nova Scotia continues until this day.

## **Advancements in Front-Line Medicine**

### **Panel Abstract: Jake Blacklaws (Chair)**

The 16<sup>th</sup> century physician Ambrose Pare said, “The only people who gain from warfare are young surgeons”. While war does bring about widespread casualty and displacement, it does serve as a major driving force for advancements in weaponry, technology, and medicine.

The Franco-Prussian war (1870-1871) was the backdrop for German surgeon Friedrich von Esmarch, who championed the antiseptic work of Joseph Lister, and utilized this practice in front-line surgeries and wound treatments. The Great War (1914-1918) saw major breakthroughs in medical treatment along the front-line, with advancements in technique, ethics, and collaboration. First, Canadian surgeon Major Lawrence Bruce Robertson resurrected the practice of human blood transfusion, which went on to save countless lives during the war. Second, triage ethics were challenged with the emergence of a debilitating psychiatric ailment known as “shell shock” that did not fit onto the physical injury triage spectrum. Finally, incredible collaboration was seen when a 5-person team of medical giants came together in the treatment of an injured Revere Osler, the only son of Sir William Osler.

While these two wars saw numerous advancements in several academic fields, the four examples noted here highlight great strides taken in front-line military medicine. In this panel discussion, the details of each advancement will be presented and the impact on current military medicine will be discussed. As 2014 marks the 100-year anniversary of the onset of World War I, it is important to reflect on, and commemorate, the glimmers of positive that came out of the terrible experiences of 19<sup>th</sup> and 20<sup>th</sup> century warfare.