

M04 590H

**Medical Discovery  
and Progress  
from War**

CfHOM

ARB

February 12 - March 12

**Winter 2014**



Washington University in St. Louis

## M04 590H – Syllabus

### Medical Discovery and Progress from War

**Objectives: Understand discoveries and treatments arising from military engagement in and organization for war.**

**Locations:**

- Archives and Rare Books 7<sup>th</sup> Floor Bernard Becker Medical Library
- Center for History Of Medicine – 6<sup>th</sup> Floor Bernard Becker Medical Library

**Time (s):** 3:30 – 5:30 pm on Wednesdays

**Format:** 3:30 – 4:00 pm, Examination of Archival Materials – Archives and Rare Books  
4:00 – 5:15 pm, Students briefly summarize assigned articles and visiting “pioneer(s)” discuss aspects of the Wars and innovations that resulted with general impacts on medicine  
5:15 – 5:30 pm, All students write and turn in a short paragraph on the topic

**Readings:** General background from Manger’s e-book, Article PDFs for each session at CfHOM on 6<sup>th</sup> Floor of the Becker Library. Students should read all materials for each session.

**Participants:** WUSM I Students: Mr. Bilal Al-Khalil, Mr. Jared Goodman, Mr. Seth Howdeshell, Mr. Kevin Li, Mr. Michael Madigan, Mr. Sagar Mehta, Mr. Alexander Padovano, Mr. Deng Pan, Ms. Arith Selda Reyes, Mr. Abraham Segura, Mr. Robert Wang

Becker Library Archives and Rare Books Staff: Ms. Elisabeth Brander – Rare Book Librarian, Mr. Stephen Logsdon – Archivist, Ms. Martha Riley – Rare Books Cataloger & Archivist, Mr. Philip Skroska – Visual and Graphic Archivist

Faculty: Robert M. Feibel, MD –Professor of Clinical Ophthalmology & Visual Sciences; Thomas A. Woolsey, MD – Professor of Experimental Neurological Surgery and Acting Director of the Center for History Of Medicine

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## Bibliography

### Web Sites:

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[http://www.nih.gov/about/almanac/historical/chronology\\_of\\_events.htm](http://www.nih.gov/about/almanac/historical/chronology_of_events.htm)

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### Chapters and Articles:

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***Physiology from Injury:  
William Beaumont, MD (1785-1853) and Mr. Alexis St.  
Martin (1802-1880) Rx of Wound in 1822***

**Week I. February 12, 2014**

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## ARB Display

### Week I. February 12, 2014

#### Artifacts:

Portrait of William Beaumont, M.D., by Chester Harding, ca. 1850. Oil on canvas, framed, total dimensions 40 x 35 1/2 inches.

#### Books:

Beaumont, William. Experiments and observations on the gastric juice, and the physiology of digestion. Plattsburgh, NY: F. P. Allen, 1833.

Miller, Genevieve. 1946. William Beaumont's formative years; two early notebooks, 1811-1812. New York: Schuman.

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#### Items from William Beaumont Papers:

William Beaumont's certificate of medical examination and license to practice medicine issued by the Third Medical Society of Vermont, June 1812. William Beaumont Papers, Series 1, Box 2, Folder 1.

Notebook kept by Beaumont when he was apprenticed to Dr. Benjamin Chandler in St. Albans, Vermont. The notebook includes prescriptions, case histories, notes and readings from his apprenticeship, and Robert Burns' poems on medical subjects, 1811-1813. William Beaumont Papers, Series 2, Box 21, Folder 1.

William Beaumont's commission as surgeon's mate in the Sixth Regiment of Infantry, signed by President James Madison, December 2, 1812. William Beaumont Papers, Series 1, Box 20, Folder 1.

William Beaumont's commission as post surgeon of the United States Army, effective December 4, 1819, signed by President James Monroe, March 18, 1820. William Beaumont Papers, Series 1, Box 20, Folder 2.

William Beaumont's notebook recording account of the Alexis St. Martin case. The notebook also includes assorted prescriptions, recipes, and formulas, 1822-1833. William Beaumont Papers, Series 2, Box 21, Folder 3.

Four articles of agreement signed by Alexis St. Martin submitting to the experiments of William Beaumont, October 16, 1832-November 7, 1833. William Beaumont Papers, Series 1, Box 23, Folder 23.

- William Beaumont's Surgeon's commission for the United States Army, signed by President John Quincy Adams, February 15, 1828. William Beaumont Papers, Series 1, Box 3, Folder 3.
- Letter from Martin Van Buren, Vice President of the United States, to William Beaumont regarding appreciation for his book *Experiments and Observations*, January 1, 1834. William Beaumont Papers, Series 1, Box 6, Folder 2.
- Letter from William G. Eliot of St. Louis University to William Beaumont regarding his unanimous election to the chair of surgery at Saint Louis University, October 4, 1836. William Beaumont Papers, Series 1, Box 8, Folder 8.
- General order number 48 from E. Schriver, Adjutant General to William Beaumont, P.H. Craig, R.C. Wood, and H.A. Stinnecke concerning orders to examine army surgeons as part of a medical board in Fort Brooke, Florida and then report for permanent duty in Florida, September 18, 1839. William Beaumont Papers, Series 1, Box 10, Folder 33.
- General order number 2 from R. Jones, Adjutant General to William Beaumont regarding the President's acceptance of Beaumont's resignation from the Army as of December 31, 1839. William Beaumont Papers, Series 1, Box 11, Folder 4.
- William Beaumont's inaugural address as the President of the Saint Louis Medical Society, May 1840. William Beaumont Papers, Series 1, Box 11, Folder 17.
- Letter from Alexis St. Martin to William Beaumont refusing his offer under conditions of leaving family, request for payment of back wages to Mrs. St. Martin for laundry services, willingness to proceed if Beaumont came to Canada for experiments, and attempts by other doctors to engage him, July 6, 1846. William Beaumont Papers, Series 1, Box 15, Folder 18.
- Letter from William Beaumont to Alexis St. Martin regarding his unsigned security and receipt of advance, travel expenses to be deducted from first year's salary, and terms of proposed contract, August 5, 1850. William Beaumont Papers, Series 1, Box 17, Folder 27.
- Letter from William Beaumont to Alexis St. Martin regarding disappointment over his nonappearance especially with regard to course of lectures at Saint Louis Medical College based on his coming, possibility of bounty land for St. Martin, renewal of offer to St. Martin, February 16, 1851. William Beaumont Papers, Series 1, Box 18, Folder 3.
- William Beaumont's obituary printed in the Missouri Republican, 1853. William Beaumont Papers, Series 3, Box 22, Folder 14.

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## Gobbets

### Week I. February 12, 2014

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Probably the most fascinating piece of information that I learned from this first session was just how bad the knowledge base for proper medical treatment was back in the early 1800s. When I was reading the anecdotes of Dr. Beaumont's average treatment plan, I was surprised at the methods – huge overdoses of ipecac and mercury along with an incredibly large procedure of bloodletting. If I personally came into the ER with the flu today and was given a paper with the script, “bleed about 12-16oz.,” I would go see another doctor. But at that time there was nothing else, so people followed the methods. It really shows how much we have come towards the light in the past 200 years and is fun to think just how far we will go in the next 200 years.

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After St. Martin's gunshot wound and subsequent fistula, the experiments done on him had great implications on the future of gastric physiology.

The beginning of medical research in the western hemisphere by someone with no formal medical training shines some light on the nature of luck in the medical field. Based on the viewpoints that he might not have been an amazing doctor, I seem to view him as the same as Alexander Fleming. It also shows an amazing amount of context at the time. Before this, we clearly had no way of looking inside the body. How people actually managed to be doctors in this time was baffling. It provides a good notion of where we were and where we are to go in the future.

The ethics of the research was a topic of interest to me as well, mostly because Dr. Beaumont's view was that he was not hurting Alexis St. Martin. However, with all we know of infections and physiology, it was very possible that those experiments could have gone poorly. What sorts of horrors are we inflicting on people in current studies that we could have no way of knowing?

The discussion centers on the history regarding Dr. Beaumont and Mr. St. Martin. The lives of both are examined using a variety of sources written with different purposes. In particular, the medical history during the period was examined which yielded some very interesting discussion including the prevalent medical belief in therapy and ethics at that time, which were very different from our current belief system. Other interesting history include the prevalence of war during the periods of time and how warfare exacerbates physician shortage, which led to the appearance of physicians who did not have formal training to appear in the army. Rare books and letters were also introduced during the course which provided interesting perspective regarding the state of medicine at that time, as well as the general life during those periods. In all, it was very intriguing and engaging session.

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At the beginning of today's meeting, we discussed the state of medicine and medical education in the 18<sup>th</sup> century. During colonial times, medicine was primarily based on a "common sense approach," and it was believed that aggressive intervention was necessary to save patients from dying. It was interesting to contrast modern minimally invasive treatments to older surgeries that were done with a very primitive understanding of physiology and pathogenesis. Before the establishment of medical schools, physicians such as Dr. Beaumont trained as apprentices, and few scientific breakthroughs were made between generations of physicians because knowledge was not centralized the way it is today.

The discussion then shifted to Dr. Beaumont and St. Martin. When I initially read about how St. Martin was injured, it was hard for me to comprehend how it was possible for him to survive without modern medical treatments. I found it fascinating that St. Martin unknowingly became the subject for the first medical research done in America. It was also sad to think of the torment that St. Martin family had to resort to decomposing and hiding his body to prevent grave-diggers from looting his body.

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Our session today covered the story of William Beaumont and Alexis St. Martin, as well as a brief contextual history of the Americanization of old world medicine. William Beaumont was a pioneer in the medical field. His experiments with St. Martin were the first of their kind and helped encourage further studies on the digestive system. He treated St. Martin for an accidental gunshot wound, which healed with a gastro-cutaneous fistula. This provided him with an ideal opportunity to study the human stomach. They set up a contract, which bears similarities with the contracts of indentured servants, for Beaumont to begin conducting experiments on St. Martin. We discussed the relationship between the two men, and the ethics of this experimentation. This discussion was interesting and very relevant to me as a medical student because I will be interacting with patients and potentially conducting clinical research in the future. There are lessons to be learned from how Beaumont viewed and treated St. Martin. I also found it interesting to learn about the old apprenticeship system that existed before the advent of medical schools.

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There were a few interesting points I took away from today's discussion. First, the article on ethics was especially interesting to me but seems a somewhat odd discussion. Discussing this case or early 19<sup>th</sup> century medicine in general in terms of today's ethical standards doesn't make any sense. Much of our biomedical ethics come from abuses inherent in a system of medicine, such as we have today, or had in the 20<sup>th</sup> century. In Beaumont's time, these were individuals, practicing alone, without any sort of medical system. Thus, one person could of course abuse a patient, and there would of course have been standards for what would have constituted that, but abuse in this case cannot be understood in terms of what we have as research practices. Those were developed in response to abuses of a system, not a contract between individuals as in this case. It is unfair to suggest that our current worldview should have been apparent at the time. We have been informed by two hundred extra years of history to arrive at our current standards and views. I believe this is what the author and my classmates were driving at, that this case must be looked at in terms of 19<sup>th</sup> century practices and views, Beaumont may not have been the best doctor, master, or friend to St. Martin, but his failings would not have been that he didn't abide by 20<sup>th</sup> century ideas of ethics, as it seems some suggested he should have somehow known to do.

Secondly, this is not a period of history I am all that familiar with, especially in regard to medical history, so the article about what an average doctor at the time, and what their treatments entailed, was quite interesting, as well as, learning about an interesting historical figure and prominent figure in St. Louis history.

In today's class, I learned about the major advances that Beaumont brought about in digestive physiology that both confirmed some previously held theories and refuted many others. I think one of the most interesting points from today's class was that Beaumont's research was one of the first instances of clinical research and was the start of medical research being shared widely among physicians. Further, I learned about how medical school used to be an apprenticeship, something I did not know much about before. Also, I thought the discussion of the ethics behind Beaumont's experiments were very interesting. Overall, Beaumont's efforts were landmarks in the beginning of clinical research. Beaumont's research opportunity essentially fell in his lap by chance.

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The medical profession had a cobbled existence in the United States during the 18<sup>th</sup> and 19<sup>th</sup> Century. There were no regulating bodies to govern practice, nor was any formal training required for one to assume the role of a physician. Perhaps the only requirement was a bold disposition; Ben Franklin required only his own approval to prescribe treatment. William Beaumont, one of the 19<sup>th</sup> century's most renowned physicians, trained only for two years as an apprentice. He is most well known for his seminal work in gastric physiology, conducted with Alexis St. Martin, a French Canadian fur trader who suffered a gunshot to the abdomen that left him with an open gastric fistula. This research, often considered the first instance of medical research in the United States, yielded great insight into human physiology. Retrospectively, this event also provides a very interesting window in time to an era when medical ethics were not firmly established in medicine. Its personal and professional conflicts paint a vivid picture of the past and show us how far medicine has progressed since then.

William Beaumont was a physician known for his experiments elucidating the content of gastric juice. Conducted during the 1820s, these experiments began after Beaumont treated a voyageur named Alexis St. Martin who sustained an accidental gunshot wound to his stomach. St. Martin's injury led to a fistula and Beaumont took this opportunity to study stomach physiology. He struck a deal with St. Martin to become his experimental subject in exchange for monetary compensation. Strikingly, Beaumont's experiment was the very first known research performed in the United States. While his work is highly commendable, Beaumont did not seem to have a commendable relationship with St. Martin. I particularly found the ethics surrounding Beaumont's experiment intriguing. Beaumont was grateful for St. Martin's cooperation, but at the same time, Beaumont may have seen St. Martin as his servant. What complicates their relationship is that St. Martin's participation in Beaumont's study was not voluntary. Beaumont must have felt entitled to St. Martin's time and effort since he was paying St. Martin. I was certainly put off learning that Beaumont at times referred to St. Martin as "boy" despite him being a grown man.

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Today's session mostly covered the lives of Dr. William Beaumont and Alexis St. Martin, and how they intersected to produce one of the first major cases of medical research in the Americas. The most interesting thing for me, learning about these two men, is seeing just how different research and medicine was 200 years ago. What Dr. Beaumont did – which was revolutionary at the time and a huge contribution to medicine – would nowadays fall far short of anything that could be considered "research." To pay your patient to allow you to perform these experiments, and to repeatedly urge him to come visit you so that you can continue your experiments throughout the years, sounds ethically dubious at best in the context of the safeguards we have in place today to protect the subjects of research studies. To me, this isn't necessarily a reflection of Beaumont as an unethical physician, but rather offers a glimpse into what "medicine" was in the 1800s, and how much it has evolved since then. It makes me wonder how the medicine of today will be viewed by the physicians of the future.

## ***Civil War and 19<sup>th</sup> Century Progress including the NLM – John Shaw Billings, MD (1838 – 1913)***

**Week II. February 19, 2014**

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## ARB Display

### Week II. February 19, 2014

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## **Gobbets**

### **Week II. February 19, 2014**

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Billings was an exceptional physician whose efforts were perhaps best described not in the advance of medicine, but the advances of the practice of medicine. His prestigious career is an impressive feat, which is a testament to how much one individual can accomplish in that time period. One wonders if that kind of accomplishment could happen in today's bureaucratic system.

His advancements in public health, hygiene, and medical education have implications today. His public health screening set the path for hygiene in the hospital. Yet, 150 years later, we still have issues with doctors and hygiene. His medical educational standards still hold today as we follow the same structure that he set up. Most impressively, in my personal opinion, was his work with topography. Setting up statistics at such a – comprehensive – level with no computers is extremely impressive. Setting up the indexing with such a wide variety of books and journals must have been no easy task and, since I'm personally very interested in databases, I am grateful for the framework that he laid down.

In all, I found the man to be a cornerstone in issues that might not have been thought about at the time. Issues that today we still deal with, and issues that we will surely advance in the future.

I really enjoyed the session as it covered a time period that I have done some prior research on as an undergrad. I wrote a paper on prosthetic development in the US and the civil war was a large influence on this, so reading the context for today's discussion was very familiar. However, I learned much more about the role of nurses and doctors and the Surgeon General through the readings. I also enjoyed going more in depth with specific characters who played large roles like Dr. Hammond and Dr. Billings.

To start with Dr. Hammond, I am amazed by the improvements he made in public health during his time, and the immense influences this had on people's wellbeing. I am personally interested in working in the field of public health later in my career and so I strongly appreciate learning about past contributions to the field and the impacts they had. As for Billings, the articles that were summarized today gave a great overview of his life and all the work he accomplished especially with the current National Library of Medicine. It gave me an appreciation for the ease at which we nowadays search through medical literature. His involvement in public health was also very notable and important especially his work with medical topography.

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Most interesting about today's selective was the way in which John Billings felt about the set-up of medical school at Johns Hopkins – it really speaks to how the University became one of the premier medical institutions of the 20<sup>th</sup> century. The fact that this was one of the first medical schools to require a bachelor's degree gives quite the perspective onto his own feelings towards education. Being the bookworm that he was, it seems as though his venture into not only the medical literature (which really makes me understand why he was so hell bent on making sure that the education prior to medical school at Johns Hopkins was liberal arts focused) was an important part of his shaping of his beliefs. To think back and consider the fact that I may have not been able to have a liberal arts education before medical school if it were not for John Billings is quite a heavy thought, and it is one thing for which I'm grateful to his strong avocations.

I was once told by someone – I forget who, perhaps a classmate of mine – that if I truly wanted to help people, I should go not into medicine but into public health, for that's where I could have the greatest impact on the most people. The advice was meant to be taken as facetious, but looking at the lives of John Shaw Billings and even last week's William Beaumont, I can see how it could contain a kernel of truth. Both men were physicians, but they gained recognition not through their clinical aptitude but through their other contributions to the medical field. In the case of Dr. Billings, it was through the development of the National Library of Medicine and the Index-Catalogue. For Dr. Beaumont, it was his research on the physiology of digestion. I suspect that in accomplishing these things both doctors improved the lives of many more people than they had directly cared for as physicians.

Nonetheless, these individuals were still physicians by training, and their backgrounds definitely provided a basis for their contributions. I just found it interesting to think about how the desire to help people is a common thread among medical professionals, but the number of people you can help in a day is inherently limited.

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In today's discussion, we were introduced to figures of medicine in the 1800s to early 1900s. These include the history of conscriptions, including medical knowledge gleaned from war, including advances in human anatomy, disease treatment, and interestingly, how to detect feigning of diseases (which was common for soldiers seeking early discharge). We discussed mainly the life of John Shaw Billings, who was instrumental in orchestrating the foundation of what evolved into MEDLINE. His life was chronicled by a variety of sources, which pictured him as a bibliophile, and one who hides behind limelight. His contribution to the formation of various library catalogs and the tasks that he had to perform underscored the difficulty of his endeavor. Indeed, more than one writer questioned the lack of popularity of John Billings. Other interesting discussion includes the history of Medical College of St. Louis and its curious head, Joseph McDowell.

Today we discussed the medical developments and progress that occurred around the civil war period, particularly the work of John Shaw Billings.

Billings was an accomplished figure during his time. His major accomplishments included organizing the Library of the Surgeon General (which later became the National Library of Medicine), overseeing the construction of the Johns Hopkins hospital, and advising the organization of the school of medicine there. His work was revolutionary for many reasons. He was one of the first people to conceive of the idea of a centralized medical library catalogue, and then implement it. His ideas of hygiene and sanitation in hospitals improved conditions greatly. He also put forth many ideas about medical education that are still followed today, such as the close relationship of medical school and hospital, the stricter requirements for admission and graduation of medical students, and the two-year preclinical education scheme. I found it interesting that so many of our current medical school education principles were suggested by him so long ago. I am also very thankful to him for giving us PubMed.

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The post-Civil War period in the United States was marked by urbanization, industrialization, and the rise of transportation across long distances. More people were living together and could reach each other more quickly. Thus, it's natural that public health would become a major concern in this time period. Big cities were havens for disease and poor sanitation and living conditions, and more people were living in these places, so it's not surprising that people like Billings would become so interested in public health as it began to be a huge (and therefore noticeable) problem. Europe (or parts thereof) had largely industrialized and urbanized earlier, so it is also not at all surprising that these ideas would have originated there, only making their way here when it became essentially necessary. He certainly isn't the only figure from this time working on similar or related topics (I'm thinking about Lister in particular, though there are many other examples). I just find it incredibly interesting that advances in medicine have almost always come about in reaction to the conditions in which human society existed. Other areas of human progress seem to push medicine ahead; the reverse seems less true.

Today's discussion focused on John Shaw Billings, a prominent and influential surgeon during the civil war. He was born in Indiana, went to a country school, but then went to college at Miami University in Oxford, Ohio and Ohio Medical College in Cincinnati, Ohio. While in medical school, he was a voracious reader and even broke into the medical school library to read after hours. He had an impressive surgical career, and successfully completed the first ankle excision.

Following the Civil War, he headed the Surgeon General's Library, helped design Johns Hopkins hospital, and was an advocate for public health and medical statistics. He was also an advocate for standardized medical school admissions criteria, and believed that students should have to train longer and harder. I found it fascinating that Billings was able to revolutionize medicine in his lifetime, and I wonder if it is still possible for individuals today to impact science to the same degree.

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The Civil War was a time of great change in the medical community. The wounded soldiers allowed military surgeons to learn much about human anatomy and improve surgical techniques. Billings was one of the most influential characters of the period. I thought it was interesting that William Welch placed Billings' accomplishments on the level of the discovery of anesthesia. Billings' founding of the National Library of Medicine and its catalogue are indeed a great accomplishment. Today, we simply have to search for topics on PubMed, a service provided by the National Library of Medicine and instantly are given an answer, something that we take for granted. Overall, Billings is a sometimes forgotten character who played a very influential role in making medical data available for medical professionals.

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John Shaw Billings was a physician during the Civil War era noted for his numerous contributions in medicine including medical topography, medical education, hospital construction and cataloguing of scientific publications. While he may not have contributed to medical knowledge (in contrast to Beaumont or other physician scientists), Billings set up systems that helped improve the practice of medicine and research. I was particularly fascinated learning about Index Catalogue/*Index Medicus* and the punch card system. As a former research assistant, I understand how important PubMed is for the present-day scientist. Billings certainly was not involved in setting up PubMed, but he did set up the groundwork for PubMed through *Index Medicus*. I also find it wonderful that a physician like Billings would be involved in setting up a system of data analysis that would later be used by computer companies like IBM.

The American Civil War, though a dark period in US history, played a pivotal role in the development of modern medicine. New weapons, such as rifling, created more effective ways to injure, kill and maim soldiers. Through this suffering endured by others, many doctors gained unique knowledge that brought forth novel medical devices and medical techniques that improved medicine. Moreover, some individuals, notably John Shaw Billings, used the experience to create order out of chaos. Billings brought a very calculated approach to medicine, eschewing the disordered state of affairs in military, clinical and later academic medicine. Inspired by Jonathan Letterman, he worked as close to the front lines of the war to treat wounded soldiers as soon as possible. Billings also made huge strides in what we know as public health, pursuing medical topography to identify where disease occurs and what populations are affected. In his later years, his penchant for books and learning led him to the Surgeon General Library where he established the *Index Medicus*, bringing order to the body of medical knowledge. Billings also applied his organization prowess in the design of hospitals, notably the Johns Hopkins Hospital, and in medical education. Surprisingly, many of his ideas for medical education, though not accepted in his time, came to fruition in the 20<sup>th</sup> century. Many would agree, in retrospect, that John Shaw Billings was a visionary. Though maybe medical academia hasn't changed as much; after all, medical students are still a "noisy" bunch.

***Late 19<sup>th</sup> and Early 20<sup>th</sup> Centuries –Walter Reed, MD (1851–1901) Cause of Yellow Fever; Sir Gordon Holmes, MD (1876–1965) Functional Organization of the Human Brain***

**Week III. February 26, 2014**

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## ARB Display

### Week III. February 26, 2014

John T. Hodgen. 'On Fractures,' St. Louis Medical and Surgical Journal, v.8, 1871

Dr. Hodgen's literary work consisted largely in contributions to medical journals.

Some of his papers were on the surgery of shock, nerve sections for neuralgia, fractures, and thigh and skin grafting. Among the many surgical appliances devised by him are a wire suspension splint, a cradle splint, a snare for the for the removal of urethral calculi, a surgeon's reel and artery forceps, and a simple siphon and stomach pump.

John T. Hodgen's office, corner of 6<sup>th</sup> and Clark Street [photograph]

John Thomson Hodgen (1826-1882) was born in Hodgenville, Kentucky. In 1848 he graduated from the Missouri Medical College and entered practiced with Dr. Joseph N. McDowell in St. Louis. He joined the faculty of Missouri Medical College, serving as Demonstrator of Anatomy (1849-1853), Chair of Anatomy (1854-1862), and Chair of Physiology (1858-1862). During the Civil War, Dr. Hodgen was appointed to the rank of Surgeon General of the State of Missouri in 1862 and had charge of the Fifth Street General Hospital. When Dr. McDowell sided with the Confederacy, Dr. Hodgen transferred his allegiance to the St. Louis Medical College where he served as the Chair of Physiology (1862-1868) and Dean of the College (1865-1882). Dr. Hodgen was a member of the St. Louis Board of Health from 1867-1871, President of the St. Louis Medical Society in 1872, President of the Missouri State Medical Association in 1874, a member of the International Medical Congress in 1876 and 1881, one of the founders of the American Surgical Association, and President of the American Medical Association in 1881.

Joseph Nash McDowell, M.D. (1805-1868) [photograph]

The dominant figure in the Missouri Medical College's early history, Joseph Nash McDowell was trained at Transylvania University in his native Lexington, Kentucky. He came to St. Louis in 1840 to organize a medical department at Kemper College and guided the school to independent status as the Missouri Medical College. An anatomist and surgeon, he was dean from 1850 to 1861, when he left to serve in the Confederate Army. After the Civil War, he resumed his former position as dean until his death in 1868. Famed for his contentious nature and colorful speaking style, McDowell considered location critical to his institution's success and proclaimed: "We believe the destiny of St. Louis in medicine is not be equaled by any position in Western America."

Missouri Medical College “McDowell’s College”, 8<sup>th</sup> Street and Gratoit, circa 1861.  
[photograph]

Letter, Joseph Nash McDowell to unknown. October 22, 1865

Dr. McDowell describes his efforts to receive a presidential pardon for his  
association with the Confederacy.

Downtown St. Louis, circa 1875.

Plates 21 and 24 taken from *Pictorial St. Louis: the great metropolis of the  
Mississippi valley; a topographical survey drawn in perspective A.D. 1875*, by  
Camille N. Dry; designed and edited by Rich. J. Compton. St. Louis: Compton &  
Co., 1876.

The locations of the Missouri Medical College after the Civil War, the St. Louis  
Medical College, John T. Hodgen’s office, and the Fifth Street General Hospital  
can be identified in this perspective map.

*Catalogue of the Library of the Surgeon General’s Office*, vol. 1, 1873

*Index Medicus: a monthly classified record of the current medical literature of the  
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John H. (John Hill) Brinton (1832–1907). *Personal memoirs of John H. Brinton: Civil  
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Brinton met, observed, and commented on practically the entire hierarchy of the  
Union army; serving as medical director for Ulysses S. Grant. Positioned  
perfectly to observe the luminaries of the military, Brinton also occupied a  
unique perspective from which to comment on the wretched state of health and  
medicine in the Union army and on the questionable quality of medical training  
he found among surgeons. A friend of John Shaw Billings, he was named the first  
curator of the Army Medical Museum, now the National Museum of Health and  
Medicine in Washington, D.C.

## Gobbets

### Week III. February 26, 2014

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In this session, disease as well as medical advances in the late 19<sup>th</sup> century leading up to the First World War was discussed. In particular, some of the diseases of interest include yellow fever, which were detailed in many medical records, including the journal of the St. Louis Medical Society. Many of the accounts of yellow fever at that time suggested that while its symptoms were well-known, the modes of transmission were not, and risk factor including water contamination, hunger and other factors were discussed at various facsimiles. Also of interest is that yellow fever was endemic during the building of Panama Canal, and the fear at that time, that the disease would spread to the Eastern parts of the globe.

We also discussed the life of three physicians: Walter Reed, Harvey Cushing and Gordon Homes. Their individual contributions to the medical field, including PTSD, brain injury and typhoid fever were also discussed.

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Because of my heightened interest in the progression, characterization, and treatment of neuropsychiatric illness, I was happy to summarize one of the articles on Dr. Holmes this week. His ability to correlate the visual cortex with the visual field astounded me – I found it to be incredible how accurate he was in the visual deficits involved with the gunshot wounds to the head. It was also fascinating to hear about the different cognitive disorders that we learn as neurobiology majors were first described, such as the inability of individuals to integrate different senses in a particular region of the parietal lobe, which I believe now is still thought to be involved with the sense of environment. Most incredible of this entire story of Dr. Holmes was his use of neurological knowledge to treat psychiatric illness associated with shell shock. Because he knew that particular deficits (such as the initial loss and reinstatement of vision following trauma) can return after time, and it was amazing to me to hear that he translated this thought into psychiatric deficits and was able to come up with a standard treatment for acute stress disorder. I'm excited to hear about these kinds of crossovers with the current chasm there is between neurology and psychiatry, instilling in me the hope that these two fields might harken back to previous thought to potentially work together on the treatment of the "whole brain."

It's quite incredible the work that Dr. Walter Reed performed still has a place in today's society. Yellow fever still infects over 200,000 people each year. In his time, he managed to not only prove that it was not a bacterium, but he also showed it was transmitted (mosquitos), which drove the movement to prevent transmission via eradication of mosquitos and the future study of the disease as a virus. If not for his discovery, our current vaccinations may have been discovered much later, and it is unfathomable to think how many more would be infected by the epidemic, which could have also led to other implications such as closing off borders and the like. After all, it almost led to the cancellation of the Panama Canal.

Dr. Holmes' contributions were also quite great as he was the first to truly map the regions of the occipital lobe to various functions of eyesight. Doing this without any use of fMRI as we have today seems almost outlandish. However, thanks to the war, we had data that we may have otherwise never gotten. It's quite interesting to think of how many lives we have saved with knowledge that resulted from a war that killed so many. Along with Cushing's extensive work on neurosurgery and developing new techniques for treating neurological injuries, Holmes' work laid down the foundation for modern neurology and neurosurgery.

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In today's session, we talked about three different physicians -- Walter Reed, Harvey Cushing, Gordon Holmes -- and their contributions to medicine. The common thread between all three was that they were all military doctors at one point or another, and that their military service directly led to their achievements. For Reed, that was the study of yellow fever and other infectious diseases. For Cushing and Holmes, it was a deeper understanding of neurology and neurosurgery gained from studying casualties of the First World War.

Medical advances from war have always intrigued me, because they come from something that is directly antithetical to what medicine is all about. The ultimate goal of war is to weaken, disable, and even kill other people, whereas the ultimate goal of medicine is to strengthen, re-enable, and save from death. So I always have conflicting feelings when I realize that much of our understanding of the human body comes from war, since the best way to understand what something does is to see what goes wrong when it's missing or injured. It's not okay to deliberately lesion patients' brains and spinal cords to study the central nervous system, but if it's someone else doing the lesioning, it leads to significant medical progress.

Like much of our medical knowledge, much of the knowledge discussed in this week's materials (particularly in World War I) was obtained with harsh consequences. It's hard to know whether the millions of deaths from these wars is "worth it" in terms of the knowledge gained. How many people have been saved via these advancements in comparison to those who suffered because of them? Is thinking about it in such a utilitarian way even justifiable? I really like the following quotation from Lepore, "The importance of these achievements is too often lost as one generation's discoveries become the next generation's assumptions. Which is something all too easy to do." As great as some of these discoveries have been, would it be better never to have such a situation? Our medical knowledge would have progressed more slowly and some advancements may not have been made at all. Maybe that's an irrelevant sentiment though, as World War I, and the other wars through which we've advanced our medical knowledge, did happen. Though, at least some good came from an essentially pointless situation like World War I, so using that knowledge in some small way helps make up for the terrible things we humans are often capable of. It makes me think about other trade-offs we often make for advancement of knowledge, such as animal research, and whether that knowledge is truly worth the cruelty we often inflict. Interesting questions, and ones without great answers.

The first half of today's session was a great discussion on the important medical developments with yellow fever in the late 1800s and early 1900s. As one of the readings mentioned, it was the first virus transmitted disease to be discovered, and represented a huge breakthrough in research and disease epidemiology. It is amazing to see how far the army was able to extend its reach through medical progress by initiating a push for research on yellow fever near the US and far away internationally in diverse settings. The research of Reed seemed very methodological and groundbreaking at the time. The army and others used his information to target mosquitoes and thus eradicated yellow fever for the time being in some locations. I have a particular interest in policy and how certain health issues translate into action through policy, and so it was very neat seeing how this interaction played out with Reed's discovery.

The second half of the selective focused on neurology and neurosurgery discoveries from the First World War. It is saddening to think that the sheer number of injuries could lend itself to so many clinical findings but at least something beneficial and influential came from such carnage. It is quite interesting to see how Holmes pursued his research and discussed his findings in comparison to what we know today in the medical field and what has been added on to his research. The brain and neurology is a field that I am considering pursuing because of the developing large base of knowledge and progress still to be made, and so I found today's readings and discussion very relevant and inspiring.

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Today we discussed medical developments of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, such as the characterization of yellow fever by Walter Reed and the advancement of neurology and neurosurgery by Holmes and Cushing. Much of the interest in yellow fever research was militarily based. The Spanish American War and the occupation of Cuba resulted in breakouts of yellow fever in the US Army, and much funding went towards Reed's yellow fever research. That work eventually contributed to the development of a yellow fever vaccine. We discussed the relationship between advancements in war technology and the types of injuries sustained by soldiers. Holmes' work on shell shock laid the foundations of today's treatments for post-traumatic stress disorder; his work on combining findings from the ward and the laboratory were groundbreaking. I also found it fascinating that the gun technology of the era and the development of trench warfare led to the prevalence of head injuries and allowed for the localization of human brain function.

American expansion and conflict during the Industrial Revolution played a pivotal role in the development of modern medicine, particularly in epidemiology and neurology. The Spanish-American War served as the backdrop for research focusing on yellow fever. Though the disease had been known by this time, the mechanism(s) of its transmission was still not elucidated. Walter Reed, seasoned by military experience in the American frontier and work with public health issues, was commissioned to study yellow fever in US-occupied Cuba. It was there that he performed his seminal research, identifying the role of mosquitos in transmitting the disease.

Our understanding of neurology received a shot in the arm from work performed by Drs. Gordon Holmes and Harvey Cushing during World War I. The sheer number of head injuries caused by new weapons provided enormous number of cases that allowed Holmes and Cushing to pioneer many discoveries in the field. Holmes was able to create detailed functional maps of the occipital lobe and develop new treatments for “shell shock,” or what is now known as post-traumatic stress disorder. Cushing was able to perfect surgical techniques to treat many forms of brain injury. Upon the end of the war, Holmes and Cushing used their experience to lay the foundation for modern neurology and neurosurgery.

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Walter Reed was a physician who discovered that the transmission of yellow fever was through mosquitos. On the other hand, Sir Gordon Holmes was a neurologist who mapped vision in the cerebral cortex and who mapped spinal cord injuries according to the level of injury. While both individuals made substantial contribution to medicine, I find the story of Sir Gordon Holmes to be more fascinating. Arguably, World War I made Holmes’ discoveries possible. Had there not been a WWI, Holmes probably could not have examined such a large number of head injuries. It was discussed during class that the conditions leading to a high volume of head injuries included poorly designed helmets, shallow trenches, and bullets that only made localized wounds. The injuries were certainly unfortunate for the soldiers but these injuries allowed for greater understanding of brain function. I find it unnerving that wars as deadly as WWI actually allow for the advancement of science.

The period of the early 1900s was a period of frequent military conflict in the world (as was the case for most of recorded history, at least from 6000 BCE). Some of war's tragedies allowed army physicians to gain valuable knowledge in the fields of infectious disease, neurology, ophthalmology, and neurosurgery. Walter Reed discovered the transmission of yellow fever from mosquitoes. Gordon Holmes made great strides in our current understanding of vision and its relationship to the occipital lobe. Further, Holmes made advances in understanding the parietal lobe's role in visual space perception. Finally, Holmes advanced our understanding of the cerebellum. Last, William Cushing advanced many neurological surgery procedures. Overall, many of these advances in our understanding of the brain came as a result of directly studying wounded soldiers.

## ***WW II Organization of Improved Medicine – Infectious Diseases, Transfusions, Physiology***

**Week IV. March 5, 2014**

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## ARB Display

### Week IV. March 5, 2014

Flag presentation by General Joffre to Dr. Fred T. Murphy, Base Hospital 21, May 7<sup>th</sup>, 1917.

French General Marshall Joseph Joffre presenting an American flag to Dr. Fred T. Murphy, director of Base Hospital 21, on May 7, 1917. Joffre, who headed the French mission to the U.S., visited St. Louis to review the unit and to present it with American, British, and French flags. Base Hospital 21 was one of the first six hospital units mobilized for service overseas. The unit left St. Louis for New York on May 17, 1917, and two days later sailed 'destination unknown' on the S. S. St. Paul. VC025001

Presentation of the unit flag to Base Hospital 21, May 7<sup>th</sup>, 1917.

Celebration on May 7, 1917 in front of Barnes Hospital for the visit by the French mission to the U.S., led by General Marshall Joffre, and the presentation of flags to Base Hospital 21. Ten days later more than 8,000 people crowded St. Louis' Union Station to watch the unit depart on a special train of seven sleeper cars, two dining cars, and a baggage car. As the train pulled out of the station, the crowd waved American flags and every train in the area saluted its departure with a whistle. VC025003

Recruiting ad, Base Hospital 21, [1917].

Recruiting ad for the American Red Cross Hospital Unit 21 that appeared in the St. Louis Post-Dispatch in May 1917. The ad sought men between the ages of 18 and 45 in good health. Further, 'preference will be given to unmarried men and men without dependents and home responsibilities which will interfere with their efficiency. It is a great work for humanity that this unit will perform and only those who can go into it with their whole heart and soul are desired.' VC025310

Members of Base Hospital 21 en route to France, 1917.

Base Hospital 21 set sail on May 19, 1917 for its eight-day transatlantic crossing. Dr. Arthur W. Proetz, a medical officer of the unit, reflected back on the experience in a 1963 article: "Actually it was what we didn't know that kept us from jumping out of our skins as we sat around waiting for orders and commissions. We didn't know that they were presently going to send us across the water among the U-boats in an ancient tub, a White Star Liner, armed fore and aft with a couple of cannons left over from the Spanish-American War. On her next visit home somebody left something open and she sank. We did not know that for the next six months we were going to inhabit moss-covered bell tents in the light and warmth of our comic candle-lanterns near Rouen, the

wettest spot in all Europe. (Even local picture postcards described that town as the 'pot de chambre de France.')

VC025017 – VC025023  
Arrival of casualties, Base Hospital 21, Rouen, France, [1917?].

Casualties were transported from the various fronts to Rouen by hospital train. Motor ambulances transferred the patients the two miles between the train station and the Base Hospital. Base Hospital 21 received patients wounded in fighting in the Somme area at the southern end of the line held by the British forces, as well as casualties from the October 1917 Flanders offensive and the March 1918 German drive toward Amiens. VC025036

Base Hospital 21, Rouen, France, 1918. VC025076-79

World War One ambulance, ca. 1917. VC025122

Mustard gas patient, Base Hospital 21, Rouen, France. [1918?] VC025186

Ernst fluoroscopic table, Base Hospital 21, Rouen, France, [1917?]

The fluoroscopic table designed by Capt. Edwin C. Ernst, roentgenologist for Base Hospital 21. The device was heralded for allowing patients to be X-rayed while remaining on the same stretcher they arrived on and for reducing the amount of radiation exposure to the examiner. Patients arriving at Base Hospital 21 were given X-ray examinations prior to their tent bed assignments whenever possible. Much suffering was avoided by examining the soldiers on their original ambulance stretchers, immediately upon their arrival from the casualty clearing stations. Unnecessary congestion of the wards was also prevented; wounded soldiers were classified upon their arrival as follows: emergency cases (more seriously wounded soldiers requiring surgery, labeled 'operation immediately'); less serious cases (requiring surgery at a later date, marked 'defer operation'); trivial (lightly wounded soldiers immediately rerouted to other hospitals); and non-operative cases (British soldiers were sent home to England while French and American soldiers were routed to the south of France). Ernst is at center of photograph. VC025196

Scrap Iron Jazzerinos.

Base Hospital 21 staff members Arshav Nushan, drums, Edwin Dakin, violin, Syl Horn, banjo, and Clarence Koch, trumpet; Clevelanders Russell Hauslaib, saxophone, Clayton Thirkill, piano, and Albert Angelotta, trombone, made up the "Scrap Iron Jazzerinos" which entertained the base hospital staff and patients. When the hospital was deactivated, the band played for YMCAs all over Europe, at the Peace Conferences, for the Queen of Romania and other dignitaries, and at the Casino de Paris. Appearing with them were stars of the entertainment world: John Boles, singer and movie actor, Maurice Chevalier, singer-entertainer, and Bob Carleton, composer of the words and music of the 1918 popular hit, "Ja-da." The singer Sophie Tucker was their "godmother," arranging for the band to get all the music publications they needed. The Victor and Pathe Companies recorded their music. Staying in Europe until 1921, the band was among the first to bring Jazz to European audiences. VC025101-103

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The colors, originally presented to Base Hospital 21 by French Marshall Joffre, were transferred to the 21<sup>st</sup> General Hospital at a ceremony presided by Frank C. Rand, Chair, Board of Trustees, Washington University. Lee D. Cady, MD, commanding officer of the 21<sup>st</sup>, is sitting in the front row. VC013089
- Gas chamber drill, Ft. Benning, Georgia, 1942. VC208154
- Nurses and officers of the 21<sup>st</sup> General Hospital drilling during basic training, Ft. Benning, Georgia, 1942. VC208157
- Le Grand Hôtel resort and spa, Bou Hanifia, Algeria, 1943. VC013136
- Pre-war pamphlet advertising the resort and spa at Bou Hanifia, Algeria. VC208177
- Orthopedic surgery, 21<sup>st</sup> General Hospital, Naples, Italy, October 3<sup>rd</sup>, 1944.  
Surgeon operating is Russell J. Crider is performing a closure of a gun-shot wound over a fracture. Nurse Eleanor Brinkmeyer assists. VC013199
- Doctors examining patient, 21<sup>st</sup> General Hospital, Ravenel Hospital, Mirecourt, France, 1945.
- Lt. Col. Sim F. Bean, Maj. Joseph C. Edwards, Maj. John H. Wedig, and 1st Lt. Carolyn Klinge examine a patient during rounds. VC013015
- Consultation on fractured femur with sciatic nerve injury, 21<sup>st</sup> General Hospital, Ravenel Hospital, Mirecourt, France, 1945.
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*Activities of Surgical consultants by United States Army Medical Service.* John Boyd Coates, editor. Medical Department, United States Army Surgery in World War II. Office of the Surgeon General. Dept. of the Army, 1962. ARB UH 215 U58a 1964.

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James Barrett Brown, MD, chief of the WUSM plastic surgery division, was named head of the U.S. Army's plastic surgery division during the Second World War. While at Valley Forge General Hospital he met a young surgeon, Joseph E. Murray, MD, and spoke with him about the rejection of skin grafts and his experiences with successful grafts between identical twins.

In December of 1954, a surgical team led by Joseph E. Murray demonstrated that organs could be transplanted between identical twins. In 1990 Dr. Murray was awarded the Nobel Prize in Medicine for his work as a pioneer in transplantation. Murray often credited Brown for inspiring his work in transplantation immunology.

Gibson T, Medawar PB. 1943. The fate of skin homografts in man. *J Anat 77: 299-310.*

Sir Peter Medawar's research into transplantation immunology began during the Second World War, when Medawar's interest in immunological tolerance grew directly out of his research in skin grafts begun during the Second World War.

When a plane crashed near his Oxford home during the Battle of Britain, the doctors treating the severely burned pilot sought Medawar's advice, hoping that his studies in cell development might provide some critical insight. Medawar believed skin grafts were the best possible treatment, but he also knew that they almost always failed. Unable to help the pilot, Medawar became fixated on the problem of treating burn victims and traveled to Glasgow to further investigate the matter for the Medical Research Council with the surgeon Thomas Gibson. Experimenting with autografts from a patient's own body and homografts (now called allografts) from donors, Medawar and Gibson found that, although both autografts and homografts initially healed successfully, homografts were rejected within two weeks. When a second homograft from the same donor was attempted, the graft was rejected much more quickly. Medawar suggested that the latent period following the initial graft and the heightened resistance to subsequent grafts were characteristic of an immune response.

Continuing his study of skin grafts on rabbits in his laboratory at the University of Oxford, Medawar was further convinced that his initial suspicion was correct: the homograft reaction was in fact immunological. He investigated possible improvements in skin grafts. Medawar was awarded the Nobel Prize in 1960 "for discovery of acquired immunological tolerance."

Spear, Frederick Gordon. *Medical uses of the cyclotron*. Smithsonian Institution Board of Regents. Smithsonian Report – 1945; Publication 3819. Washington, D.C.: Smithsonian Institution, 1946.

In 1938, one year before the cyclotron's inventor Ernest Lawrence would win a Nobel Prize for his work, Washington University began planning for its own cyclotron. In 1939 Lawrence would endorse WU's plan saying it "offers an ideal set-up for a medical cyclotron project." With a grant from the Rockefeller Foundation construction began on a site near the power plant on the Danforth Campus. Beginning operation in 1941 and administrated by the Mallinckrodt Institute of Radiology it was regarded as the first cyclotron dedicated for medical research. However, during World War Two it was used to create plutonium.

After the war Washington University's cyclotron would be a big draw for Nobel Prize winning physicist Arthur Holly Compton to return to the University as Chancellor. In 1941 Compton had been placed in charge of the Office of Scientific Research and Development (OSRD) S-1 Committee, charged with investigating the properties and manufacture of uranium. In 1942, Compton appointed Robert Oppenheimer as the Committee's top theorist.

Research made possible by the cyclotron would bring together a nucleus of chemists, physicists and physicians including in 1945, Martin Kamen, the co-discoverer of Carbon-14, and in 1950, Michel Ter-Pogossian. Ter-Pogossian would be instrumental in having another cyclotron built on the Medical Center in 1964, the first cyclotron in a hospital setting in the United States. In 1977 a second cyclotron was installed at the medical center. Ter-Pogossian would lead a team in the 1970's which would develop the first PET scanner although the major players in its development were Michael Phelps and Jerome Cox. xxQZ 269 S741m 1946

Hacker BC. 1987 *The Dragon's tail : radiation safety in the Manhattan Project, 1942-1946*. Berkeley : University of California Press.

The head of the radiation safety for the Manhattan Project facility at Los Alamos was Louis H. Hempelmann, Jr. WUSM Class of 1938. J. Robert Oppenheimer recruited Hempelmann from WU where he had been working with the University's new cyclotron. Hempelmann in turn recruited James F. Nolan and Henry L. Barnett, both were also WUSM Class of 1938 graduates. Nolan and Barnett were initially recruited to serve as the post's obstetrician and pediatrician. Paul O. Hageman, a WUSM Class of 1934 graduate, would also be a physician at Los Alamos. Nolan and Barnett would be a part of the US Army teams which surveyed Hiroshima and Nagasaki immediately after the bombings. WN 610 H118 1987

Cover, *Washington University Alumni Bulletin*, 15, #6 1946.

E.V. Cowdry (far right), head of the WUSM department of anatomy and the division of cytology, receives some of the first radioactive material made at the

Manhattan Project's Oak Ridge, TN facility released for civilian purposes in 1946. E.V. Cowdry vertical files

Oral History Interview with Crawford F. Sams, WUSM Class of 1929.

During the Second World War Sams served as a research physician and Brigadier General in the U.S. Army. At the end of the war Sams was made Chief of the Public Health and Welfare Section of the General Headquarters, Supreme Command Allied Powers and was responsible for the establishment of all activities pertaining to the health and welfare of the Japanese. In the oral history Sams relates his contributions in the rebuilding Japan, including studying the effects of radiation after the bombing of Hiroshima and Nagasaki, establishing mass immunization programs, improving medical care and education, and nutrition initiatives during this period. OH037

## Gobbets

### Week IV. March 5, 2014

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Today we talked about advances in antibiotics, transfusions, and motion sickness physiology. World War II saw an astounding increase in technological advancements, due to both the urgency of the war and the opportunity for monetary profit. The first sulfa drugs were discovered in the 1930s and were immediately recognized as effective, and then mass produced during the war. Soon, however, it was discovered that penicillin was just as effective (or more effective), and had fewer side effects. Penicillin went from no production at all to mass production that was capable of supplying the country. Another problem prompted by the war was the preservation of whole blood for transfusions. Researchers at various universities in the US urgently searched for a solution that would allow for the transportation of blood from the US to the battle arena overseas, and found one relatively quickly. Another health problem that surfaced due to the new ways that war was being fought was motion sickness. Researchers conducted many tests to learn more about the physiology of motion sickness. They were able to determine factors that contributed to the development of motion sickness and tested many potential treatments. It is fascinating to see that so many of the crucial technologies we use today were developed in such a short time span, as a result of the war.

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The most glaring point from today's session was the sheer magnitude of production and research that was performed during the Second World War. Previous sessions seemed to focus primarily on the advances that a few select people did and how those educated individuals were able to push forward medical practices and administrations in the US and western Europe. But this session had a strong point on the globalized and national effort towards a particular purpose and focused more on the advances rather than the individual. This clearly represents the trend that has continued onto today of collaboration and what some might say is the end of the "age of the geniuses" in that there are really no more Einsteins or Newtons that will single-handedly change their respective fields because collaboration is so much easier through technological advances. But when you put things into context in relation to how medical advances previously were made, the single individual is definitely not as good as the whole. When you have an entire country focused on a single issue (such as penicillin, blood transport in WWII and now HIV), you are prompting for rapid advances in the field. And, it is clear by this session that this shift occurred during the World Wars.

Whether the effort is towards blood preservation, sulfa drugs, penicillin, or motion sickness, the rate of discovery during World War II was one of the most explosive of any time in history. Particularly, the rate at which penicillin production increased was one of the most staggering displays of what we can do as a country. If we could replicate that level of collaboration in an effort against today's diseases, perhaps we could spearhead even more incredible treatments against various cancers. It honestly makes one question why such collaboration isn't constantly pursued; after all it worked with the yellow berets with the discovery of oncogenes.

Of course, it was the war that catalyzed these efforts and that sense of jingoism and urgency could not be replicated in every day civilian life. Once again, I am utterly shocked by how much good could come from such a terrible war. We still use most of these discoveries even to this date. Considering in 12 years we had not had enough penicillin to treat a patient, yet in only another four we had enough for the entire country and then some, we should almost be grateful that the war occurred to radically accelerate research. It's fathomable that we might be in a worse situation today with more deaths than even in the war due to lack of discovery if the war had not occurred.

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In today's session, we discussed a series of medications and procedures that were discovered or developed over the course of the second World War – sulfa drugs, penicillin, whole blood preservation, and motion sickness. One common thread that I noticed in all of these articles is how much of a collaborative effort went into these medical discoveries. Unlike the past three sessions, in which the discoveries could be attributed to a single individual or a small group of people, these advances were made by entire institutions or even countries. For example, while Fleming may have discovered penicillin, it was the joint effort of many pharmaceutical companies and many research groups that nailed down its production and use.

In class, we discussed a variety of factors that could have contributed to this shift – advances in communications and transport technology made this wide-scale collaboration possible. Government coordination and funding allowed this research to happen and also gave it direction. An increase in academic institutions and scientists provided the necessary brainpower. The global nature of the conflict that was the ultimate impetus for this research also allowed allied countries to draw on each other's resources. In many ways, this is where we start to see medicine and medical research resemble its current-day form.

Today's session covered many of the amazing achievements in medicine surrounding WWII. The first reading, which I completed, covered the usage of sulfa drugs for many different illnesses, and the relationship these had with penicillin as its production was revved up. It is amazing to read about the mass production and distribution of sulfa drugs at the time, and how it was found to be so effective for so many illnesses. It was also interesting to see the same theme pop up for its usage for different diseases, namely that one drug would be used for a year until a more effective (and less side-effect resulting) sulfa drug was discovered and then that would replace the standard. This seemed to occur for the majority of these diseases until after the World War when penicillin was finally decided as the main standard for many of them. Another aspect that surprised me was how the civilian research that found a lack of effectiveness for sulfa drugs as local treatment in burns did not influence the usage in the army or navy during the war. It's alarming that the military decided to continue their practices in the face of such evidence, and somewhat fooled themselves into thinking that it was because the civilian research was not generalizable. The next part of the discussion with penicillin further added on to this discussion and it is amazing to see the potential of the industry at the time and their ability to completely ramp up production of a drug despite it being much more complicated than Sulfa. The other two areas we talked about further emphasized the booming exploration and discovery consequence of the war in those medical areas.

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Today, multiple primary (photos and interviews) and secondary sources (records) were studied to learn about WUSM's involvement in WWII. This includes the many physicians who served in various roles in Base Hospital 21, which was active in the European Theater. Some history of the Manhattan Project was also discussed. For example, bulletins were read to study the involvement of Washington University's involvement in the project. This includes the work of Arthur Compton, who made significant contributions to the production of the nuclear bomb with his involvement in construction of the nuclear reactor and its research.

In addition, articles were discussed to study the history of production of various drugs including sulfa drugs and penicillin. Our understanding of sulfa drugs in particular, was rapid during WWII, and much knowledge in toxicity and potency of the drug was learned during that time. Interestingly, sulfonyleureas, a drug for diabetes, was also discovered during that time.

There were many revolutionary discoveries that occurred before and during WWII. Two of the most important discoveries to the medical community were sulfonamides and penicillin, which revolutionized our treatment of bacterial infections both on the battlefield and in civilian hospitals. Another major achievement in the medical community that occurred during WWII was the ability to transport whole blood over longer time scales, greatly reducing the deaths from shock. These discoveries came as a result of different societal changes occurring at the time. First during WWII, the government heavily invested in the war effort causing numerous industries to appear, including large-scale pharmaceutical companies. Second, communication on a global scale, along with an increase in the number of scientists and doctors helped achieve these discoveries.

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Medical progress, in the context of World War II, advanced at an unprecedented pace at the time. The American war effort resulted in an explosion of research that led to the improvement of sulfa drugs, high-yield production of penicillin, long-term storage of blood products, and development of anti-motion sickness drugs. The international scope and technological advancements in weaponry, carried over from World War I, radically changed the war landscape and led to new challenges in military medicine. The number of burn and hemorrhagic wounds, and exotic pathogens significantly increased the demand for better antimicrobial pharmaceuticals and whole blood products. Massive amphibious and aerial assaults, whose magnitude far exceeded any of those in previous conflicts, spurred the need of agents that would help combat sea and air-sickness. Thanks to the unprecedented organizational effort spearheaded by the US military, these and other medical problems were solved. Of course, these discoveries met some resistance at the time, but many remain today, a true testament to the power of the scientific revolution of the war.

Today's discussion was centered on the rapid advances in science in medicine brought about by WWII. Specifically, we discussed the discovery and manufacture of sulfa drugs and penicillin and research conducted on motion sickness and preserving blood for transfusions.

The discovery of sulfa drugs and penicillin had a profound effect on the war effort and on medicine, and I found these topics most interesting. These pharmaceuticals were used to treat diseases like pneumonia, gonorrhea, meningitis, and saved tens of millions of man (person) -days, and reduced the mortality of staphylococcus infections and bacteremia from 70% to 10%.

Initially, the use of sulfa drugs was controversial because there were severe side effects. Several variants of sulfa drugs were produced in the 1940s, and eventually less harmful versions were produced that allowed for widespread use. When penicillin was first discovered, it was extremely hard to manufacture, and it cost over \$200 million dollars to produce a single unit. Over the next 4 years, however, centralized efforts by the federal government improved manufacturing techniques and allowed sufficient quantities to be made for both civilian and military use.

It was fascinating to learn how the desperation of war allowed for significant advances on nearly every scientific frontier.

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This week focused on the effect of WWII on the advancement of prevention, care and treatment with medicine. I particularly found the question posed at the end of class to be thought provoking. Indeed, why was there a sudden surge in the advancement of science and medicine in WWII? Of the possible reasons presented, I liked "fear" the best. While WWII may have seen more scientists, better communication, transportation and organization, I think that the fear of losing the war and what that would look like contributed significantly to hastening the understanding of medications such as sulfa drugs and penicillin. Sulfa drugs were discovered in 1938 and penicillin in 1929, but mass production of these drugs as well as production of better forms of these drugs occurred specifically in WWII. The archivist in the Rare Book Library also pointed out that WWII was largely a war driven by logistics. In order to win, even citizens became involved in supporting the troops. This effort must have been fueled by fear, and medical advancement may simply have been one of its many fruits.

## ***NIH 1937+ – Origins and Impacts on Health and Health Research***

**Week V. March 12, 2014**

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## ARB Display

### Week V. March 12, 2014

National Cancer Institute Act, correspondence and applications for support, 1938.

Evarts A. Graham Papers, Box 66, Folder 478:

Siteman Cancer Center grant application for a cancer center support grant submitted to the National Cancer Institute, October, 2000. One bound volume, 916 pages. RG051 Siteman Cancer Center Records, Accession 2001-016

Letter from Leonard Scheel, Director of the National Cancer Institute, announcing the appropriation of federal funds for the purpose of building the construction of cancer research facilities, 1947.

Central Administration, Washington University School of Medicine (RG01C), Series 9, Box 5, Folder 9.

Cancer Research Building construction, circa 1950. VC423

Hill-Burton Application for construction of Wohl Clinics Building, 1958.

Robert E. Shank Papers, Series 12, Box 35 Folder 3, Clinic Building -- David P. Wohl, Jr. Washington University Clinic, 1954-1962.

Hill-Burton Act

The Hospital Survey and Construction Act (or the Hill-Burton Act) was passed in 1946. The Act was the congressional response to President Truman's proposals and was designed to provide federal grants and guaranteed loans to improve the physical plant of the nation's hospital system. In 1975, the Act was amended and became Title XVI of the Public Health Service Act. Currently, a facility assisted under Title VI or XVI of the Public Health Service (PHS) Act is required to provide uncompensated services at its Adjusted Annual Compliance Level with some exceptions.

Wohl Clinics Building, architect's drawing, circa 1957. VC423

Former Dean of WUSM, Edward W. Dempsey being sworn in as Special Assistant to the Secretary of the Department of Health, Education, and Welfare while Anthony J. Celebrezze, Sr looks on, 1964. Celebrezze was at that time the United States Secretary of Health, Education, and Welfare, a cabinet position now known as the Secretary of Health and Human Services. Dempsey had left WUSM over a controversy which developed between the school and Barnes Hospital over the patient care compensation from the newly planned Queeny Tower. VC415--DempseyEW--O'BrienLF--CelebrezzeAJ--1964

*Impact on Medical Education of NIH Research and Training Grants.* National Opinion Research Center, University of Chicago. Unpublished report, 1959.

Central Administration, Washington University School of Medicine, Records, Sub-Group 1: Dean and Executive Vice Chancellor Records, Series 9, Folder 12, Box 32.

Reports on the Training Grant Program, US Public Health Service.

The program was created to encourage medical schools to support medical students in independent research.

Central Administration, WUSM Records, Sub-Group 1: Dean and Executive Vice Chancellor Records, Series 10, Box 42, Folder 11.

Olin symposium program commemorating the 20th year of NIH funding for WU's MSTP, 1990

Medical Scientists Training Program, WUSM Vertical Files

WU School of Medicine Dean's Report announcing that the Public Health Service has reviewed and accepted the school's steps to comply with PPO#129.

Review of Research on Human Beings Vertical File \*\*PHS Acceptance of Our Statement of Assurance, 1966

During the late 1950s and early 1960s, the National Institutes of Health (NIH) was growing rapidly. It was a time of great energy in medical research and a time of great trust from the community at large that there would be public benefit from these research efforts. Patients were eager to enroll as participants in this new enterprise of medical research. However, enthusiasm waned when doubts about the benefits of research results, and concerns for the risks to research subjects, began to surface in the public media. The news reports from Europe covering the tragic consequences of the drug Thalidomide were especially troubling. Thalidomide, administered to pregnant women in many countries as a sedative and to prevent morning sickness, was associated with limb anomalies in newborn infants. Thousands of infants whose mothers had used thalidomide were born without arms or legs. Spurred in part by these reports, Senator Estes Kefauver, chairman of the Senate Subcommittee on Antitrust and Monopoly, began a series of hearings concerned with the cost and availability of drugs in 1959. The result of the hearings was the 1962 Kefauver-Harris Amendments to the Food, Drug, and Cosmetic Act. A major proviso added to the amendments of this act had been introduced by Senator Jacob Javits. It required that research subjects provide informed consent prior to their participation in any FDA regulated study. The Javits provision was the first time that any sort of protection for human research participants was included in a federal statute.

James Shannon, then director of the NIH, also had concerns about the oversight of scientific integrity and the maintenance of professional standards in research. Shannon testified before the National Advisory Health Council (NAHC) on September 28, 1965. *"Research involving [humans] departs from the conventional patient-physician relationship where the patient's good has been substituted for by the need to develop new knowledge. [The] physician is no longer in the same relationship that he is in the conventional medical setting and indeed may not be in*

*a position to develop a purely or wholly objective assessment of the ... ethical act which he proposes to perform. The Public Health Service has a dual responsibility. One is a minor one of keeping the Government out of trouble ... but really the major one is ... to try to encourage the nourishing of sound clinical investigation rather than discouraging it. I am searching for some way of creating a more profound sense of an institutional awareness of the importance of this aspect of the problem without tying [investigators] down and immobilizing them in their capabilities."*

NAHC deliberated for several months and then issued Policy and Procedure Order #129 (PPO #129) on February 8, 1966. Shannon then went about quietly implementing the new requirement that scientists receiving federal funds should have an oversight committee composed of "peers" that would review and approve a research proposal prior to its implementation. Because virtually all federal funding went to universities and large medical centers, these institutions founded research review committees.

Through a series of evolutionary steps in the 1970s and 1980s, the current concept of the Institutional Review Board (IRB) was developed. As with the original "peer" oversight committees required by PPO#129, IRBs are the responsibility of the institution themselves. While today there are independent organizations which serve as IRBs under contract to an organization, most are still internal panels. This internalization of review is unlike the approach taken in other parts of the world. In the United Kingdom, review boards are centralized under the authority of the National Health Service.

In the United States, the responsibility for forming oversight committees has been left with the institution. All clinical activities are overseen by the Institutional Review Board (IRB) to comply with ethical standards as well as governmental and institutional regulations. Management of the application of these requirements is conducted by a governmental oversight body called the Office for Human Research Protections (OHRP). This office was originally established within the NIH, but is now contained within the US Department of Health and Human Services.

Letters expressing concern over NIH funding, May 6, 1966.

M. Kenton King and William Danforth to WUSM faculty, May 6, 1966.

William Landau to William Hull, Committee for Health Appropriations, US House of Representatives, May 6, 1966.

Central Administration, WUSM Records, Sub-Group 1: Dean and Executive Vice Chancellor Records, Series 10, Box 46, Folder 5.

Testimony on the Costs of Biomedical Research, 1981.

William Danforth, University Chancellor, and David M. Kipnis, Chair of Internal Medicine, were invited to provide testimony to the Advisory Committee to the Director of NIH.

William H. Danforth Vertical Files \*\*Testimony, NIH grants, 1981

William H. Danforth Oral History (OH122)

Clinical Sciences Research Building, dedication, 1984.

William H. Danforth, Chancellor of Washington University speaks at the dedication ceremonies for the CSRB. David M. Kipnis, was head of the Clinical Research Center from 1960-87, and was chair of the Department of Medicine from 1973 to 1992. Kipnis was instrumental in the construction of the School of Medicine's Clinical Sciences Research Building (CSRB). VC265 – CSRB

Architect's drawing of planned McDonnell Medical Sciences Building, ca. 1966. VC047201

McDonnell Medical Sciences Building, construction, ca. 1968.

A view from the top of the McDonnell Medical Sciences Building under construction looking east toward the urban cityscape destined to be the location of future CORTEX developments. VC047090

WU Medical Center, circa 1974. VC421

Jerome Cox works out a problem on the chalkboard in the Computer Systems Laboratory, WUSM.

Beginning in the 1960s major biomedical computing activities were initiated and supported by the NIH. Director of the National Institutes of Health, James Shannon, at the suggestion of the National Academy of Sciences, created a working group to advise the NIH on how computer technology could be used to enhance biomedical research. Shannon charged the group, called the Advisory Committee on Computers in Research (ACCR), to bring NIH into the modern computer world. In 1964 the ACCR became the NIH's Computer Research Study Section (CRSS.) Washington University faculty members Jerome Cox and William N. Papian were members of the CRSS. In 1964 Cox also helped recruit Papian from MIT, along with Wesley Clark and Charles Molnar, the developers of the LINC computer - an important advancement for the use of computers in biomedical applications. Biomedical Computing Institute Records RG035

Charles Molnar, Wesley Clark, Sidney Goldring and Jerome Cox with LINC computer.

In the 1960s the NIH made 12 of the LINC computers available for research. Sidney Goldring, Professor of Neurosurgery, and James O'Leary, chair of the department of Neurology, were the first clinicians to apply for and to receive a grant from NIH for a LINC computer. Biomedical Computing Institute Records RG035

Wesley Clark with the LINC computer. Biomedical Computing Institute Records RG035

Charles Molnar with the LINC computer. Biomedical Computing Institute Records RG035

## Gobbets

### Week V. March 12, 2014

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The main topic of today's discussion was basically a crash course on how the modern American research institution came to be. We heard summaries on the histories of the National Science Foundation and the National Institutes of Health, as well as a short biography of Dr. Vannevar Bush, who was instrumental in pushing for establishment of the former.

All this is a far cry from what we talked about in the first session of this selective, and I'm struck by how much medical research has changed – from the self-initialized individual case study of digestion by Beaumont (who basically had the opportunity fall into his lap), to haphazard as-needed studies like Reed's famous yellow fever experiments, to the first stirrings of government and industry collaboration in the production of penicillin, to the final establishment of large, multi-million dollar, now multi-billion dollar, foundations dedicated solely to funding scientific and medical research in the United States.

I always knew that a lot of medical progress came from war, but I had always thought of the progress in terms of new techniques or inventions created to deal with the unique traumas of combat. This class has helped me realize that while these are definitely important contributions, war has also driven larger-scaled (and arguably more impactful) changes to medicine – namely, the progression from individual to institutional, and from “wisdom-based” to science-based that we followed in this class and that I outlined above. I didn't learn what I expected to learn in this class, but I think what I actually did learn might be more important. Thank you for teaching this selective!

When former President Jimmy Carter received his Nobel Peace Prize, he delivered a speech concluding with the words, "War may sometimes be a necessary evil. But no matter how necessary, it is always an evil, never a good." After participating in a selective focused on medicine from war, I cannot help but think how medical advancements borne out of wars support the inflammatory idea that war may sometimes be a necessary evil. Through the selective, I learned that a number of physician-scientists who made significant contributions in medicine were once army doctors and I learned that wars provide unique circumstances that push for medical discovery.

Among the army physicians discussed in class, I still find William Beaumont to be the most fascinating as he is also the most controversial. Even as a high school student, I had already heard stories about a scientist who used an open stomach wound of a peculiar subject to insert food and study gastric content. I will only admit in this writing that I have dismissed this story as an urban myth. Were it not for the selective, I would still be walking around thinking that a scientist named William Beaumont and a subject named Alexis St. Martin could not have possibly existed. While the experiments were not done during wartime, Beaumont's experience as an army surgeon may have informed his civilian practice as well as his scientific endeavor.

On a different note, I think that the selective wrapped up nicely with how World War II experience provoked the development of governmental institutions for public health. Wars certainly accelerate progress in medicine as exemplified by mass production of penicillin years after it was discovered, but peaceful times should also see medical discoveries as advocated for by Vannevar Bush. Also, I learned about the history of NIH for the first time. Who knew that the roots of this behemoth institution could be traced back to a one-man show by a hygienist named Joseph Kinyoun. All in all, I thoroughly enjoyed the selective. One could only hope, however, that there would no longer be wars, because despite all the medical progress borne of them, they are still always an evil, never a good.

The advent of information technology and rapid global communication and dissemination of information is at the heart of today's topic and indeed the latter half of the 20<sup>th</sup> century history of medicine. Most of the advances of that time period, like genetic sequencing, have only been possible due to our increasing computing power, and with the ability of countless hospitals and academic centers to be linked together via the internet. Perhaps no other factor has been more crucial than this to the development of modern medicine.

Taking a more holistic approach about the class, seeing the development of our current medical practices and systems formed piece by piece over the centuries has been really interesting. To have a somewhat better idea of when important advances were made and the important players in the development of our modern medicine is valuable insight and indeed, makes me feel hopeful about all the myriad discoveries and advances yet to come, some of which will no doubt be made by my very dedicated and talented classmates (or maybe even myself!).

Thank you for the opportunity to learn and to get to view the first-hand artifacts. This was a valuable and interesting course, and I will definitely recommend it to future classes!

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Base Hospital 21's story is an interesting one to say the least. Starting in World War I with a group of physicians, medical students, and nurses from WashU and St. Louis, 21<sup>st</sup> Base Hospital was one of the first six hospitals set up by the American Red Cross during the First World War. Although the physicians were Americans, they were primarily serving British casualties – estimates say that only 4% of the patients seen by these physicians during WWI were actually American. It primarily served as a throughput station, having up to 500 units transferred once the individuals were healthy enough to travel. Portable X-ray and other logistical medical advances came out of this hospital during this time. World War II reigned in another era for Base Hospital 21, this time set up in Bou Hanifa in northern Algeria. Then, they relocated to Naples and finally Mirecourt after a brief stay in Marsailles. The European sites were much less suitable for housing than the spa at Bou Hanifa. The sheer magnitude of operations performed by the ~2,000 physicians was daunting, and the fact that the captured Axis military medical professionals worked beside those in Base Hospital 21 is an interesting profile on the collective push towards saving lives. This is really a fascinating story in the history of WashU in wartime, and it makes me wonder why the Base Hospital was immediately disbanded following WWII.

I have very much enjoyed the progression of this course in its entirety. It has given me a good sense of the enormous amount of medical progress we have obtained from the pressures of war. Time and time again, from the establishment of penicillin to Beaumont's study of a gunshot wound, this course has shown me that some of the best advances in medicine have come from extremely unfortunate situations. I have echoed this mentality again and again, but it makes me grateful that I live in a post-war era that has retained all these advances.

What's very interesting is that the rate of medical discovery from war has accelerated rapidly throughout time, mostly through the efforts of collaboration. At the beginning of the course, we discovered a vast amount of information about gastrointestinal physiology from one individual. By the middle, we were engaging the entire country in the production of a seemingly impossible-to-produce drug, penicillin, and achieved even greater strides. Then by the end, we have noted an establishment of central agencies to further push research in times of peace to the levels we had during war, causing even more rapid advancement. It was quite a remarkable view and was certainly essential to today's ever-changing medical climate.

In total, we have learned that war was vital to the progress of medicine. The efforts of individuals under times of great stress have shown what our country and others are capable of. This may hold true for much of human experience – that we achieve our greatest under times of hardships, but no situation other than war can possibly engage an entire country to their limits as it has done. For those who have put in effort and for those who have lost their lives in the process, we must be thankful.

This selective covered the history of various developments in the field of medicine in the context of war. We began by discussing the work of William Beaumont on the physiology of digestion. He took advantage of a unique opportunity to study digestion by conducting experiments on Alexis St. Martin, who had a gastric fistula from an accidental gunshot wound. Next we discussed the work of John Shaw Billings, an army surgeon who spearheaded the development of the Library of the Surgeon General (which would become the National Library of Medicine), oversaw the construction of Johns Hopkins Hospital, and advised the organization of the school of medicine at Johns Hopkins. Then we discussed the war driven research into yellow fever, shell shock, and brain surgery of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries. Moving forward to WWII, we discussed advances in antibiotics, transfusions, and motion sickness physiology. Finally in our last session, we discussed the history of the NIH and how the major wars spurred on federal support of medical research.

I found the material discussed really interesting. It is intriguing and perhaps somewhat sad that war has been the catalyst for so many of our medical discoveries. I noticed a trend where the earlier developments were the work of mostly one or two people and, as time went on, medical research starting becoming the combined efforts of multiple people and larger organizations, eventually to the level of the federal government. The time spent upstairs in the rare book archives was really cool and I enjoyed hearing the historical summaries given by the staff. Discussions were useful for synthesizing the material and hearing other's opinions.

Thank you so much for leading such a wonderful class!

Today's session covered the emphasis placed on scientific research as a result of WWII. Vannevar Bush's immense influence through the OSRD and afterwards cannot be overlooked, as his impact is still felt in our research focus today. During and after WWII, Bush headed OSRD and realized the profound importance of carrying out research during peacetime to prepare for such wars. There were certain areas in the War where the Germans had superior technology, and this was a lesson on how research preparations before war can play determining roles in aspects of the battles. As such, Bush recommended to Roosevelt (at Roosevelt's request) that funds be allocated to support research during peacetime. This influence can be felt in how other research foundations and institutions such as NSF and NIH were created or gained increasing funding and attention post WWII. I was particularly interested to see Bush's support for basic science and his label of translational research as short-sighted. It was surprising because of the current priority that I feel gets placed on translational research in many settings, almost as if it is the 'trendy' thing to do. Of course without basic science research certain fields will become stagnant, and it is great to see that Bush had the foresight on this issue when he wrote his report.

It is also amazing to see how far such a research-focus has come especially when propelled by our defense spending in our more modern time period. For example, DARPA nowadays is involved in many cutting-edge projects (e.g. new intuitive prosthetic replacements) that came about from a surge of funding and research priority. It has been and will continue to be interesting to see how the outcomes of such scientific discoveries will enter into the civilian spheres and how long this process will take before people can adopt the devices or discoveries. It will depend on many factors such as pricing and access and quality.

From our discussion last Wednesday, it is clear that Vannevar Bush was instrumental in promoting science research through his role as the head of the Office of Scientific Research and Development. His work helped to start the development of the National Science Foundation and the NIH. Further, he himself was a very talented scientist who made great contributions in the field of computers. The NIH began in 1887 as a single room laboratory, under a scientist named Joseph Kinyoun, and it slowly became world renowned for its research and funding. Over the years, the NIH has funded research in virtually all areas of medicine. Discoveries funded by the NIH have had profound impacts on the public health not only in the US, but also around the world. More than eighty Nobel prizes have been awarded to investigators supported by the NIH.

I have thoroughly enjoyed this class. It has given me a historical background on medical advancements made during the periods of war. Many of these advances, such as penicillin and sulfonamides, are still instrumental to the practice of medicine. Further, many of the wounds suffered by soldiers during war offered great insight into human physiology. For example, Gordon Holmes made great strides in our understanding of visual fields and space perception based on his examination of soldiers wounded by bullets.

Overall, "Medical Discoveries & Progress From War" is an excellent part of our first year curriculum, giving me valuable knowledge about the history of the physicians in the context of wartime. It has given all of us a chance to get out of large classrooms and engage in small groups with faculty. Last, the library faculty has done an excellent job of displaying and explaining original relevant documents. I never realized what an excellent collection of historical documents that Becker has accrued.

The Great Wars of the 20<sup>th</sup> century revealed the great importance of scientific research to the advancement weaponry, medicine and, ultimately, Western society. However, near the end of the Second World War, it became evident that there wasn't a robust mechanism in place to ensure sustainable scientific productivity in the US during peacetime. The industrious Vannevar Bush, an electrical engineer by training, identified this issue and led the movement to create what is now known as the National Science Foundation. As head of the OSRD, Dr. Bush oversaw projects that significantly advanced healthcare, such as the mass production of penicillin, and initiated the Manhattan Project. He recognized the importance of scientific research and education to the wellbeing of the US during peacetime and actively encouraged President Roosevelt, and later Truman, to expand government support for science. Ultimately, this led to the creation of the NSF, which still exists today to fund scientific research and education at all levels in the US.

My experience with clinical medicine and scientific research has all been exclusively during peacetime. In that regard, I consider myself very fortunate. However, it is impossible not to recognize that modern medicine rests upon discoveries dependent on needs created by conflicts in the past. New weapons introduced new ways of harming soldiers and civilians. Opportunistic physicians like Sir Gordon Holmes and Harvey Cushing in World War I, used this opportunity to learn about human physiology and, as casualties piled high, to perfect new techniques. High patient volumes also led to the development of more effectively organized hospital systems that could get an injured soldier from the battlefield to medical care in as little time as possible. Exotic and distant theaters of war spurred the need for hardy, robust medical resources and also provided a natural laboratory to study the spread of disease. William Beaumont and John Shaw Billings, pioneers of human physiology and the cataloguing medical knowledge, respectively, employed their previous military experience to advance their work.

War is a terrible enterprise. All sides pay a significant price, and those who live through the ordeal bear physical and emotional scars for life. Modern medicine, however, owes much of its existence to conflict. Specifically, it is indebted to ingenious, resourceful physicians, like Beaumont or Billings or Holmes or Cushing or any doctor that seized the opportunity to learn about the human condition to perfect and advance medical science. We must continue to advance medicine to improve patient care in our time, so that we can minimize the size of physical and emotional scars in future conflict and in peace.

In this fascinating course, we explored medical and scientific innovations that emerged during turbulent times of war, and delved into the lives of influential American physicians from colonial times up through WWII.

Our first discussion was centered on Dr. Beaumont and his unique patient Mr. St. Martin. We examined the medical ethics of that era, and contrasted it to our modern belief system. We also discussed how physicians were trained during this time, and how the lack of a standardized medical education led to the licensing and practice of physicians who had little to no formal medical training

Our discussion then advanced to the Civil War, in particular to biographical accounts of John Shaw Billings, a colorful and influential civil war surgeon. During his youth, Billings was an extraordinarily motivated self-learner who reportedly broke into his medical school library to read after hours. He had a successful surgical career, and following his retirement from the Army, he headed the Surgeon General's Library and helped design Johns Hopkins Hospital.

The session on medical discoveries from WWII focused on the rapid advances in medicine brought about by America's struggle against the Nazis. Specifically, we discussed the discovery and production of sulfa drugs and penicillin, and also the important research that was conducted on blood transfusions.

This course was interesting and intellectually stimulating, and I now wonder what groundbreaking innovations and discoveries will be made in future conflicts and war.

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In this session, the founding of the National Science Foundation was discussed. Its history with the United States' involvement in WWII (continuation of scientific advantage over rivals of the United States in order to act as an engine of growth) was particularly intriguing. The life story of Vennevar Bush was studied via the memoir of Wiesner. His continued innovation during his lifetime was invigorating, as was his involvement in the transformation of many modern institutes of higher education including Tufts College, MIT and many others. Washington University's period of rapid growth after the 1950s was showcased through a plethora of documents of grant proposals and other writings. Some of these notable points of growth include the building of McDonald Science Research Building, and the founding of Washington University's MSTP.

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His discovery left scientists with no choice but to reconsider the vast majority of medical theories which were up until then accepted, and to place medicine on a new footing. In effect, it was the beginning of modern medicine. The Smallpox Vaccine. Many centuries later, Felix Hoffman, an industrial chemist, synthesized the substance salicylic acid, and in 1893 he developed a commercial process for its production. In 1897, Hoffmans' superiors at Bayer and Company named this product Aspirin.

### 3.1 Syllabus goals and objectives

The syllabus goals, ordered according to frequency of the questionnaire responses are provided in Table 2 below:

Goal
Table 2: Results of the Teacher Questionnaire To expose learners to native English speakers, and by implication to expose learners to.
1. natural, authentic spoken English.
2. To help build learners' confidence when using English.
3. To supplement the traditional GT lessons taught by JTE with a spoken component.

Employs a discovery approach to learning

18. Explicitly utilizes TBL activities
19. Explicitly utilizes C-R activities

Learners' language use and progress is monitored and encouraged. Groups present their finished projects, and are evaluated by their peers and the teacher. Review of the most frequent language forms.