In the Wake of the Great War:

How Pathology Became a Clinical Discipline in America? ©

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World War I began during the summer of 1914 with the major European combatants entering the War over about a 6-week long period. On August 4, Great Britain declared war on Germany and the United States declared its neutrality. On April 6, 1917, the United States declared war on Germany and the arrival of the American Expeditionary Forces (AEF) in France greatly changed the balance of power. Between the Spring of 1918 and the Spring of 1919, the Great Influenza Pandemic struck North America and Europe in three waves; the worst was in the Fall of 1918, crippling war efforts on all sides. The hostilities ended with Germany signing the Armistice of Compiègne on November 11, 1918. Germany and the Allies signed the Treaty of Versailles in mid 1919**.** The United States involvement in the war lasted less than 18 months. However, this brief involvement in the War had dramatic effects on medicine and surgery at home. In this talk, I will focus on how the practice of pathology in North America changed drastically in the wake of the Great War. The "Roaring Twenties" was very good to pathology (**1**).

In the 19th Century, pathology was not a clinical specialty. One could not really make a living as a pathologist. North American pathologists were Professors of Pathology teaching in medical schools (**2**); they generally performed autopsy-related or bacteriological research trying to understand disease (n.b., in North America, pathologists led bacteriological research while in much of Europe, this was done by Hygienists and pathologists did only autopsies). On neither side of the Atlantic, were pathologists involved in patient care. In fact, for about the first seven decades of the 19th Century, laboratory tests did not even exist. Into the 1800s, internists relied extensively upon a century old technique, "uroscopy," to make diagnoses. Here, physicians examined a flask of patient urine visually while holding it up to the light and comparing its color with a "uroscopy wheel"; when the color of the urine in the flask matched that of one of the colored flasks on the wheel, the diagnosis could be read off of the wheel. Well-trained internists also took into account urine smell, consistency, and even taste.

American involvement in late 19th Century conflicts at home and abroad began to change the practice of pathology in the United States. During the American Civil War (1861-1865), the Army Medical Museum was established in 1862 when the Surgeon General's Office issued a circular telling medical officers to send it "all specimens of morbid anatomy, surgical or medical, which may be regarded as valuable ... in the study of military medicine or surgery." (**3**) The Union Army leadership's belief was that by collecting instructive pathological specimens from soldiers documenting war-related injuries as well as "camp diseases" like typhoid fever, diarrheas, parasites, etc., military physicians and surgeons could study these specimens and possess greater knowledge which would pay a dividend of enhanced troop readiness. 7,630 pathological specimens were collected during the Civil War.

By the time of the Spanish-American War in 1898, the Army Medical Museum's focus changed to the new field of bacteriology. In this War, there was a 7:1 ratio of deaths from infectious diseases compared to deaths from battle wounds. Typhoid Fever was the major culprit, but yellow fever and malaria were also major contributors. Research led by Walter Reed (Typhoid Commission of the US Army Medical

Museum) eventually resulted in vaccines decreasing the incidence of typhoid fever by 800-fold. Reed also confirmed Cuban physician Carlos Finlay's theory of mosquito transmission of yellow fever. The Army Medical Museum not only continued collecting instructive pathological specimens, it was conducting epidemiological research and producing vaccines promoting American troop readiness (**3**).

Meanwhile, in civilian America, pathology was evolving. Its scope was broadening from medical school-based autopsies into Pathology & Laboratory Medicine. In the 1880s and 1890s, the few laboratory tests that existed were simple enough that they could be performed on the wards by an internist or his resident. However, by the turn of the century, the number of possible laboratory tests and the number of hospitals in North America were both increasing exponentially, and many of the new laboratory tests were too complex to be performed by an internist on the wards. By the mid 1910s, the magnitude of testing was sufficient to create a potential niche for a specialist to provide these services and two competitive models arose in large American cities: hospital-based clinical pathologists vs "mail in" private commercial laboratories. The former tended to be small and less efficient, but provided personalized service and ease of consultation with the clinical pathologist. The latter, tended to be larger and more widely available, provided faster turnaround times, advertized low prices in medical journals and elsewhere, but were often run by technologists with unknown qualifications. Quality assurance on lab tests was almost non-existent. While a large city like Chicago had at least 8 different private commercial laboratories competing for the clinician's laboratory testing business (**1**), it should be noted that neither model really met the needs of rural physicians (**1,2**).

Ironically, even autopsy pathology, had not exactly flourished in the hands of academic pathologists during the last few decades of the 19th Century, as it was not uncommon for internists, such as William Osler, to perform autopsies on their patients who died, allowing them to obtain optimal clinic-pathological correlation and improve their patient care skills (**4**). While autopsy consent laws were fairly similar to those now in place, pathologists and internists alike sometimes circumvented these laws to obtain desirable teaching specimens; in fact, beginning in the 1880s, techniques to perform covert "arms-length" autopsies through the anus or vagina were published in the medical literature (**5**). To make matters worse, clinicians were sometimes at odds with institutional pathologists over who should perform autopsies when inpatients died. For instance, at Blockley Hospital (Philadelphia General Hospital), William Osler had ongoing battles with the two Blockley pathologists, E.O. Shakesphere and H.F. Formad (**6**). Part of the importance of autopsies was that instructive specimens were critical for teaching medical students. In 1907, the International Association of Medical Museums was formed to facilitate exchange of pathological teaching specimens between medical schools. While a basic understanding of pathophysiology was widely recognized as a necessity for physicians to practice scientific medicine and while it was recognized that teaching pathology to medical students was a critical element of medical education, pathology, as a medical specialty, was in a mess when America entered WWI.

In the early decades of the 20th Century, surgery was also in a mess and better trained surgeons wanted to begin policing surgical practice in North America. The American College of Surgeons (ACS) formed in 1913 as an elite guild with the goal of elevating the practice of surgery. At the time, there was an oversupply of medical practitioners and the quality of their training was highly variable. This was a time period before formal residency training programs and board examinations existed, and so there was no way for patients to carefully select a surgeon. Furthermore, the separation of surgical and medical practice was incomplete and many physicians also practiced surgery, often with very bad results. This oversupply of surgical practitioners resulted not only in the surgical profession having a very poor reputation, it also adversely affected incomes. The ACS was formed to rectify these issues. Membership

in the ACS required a minimum level of competency which must be documented. Members of this elite guild naturally assumed that patients needing surgery would flock to them rather than "surgeons" of lesser ability and training. However, most hospitals allowed any medical practitioner to operate and the ACS desired to change this. The ACS wanted autopsies performed on patients who died and wanted all surgical specimens, which up until this time were usually thrown in the garbage can, to be examined as new forms of surgical quality assurance. Elite surgeons believed that this would eventually limit competition from poorly trained surgical practitioners. Pathologists had not recognized or seized this opportunity and in some top centers surgeons were taking on this role and it appeared as if surgical pathology might develop as a subspecialty within Surgery Departments rather than within Pathology Departments (**1,2**).

WWI was transformative. It was the first war in which Clinical Pathology played a major role (**3**). Before continuing, I should digress and highlight that the term "Clinical Pathology" had a different meaning a hundred years ago than it does now. As alluded to previously, pathology in the 19th Century was not a clinical specialty and it played no role in patient care. By the early 20th Century, both surgical pathology (discussed below) and laboratory tests were becoming critical components for the provision of science-based medical and surgical care. In this context, "Clinical Pathology" simply meant "patient-oriented pathology" and its scope included both anatomical pathology and what we today call clinical pathology. Related to the War, in addition to providing many thousands of Wasserman complement fixation tests for syphilis and Widal agglutination tests for typhoid fever (i.e., the two most important tests promoting troop readiness), pathologists were providing bacteriologic cultures, examinations for parasites, a number of chemistry tests, hematocrit and iron measurements, differential blood counts, blood morphology assessments, microscopic examination of urine and sputum, urine glucose measurements, surgical pathology, autopsies, and many other tests. In fact, Clinical Pathology was deemed to be so important in WWI that all of the major warring factions created and utilized mobile laboratories, allowing laboratory testing to be done to support troops near the front (**7**). The quality of the laboratory services provided to AEF physicians and surgeons was outstanding! Colonel Joseph Siler was the director of the Division of Laboratories and Infectious Diseases for the AEF. He appointed Colonel Louis B. Wilson (**8**), who was on leave from his position as Director of Laboratories at the Mayo Clinic, as his Assistant Director (**Fig. 1**). Over a one year period, they organized 300 efficient laboratories which provided high quality services. Because of the rapid expansion in numbers of hospitals in the early decades of the 20th Century and the relatively small numbers of hospital-based clinical pathologists, many AEF physicians had never worked with a pathologist in their earlier civilian lives and did not know the scope of services that pathologists could provide until they had enlisted. AEF physicians and surgeons were suddenly encountering types of trauma that they had never seen before as well as dealing with the consequences of chemical warfare and a deadly influenza outbreak. Wilson's surgical pathology service and his autopsy service helped physicians and surgeons learn from their mistakes. Wilson set high standards and was a stickler for providing personalized services directed at helping clinicians address clinically important problems. Wilson considered every interaction between his pathologists and AEF clinicians to be a consult, which proved to be an exceedingly different level of service than most AEF physicians were accustomed to prior to enlisting. After the War, both Siler and Wilson were awarded Distinguished Service Medals, which were first authorized by Congress and then personally presented by the President, for organizing and providing outstanding laboratory services that were of "inestimable value to the medical and surgical services" and were delivered "in a manner not believed possible." (**3**) AEF physicians and surgeons had much higher expectations related to laboratory services when they returned home.

North American surgical and hospital care changed quickly in the wake of the War. At the beginning of the 20th Century, typical patient encounters with surgeons and hospitals could generally be described as highly unsatisfactory and some were abysmal (**9**). The ACS had begun to roll out its plans to introduce Minimum Standards for Hospitals just as the United States was entering the War. This ACS Minimum Standards for Hospitals campaign went into full swing immediately after the War, when several top ACS surgeons (ACS Board of Trustee members) who had played major roles in establishing efficient AEF hospitals in France, brought home additional practical knowledge. However, the ACS leadership had no authority to impose any kind of regulations on hospitals and so it needed to tread lightly at first. The ACS had initially approached the American Medical Association (AMA), which also recognized the need to improve hospitals, but the AMA did not want to participate as this might alienate its membership, leaving the ACS to do take on this tricky task on its own. The ASC conducted an internal fund-raising program raising approximately $1 Million from its membership and then hired John Bowman, the former Secretary of the Carnegie Foundation for the Advancement of Teaching, to oversee the project (n.b., shortly after this, the Carnegie Foundation also provided financial support for the project). Next, the ACS, by developing a massive and expensive engagement process, sought input from a wide variety of stakeholders (internists, other specialists, medical societies, hospital administrators, hospital trustees, hospital organizations, etc.) and then asked these stakeholders to help develop the standards. By taking this highly consultative approach, the ACS Minimum Standards were so reasonable (i.e., the general focus was on working together to achieve better patient care) that it was difficult for any parties to publically oppose them and they were widely adopted throughout the United States and Canada throughout the 1920s. Even though it was almost impossible for anyone to oppose the intent of the Minimum Standards, only 89 of the 692 large (100+ bed) hospitals in the United States and Canada, met the Standards in 1918 and several of North America's most prestigious hospitals failed; however, the pressure (mostly competition with hospitals who could advertise that they had met the ACS Standards) was so great that the percentage of compliant large hospitals exceeded 80% by 1922 and approached 100% before the end of the 1920s. While the initial 1918 version of the Standards cited the importance of laboratories in a vague way, this was not its major focus and it was clear that surgeons did not have sufficient content knowledge to really know what they wanted related to clinical laboratories. Clinical pathologists were very happy to provide input as to what constituted an "adequate laboratory" (n.b., this term reflects that the ACS was establishing Minimum Standards). This will be addressed in detail below. Regardless, the development and implementation of the ACS Hospital Standardization program is perhaps the best example of successful continent-wide change management initiative in the history of health care, and it is worthy of study even today (**9**).

At the same time, the new profession of clinical pathology was struggling for its very survival. Hospital-based clinical pathologists were in a fight for their professional lives with private commercial laboratories. There were only about 450 clinical pathologists practicing in the United States in 1922 and many of these believed that hospital-based pathology practice would soon be extinct. In large American cities, there were often multiple commercial laboratories which advertised their low prices. Some of these laboratories were run by unsupervised technologists, others were run by technologists who advertised meaningless associations with famous academic pathologists (honorary directorships), and others were well run legitimate operations where the work was directly overseen by well-trained clinical pathologists. Therefore, it was not easy for physicians at the beginning of the 1920s to know which commercial laboratories offered high quality services. To make matters worse, the AMA allowed commercial laboratories to advertise their services and prices in the *Journal of the American Medical Association*. When questioned about this, the AMA Advertising Committee deemed that these laboratory tests were "commodities" rather than medical services, that these services could be provided by any competent person with minimal training (i.e, did not require medical training), and that, as

commodities, it was not unethical, in fact was appropriate, to advertise prices. The Advertising Committee further alienated laboratory physicians saying they were "not the same as internists and surgeons," and by calling them "manipulators of test tubes and inanimate substances" (**1,2**).

Starting in 1922, two Denver pathologists Philip Hillkowitz (**Fig. 2**) and Ward Burdick (**Fig. 3**) organized pathologists in the City of Denver, followed by the State of Colorado, and finally the whole country over a period of only 13 months. They established the American Society of Clinical Pathologists (ASCP) in 1923 (n.b., the organization changed its name to the American Society for Clinical Pathology in 2001). Hillkowitz became first president, and Burdick became the ASCP's Secretary for the rest of his short life. Their first task was to fight the powerful AMA over its advertising practices which prevented hospital-based clinical pathologists from earning a decent living, because without winning this battle the new specialty of clinical pathology appeared rapidly to be on its way to extinction. Hillkowitz, Burdick, and the ASCP Executive quickly and astutely recognized that they had a potential powerful partner. Therefore, they worked hand in hand with the ACS helping them in their quest to standardize hospitals. The ACS leadership knew that their standardized hospital should have adequate laboratories, but they had not the slightest idea what this should look like. ASCP pathologists were heavily involved in shaping the adequate laboratory for a standardized hospital, and their strategic involvement explains how pathology evolved in the 1920s to resemble what we practice now. In 1922, Louis B. Wilson was asked by ACS leadership to serve on a five person ACS standardization of laboratories committee tasked with designing laboratory services for the standardized hospital.

The ACS initial 1918 Minimum Standards for Hospitals document was only one page long. Related to laboratories, it simply stated that diagnostic facilities "under competent supervision be available for the study, diagnosis, and treatment of patients, these to include, at least, (a) a clinical laboratory providing chemical, bacteriological, serological, and pathological services; (b) an x-ray department …" It should be noted that there was no requirement that the supervision be a physician, let alone a trained clinical pathologist. There were also no staffing requirements or the minimum qualifications for staff (n.b., since there was an educational requirement at that time for interns to learn to perform basic laboratory tests, laboratories could theoretically be staffed only by interns).

As alluded to earlier, routine surgical pathology did not exist. Specimens removed at surgery were normally discarded rather than examined. However, if a surgeon wanted a specimen examined, he could either send it to a mail order commercial laboratory, which typically charged $5, or he could, in most states, send it the state public health laboratory, which provided the service for free but with much slower turnaround times (**10**). The ASCP leadership, although most were primarily chemists, hematologists, and bacteriologists, astutely recognized that what the ACS really wanted was anatomic pathology -- especially surgical pathology with intraoperative frozen section support (**2,11**) and autopsies, both services that mail order commercial laboratories could not easily provide from a distance (**1**). By 1926, the Minimum Standards document was much more detailed. Related to laboratories, there were now a page and a half of explicit standards addressing qualifications for the laboratory director, types of testing, mandatory examination of surgical specimens, laboratory and hospital record keeping, and mandatory pathologist participation in quality assurance by attending monthly medical staff conferences. The 1926 document's proclamation that "all tissue removed at operations shall be examined in the laboratory and reports rendered thereon …" essentially created the field of surgical pathology. While the 1926 standard did not require a minimum autopsy rate, the ACS forcefully stated that modern standardized hospitals should have high autopsy rates, suggesting that this was a quality indicator for modern hospitals. Prior to 1926, it was difficult to pay for autopsies as it

seemed indelicate to ask the family of the deceased to pay. However, now, autopsies could be subsidized by the more lucrative clinical laboratory testing and surgical pathology.

Pathology and laboratory medicine became a highly dynamic field in the 1920s. Tumor grading, introduced by Mayo pathologist Albert C. Broders in the early 1920s, had become state-of-the-art for cancer prognostication (**12**). Many new chemistry tests were introduced; test sensitivities improved and volumes of blood required per test decreased (e.g., in 1910 it required 20 ml to measure blood glucose; by the early 1920s, it required only 0.2 ml, which actually was a fundamental enabler for the discovery of insulin by Banting and Best). The War had resulted in important advances in transfusion technologies which soon evolved into new roles for clinical pathologists (**13**). By the late 1920s, after a 60-year hiatus, a new era in the use of exfoliative cytology had begun (**14**).

The ACS Minimum Standards for Hospitals was an important regulatory framework for hospitals for 32 years and then evolved into the Joint Commission on Accreditation of Hospitals in 1951, the Joint Commission on Accreditation of Healthcare Organizations in 1987, and the Joint Commission in 2007.

In less than a decade, Hillkowitz and Burdick transformed the practice of pathology and laboratory medicine in America; by the end of the decade, private commercial laboratories had largely been driven out of business and the hospital-based mode of practice had prevailed (**1**). Surprisingly, other than brief obituaries, not much had been written about either of them. While Ward Burdick's name is known within the ASCP because there has been a Ward Burdick Award Lecture at the annual ASCP meeting for the past 80+ years, few pathologists even know the name Philip Hillkowitz. However, from attending some of the Ward Burdick Award lectures, it seems clear to me that even his award recipients have trouble saying much about him. Burdick, early in his career, was Director of Laboratories at the National Jewish Hospital for Consumptives in Denver and, later (i.e., when the ASCP was formed), was Director of Laboratories at the Children's Hospital of Denver. Burdick was neither a teacher nor a researcher, but he was an outstanding organizer, and his contemporary professional colleagues deemed his contributions to the profession so great that the ASCP named its first and most prestigious annual award after him. I have just published a brief biographical sketch about Ward Burdick (**13**) and am writing one on Hillkowitz.

Philip Hillkowitz is a much more substantial figure than Burdick. Yet, his name has been totally forgotten within the ASCP. He developed a symbiotic relationship with the ACS and helped broker a truce with the AMA. After he finished his presidency of the ASCP, Hillkowitz established the ASCP Registry of Medical Technicians and ran this out of his office for more than a decade Hillkowitz and Charles Spivak were Denver-based prominent Jewish-American physicians of Russian origin and they co-founded the Jewish Consumptives' Relief Society (JCRS), a TB sanatorium on the outskirts of Denver which became a nationally leading sanatorium in the first half of the 20th Century. Hillkowitz was JCRS President for over 40 years and became a celebrity in New York City, where the Denver-based JCRS had its second office. Hillkowitz was an outstanding organizer and fund-raiser; the JCRS grew from a few tents in 1904 to a campus with 30+ modern buildings while he was president. The JCRS had Ladies Auxiliaries raising funds for new buildings and expansion of the Denver campus in almost every major city around the country. During the 1940s, the New York Giants NFL football team played an annual fundraising game for the JCRS. The JCRS clinical laboratory was interesting as well. Hillkowitz established it in 1908 and this laboratory was totally state of the art for its time. The JCRS met ACS Minimum Standards for Hospitals standards from their inception in 1918 (n.b., even some of the major academic hospitals on the east coast could not do this). Amazingly, even though many of the patients were orthodox Jews whose beliefs should have precluded the performance of autopsies, the ratio of autopsies to patient

deaths at the JCRS were triple that of the average secular American hospital at the same time. Hillkowitz and Spivak did everything they could to make their sanatorium an ethnically sensitive but totally modern American hospital. After antibiotics brought tuberculosis under control, the JCRS fell into obscurity (its campus buildings are now the Rocky Mountain College of Art + Design and much of the rest of its campus became a shopping mall in the Denver suburb of Lakewood).

Pathology societies and journals thrived in the wake of the Great War. In addition to the ASCP, there were three major pathology societies. The American Association of Pathologists and Bacteriologists established in 1901, the International Association of Medical Museums established in 1907, and the American Society of Experimental Pathologists established in 1913. The *Bulletin of the International Association of Medical Museums* was edited by Maude Abbott throughout the decade. Two new pathology journals were formed: the *American Journal of Pathology*, edited by F.B. Mallory and the *Archives of Pathology and Laboratory Medicine*, edited by Ludvig Hektoen. The ASCP's first "affiliated" journal was the *Journal of Laboratory and Clinical Medicine,* edited by Victor C. Vaughan, but in 1931 the ASCP established the *American Journal of Clinical Pathology,* as it wanted its own journal (**1**).

The profession of Clinical Pathology was established on firm footing in the Roaring Twenties. By the end of the 1920s, the ASCP and the AMA had even made friends and were now working together. Although the ACS expressed concern that autopsy rates were too low in standardized hospitals, the ACS Hospital Standardization process had shied away from setting a minimum autopsy rate, as it wanted hospitals to quickly succeed in meeting their standards and believed that requiring a specific autopsy rate might prevent many hospitals from meeting the Standard. By 1920, the AMA, regretting that it had not played a role in Hospital Standardization, renamed its Council on Medical Education; the new name was the AMA Council on Medical Education and Hospitals, foreshadowing their intent to move into the hospital accreditation arena. The renamed Council required hospitals wanting to train interns or residents meet their own standards. In 1927, this Council announced that no hospital could continue to be approved as a training site if they did not perform autopsies on at least 10% of hospital deaths starting in 1928 and 15% in 1929 and thereafter. This drastically increased autopsy rates (in 1927, it was projected that >36% and >55% of training hospitals would not meet the 1928 and 1929 requirements). Finally, in 1929, the ASCP and AMA agreed to a brief AMA document entitled *Essentials of an Approved Clinical Laboratory* which required Laboratory Directors to be physicians who have “specialized in clinical pathology ... for at least three years subsequent to graduation.” The AMA, which took credit for putting many technician run laboratories out of business, issued a list of 174 approved laboratories. Although the AMA never publically reversed its earlier decision favoring the advertisement of prices for laboratory tests, the *Essentials* required that “publicity of an approved clinical laboratory should be in professional good taste.” (**1**)

In summary, the decade in the wake of the Great War was very good to Clinical Pathology and it was during this period that Pathology and Laboratory Medicine evolved into a model similar to what we practice today.

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Fig 1. Col. Louis B. Wilson Credit: Arch Pathol Lab Med 2015: 139(9):1163

Fig 2. Philip Hillkowitz credit: JCRS Bulletin 18(2) Feb 1948 (Beck Archives, Univ. of Denver)

Fig 3. Ward Burdick Credit – J Lab Clin Med 1925; 10:678–690.