“With the Greatest Admiration:” Lessons Learned from Correspondence Among Foundational Leaders in Public Health

by

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Abstract

During the late nineteenth century, modern medicine was taking off due to revolutions in scientific discovery. New fields of medicine like bacteriology and sanitation were established, with advancements in these fields leading to an increase in overall life expectancy. Leaders like Dr. John Shaw Billings, Dr. George Miller Sternberg, and Dr. Robert Koch revolutionized medicine by discovering, establishing, and communicating public health practices. With my mentor Dr. Kastner, and fellow students, I visited the National Library of Medicine in Bethesda, Maryland to explore primary documents from these leaders. In our archival research, I found a letter written by Koch to Sternberg, suggesting a positive relationship between the two leaders across the Atlantic. Koch's communication about infectious diseases and commentary on prevention measures, like city water design, particularly piqued my interest. This letter suggests that Koch was a firm believer in applying the Germ Theory he learned in a lab to the real world. I also included material from Dr. Kastner's UHP course I took in 2021, detailing two letters showing correspondence between physicians and medical officers between countries. This collaboration serves as a model for how public health practices should and do often look today. With Dr. Kastner, I plan to publish the results of this project in K-State's One Health newsletter and submit it for my honors project.

“With the Greatest Admiration:” Lessons Learned from Correspondence Among Foundational Leaders in Public Health

By Grace Schieferecke

Introduction

The discipline of medicine is rooted in a rich history of horrifying practices coupled with knowledge drawn from science. Fortunately, scraps of this history have been preserved by museums and libraries around the world, cradling immense value. In the late nineteenth century, medicine was adapting to new discoveries made possible with wider implementation of the scientific method. As microbiological science improved and population growth and urbanization contributed to new epidemics, a metaphorical “bronze age” of disease understanding was underway. Physicians, scientists, veterinarians, and engineers worked tirelessly to better understand and, therefore, prevent disease; by working together and combining their methods and disciplines, they fostered an early version of the One Health framework. Indeed, these leaders established a foundation for public health through communication, determination, and trustworthy science.

The principal author, a Spring 2025 graduating medical microbiology student, will soon begin her pursuit of a medical degree. Her interest in medicine, and its history, was piqued during her first-year Honors seminar course UHP 189 *Human and Veterinary Public Health in the Age of Sherlock Holmes*. Three years later, she had the opportunity to travel as part of the 43rd *Frontier* Field Trip to Washington, D.C., to explore primary many of the very archival documents mentioned in that course. In doing so, she deepened her appreciation for the beginnings of modern public health.

Methodological Framework

This paper's method of inquiry features a mixed-methods approach. After providing an overview of the most salient and/or emerging "new ideas" of 19th- and 20th-century medicine and public health, the authors identify and detail primary archival materials that align with those ideas. Second, the authors integrate the specific writings (found in these materials) and use induction to draw conclusions about the nature of leadership during this nascent formation of One Health networks. Induction, distinct from deduction, is a legitimate scholarly practice and may be defined as "beginning with the observation and measurement of phenomena and then developing ideas and general theories about the universe of interest" (Bowling, 2005, p.604). Historical documents (including the kinds explored

in this paper) offer scholars the opportunity to *induce* observations and lessons from key moments in history, including the history of science. To be sure, archival materials offer important lessons about how medicine (not only in history, but today) relies upon leadership among One Health-minded scientists and practitioners.

Foundational Ideas and Leaders in Public Health

During the late nineteenth century, modern medicine was accelerating due to revolutions in scientific discovery. New fields of medicine like bacteriology and sanitation were established, with advancements in these fields leading to an increase in overall life expectancy.

One major leader from the United States was Dr. John Shaw Billings (1838 - 1913), director of the National Board of Health (1879-1882), director of the Library of the Surgeon General (1864 – 1894), and, most importantly, the founder of the National Library of Medicine (NLM) (Michael, 2011). Dr. Billings was devoted to improvement, as he taught himself microscopy, dissection, and German to decipher papers published originally in German (Garrison, 1915, p.138). He also corresponded with hundreds of medical doctors, veterinarians, and other major scientific leaders, and much of his correspondence is stored in the National Library of Medicine in Bethesda, Maryland (Garrison, 1915, p. 391). Communication from

nearby cities to across the world can be found there, as Billings obtained important medical literature from the source. The authors visited the NLM in December of 2024 as part of the 43rd *Frontier* Field Trip, and the details of the trip can be found in the article, “Frontier students discover historical connections to public health and Sherlock Holmes on national field trip” (Coy, 2025).

Another physician leader of the United States was George Miller Sternberg (1838-1915). Spending much of his early medical career as an army surgeon, Dr. Sternberg encountered gangrene, cholera, and yellow fever, including a yellow fever outbreak at Fort Harker, Kansas, where he lost his wife (Kober, 1915, p. 1234). These encounters led Sternberg to study bacteria, and he is regarded as the first bacteriologist of the United States (Kober, 1915, p. 1234). For many years, Dr. Sternberg studied yellow fever, searching for a bacillus carrier, although it wasn’t until many years later it was determined to be from a virus (Kober, 1915, p. 1234, Heymann, 2022 p. 714). However, his studies helped in the identification of mosquitoes as the disease vector, which allowed for prevention measures to reduce incidence of disease (Kober, 1915, p. 1234, Heymann, 2022 pp. 714-716). He went on to serve as Surgeon General, noting the decreases in casualties following the employment of antiseptics and improved wound treatment (Sternberg, 1899, p. 550).

European scientists, like Louis Pasteur, Dr. Robert Koch, and Dr. Joseph Lister, were instrumental to the life-saving advancements made in medicine in the late nineteenth century. Pasteur, a chemist by training, developed the Germ Theory of Disease, identifying living things (microorganisms) as agents of disease and food spoilage and introduced processes now referred to as pasteurization (Goetz, 2014, pp.54-55, 58). Koch discovered many disease-causing bacteria with his Postulates, including those that cause anthrax and tuberculosis, and their relation to livestock and wild animal infection, particularly with bovine tuberculosis and its transmission through milk (Goetz, 2014, p.29, 85-88, Koolmees, 200, p.61). Lister pioneered antiseptics for use in surgery, as surgeries often introduced infection before the widespread use of antiseptics (Goetz, 2014, pp.60-61). Rudolf Virchow (1801 – 1902), a German pathologist, surgeon, and hygienist, linked animal health and trichinosis from meat to socioeconomic factors and cancer (Goetz, 2014, p. 102, Tawde, 2024); in making these interdisciplinary connections, Virchow modelled a One Health mindset Finally, John Snow, an inquisitive, largely self-trained British anesthesiologist, traced the 1854 London cholera outbreak to a single water pump (Johnson, 2006, pp. 65-66).

Other, less prominent figures were important in implementing the practices that these scientists recommended. Peter Braidwood (1842 – 1905) was an established physician in Birkenhead, who had received his M. D. from Edinburgh,

training throughout Europe (British Medical Journal, p. 164). Receiving multiple awards throughout his career, Braidwood later served as a Medical Officer (Dr. Peter M. Braidwood, 1905, p. 164).

Other non-physician figures were also important for the public health and sanitation movement. Rudolph Hering (1847-1923), a civil engineer, was commissioned by the National Board of Health to learn from European municipal waste treatment in the years 1880-1881 (Fuller, 1924). Studying both dry removal and water carriage systems, he reported that the movement of waste by water to a treatment facility before re-entry into public waters was advisable for developing U.S. cities (Fuller, 1924). He continued much of this survey of municipal water throughout many cities, such as Philadelphia, Chicago, New York, L.A., and, in 1889, Washington D.C., by appointment of then-President Benjamin Harrison (Fuller, 1924, Figure 1).

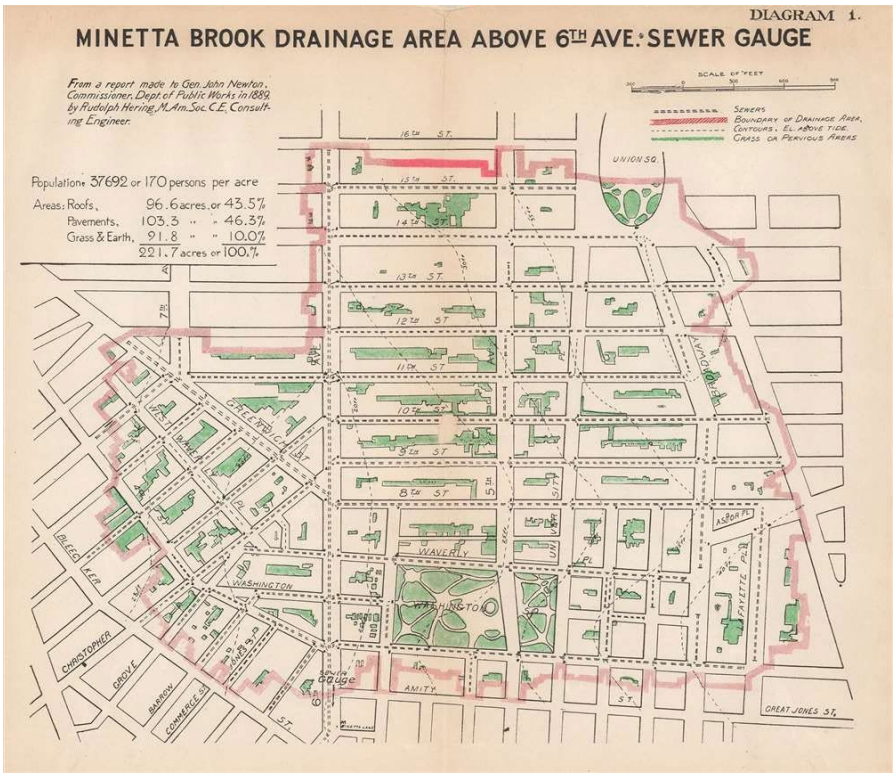


Figure 1. Map of drainage area in Manhattan, NY by Rudolph Hering, 1889

The Sanitation Movement of the 1880s

A multitude of illnesses are maintained through human fecal contamination of water or food sources, these illnesses including those caused by perilous helminths like *Ascaris lumbricoides* and bacteria like *Vibrio cholerae* (Heymann, 2022 pp. 52, 101-102). The primary mode of prevention for each of these infectious diseases is, put simply, removing feces from public water (Heymann, 2022 pp. 53, 103). While this modern innovation seems intuitive, there was a time when large scale municipal sanitation was only beginning.

Public sanitation for infectious diseases began to become a worldwide sentiment after John Snow proved a London cholera outbreak arose from a contaminated water pump in 1854 (Johnson, 2006, pp. 159-160). Just six years prior, a separate English outbreak of cholera killed 50,000 (Johnson, 2006, p. 34). That same year, Edwin Chadwick advocated for sanitation improvements in Victorian England, turning the public eye towards public health (Lyons, 1987 p.497. However, widespread acceptance and constructing sewers are daunting tasks, especially among wars and other contributors to calamity, so much time passed before major cities began making changes (National Research Council, 1977). However, the mapping of municipal water systems did become more common (Figure 2).

Figure 2. This schematic, one of sewer infrastructure, illustrates well the need for engineering-minded disciplinary expertise in public health. (Source: Center for Brooklyn History)

The National Board of Health appointed Rudolph Hering to visit European water treatment facilities in the years 1880 – 1881 then report his findings and recommendations for the United States (Fuller, 1924). During these exact same years, Dr. Robert Koch was working on his cure for tuberculosis. In the year 1880, Koch published three major papers, including one detailing his plating techniques, which are now the standard in microbiology laboratories (Goetz, 2014, p.81).

In 1882, George Miller Sternberg was the first in the U.S. to demonstrate Koch's tubercle bacillus, and in 1885, he was the first to demonstrate Laveran's plasmodium in the U.S., the causative agent of malaria (Kober, 1915, p. 1234 p.1234). A scientist at heart, Sternberg was deeply interested in Yellow Fever, its cause, and its prevention. In the years between 1879-1888, he "twice returned to Havana during the months of yellow fever prevalence, and visited Rio de Janeiro and Vera Cruz, also the town of Decatur, Alabama, during the epidemic of 1888," (Kober, 1915, p. 1234 p.1234). Following these investigations, Sternberg then published a report revealing all claims at identifying the cause of yellow fever had failed, including those of Brazilian Domingos Freire, who had claimed yellow fever

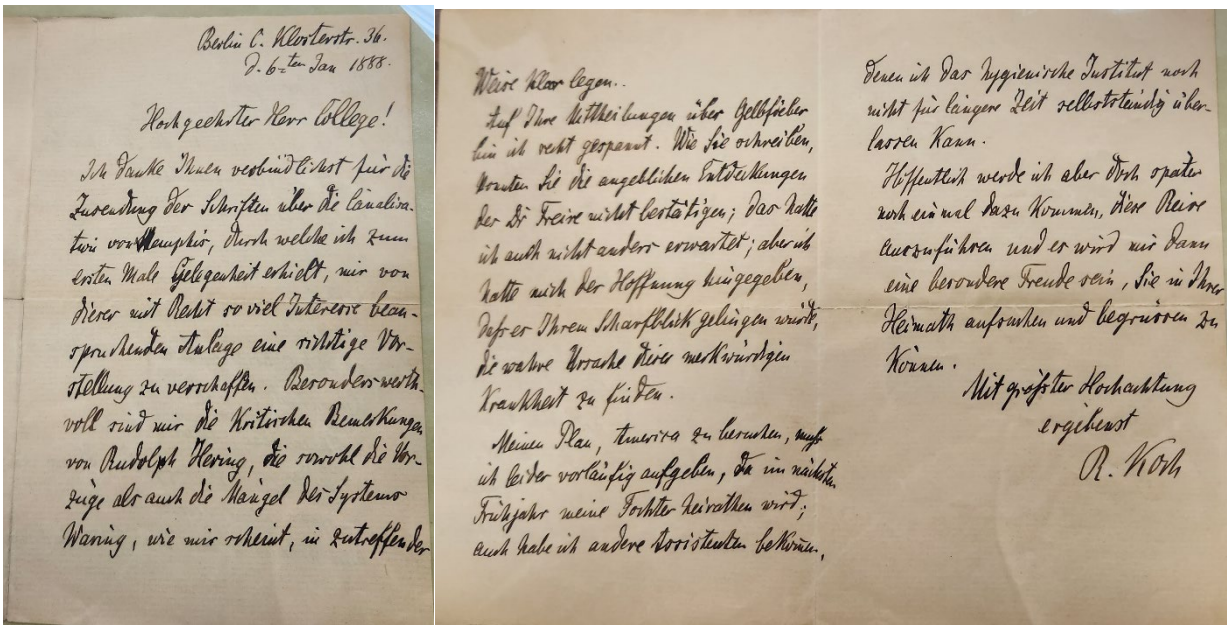
to be caused by "*Cryptococcus xanthogenicus*" using a flawed method (Kober, 1915, p. 1234 p.1234).

As Sternberg battled yellow fever, the concern for waterborne diseases like cholera and typhoid inspired studies of sanitation in the United States. The Massachusetts State Board of Health established an "experiment station" in 1887 (National Research Council, 1977). Studies were conducted in conjunction with experts in chemistry, biology, and engineering, including MIT professor W. T. Sedgwick (National Research Council, 1977). These studies indicate that the sanitation movement was progressing in a positive direction in the year 1889.

Throughout the 1880's, Koch continued to study his tubercle bacillus, searching for a cure to tuberculosis (Goetz, 2014, p.167). During this time, he also discovered the causative agent of cholera in 1884, and soon after was appointed to direct the new Institute of Hygiene at the University of Berlin in 1885 (Goetz, 2014, p.165).

Archival materials: From One Bacteriologist to Another

Writing from Berlin, Koch penned a letter (Figure 1) to Sternberg on January 6th, 1888. The letter appears on yellowed paper with swoops and scrawls of black ink, suggestive of a quick-witted author.



Berlin C. Klosterstr. 36.
d. 6ten Jan 1888.

Hochgeehrter Herr College!

Ich danke Ihnen verbindlichst für die Zusendung der Schriften über die Cholera in Memphis, durch welche ich zum ersten Male Gelegenheit erhielt, mir von dieser mit Recht so viel Interesse beanspruchenden Seuche eine richtige Vorstellung zu verschaffen. Besonders werthvoll sind mir die kritischen Bemerkungen von Rudolph Hering, die sowohl die Vorzüge als auch die Mängel der Systeme Waring, wie mir scheint, in zutreffender Weise klar legen.

Auf Ihre Mittheilungen über Gelbfieber bin ich recht gespannt. Wie Sie schreiben, konnten Sie die angeblichen Entdeckungen der Dr Freire nicht bestätigen; Das hatte ich auch nicht anders erwartet; aber ich hatte mich der Hoffnung hingegeben, Sie würden Ihrem Scharfblick gelingen wird, die wahre Ursache dieser merkwürdigen Krankheit zu finden.

Meinen Plan, Amerika zu besuchen, muß ich leider vorläufig aufgeben, da im nächsten Frühjahr meine Tochter heirathen wird; auch habe ich andere dringendere Geschäfte, denen das hygienische Institut noch nicht für längere Zeit selbstständig überlassen kann.

Hoffentlich werde ich aber doch später noch einmal dazu kommen, diese Reise auszuführen und es wird mir dann eine besondere Freude sein, Sie in Ihrer Heimath aufsuchen und begrüßen zu können.

Mit größter Hochachtung
ergebenst
R. Koch

Figure 3: Letter from Robert Koch to George Sternberg, 6 January, 1888 (Source: National Library of Medicine)

The letter (Figure 3) was written in German. Fortunately, the author was able to confer with a professor of German (Dr. Sara Luly, KSU) to elaborate a rough translation:

Berlin E. Klosterstrass 36

Jan. 6th 1888

Dear esteemed colleague!

I thank you greatly for sending the writings about the [Water system]. First time had the opportunity, to get a proper understanding of it. Of particular worth is the critical commentary from Rudolph Hering, which laid bare for me the advantages as well as the limitations of the system of [Waring].

I am very excited about your report on yellow fever. As you said [wrote] you could not confirm the current discovers of Dr. Freire; I hadn't expected anything else; but I had had hope, that your keen eye would be successful in finding the true cause of this strange illness.

Unfortunately, I have to temporarily abandon my plan to visit America because next spring my daughter is getting married. I also have received additional [lab assistants] therefore I can't leave the hygienic institute alone on its own for very long.

Hopefully I will later be able to get around to making this trip and it will be a particular joy for me to seek you in your home town and be able to greet you.

With the greatest admiration,

R. Koch

Figure 4. Letter from Robert Koch to George Sternberg, rough English translation

Much can be inferred about the relationship between Koch and Sternberg from this translation (Figures 3 and 4). Some context about the subject matters of the letters is important in the interpretation. According to the heading, the letter was written on 6 January 1888, from a Berlin address. At this time, Koch would have

been working with the Institute of Hygiene at the University of Berlin. Koch's salutation of "Deer esteemed colleague!" suggests that he held Sternberg, the American bacteriologist, in high regard.

In paragraph one, Koch describes a publication he was sent by Sternberg about a presumed "water system." The deduction of this translation is due to the original writing containing the root "Canal" in line 2 (Figure 3, paragraph 1). It is inferred that this publication about water systems included writings of Rudolph Hering, who has been established as an important American sanitation engineer (Figure 4, paragraph 1). The" system of [Waring]" is possibly referring to Colonel George E. Waring Jr., a member of the National Board of Health that surveyed the Memphis yellow fever epidemic of 1879 with John Shaw Billings (Figure 4, paragraph 1, Garrison, 1915 p. 395).

In paragraph two, Koch notes his admirations of Sternberg's recent publications on Yellow Fever. The report Koch references likely referred to Sternberg's yellow fever investigations of Brazil, as he referred to Dr. Freire (Figure 4, paragraph 2). Recall that Dr. Freire had falsely claimed the cause of yellow fever to be a bacterium using flawed methodology, as yellow fever is caused by a virus (Kober, 1915, p. 1234, 1234). Like Koch, Sternberg had a "keen eye" in identifying *vollstandigkeit* and *nachvollziehbarkeit*, or completeness and reproducibility, the "two

pillars of German science" (Goetz, 2014, p. 50). Therefore, Koch trusted Sternberg's critical interpretation of Dr. Freire's incomplete study.

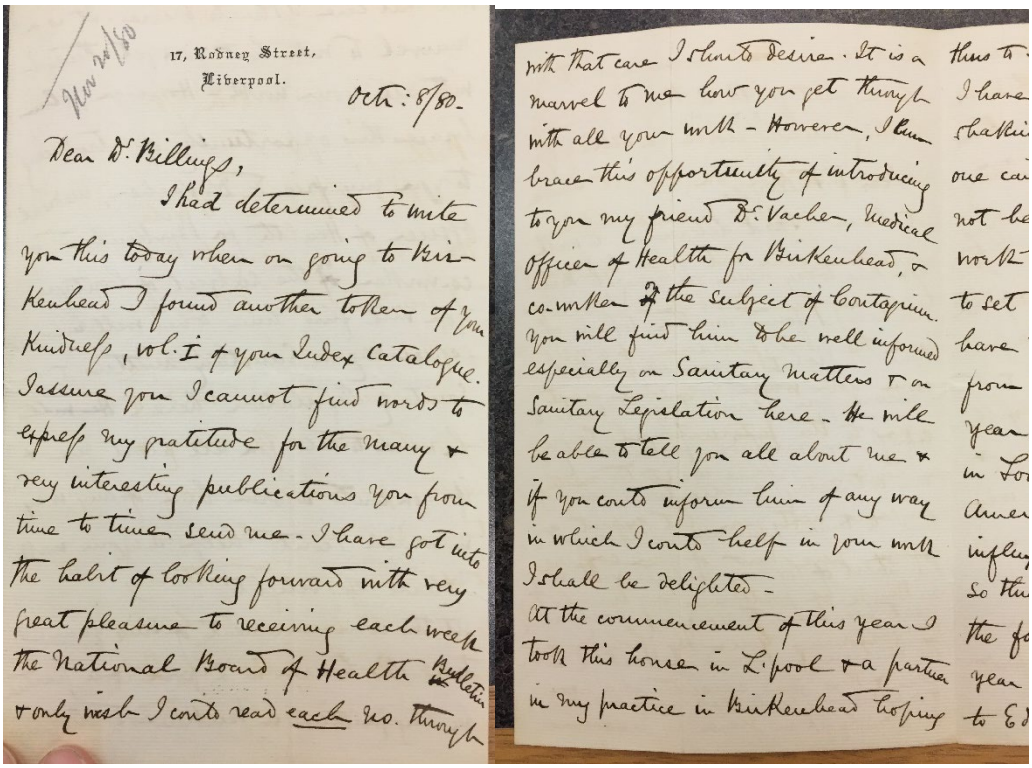
In paragraph three, Koch explains the reasons he will be unable to visit Sternberg in America, as he had planned (Figure 4, paragraph 3). It is rather inspiring to read that Koch had planned to visit Sternberg in the U.S., and it indicates that their correspondence is beyond strictly scientific communication (Figure 4, paragraph 3, line 1). Koch, often thought of as a cold, sterile scientist, believed it was important to be near his daughter prior to her wedding; this adds a dimension of personality to our understanding of the pioneering microbiologist, which we would not be able to ascertain merely by reading his scientific works (Figure 4, paragraph 3, line 2). In his second reason for being unable to leave Berlin, Koch attributes to receiving two new lab assistants, which aligns with Koch's described necessity for control, particularly with his work on the tuberculosis cure (Figure 4, paragraph 3, lines 2-4, Goetz, 2014 177, 190). This letter was written merely two years before Koch demonstrated his tuberculin to the world (Goetz, 2014, 174-175).

Koch concludes his letter with words of encouragement and hopefulness. In writing, "it will be a particular joy for me to seek you in your hometown and be able to greet you," Koch demonstrates that his relationship with Sternberg is close

enough to visit each other's homes (paragraph 4). This tone is refreshing; it illuminates the whole person these scientists truly were. The closing, “With the greatest admiration,” served as an inspiration for the title of this paper. How often are emails signed “With the greatest admiration”? This affectionate closing is not simply a customary practice of the time; it is demonstrative of a true friendship, indicative of a genuine person behind the lab coat.

A Letter “Triangle”

In late 1880, Peter Braidwood of Liverpool, writes to John Shaw Billings, “introducing [Billings] to [Braidwood’s] friend D. Vacher, Medical Officer of Health for Birkenhead” (Figure 5). As explained above, Birkenhead was a key “One Health”-related port area near Liverpool. Braidwood’s reasoning for this introduction is that his friend is “well informed especially on sanitary matters and in sanitary legislation,” and he would like to offer his expertise, noting if Vacher can help, “I shall be delighted” (Figure 5). At this moment, Billings was director of the National Board of Health, and Vacher would have likely been authoring his report, “What diseases are communicable to man from diseased animals used as food?” (Haynes, 2019). Therefore, this correspondence indicates a connection between animal health and sanitation, and its impact on human health.



17, Rodney Street,
Liverpool.

Oct: 8/80.

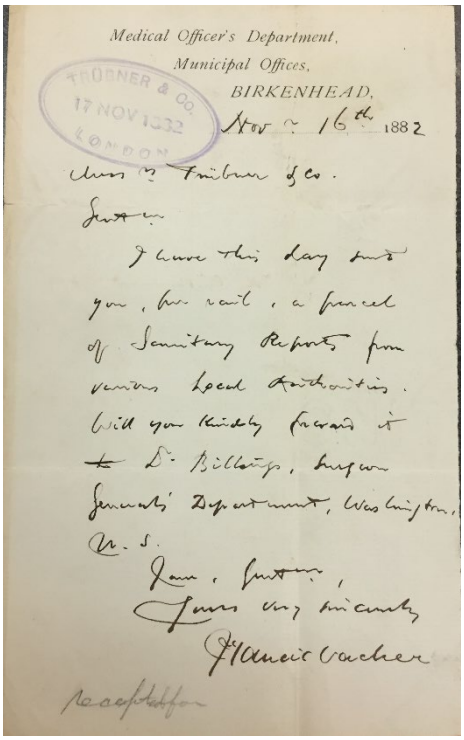
Dear Dr. Billings,

I had determined to write you this today when on going to Birkenhead I found another tome of your Kindness, Vol. I of your Index Catalogue. I assure you I cannot find words to express my gratitude for the many & very interesting publications you from time to time send me. I have got into the habit of looking forward with very great pleasure to receiving each week the National Board of Health Bulletin & only wish I could read each no. through with that care I should desire. It is a marvel to me how you get through with all your work. However, I embrace this opportunity of introducing to you my friend Dr. Vacher, Medical Officer of Health for Birkenhead, a countryman of the subject of Contagium. You will find him to be well informed especially on Sanitary matters & on Sanitary Legislation here. He will be able to tell you all about me & if you could inform him of any way in which I could help in your work I shall be delighted.

At the commencement of this year I took this house in Liverpool & a partner in my practice in Birkenhead hoping

Figure 5. Letter from Peter Braidwood to John Shaw Billings, 8 October 1880

(Source: National Library of Medicine)



Medical Officer's Department,
Municipal Offices,
BIRKENHEAD,
Nov 16th 1882

Messrs Trübner & Co.

Gentlemen

I have this day sent you, by rail, a parcel of Sanitary Reports from various local authorities. Will you kindly forward it to Dr. Billings, Surgeon Generals' Department, Washington, U.S.

Yours, Gentlemen,
Yours very sincerely
Francis Vacher

Accepted for

Figure 6. Letter from Francis Vacher to Peter Braidwood, 16 November 1882 (Source: National Library of Medicine)

Two years later, Vacher penned a short message addressed to Billings: "I have this day sent you, by mail, a parcel of Sanitary Reports from various local authorities. Will you kindly forward it to D. Billings" (Figure 6). It can reasonably be inferred that this parcel of sanitary reports was a response to a request of Billings. Indeed, in Braidwood's offer of Vacher's help, Vacher delivered! Without Braidwood's letter of introduction, it is possible that Vacher may have never sent these reports to Billings. Here we can inductively observe that forming second-degree connections helps "grow" branches of relationships that develop into

professional networks, and leaders like Billings recorded those very networks. Billings documented this One Health branches-and-networking phenomenon by collecting reports, letters, articles, images, and more, in his inception of the National Library of Medicine (Garrison, 1915, p. 379).

Inducing lessons learned from the primary sources

Considering each of these perspectives, a number of lessons emerge. First, in interdisciplinary work, self-motivation, and creating widespread change. One can only imagine the difficulty of attempting to prove invisible scientific phenomena to the general public. Because of the immense cost of restructuring a city, the public required physical, visible proof. Fortunately, bacteriologists like Sternberg and Koch pioneered methods like plating and microscopy to visually demonstrate their findings (Sravanthi et al, 2024).

Koch's letter accentuates the importance of centering modern city design around sanitation. Koch's reference to Rudolph Hering and George Waring evokes this necessity for adapting municipal design (Figure 4). Hering, and other civil engineers, were instrumental in designing the water carriage systems employing the then-skeptical theory of sanitation.

This story also proves how interdisciplinary work has been essential to solving the problems of the world throughout history. Collaboration of engineers,

scientists, physicians, and medical officers provides for innovative science to become real life. One can take note of these leaders in their willingness to correspond and develop relationships with one another. In the dawn of the digital age, conversation can be difficult to interpret through email, just as it may have been difficult through writing. It is refreshing to read that Koch and Sternberg were close enough that Koch had planned to visit America for him. In particular, the triangular relationship of Billings, Braidwood, and Vacher illustrates the notion that networking, even across the ocean, results in fruitful collaboration in a field built on discovery.

This type of archival research through a historical lens also allows us to truly appreciate the efforts of scientists like Sternberg and Koch. Sternberg was likely inspired to make finding the cause of Yellow Fever his life's goal after his own wife passed because of the disease. Koch's infatuation with curing tuberculosis likely arose from a similar sentiment, feeling inspired to find a cure for a disease someone close to him experiencing debilitation. Similarly, today thousands of physicians and researchers have chosen their fields of work to find cures for the incurable diseases of today, notably cancer, autoimmune conditions, and neurodegenerative diseases. These foundational leaders worked with each other in an interdisciplinary manner, striving for cures that were just out of reach. The true cure for tuberculosis didn't come around until the discovery of streptomycin in

1943 (Goetz, 2014, p. 245), and while yellow fever was largely contained through public health efforts of reducing mosquito transmission, a working vaccine wasn't available until the 1930's (Prinzi, 2021). While cures for these diseases were far out of reach, the work that the scientists, physicians, engineers, and politicians of this time was not in vain. These leaders laid the foundations on which functional cures and treatments would later be based. In doing so, they confirm that adage, "We each will start things that others will finish, and we each will finish things that others have started" (anonymous).

Science, at its core, is an historical tradition. Discoveries become knowledge while knowledge makes new discoveries possible – imagine if all of Koch's work had been forgotten, agar plates may not be used to grow bacteria in laboratories. The meticulous nature of keeping a lab notebook continues to be an integral piece of any research experience. Publications and correspondence are how the greater scientific community builds this knowledge base. Billings understood this as he was collecting papers to eventually establish the National Library of Medicine. Koch and Sternberg and Hering published stacks upon stacks of papers to communicate their discoveries and their failures. These early public health leaders diligently devoted their lives to their noble goals of ridding the world of disease and death. While one may never see the true fruits of their labor, they can still meaningfully contribute to the causes they so desperately believe in.

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