American medicine's quintessential polymath: **John Shaw Billings**

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In his 1953 essay, "The Hedgehog and the Fox," Isaiah Berlin quotes from the ancient Greek poet, Archilochus, "A fox knows many things, a hedgehog knows one big thing."[1] In the history of American medicine, a notable fox stands out: a single person in whom were combined greatness as a student, librarian, vital statistician, informatician, public health official, architect, administrator, medical school founder, consultant to titans of academics and philanthropy, and a master at bringing order out of chaos. That fox was John Shaw Billings, whose sometimes forgotten legacy continues to enrich the lives of physicians, scientists, and knowledge seekers the world over.

Many contemporary observers might reasonably question how one person could possibly contribute as much as Billings, to which the man himself provides a partial answer, "There is nothing really difficult if you only begin," he writes. "Some people contemplate a task until it looms so big, it seems impossible, but I just begin, and it somehow gets done."[2]

Billings embodies the can-do attitude of a person who relishes a challenge and simply rolls up his sleeves and sets to work. A physically imposing figure, his clarity of purpose and dedication to service shone so brightly that they inspired and drew in many collaborators.

Early years

Born in Allenville, Indiana in 1838, Billings was the son of a postmaster, and shared his mother's deep love of reading and learning both Greek and Latin. Having determined that his destiny was to pursue higher education, Billings entered Miami University of Ohio in 1852 at 14-years-old. He quickly realized that what the faculty had to say in the classroom generally offered less in illumination than what he could discover independently in the institution's library. His love of reading was so great that he frequently persuaded his fellow students to sign out volumes on his behalf, thereby transcending the library's borrowing limits. Despite his habitual absence from the classroom, he graduated second in his class, having resolved to enter medicine.

Billings then worked for a year to get money to attend medical school before enrolling in what is now the University of Cincinnati College of Medicine. Due to his straitened circumstances, he took a job in the dissection lab, which enabled him to live at the school and avoid paying rent. Billings decried the standards of medical education at the time—a two-year course in which the second year of lectures merely repeated the first. He produced a thesis on the surgical treatment of epilepsy that earned him the respect of the faculty, and by the

John Shaw Billings portrait in the National Library of Medicine, Cecilia Beaux, 1895. Public Domain

time he graduated in 1860, the nation was teetering on the edge of civil war.

Billings became an anatomy demonstrator at his medical alma mater, but with the onset of the Civil War in 1861, he determined to join the army. Legend has it that he scored so highly on the three-day entrance examination that foul play was suspected, but all doubts were dissolved when a closely supervised retake produced an equally high score.

Appointed an assistant surgeon in Georgetown, he was assigned to help turn army barracks in the District of Columbia into a 1,000-bed hospital that would serve both Union and Confederate troops. While in D.C., he met and married Kate, the daughter of U.S. Congressman Hestor Lockhart Stevens. The couple enjoyed a long and happy marriage that produced four daughters and one son.

Billings later recalled that even as a student he longed to "try to establish for the use of American physicians a fairly complete library, and in connection with this to prepare a comprehensive index which should spare medical teachers and writers the drudgery of consulting thousands or more indexes or the turning over the leaves of many volumes to find the dozen or more references of which they might be in search."[3] He enjoyed the opportunity to fulfill this aspiration on behalf of both physicians and the general public on more than one occasion throughout his long and varied career.[3]

Civil War

During the Civil War, Billings saw duty in Chancellorsville, VA, and Gettysburg, PA. His harrowing and heroic experiences as a surgeon in Gettysburg, during which he was stationed near Little Round Top,

A group of 1st U.S. Calvary soldiers stand before the U.S. Army Surgeon General's Office Circa 1865. Back row, from left, J. Hamilton Porter, Brinton Stone, Joseph Woodward, Craig Janvier, John Shaw Billings, William Canfield Spencer, C.C. Lee, George Otis, Edward Curtis; front row, from left, Charles Henry Crane, and Joseph K. Barmes. Public Domain

site of one of the most famous battles, are detailed letters he wrote to his wife in the summer of 1863.

> I am utterly exhausted mentally and physically, having been operating night and day and am still hard at work. I have been left here in charge of 700 wounded with no supplies and have my hands full.[4]

Just three days later, he wrote,

> I am covered with blood and am tired out almost completely, and can only say that I wish I was with you tonight and could lie down and sleep for sixteen hours without stopping. I have been operating all day long and have got the chief part of the butchering done in a satisfactory manner.[4]

The next day, he wrote that his orderly "has just scrubbed all the blood out of my hair with Castile soap and bay-rum, and my scalp feels as if a steam plow had been passed through it."[4]

Library of Medicine

In 1864, Billings was reassigned to the medical director of the army, and with the war's conclusion, was placed in charge of dismantling wartime hospitals. During this time, he contributed to the *Medical and Surgical History of the War of the Rebellion (1861-1865)*, which was published in six volumes. He was placed in charge of the army's library in 1865, and perceiving the inadequacy of its current home, he arranged to have it moved to Ford's Theatre, site of Lincoln' assassination, which the government had recently purchased. There, he began cataloguing medical and scientific publications from around the world, including pamphlets, journal articles, and doctoral dissertations.

Billings soon built up the largest medical library in the United States, which in 1873 included 50,000 volumes. In today's era of instant electronic access to information, it is difficult to appreciate the full magnitude of this achievement, to which Billings added an extensive card catalog system that organized these resources and made them accessible. He established the policy that the holdings would be available to physicians all over the country, and among those who borrowed books were many of the most eminent physicians of the era, including three of the founding faculty members of the Johns Hopkins School of Medicine, William Welch (ΑΩΑ, The Johns Hopkins School of Medicine, 1906), William Halstead, and William Osler.

Billings recognized that the rate of growth of the medical literature was accelerating and would soon become unmanageable, writing:

> What will libraries and catalogues and bibliographies of a thousand, or even a hundred years hence be like if we are thus to go on in the ratio of geometric progression which has governed the press for the last few decades? There is coming a time when our libraries will become large cities, and when it will require the services of everyone in the world, not engaged in writing, to catalogue and care for the annual product.[5]

Hall at the Army Medical Museum and Library. Dr. John Shaw Billings (1838–1913) sits at table on right; circa 1890.
Public Domain

As the number of articles and books increased, so did the challenge of cataloging them, which called for a systematizer who could index them in a way that would make them easy to reach.

Index Medicus

With colleague Robert Fletcher, Billings developed a monthly index of the medical literature, the *Index Medicus*. Although financially a break-even prospect at best, the *Index Medicus* made it possible for readers to access the sprawling discourse of medicine, a monumental advancement.

At the time of its founding, an annual subscription carried a price of three dollars. If not for financial support from the Carnegie Institute and the American Medical Association, it is quite possible that the venture, which was published from 1879 to 2004 and eventually incorporated into MEDLINE and now PubMed, would have folded.

Welch, asked to name what he regarded as the U.S.'s most important contributions to medical knowledge, listed four:

> (1) The discovery of anesthesia, (2) the discovery of the insect transmission of disease, (3) the development of the modern public health laboratory, and all that term implies, and (4) the Army Medical Library and its index catalogue, and this library and catalogue are the most important of the four.[6]

Census

Billings played an important role as an advisor to the U.S. census, urging that medical data should be collected as part of the 10th, 11th, and 12th censuses, and helping to ensure that its vital statistics were published. Impressed by the massive amounts of information involved, he suggested to one of his assistants, Herman Hollerith, "data might be recorded on a single card or slip by punching small holes in it, and that these cards might then be sorted and counted by mechanical means."[8]

Thus was born the punch card, an innovation Hollerith then drew on to found the Tabulating Machine Company, which was eventually amalgamated into the International Business Machines Corporation (IBM).

Billings recognized that there is something less than glamorous about compiling demographic and vital statistics, but he also knew that it was essential to base decision-making on an accurate picture of what is really happening in the world. He wrote:

> Statistics are somewhat like old medical journals, or like revolvers in newly opened mining districts. Most men rarely use them and find it troublesome to preserve them so as to have them easy of access; but when they do want them, they want them badly.[9]

Again, Billings devised systems not only for collecting and compiling such statistics but also for making the results of such compilations readily accessible to those in need of them.

Public health

Billings became more involved in public health in 1869 when he was commissioned to report on the Marine Hospital Service, for which he traveled throughout the country. He also prepared reports to the Surgeon General on the hospitals and hygienic practices of the U.S. Army, determining that U.S. soldiers were among the best fed and worst housed army in the world, and criticizing the military for allowing the desire to save in boards and brick to supersede the health and the life of the soldier.

Billings pushed for barracks and hospitals that would provide good ventilation and bathtubs and showers, and urged that chief cook at every post should become a permanent position.

In 1879, Billings was part of a team that investigated a yellow fever outbreak in Memphis, TN. In his report, he speculates that the disease is transmitted by a minute organism.

He became one of the nation's leading authorities on public health, addressing such varied topics as vaccination, the heating and cooling of school buildings, sewage disposal, water supplies, and studies of municipal sanitation in numerous large American cities. He served as an effective advocate of the view that public health could not remain the purview of individual physicians, but required the development of a public health system focused on the prevention of disease, writing:

> Medical men have been foremost in urging attention to the prevention of disease, both on the part of individuals and the public, not because it is specially to their interest to do so, but because their sympathies are daily and hourly appealed to by the spectacle of human suffering which they know might have been prevented, but which they find difficult or impossible to relieve.[10]

Johns Hopkins

Sketch of Johns-Hopkins Hospital, Baltimore, MD, circa 1989.
Public Domain

In the 1870s, Billings became involved in the founding of the Johns Hopkins Hospital, and new university's medical school. He was the hospital's principal designer. It opened in 1889, and his portrait still hangs at the entrance to the administration building.

Billings recruited key faculty to the hospital, including Welch, Halstead, and Osler. It is said that Billings required all of two minutes to recruit the latter. He arrived at Osler's apartment at the University of Pennsylvania and asked him point blank if he would accept a position at the new medical school. Osler replied in the affirmative. Billings then departed, telling Osler to expect to hear more from the university in the coming days.

Billings embodied a new and progressive spirit of medical education, inspired in part by John Dewey, having once told the graduating class at the University of Pennsylvania, "Your new textbooks will be antiquated in five years."[4] Hence he also served as Hopkin's intellectual and professional architect. In a letter to the trustees, he urged that the hospital should:

> Advance our knowledge of the causes, symptoms, and pathology of disease, and methods of treatment, so that its good work shall not be confined to the city of Baltimore or the state of Maryland, but shall in part consist in furnishing more knowledge of disease and more power to control it, for the benefit of the sick and afflicted of all countries of all future time.[11]

He emphasized that students should be trained as investigators, that they needed to be prepared to serve as public health officers, and that their knowledge should come less from books than from personal observation and investigation. He wrote:

> What is desired is that the medical faculty shall increase knowledge—and shall fit its students to increase knowledge—and that its attempts to do this shall not be restricted or limited by the fact that a part of its own work is to teach the practical applications of this knowledge. Let this last be the secondary and not the primary object, and by so doing we shall be free to do, and shall have the means to do work which is not only highly desirable, but which cannot be done elsewhere.[11]

Billings was offered the job of superintendent, the equivalent of today's position of chief operating officer, but he declined, ending his official ties to the hospital the year it opened. For the next few years, he taught public health at the University of Pennsylvania.

New York Public Library

The New York Public Library was created in 1895 by combining the resources of the Astor Library, the Lenox Library, and the Tilden Trust. Billings was named the founding director, a capacity in which he served until his death in 1913.

He created the overall plan for the library building, commissioned the two lion sculptures that flank the entrance, and created space for seven floors of stacks. By the time it opened in 1911, more than one million books had been accumulated, and U.S. President William Howard Taft presided at the dedication.

New York Public Library, circa 1908. Public Domain

Billings also helped persuade Andrew Carnegie to fund the construction of 65 branch libraries around the city, as well as an additional 2,500 libraries elsewhere in the U.S. and Britain.

A key part of the genius of Billings was his determination to always keep in mind the interests of the patrons, the people who would be using the library on a daily basis. In developing the library's classification system, he wrote:

> The main principle kept in view in the classification is the convenience of the readers in the library, including both those who are allowed access to the shelves and those to whom books are delivered in the general reading rooms, and in endeavoring to provide for the convenience we have relied on the experience gained with our own readers as to what books or groups of books are most frequently called for. The books relating to the subjects which are most studied by our visitors we wish to have either on the open reference shelves or near the delivery desk, while those that are rarely called for may be placed in the stack at a greater difference. The relative importance of different subjects as they would appear in a scheme of the divisions of human knowledge has, therefore, very little weight in our classification.[4]

An absolutely reliable man

It can be difficult to grasp the remarkably high esteem in which Billings was held by his contemporaries. One biographer described his approach:

> Everything to be done, every public duty or private obligation, was duly pigeon-holed in his mind, and all promises were faithfully kept and easily performed. He worked, as Osler says, "easily, without fuss or effort," dispatching everything with military promptitude, and except in hours of relaxation or vacation periods, when he threw himself into simply enjoyments with zest, he was accustomed to economize and give account to himself of every hour of his waking life.... Few sentences went from his lips which did not wing the center of the target or near it, and he never wasted words in business. Thus he came to be looked up to and sought after everywhere as that rare thing in modern life, an absolutely reliable man.[11]

Why is it that such a remarkable person is relatively unknown today? The answer lies, in part, in the wide dispersion pattern of Billings' contributions. His entire body of work is nearly unparalleled in heft, yet it is divided up among so many different fields that the impact in any one area tends to be dwarfed by the magnitude of the whole. Billings was not a seeker of glory, but instead a man who simply got things done. He lacked the egoism and flair of many other important figures in the history of American medicine. He is not as well known as he deserves to be because the contemporary appetite for history in medicine is relatively slight. Curricula, meetings, and journal articles tend to focus on the actionable and the new, at the expense of the stories of the giants of medicine's past on whose shoulders contemporary physicians are perched.

Billings' vulpine array of seminal contributions was underwritten by his deep sense of calling to service, great clarity of vision, and extraordinary dedication, qualities that rendered him a human dynamo and source of amazement. Above all, he possessed the quality of practical wisdom, a knack for discerning what most needed to be done and how to do it. He inspired countless others, including some of the most highly regarded physicians of his day.

At a memorial meeting of the Johns Hopkins Historical Club in Billing's honor in May 1913, Welch said of him:

> Of all the men I have ever known, he was about the wisest. He was a man whose judgment you sought on any difficult subject, and you pinned your faith to him more than to any man of your acquaintance. He was wisest because he was under no illusions. He got at the heart and essence of things. He was an eminently sane man, who knew what it was best to do under the circumstances, and what it was practicable to do. This quality was associated with a wide vision and high ideals.[12]

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