Letter from Mangalore

OUR OPEN SESAME AND A TRIBUTE TO SAINT JOHN

> *All men are interdependent. Every nation is an heir of a vast treasury of ideas and labor to which the living and dead of all nations have contributed. Whether we realise it or not, each of us lives eternally 'in the red'. We are everlasting debtors to known and unknown men and women.*
>
> —Martin Luther King, Jr.[1]

OUR OPEN SESAME

She seemed to be in her eighties, one of those elderly women who radiate good cheer and whose wrinkles are 'where their smiles have been.' It was the Montreal of 2010 when I was doing my Masters in Epidemiology at McGill, and the place was a local bank branch at the corner of the street. She looked my way, smiled, and asked me what I was doing in Montreal. We chatted for a while, and later, as we approached the exit door, she paused and uttered a command with a dramatic flourish: 'Open Sesame.' The automatic door opened as it had to, but the lady's eyes shone with glee, and I could sense that this had ignited her childhood fantasies drawn from the tales of Ali Baba. I return to this memory whenever I feel that life has been dulled by routine, and I take the enormous privileges that I enjoy and the wonders of the modern world for granted.

The encounter with the elderly lady in Montreal was brought back to life by an experience in a recent teaching session … The postgraduate seminar was a dreary affair whose esoteric choice—haemophagocytic lymphohistiocytosis—was triggered by recent experience in patients. The resident's lack of engagement and preparation was also reflected in the outdated references he discussed in painful detail. I asked him about his strategy for searching for information on the topic, and he seemed to have no coherent answer. I asked him pointedly whether he had accessed the US National Library of Medicine's PubMed. He hadn't. I then opened the site on the smart screen, typed in the search terms with tags, applied the right filter for review articles in the past 5 years, and voila! Three relevant reviews from the previous two years could have made the presentation current.

The lightning-quick retrieval of these relevant references at the point of discussion (a seminar room) was an Open Sesame moment for me too. However, I suppressed this feeling of excitement under my professorial facade. It brought back memories of the past when a similar search was a laborious, painstaking, painful exercise conducted in the dusty and musty environs of often poorly maintained libraries. In 1988, when I joined the MD Medicine programme at AIIMS, New Delhi, searching for articles on bronchial asthma took me over 2 months. I received some peremptory advice to go to the library to search for articles that reflected the current directions of asthma research. But the search in journals seemed a forbidding task—which journals and how many could I search, and with many volumes missing on the shelves, how could I be sure I had not missed something of relevance? One of the library staff directed me to search the *Index Medicus* volumes published by the US National Library of Medicine (NLM), which publishes the bibliographic record of the current biomedical literature. This seemed sensible advice, but my heart sank when I saw these for the first time. What I assumed would be the index for the entire year turned out to be volumes for each month. However, when I took one down, I found it a convenient and well-organized resource, with recent publications on all aspects of each disease, from basic science to epidemiology and treatment. My job was to get these tomes down from the shelves, scan the relevant sections, and note anything of interest on index cards. Then, one would embark on another search for the journals/books in the AIIMS library or the National Medical Library next door to look for the specific article/chapter. This was always a matter of luck because the journal/book may not be available or missing, and finally, you may find that the specific pages you have been looking for have been torn off the book or journal by a vandal aiming to save a few rupees. In my case, I successfully zeroed in on the reported use of magnesium sulphate in bronchial asthma in a JAMA article from scrutiny of around 60 dusty volumes of *Index Medicus*, each weighing about 3 kg. I suffered mild collateral damage, developing medial epicondylitis and mild allergic asthma. I was, however, thankful to the *Index Medicus* for the

FIG 1. John Shaw Billings in 1911. Source: Medical World: Biographical Sketches of Notable Physicians and Surgeons of the Present: Berlin Publishing Company, New York 1911

process. I encountered only the print version of *Index Medicus*. In the 1960s, the NLM launched a computerized version of the index called Medical Literature Analysis and Retrieval Systems (MEDLARS). In 1971, it launched an online version of MEDLARS or MEDLINE, accessible only via specialized telecommunications systems. In the early 1990s, at AIIMS, researchers could search for *Index Medicus* in compact discs, and I marvelled at the miniaturization of years of *Index Medicus*. After the birth of the internet, in 1996, the National Library of Medicine launched PubMed, which liberated us from libraries and made searches possible from home and office. PubMed is the free internet interface of NLM for searching its MEDLINE database of nearly 5200 biomedical journals selected based on scope and quality (Journals can lose their indexed status, as has happened with some Indian journals lately). PubMed also offers a search of non-MEDLINE citations and free full-text articles provided by the publishers through its PubMed Central feature. So, a journal appearing on PubMed may not be indexed in MEDLINE, which needs to be remembered before one regards the journal as PubMed indexed.

The lack of a coherent search strategy for the resident reflects a lack of formal training in searching the literature, which is a critical gap in our undergraduate and postgraduate medical training in India. We need to make training to retrieve relevant articles using PubMed and creating a bibliography with citation managers (e.g. free tools such as Zotero and Mendeley) a basic skill for all our health science students (including nursing). The undergraduate foundation course speaks of the ability to demonstrate basic computer skills and the ability to access online resources. In the postgraduate curricula, an online course in research methodology is mandatory, but different institutions differ in the content of these courses. The lack of grounding in these skills makes any literature review in our students' thesis suspect, and students waste much time typing references manually. I got trained in these aspects in 2004 when, as a rural physician, I travelled to Mahatma Gandhi Institute of Medical Sciences (MGIMS) for a workshop conducted jointly by MGIMS and the University of Berkeley. It was an empowering experience and made my medical writing more organized and efficient. At McGill, the librarians offered this training to all students. Now, more such courses are offered in India, but we have a long way to go. The NLM website now has excellent resources for conducting simple and advanced searches, managing and saving results, and creating email alerts (*https://learn.nlm.nih.gov/documentation/training-packets/T0042010P/*). The Johns Hopkins Library has a good tutorial on expert searches (*https://browse.welch.jhmi.edu/searching/pubmed-search-tips#when-to-use*). PubMed is also a great tool for clinicians, not just researchers, and its availability on mobile devices has made it possible to look for answers to focused clinical questions at the bedside and practice evidence-based medicine. The clinical queries tool in PubMed has built-in filters that allow one to access updated evidence directly, including systematic reviews on diagnosis, treatment, and prognosis.

I am concerned about the trends of increasing healthcare costs leading to medical poverty and growing inequalities in access to care, with commodification and bureaucratization of healthcare. Bedside medicine is declining, and there is excessive use and dependence on investigations. This and the practice of defensive medicine mirrors trends in the USA. However, I have nothing but unqualified admiration and gratitude for the institution of the NLM, which created the *Index Medicus* and its later transformations to MEDLINE and PubMed. It is the most extensive medical library in the world, and PubMed, with its 30 million citations accessible to anyone anywhere, is a treasured global resource—our Open Sesame to the current biomedical literature.

A TRIBUTE TO SAINT JOHN

'An institution is the lengthened shadow of one man,' wrote Ralph Waldo Emerson in his essay on self-reliance. I can now introduce Dr John Shaw Billings, the founding father of the NLM, whom some people in the NLM lovingly refer to as Saint John. John Shaw Billings led many lives—a battlefield surgeon in the American Civil War, librarian, bibliographer, hospital architect, medical educator, administrator, sanitarian, statistician, inventor, and innovator, and ultimately director of the New York Public Library, who launched hundreds of libraries across the USA. He created 'order out of chaos in many of his roles.'[2–4] My curiosity about the history of the NLM led me to him. The institutions he created and the ideas he shaped in the diverse fields were revolutionary. He is far less known than he deserves, and A. McGehee Harvey rightly called him the 'Forgotten Hero of American Medicine.'[5]

Billings as an Army surgeon, hospital reformer, and hygienist

John Shaw Billings was fascinated by books from an early age. He graduated as a doctor from Ohio, and the difficulty he experienced in accessing a bibliography for his MD thesis (The Surgical Treatment of Epilepsy) sowed the seeds for his future aspiration—'*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.*' After graduation, he became an Army surgeon, joined the Civil War effort, and served in some of its bloodiest battles, like Gettysburg, where he toiled day and night. He was later put in charge of managing a hospital in Washington, one with very inadequate facilities and 'no drainage whatever, no sinks, no water within half a mile, 'and became involved in inspections and improvements of all hospitals in the Marine Hospital Service (later evolved into the US Public Health Service). He implemented diet, sanitation, and housing standards for the US military and became a practitioner of preventive medicine all his life. He became a self-taught expert on ventilation and was appointed a commission member to improve ventilation in the House of Representatives. He was closely involved in plans for a national sanitary survey of the USA where all habitations would be mapped for environmental conditions—water supply, garbage and excreta disposal, manufacturing units, slaughterhouses, availability of schools, hospitals, public grounds, and disease-related data. He was the President of the American Public Health Association in 1880, an unusual honour for a surgeon. As the Vice-President of the National Boards of Health (short-lived for lack of Congress funding), he controlled the yellow fever outbreak in the southern US and also started a system of disbursal of research grants to institutions, a precursor to the future National Institutes of Health.

Billings, the Surgeon General's library, and the Index Medicus

In 1865, he joined the Surgeon General's office and served there for 30 years. He built the surgeon general's library on a shoestring

budget and transformed it from a modest library of 602 titles and 2282 volumes to 619 558 volumes when he retired in 1895.[5] This library evolved from a small library for the army to the largest medical library in the USA and the world. For this enterprise, Billings had only a slush fund of $80 000 turned in from the army hospitals and derived 'from the sale of bones, fat, stale bread, slops, flour barrels, straw, manure, waste paper, old newspapers, etc., and from the tax on the sutler.'[6] Billings built a network of agents, purchased second-hand books if in good condition, used the outreach of the army and the diplomatic missions to procure books, bid in auctions, and coaxed people with personal collections from across the world to donate their books. He also created an Index Catalogue for the library and brought out 15 volumes until 1895, each a thousand pages. In 1879, with the assistance of Robert Fletcher, he released the first *Index Medicus*, the forerunner of MEDLINE and PubMed. The *Index Medicus* continued its print form for 125 years till 2004.

In his writings, he envisioned the Surgeon-General's library as the NLM more than 60 years before it became officially designated. It was another surgeon, a consultant to the Army in the Second World War, and renowned cardiovascular surgeon Dr Michael DeBakey (originally Michel Dabighi, born of Lebanese immigrants), who recognized the library as a national and international treasure and lobbied senators Lister Hill and John F. Kennedy (later President of the USA) to craft the legislation that officially created the NLM in 1956.[7] It was moved to the National Institute of Health campus in 1962.

Billings as the intellectual architect of the care, education, and research model of the Johns Hopkins Hospital and School of Medicine

Billings is also the lesser-known intellectual architect and one of the founding fathers of the Johns Hopkins Hospital and its medical school, as is evident from a series of articles on the plans and purposes of the hospital.[8] The webpage on Billings at the Johns Hopkins School of Medicine states, 'In fact, after Johns Hopkins himself, Billings is probably the single most critical player in giving shape to a novel idea for revolutionizing American medicine.' He not only designed the Johns Hopkins Hospital, the largest medical centre in the USA at the time, and helped develop the admission standards and the curriculum, but as an outstanding 'fisher of men' and personally recruited two of the Big Four founding Professors at Johns Hopkins—William Henry Welch in Pathology, William Osler in Medicine, and the other two were William Stewart Halsted (Surgery) and Howard Atwood Kelly (Gynaecology). He convinced the President of the University, Daniel Coit Gilman, to recruit 34-year-old William Welch as the Professor of Pathology after he met him during a visit to a laboratory in Germany, predicting that the young pathologist would mature into a natural leader. Welch fulfilled Billings prediction and became the first dean of the Johns Hopkins University School of Medicine and the founder of the first school of public health at the Johns Hopkins University School of Hygiene and Public Health. 'His students at Hopkins (caricatured as Welch's rabbits in a cartoon by Max Brodel) included the likes of Walter Reed and Nobel Laureates Peyton Rous and George Whipple. Welch was instrumental in setting up the Rockefeller Foundation, which supported the development of research facilities in University Medical Schools in the USA. Billings recruited Sir William Osler after a 2-minute visit to Osler's rooms in Philadelphia, which Osler describes thus: Without sitting down, he asked abruptly, 'Will you take charge of the Medical Department of Johns Hopkins? 'Without a moment's hesitation, I said Yes. 'See Welch about the details; we are to open very soon; I am very busy today; good morning, 'and he was off, having been in my room for a few minutes.'[6] Time was gold for Billings. Osler would later speak at his memorial service in New York and write his obituary for the *British Medical Journal*.

Billings advocated for high admission standards and recommended a three-year Bachelor's degree as a requirement for entry. The programme was a 4-year graded curriculum with two years of pre-clinical subjects with an emphasis on exposure to the dissecting room and laboratories, small classes, and clinical teaching, and the final year was one of residence in the hospital. Faculty members were encouraged to do research and create knowledge, and there was careful maintenance of records and publication of reports. In his own words, '*I would have in this hospital the professors and lecturers and students all to be seekers and learners together, each in his own place, and if twenty-five, or ten, or even only three such graduates as I would have them, can be produced each year, it will repay the effort. They will be fitted to be general practitioners no doubt, but they will also be fitted to undertake special work which the average graduate would not dream of attempting*.'[8] He dreamt of creating practitioners and investigators, and Johns Hopkins became the birthplace of modern medical practice, education, and research in America. The Flexner report in 1910 had Hopkins as a reference point, and he praised it thus: 'This was the first medical school in America of genuine University type… The influence of this new foundation can hardly be overestimated. It has finally cleared up the problem of standards and ideals; and its graduates have gone forth in small bands to found new institutions or reconstruct old ones.'[9] The Johns Hopkins model was a strong influence on our own All India Institute of Medical Sciences, New Delhi, and the story of its inception had been discussed by Dr C.G. Pandit, a towering figure of Indian medicine and the first Director-General of Indian Council of Medical Research, in his memoir that is worthy of careful reading.[10]

Billings, vital statistics, a revolutionary innovation in the US Census, and the launch of the International Business Machines (IBM)

In the 19th century, information on births and deaths in the USA was unavailable or unreliable, and Billings argued for their systematic collection and analysis. He was one of the first to develop age-corrected adjustment of death rates and one of the few Americans at the time to create life tables.[11] Billings worked with the US Census from 1880 to 1910 and introduced the collection of birth and death data, current health at the time of death, questions related to disease prevalence, and even the costs and type of healthcare into the schedule. He wanted an analysis of the data stratified by race. The problem with the census data was that data collation was laborious, delaying analysis by years. In 1880, when he was being assisted by Hermann Hollerith, an engineer and inventor, Billings suggested to Hollerith that statistical data 'might be recorded on a single card or slip by punching small holes in it and that these cards might then be assorted and counted by mechanical means according to any selected group of these perforations.'[12] Hollerith then developed this idea for sorting, collating, and tabulating data and developed and patented an electrical counting machine based on this concept for the 1890 census.

In a document of the US Census, Billings is recognized as the discoverer of this concept, and Hollerith is the inventor of this system.[13] According to the IBM website, this system saved the US Census 2 years and $5 million. Censuses and commercial enterprises globally soon adopted this technology. Hollerith's company was the leading company, which formed the company's nucleus and renamed the International Business Machines (IBM). Punch cards became the first data storage devices, preceding floppy disks, hard drives, and a big money spinner for the IBM. Hollerith acknowledges getting the idea from Billings in a Sunday evening tea-table conversation but also that Billings was not interested in sharing the patent.[13] Billings had a role to play not only in founding the field of bioinformatics but played a catalytic role in the information processing revolution with his punched card idea applied to health.

Billings and Public Libraries in the USA

The final chapter of Billings's life was as a Trustee of the Carnegie Institution of Washington and the Director of the New York Public Library. He reorganized the entire library system, created 40 branch libraries, and designed and created a new main building. He convinced Andrew Carnegie to fund the creation of around 2500 public libraries across the length and breadth of the USA.

Billings rules for writing

Billings has left us a massive bibliography of articles, books, reports, and letters that now form part of a NLM collection.[14]

One of Billings's lesser-known but still valuable legacies is the writing rules (now labelled the Billings rules) that appeared in a paragraph in his Address on Medical Literature. 'The four rules for the preparation of an article for a journal will then be: 1. Have something to say; 2. Say it; 3. Stop as soon as you have said it; 4. Give the paper a proper title.' That is sound advice indeed for all time.[15]

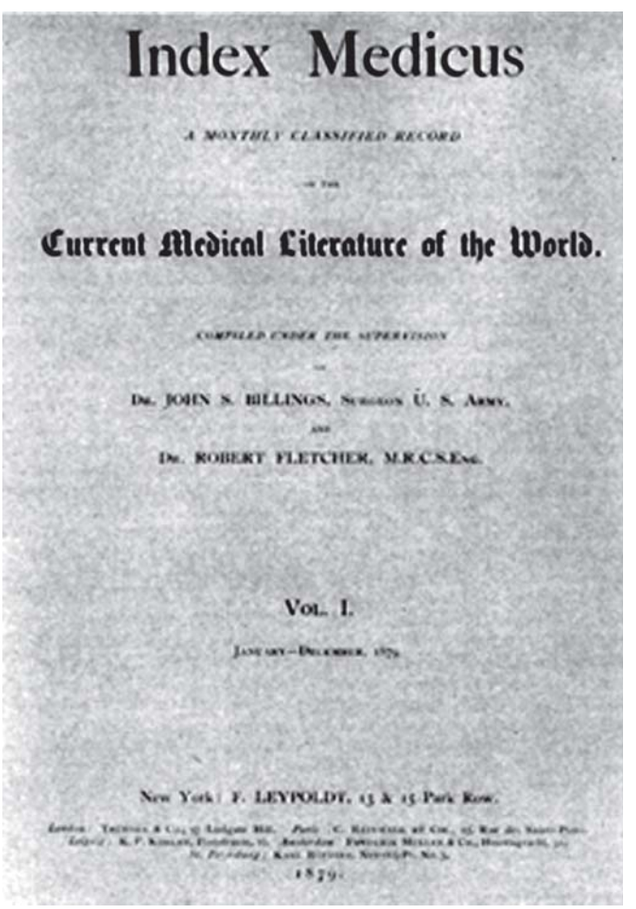
Billings lessons for us in the 21st century

Does this lengthy tribute to a distinguished member of our profession who died more than a centenary ago have any relevance in 2024? Should we, as one tribute put it, 'gasp at the many lives he led'? If we, as a profession, honour the ideas of Hippocrates, Charaka, and Sushruta, then John Billings' much closer life will have lessons for us. At an individual level, Billings' diverse, monumental, and purposeful contributions, made possible by his indefatigable zeal, provide an intellectual and moral benchmark and an antidote to the overdose of intellectual arrogance and cynicism. We in India stand in the same relation to the years after Independence as Billings stood in regard to America after its Independence in 1776. Billings wanted a sanitary survey of the USA and India, which desperately needs one followed by concrete action. The situation about the environment in our cities and towns is not very encouraging, and few cities can boast of clean air quality, potable and safe water, and an organized system of drainage, garbage, and sewage treatment. Billings pointed to the gaps in the registration of deaths and their causes in the US, and we again need to address these long-standing issues with vital statistics in India, including their analysis by social and economic strata.

Billings' work with medical education and hospitals provided the template for America. Have our leading institutions 'settled the problem of standards and ideals' Flexner referred to and evolved templates that the newer ones might follow? There is a creeping sense of laissez-faire in our healthcare and medical education system with a dilution of standards, which many of us feel personally but may not voice collectively. There is a frenzy in the opening of new medical colleges without due attention to faculty, facilities, and standards, and colleges are in danger of becoming the commercialized unregulated 'diploma mills' that existed in the USA in Billings's era. Medical education in India needs a review if we are not to travel on a slippery slope, and we need higher public investment and enlightened philanthropy to support education and research. Hospital design about patient safety is another critical issue. I recently visited a leading institution involved in TB care, and hundreds of unsegregated patients stood in a queue in an ill-ventilated registration area, raising concerns about disease transmission. Recall patient deaths in instances of fires in hospitals.

Billings's passion for increasing access to public libraries was exemplary, and his efforts have improved the intellectual and social lives of millions. We need these local gateways to knowledge and tools for community development in our urban and rural areas, much more than the malls that now dot urban India. As public spaces, libraries can reinvent themselves in these times, adapting to the changing needs of different kinds of literacy.

In times of despair and cynicism, Billings' words can provide some direction and encouragement. '*Privately, and between ourselves, we grumble and declare that the country*


Index Medicus

A MONTHLY CLASSIFIED RECORD

Current Medical Literature of the World.

COMPILED UNDER THE SUPERVISION

DR. JOHN S. BILLINGS, SURGEON U. S. ARMY,

AND

DR. ROBERT FLETCHER, M.R.C.S.Eng.

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JANUARY–DECEMBER, 1879.

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1879.

FIG 2. First page of the first issue of Index Medicus in 1879.

and profession are going to the dogs…While we must consider the difficulties in the way of the improvement of the science and art of medicine, difficulties due to ignorance, indolence, conflict of interests, and the eternal fitness of things, the existence of such difficulties is not a matter to be bemoaned and lamented over. These obstacles are the spice of life, the incentives to action, the source of some of the, greatest pleasures which it is given to man to experience.'[16]

The final relevance of Billings' life for us lies in one of his obituaries concluding words: 'He gave to his profession the service of a scientist interested in the most common problems, the labours of a specialist with the broadest sympathies.'[17]

In India, we need health professionals, public servants, and public entrepreneurs imbued with the spirit of John Shaw Billings. We badly need the service of men and women scientists who are interested in solving the most common problems and labours of specialists with broader sympathies.

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Obituaries

Many doctors in India practise medicine in difficult areas under trying circumstances and resist the attraction of better prospects in western countries and in the Middle East. They die without their contributions to our country being acknowledged.

The National Medical Journal of India wishes to recognize the efforts of these doctors. We invite short accounts of the life and work of a recently deceased colleague by a friend, student or relative. The account in about 500 to 1000 words should describe his or her education and training and highlight the achievements as well as disappointments. A photograph should accompany the obituary.

—Editor