

The great contribution: *Index Medicus*, *Index-Catalogue*, and IndexCat

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Objective: The systematic indexing of medical literature by the Library of the Surgeon-General's Office (now the National Library of Medicine) has been called "America's greatest contribution to medical knowledge." In the 1870s, the library launched two indexes: the *Index Medicus* and the *Index-Catalogue of the Library of the Surgeon-General's Office*. *Index Medicus* is better remembered today as the forerunner of MEDLINE, but *Index Medicus* began as the junior partner of what the library saw as its major publication, the *Index-Catalogue*. However, the *Index-Catalogue* had been largely overlooked by many medical librarians until 2004, when the National Library of Medicine released IndexCat, the online version of *Index-Catalogue*. Access to this huge amount

of material raised new questions: What was the coverage of the *Index-Catalogue*? How did it compare and overlap with the *Index Medicus*?

Method: Over 1,000 randomly generated *Index Medicus* citations were cross-referenced in IndexCat.

Results: Inclusion, form, content, authority control, and subject headings were evaluated, revealing that the relationship between the two publications was neither simple nor static through time. In addition, the authors found interesting anomalies that shed light on how medical literature was selected and indexed in "America's greatest contribution to medical knowledge."

INTRODUCTION

William Henry Welch (1850–1934), the great pathologist and bibliophile, is famously quoted as saying that the systematic indexing of medical literature, begun by John Shaw Billings at what was then the Library of the Surgeon-General's Office, United States Army (known today as the National Library of Medicine [NLM]), was "America's greatest contribution to medical knowledge."^{*} He apparently was sincere in this belief. In fact, he made this statement several times, to different audiences, and in such varied contexts that it is not easy to be certain just what Welch was praising: Billings's commitment to indexing or the two products of this commitment, *Index Medicus* and the *Index-Catalogue of the Library of the Surgeon-General's Office, United States Army*.

Index Medicus may be better remembered today (if somewhat hazily) as the forerunner of MEDLINE and now PubMed. But *Index Medicus* began its publication career (in 1879) as very much the junior partner of what Billings saw as his library's major publication: the *Index-Catalogue*, whose first volume appeared in 1880, but whose genesis preceded *Index Medicus* by

several years. In the experience of the authors of this article, the *Index-Catalogue* had been largely forgotten by many older medical librarians and never encountered by younger ones, primarily because it just was not available in most collections (though it had continued to be a major tool for history of medicine specialists) until 2004, when, after years of work with a number of partners, NLM released IndexCat, the online version of the complete *Index-Catalogue*.[†]

The release of IndexCat provided free and readily available access to a huge amount of material (over three million citations, many available or searchable nowhere else) but also raised a number of new questions. What had been the coverage of the *Index-Catalogue*? How did it compare with *Index Medicus*? How great was the overlap, and why did the overlap happen? Does the conscientious librarian or researcher need to search both? This paper seeks to answer these questions.[‡] In addition, the paper will discuss some interesting anomalies found in the process of addressing these questions that shed a great deal of light on how medical literature was selected and indexed in "America's greatest contribution to medical knowledge."

* For example, see Welch WH. Memorial meeting in honor of the late Dr. John Shaw Billings, April 25, 1913. New York, NY: The New York Public Library; 1913. p. 10; Hume EE. The centennial of the world's largest medical library: the Army Medical Library of Washington. *Mil Surg*. 1936 Apr 78(4):241–2; Blake JB. Billings and before: nineteenth century medical bibliography. In Blake JB, ed. *Centenary of Index Medicus*. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health; 1980. p. 31n. For a publication history of the *Index Medicus* and all of its variant titles, formats, and publishers, go the National Library of Medicine (NLM) website at <http://www.nlm.nih.gov/services/indexmedicus.html>; for the publishing history of the *Index-Catalogue*, go to <http://www.nlm.nih.gov/hmd/indexcat/aboutcatalogue.html>.

† More or less following NLM's own usage, this paper will use the name "*Index Medicus*" to refer to the *Index Medicus* proper, published 1879–1926, and the successor title and format variants, although a more pedantic usage would insist that "*Index Medicus*" should refer to the pre-1926 publication only. "*Index-Catalogue*" refers to the sixty-one printed volumes published 1880–1961, and "IndexCat" is the database version released in 2004. For the "junior partner" status of *Index Medicus* versus the *Index-Catalogue*, see Blake JB. Billings and before: nineteenth century medical bibliography. In Blake JB, ed. *Centenary of Index Medicus*. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health; 1980. p. 36–8.

‡ For more on the history of the IndexCat, see the home page at: <http://www.nlm.nih.gov/hmd/indexcat/ichome.html>.

Highlights

- During the period under discussion, the overlap of articles appearing in *Index Medicus* and *Index-Catalogue* varied between 96.6% and 46.9%.
- A comprehensive search of medical literature during the period 1880 to 1925 requires a search of both *Index Medicus* and *Index-Catalogue*.

Implications

- The creation of the IndexCat database neither replaces nor precludes searching the printed *Index Medicus*.
- The apparent authority control based on gender can facilitate identification of female authors.
- Expert search skills require an understanding and appreciation of database structure and of overlap implications with other databases.

HISTORY OF THE INDEX MEDICUS AND INDEX-CATALOGUE

According to Miles, the origins of the *Index Medicus* and *Index-Catalogue* go back to the 1870s, when Billings first became interested in indexing the library's serials. He had already published catalogues of its books, but these were author-title catalogues, which could be very frustrating for the researcher. Billings himself had had a very difficult time in 1859–1860, compiling a bibliography for his thesis on the surgical treatment of epilepsy. He wrote about it years later, and it may have been the defining moment of his life [1].§ At any rate, Billings began to develop a prototype for his new catalogue. In 1875, he published a 316-page, 18,000-entry bibliography on cholera. It added great prestige to the library's name and gave Billings leverage to move on to his next project. He prepared a sample volume of his proposed index, the *Specimen Fasciculus*, sent copies to everyone who might support the idea, and went to Congress to ask for money [2]. In addition to obtaining funding from Congress, Billings requested and received an assistant from the US Army: Robert Fletcher, who would stay at the library until his retirement in 1911 at the age of 88. It was the team of Billings and Fletcher who would make the *Index-Catalogue* and *Index Medicus* realities.

Looking at the slender *Fasciculus* volume (it is only seventy-two pages long), it is easy to see that Billings had already determined what he wanted. The scope and format of the *Index-Catalogue* are already in place. However, it would not have been so obvious that the end product of their labors would be so large and that production would be so painstaking and slow. It took

§ See also Chapman CB. Order out of chaos: John Shaw Billings and America's coming of age. Boston, MA: The Boston Medical Library; 1994. p. 40–1.

fifteen years (1880–1895) to produce the first series of *Index-Catalogue*. Billings celebrated the event by retiring and moving to New York, where he became the first director of the New York Public Library. Fletcher stayed behind, and work on the second *Index-Catalogue* series began.

The long time lag inherent in the production of the *Index-Catalogue* was always its curse. If an article on the abdomen appeared just after the "A" volume went to press, it would be a decade or more before the new citation would appear in print. Eventually, the backlog would prove to be the *Index-Catalogue's* undoing. By the 1950s, with the fourth series incomplete and the need for a fifth series looming, the controversial decision was made to cease publication of the *Index-Catalogue*. Even though the library stopped new indexing for *Index-Catalogue* in March of 1950, so huge was the backlog that print volumes continued to appear until June 1961 [3].

Billings did not anticipate this backlog when he presented the *Fasciculus* to Congress, but he and Fletcher quickly realized the issue when production began. Fletcher devised a plan to combat it: they would publish a second index, a "monthly classified record of the current medical literature of the world" (the official subtitle of the *Index Medicus* as it appears on the title page of volume 1 in 1879). It was Fletcher who suggested that it be called *Index Medicus* [4].

From the outset, the two publications had fundamental differences. First of all, *Index-Catalogue* was to be the "official" publication, detailing the actual holdings of the library, be they books, journal titles, individual articles, theses, or even portraits. *Index Medicus* would be far narrower in scope, focusing on new articles from selected journals, selected new books, and theses. A journal list was included in the first volume of the *Index Medicus*, but subsequent volumes generally lacked such a list.

Functionally, however, the greatest difference between the two publications was that the *Index-Catalogue* was a government publication and *Index Medicus* was not. For its entire run, the *Index-Catalogue* was published by the Surgeon-General's Office of the US Army, while *Index Medicus* was privately published by a series of small publishers, who had difficulty making the work profitable. In this period (1879–1926), the *Index-Catalogue* had a secure source of funding, while *Index Medicus* was expected to be self-supporting. As Billings wrote in his introduction to the first volume of *Index Medicus*:

It has often been suggested that it is highly desirable that [the *Index-Catalogue*] should be supplemented by some current publication, which should show all recent works, together with articles in periodicals, arranged by subjects [emphasis in the original], but until quite lately no proper means have been available for such an undertaking. Now, however, Mr. F. Leypoldt, of New York City, proposes to undertake the publication of such a current medical bibliographical serial. [5]

The role of Leypoldt has been described in different ways,** but it is undeniable that, between 1879 and 1926, *Index Medicus* had a number of publishers, including Leypoldt in New York, George Davis in Boston, and the Carnegie Foundation in Washington. There was even a period (1899–1902) when publication of *Index Medicus* ceased and was briefly replaced by a Paris publication called the *Bibliographica Medica*. There were also years, such as 1895–1899, when the title page mysteriously read only “Published by the Editors, New York and Boston.” Sometimes (as in 1879), publishers were listed for London, Paris, Leipzig, Amsterdam, and St. Petersburg, and would-be contributors were advised to submit their publications to these European offices for inclusion in *Index Medicus*. A certain collection development objective is implied here: the introductory letter already cited made it clear that, after indexing, the publications would be added to the collections of the library.

It should be noted that 1926 was the last year that *Index Medicus* was published in its original format and so is the last year used for comparison in the current study. For 1927, *Index Medicus* was merged with a publication called the *Quarterly Cumulative Index to Current Literature*, begun by the American Medical Association (AMA) in 1916. The new publication, named the *Quarterly Cumulative Index Medicus*, was published jointly by the Army Medical Library and the AMA, with some funding from the Carnegie Foundation, until 1956. In scope, structure, and format, it was a fundamentally different publication from its predecessor, as can be quickly seen by a side-by-side comparison.

Through these years, however, the *Index-Catalogue* marched on: series 1, 16 volumes, 1880–1895; series 2, 21 volumes, 1896–1916; series 3, 10 volumes, 1918–1932; series 4, 11 volumes, 1936–1955. As already noted, the increasing volume of medical literature eventually overwhelmed the library’s processing capacity, but in the days of the original *Index Medicus* (that is, 1879–1926), the library prepared citations for both series, shouldering both tasks with a very small staff. The work must have been staggering. The authors have found that Billings solicited citations from publishers worldwide in the name of the *Index-Catalogue*, and he obtained permission from the US Army surgeon-general to send citation cards prepared for *Index-Catalogue* for use in *Index Medicus* [6]. Library staffers were paid by the *Index Medicus* publishers to make duplicate cards.

This processing workflow implies a considerable amount of overlap between the two publications and brings up the original questions: how much overlap was there? Must a present-day researcher check both

indexes? NLM’s decision to digitize the *Index-Catalogue* raised these questions anew and coincidentally provided the tools required to answer them by allowing a random sample of citations from *Index Medicus* to be extracted and searched for in the IndexCat database.

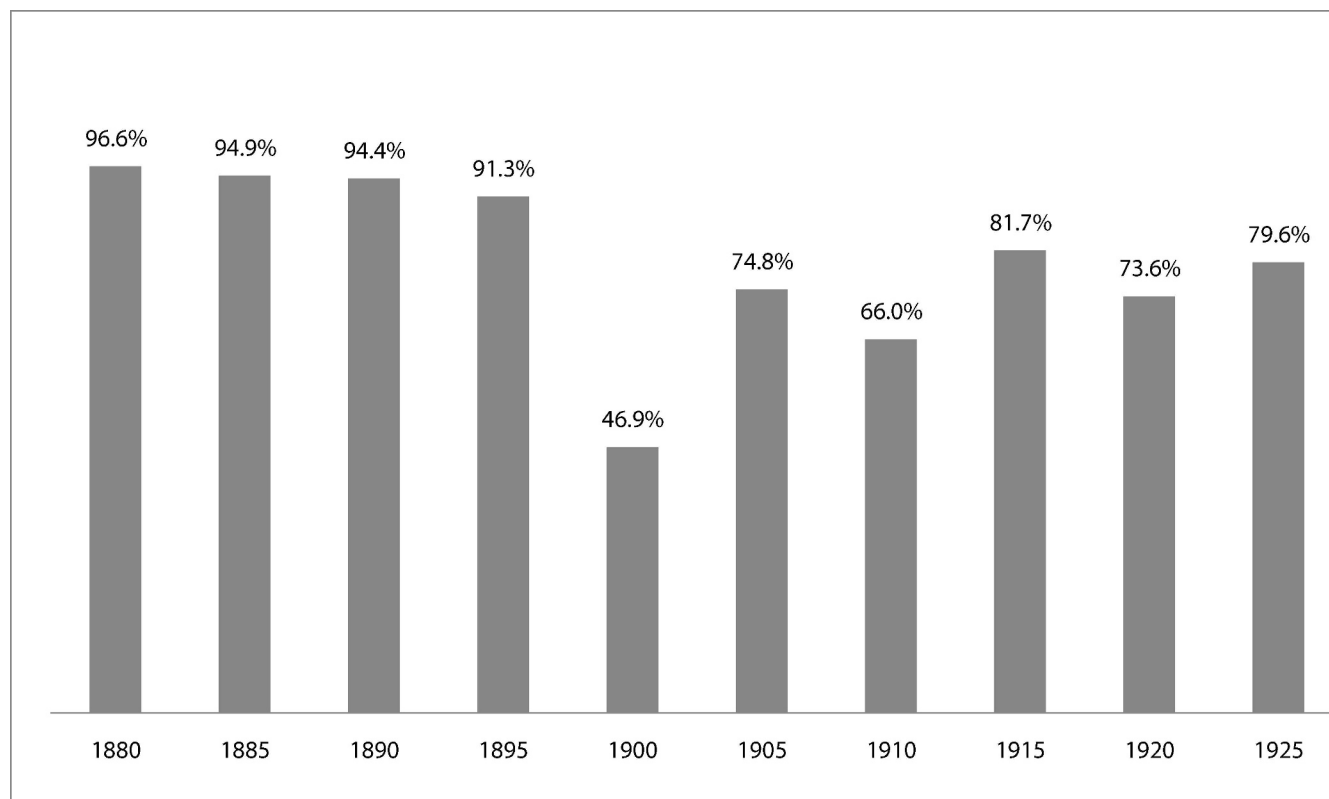
Before presenting the results of this analysis, it is helpful to review the known differences in material included in these two publications. Our examination of the *Index-Catalogue* and *Index Medicus* indicate that certain classes of materials were always included in *Index-Catalogue*, and largely excluded from *Index Medicus*. Monographs accounted for the chief difference: they showed up only rarely in *Index Medicus* and then only when they seem to have been of particular importance, while they were included as a matter of course in the *Index-Catalogue*. Journal titles were not indexed in *Index Medicus*, although their contents were. In other words, articles from *The Lancet* were indexed individually, but *The Lancet* itself had no entry. The *Index-Catalogue* included entries for both articles from a given journal and the journal itself.

The most vexing question seems to be how books, journals, or articles were selected for inclusion in either publication. On the surface, it would seem that for the *Index-Catalogue*, the level of selection was the availability of the periodical itself. If a publisher sent a copy of a periodical to Billings, the expectation was that all of its significant contents would be indexed. We have found no evidence indicating that Billings or his successors rejected any submission to the *Index-Catalogue* during the period 1879–1926. (Folklore has it that Billings, and possibly Fletcher, would go home in the evenings with baskets of periodicals under their arms and, after dinner, fortified with port and cigars, make selections and assign subject headings. Sadly, such tales cannot be verified.) All of this is a far cry from NLM’s Literature Selection and Technical Review Committee (LSTRC), which since the 1960s has carefully examined and recommended journals to be indexed by NLM. However, our examination has made it clear that articles included in *Index Medicus* were sometimes excluded from the *Index-Catalogue*. It does not seem possible to determine why, but one thing can be said with some certainty: *Index-Catalogue* primarily indexed journal articles selected on an individual basis while *Index Medicus* eventually selected and indexed the entire contents of particular journal titles. Unfortunately, it seems impossible to track the exact process and inconsistencies abound.

Moreover, this pattern of selection would seem to contradict the traditional accounts by Miles and others, which state that indexing for the *Index-Catalogue* took priority. This certainly seems to have been the original intention, but one wonders if it remained so in practice, particularly as work on the *Index-Catalogue* fell farther and farther behind that for *Index Medicus*. Our examination strongly suggested that citation cards were produced by the *Index-*

** Compare Miles WD. A history of the National Library of Medicine. Bethesda, MD: US Department of Health and Human Services; 1982. p. 132n; with Blake JB. Billings and before: nineteenth century medical bibliography. In Blake JB, ed. Centenary of Index Medicus. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health; 1980. p. 37–8.

Figure 1
Percentage of *Index Medicus* entries in IndexCat



Catalogue staff, never to be used in that publication, but solely for inclusion in *Index Medicus*. Journals lists were included in the first volumes of both publications (in later years, a list would be printed for each *Index-Catalogue* series, but only rarely for *Index Medicus*), but the scope was very different. The *Index Medicus* list was 25 pages long, while the *Index-Catalogue* list, printed in similar format, was 5 times longer at 125 pages. Coupled with the fact that the 2 indexes used different subject headings (a point addressed below), it seems likely that, over time, the workflow diverged considerably in method, though not in scope.

METHODS

The current study used a sample derived by selecting *Index Medicus* volumes at 5-year intervals between 1880 and 1925. The contents of *Index Medicus* expanded over time (the 1880 volume contains an estimated 22,248 citations; the 1925 volume over 55,000). So, to avoid biasing the sample in favor of later years, a fixed percentage of entries was selected from each volume. This resulted in 1,042 citations randomly selected from over 393,000 entries in the selected *Index Medicus* volumes that were then searched in IndexCat. It should be noted that, because the sample was derived from *Index Medicus* and then compared to IndexCat, rather than the other way

around, no correction needed to be made for classes of material included in the *Index-Catalogue* but generally omitted from *Index Medicus*.

RESULTS

Figure 1 shows the results. Overall, 77.2% of the citations selected from *Index Medicus* could be found in IndexCat, but there was considerable variation over time. The “best” years, the ones with the most overlap, were the early years, when the library presumably exercised the most control over the process. The “worst” were the years 1899–1902 when the process moved to Paris (the authors have been unable to find much about how indexing decisions were made in those years). Moreover, if we took those “French years” out of the equation, the overlap rose to 80%. Was Robert Fletcher, who stayed on the job throughout those troubled times when no US publisher could be found or his new, young assistant, Fielding Garrison, actually sending cards to France? Garrison, incidentally, was “given the opportunity to revive the *Index Medicus*” in 1902 [7]. The Carnegie years (1902–1925) are better, but they never achieve the results of the first few years. Perhaps they should not. After all, *Index Medicus* was not designed to be a temporary *Index-Catalogue*; this was not a Pre-MEDLINE–MEDLINE relationship. *Index Medicus* was the newsletter of the medical publishing world, while the

Table 1
Subject headings and publication dates for articles indexed in both *Index Medicus* and the *Index-Catalogue*

IC UI	Pub year	IC pub year	IC heading	IM pub year	IM heading
10806261420	1879	1887	Marshes	1880	Malarial Diseases
20608291360	1884	1901	Head (Injuries of) with fracture	1885	Fractures
20403971280	1890	1894	Disinfection [and disinfectants]	1890	Antiseptics and Disinfectants
21607821140	1895	1911	Stomach (Ulcer of, Diagnosis of)	1895	Diseases of the Stomach
21706051290	1900	1912	Tapeworms	1900	Comparative Anatomy
40906841630	1904	1945	Lens, Dislocation	1905	Wounds, etc., of the Eye
21805281710	1910	1913	Trypanosomiasis (Human, Treatment of).	1910	Trypanosomiasis
30307431800	1915	1922	Calculus (Ureteral, Cases of)	1915	Surgery of the Genito-Urinary Organs (Male)
30304751620	1920	1922	Breast (Diseases of)	1920	Diseases and Tumors of the Female Breast
30708561140	1925	1928	Lymphatic system (Cancer of)	1925	Lymphatic Glands (Diseases and Tumors)
40108551590	1929	1936	Atropine, Therapeutic use	1930	Eyes, diseases
41001581140	1940	1948	Malariography Cuba	1940	Malaria, epidemiology and statistics
41108981590	1949	1955	School, Medical school: Reserve officers' training	1950	Military Medicine, training

IC UI: IndexCat unique identifier. These are not arbitrary numbers: they reveal the series, volume, and page number in the *Index-Catalogue* where the original citation can be found.

Pub year: Year article was published.

IC pub year: Year citation was published in *Index-Catalogue*.

IC heading: Subject heading in *Index-Catalogue*.

IM pub year: Year citation was published in *Index Medicus*.

IM heading: Subject heading in *Index Medicus*.

Index-Catalogue was the research guide to a particular medical library that would grow to become the world's largest.

Evidence to this effect can be found in how the materials in these two publications were indexed, by which we mean the vocabulary of the subject headings. In the "Prefatory Remarks" to the first issue of *Index Medicus*, the editors (that is, Billings and Fletcher) wrote: "The nomenclature and classification are essentially those adopted by the Royal College of Physicians, based on Dr. Farre's well-known system" [8]. Frederic John Farre (1804–1886) was a distinguished British botanist, physician, editor, and historian. It would make sense to adopt an already accepted system for *Index Medicus*. But *Index-Catalogue* was another story. Because *Index-Catalogue* was a government document, and a military one at that, it included a letter of transmission from Brevet Lieutenant Colonel Billings, US Army, to his superior, General Joseph K. Barnes, surgeon-general, US Army. Nearly half of the letter was concerned with the new system of headings, of which the most important points were:

- I. Those [headings] have been selected for subjects for which it is presumed that the majority of educated English-speaking physicians would look in an alphabetical arrangement.
- II. Where there is a doubt as between two or more subject-headings, cross references are given.
- III. Where both an English and a Latin or Greek word are in common use to designate the same subject, the English word is preferred, and references are given to the other. [9]

Billings was thus consciously creating a new, no-nonsense, English-language guide to the international literature of medicine, as it existed in the library he ran:

In conclusion, permit me to call attention to the fact that this is not a complete medical bibliography, and that any one who relies upon it as such will commit a serious error. It is the Catalogue of what is to be found in a single collection—a collection so large and of such a character, that there are few

subjects in medicine with regard to which something may not be found in it, but which is by no means complete. [10]

Of course, things did not quite remain that way. As Billings's library grew from a military medical library to a national medical library (in truth, he seemed to have always had that in mind: On the title page of the *Specimen Fasciculus*, Billings calls his institution the National Medical Library) to the National Library of Medicine, its controlled vocabularies and classification system would grow in complexity, depth, and consistency, far outstripping any other [11, 12]. However, it is worth taking a moment to note the results of having two parallel subject vocabularies and two very divergent printing and production schedules, during the period under discussion.

Table 1 presents subject headings for single articles from each of the *Index Medicus* volumes examined for this paper. Included are the year the article was originally published, the year it appeared in the *Index-Catalogue*, its *Index-Catalogue* subject heading, the year it appeared in *Index Medicus*, and its *Index Medicus* subject heading. It becomes immediately apparent that the differences were so great that no more systematic sample was called for. The headings are entirely different in virtually every case. As for the year that indexing was available, the differences are equally dramatic.

As we compared entries in *Index Medicus* and *Index-Catalogue*, some other peculiarities in format became evident. One particular difference was the indexing of the authors' names. In the *Index Medicus*, while most of the entries were the traditional last name, first and middle initial, some entries included the author's first name. Those names were usually female. For the current paper, a random sample was not undertaken (the question of teasing out all of the female authors hiding behind initials was too daunting), but the *Index Medicus* volumes used for the project were examined to determine if this was just an oddity in a few years of the index or if it reflected the all of the indexing from 1880 through 1925. The latter was, in fact, the case.

To more carefully see if this convention applied to women, and not to a particular journal or entry type, the following check was performed. In the index of each volume, at least three women were found (by looking for authors whose first name was listed or by looking for noted female doctors). The journal in which they published was then examined. We verified how the woman's name was entered in that journal. We then looked for other authors in the same journal issue. Almost without exception, the woman's name was entered with the first name intact and the middle name was represented by an initial. In one case (Mary Putnam-Jacobi) where the name was hyphenated, the name appeared in this style; in fact, it assumed the absence of the hyphenation and alphabetized the author under her married name (Jacobi, Mary P.). Male authors, however, were almost always listed in the traditional style. Even in cases where a man and woman wrote together, this style was followed: woman with first name, man with initials only.

In cases where a woman's first name was not included, the index included the honorific Mlle, Mrs., or Miss. This practice reflected a title that was included in the journal itself; however, with the exception of the honorific "Sir," no man's name included a similar identification (although some early French journals use M for Monsieur and have no first name initial, so that the M was occasionally indexed in as though it were an initial and not an honorific).

There were some exceptions. In 1900 (one of the years in which the *Index Medicus* was published in Paris as the *Bibliographica Medica*), a number of male authors were listed by their first name. In all years, authors of books, male and female, included first and last name. In 1925, one woman (whose first name was listed in her article) listed only initials. Because her name (E. Christine Pillman Williams) started with an initial only, it can be assumed that the style being used required that the first name be included as the author used it in print. We also found that where an entry for an author varied between initials and full name (in 1885, Sarah J. McNutt wrote under both her full name and only the initials SJ), the index reflected exactly the way in which the author wrote her name and did not try to assume that S.J. McNutt and Sarah J. McNutt were one and the same person.

It is not really possible to know why this policy was adopted, though one is tempted to assume that the indexers were attempting to point out the sex of the authors in question. Whether this was a subtle form of marginalization is something that cannot be said with any certainty; however, it does certainly make the names of these women jump out of the index at the user.

The style adopted for women authors may seem a small point, but we think it is of considerable, but subtle, importance. Clearly, the editors did not wish to exclude women authors, but they still thought it necessary to differentiate between the women and the men. This proves to be a boon to modern researchers in the history of women in medicine, who, here at least, need not always wonder who is hiding behind a bare set of initials.

CONCLUSION

It must be said that the task undertaken by Billings and his staff was nothing short of monumental. With only ink and index cards, they tamed an enormous and complex technical literature in virtually every written language on the planet, all for an initial subscription price of \$3 per year for *Index Medicus*. Legend has it that *Index-Catalogue* sets were often bartered for books to be added to the library collections. The digital IndexCat only serves to give the modern researcher a better glimpse of how these parallel enterprises, the *Index-Catalogue* and *Index Medicus*, became first great contribution of the United States to medicine and paved the way for the great databases that now are the primary underpinnings for the medical research of the future. It also emphasizes the fact that both tools are essential components in comprehensive research of the health sciences literature.

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