

## CHAPTER IV

# Development of Cooperative Bibliography

WITH Callisen the age of the great one-man bibliography of medicine may be said to have come to an end. After his time the bibliographies which embraced all of medicine and covered any large-scale span of time were compiled by groups of workers toiling under the general editorship of an executive, using the books and journals owned by some institution, and published as a group project. This I have characterized as the industrial revolution in bibliography, and I propose to discuss this theory in more detail in the following pages. Because it is not the purpose of this work to go into the problems of the industrial revolution as an economic force in other fields or even to discuss when the industrial revolution occurred, no attempt will be made to cite more than the most obvious literature, which is used merely as background for the discussion.

The industrial revolution can be characterized by the change from the hand work and home system of the production of goods to the machine system and the factory production of these same goods.<sup>1</sup> The industrial revolution

<sup>1</sup> "Machinery was substituted for hand tools . . . A second result was the destruction of the domestic system of house work . . . and the substitution therefor of the factory system." E. L. Bogart. *Industrial Revolution*,

not only saw the substitution of the factory for home work and the machine for the hand tool, but it also brought about a need for greater capital. As a result of the introduction of factory methods, standardized parts were produced in place of the variable ones obtained by other methods, total productivity increased, greater means of communication and transportation were devised, and a class of worker formed which did not own what it had produced. In the case of medical bibliographies, we can see some of this occurring in the publication of the *Index-Catalogue* and, to a lesser degree, in the *Catalogue of Scientific Papers* of the Royal Society. In each case the bibliographies were prepared by paid workers who worked together in a single institution (here a library rather than a factory), who did not own the raw materials or the tools with which they worked (the books and journals, the cards, reference works, paper, ink, typewriters, etc.), who received from someone else (John Shaw Billings or the Committee of the Royal Society) the orders on how to work for turning out a standardized product, who produced more than other single groups because of the division of labor, who did not own the results of their labors (the *Index-Catalogue* or the *Catalogue of Scientific Papers*), and who depended upon the increased means of transportation to make their work available to a large

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(In: *Encyclopedia Americana*, 1925, v. 15: 96-98.) See also Karl Marx's own words on this: "A great number of labourers working together at the same time in one place (or, if you will, in the same field of labour), in order to produce the same sort of commodity, constitutes both historically and logically the starting point of capitalist production." Karl Marx. *Capital*. N. Y., Modern Library [c1952] p. 63.

audience. In this case, perhaps it was the use of inter-library loans. This certainly was true in the case of Billings, who devised the system of interlibrary loans especially to supplement the usefulness of his catalog, as will be shown later. And because these workers, except for the top executives and scientists, did not do any of the planning of their work, they were like the other laborers in the industrial revolution in that they were deprived of the "intellectual potencies" of their work. The one thing lacking was the substitution of the machine for the hand work of previous bibliographers. Not even today has a machine been devised into which published literature can be fed, to be processed automatically and reappear as a bibliography; though, as will be shown in the next chapter, machines have been devised which can do automatically some of the non-intellectual portions of bibliographic work.

#### ROYAL SOCIETY CATALOGUE OF SCIENTIFIC PAPERS

The first suggestion that a group undertake an index to the scientific literature appears to have been made by Joseph Henry, the first secretary of the Smithsonian Institution in Washington, and a theoretical physicist of considerable note.

Joseph Henry was born in 1797 in Albany, New York, of poor parents and was educated in Galway, New York, and at the Albany Academy, for entrance to which place he studied privately while teaching school, tutoring, and doing odd jobs. After graduation from the Academy, Henry acted as surveyor for a while and began to study privately to fit himself to enter medical school. He was

permanently shifted from this pursuit, however, by his appointment as professor of mathematics and natural philosophy at the Albany Academy in 1826, a post he held until 1832 when he was appointed to a similar position at the College of New Jersey, Princeton. During this period Henry did some of his finest work on electromagnets, both for motors and for telegraphy; indeed, in recognition of his work, the unit of conduction has been named the Henry. Later, in Princeton, after a few years of scientific inactivity devoted entirely to teaching and the preparation for teaching, Henry began experimenting in the fields of solar radiation and capillarity of liquids, at the same time continuing with his work on electromagnetism.

When the Smithsonian Institution was founded in Washington, Henry was unanimously chosen by its regents to be its first secretary. He took on this job reluctantly, but with a sense that duty to his country required it, feeling (as was later proved to be correct) that his administrative duties would occupy so much of his time he would not be able to continue his scientific work. Moreover, because of the vagueness of the terms of Smithson's will, the direction which the Smithsonian Institution should take was difficult to determine, and it is undoubtedly true that Joseph Henry's concept of Smithson's intentions molded the Institution in its formative years and determined many of its present policies.

In addition to his work as the operating official of the new foundation, Henry was also one of the organizers of the American Association for the Advancement of Science and its president in 1849; founder of the Philosophic Society of Washington, of which he was president from

1871 to his death in 1878; and head of the National Academy of Sciences from 1868 to 1878. In several of these groups he had John Shaw Billings as one of his assistants, and it is interesting to speculate on the effect each might have had on the other. Unfortunately no published material known to this writer contains any mention of the relationship of the two men.<sup>2</sup>

As a practical scientist, Henry appears to have felt the need to know what had appeared previously in the literature of his field. This may have been due, in part, to his anticipation of much of Faraday's work on the electromagnet; but whatever the reason, Henry attempted to interest the regents of the Smithsonian in doing something about the matter.<sup>3</sup> In this report Henry sets forth his reasons for desiring an index to the scientific literature:

It is estimated that about twenty thousand volumes; including pamphlets, purporting to be additions to the sum of human knowledge, are published annually; and unless this mass be

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<sup>2</sup> There have been many biographies of Joseph Henry published. Of these the best long ones are: Crowther, James Gerald. *Famous American Men of Science*. N. Y., Norton [1937]; Coulson, Thomas. *Joseph Henry, His Life and Work*. Princeton, Princeton University Press, 1950; and Taylor, William B. *Scientific Work of Joseph Henry*. Wash., Govt. Print. Off., 1880. The best short work on Henry is probably the article by William F. Magie (In: *Dictionary of American Biography*. N. Y., Scribner, 1932, v. 8: 550-553).

<sup>3</sup> See especially the Annual report of the Smithsonian for 1851. Generous quotations from this report are found in Katherine G. Murra's article, *History of Some Attempts to Organize Bibliography Internationally*. (In: Shera, J. H. and Egan, M. E., eds. *Bibliographic Organization . . .* Chicago, University of Chicago Press [1951] p. 25-53).

properly arranged, and the means furnished by which its contents may be ascertained, literature and science will be overwhelmed by their own unwieldy bulk. . . . One of the most important means of facilitating the use of libraries, particularly with reference to science, is well-digested indexes of subjects, not merely referring to volumes or books, but to memoirs, papers, and parts of scientific transactions and systematic works.<sup>4</sup>

It was soon apparent, however, that the regents of the Smithsonian would not be willing to underwrite so large a task.<sup>5</sup> In 1855, therefore, Henry proposed to the British Association for the Advancement of Science, meeting in Glasgow, that the various national scientific institutions agree to index the literature of their own countries, with some one group—presumably the British Association—arranging for its publication.<sup>6</sup>

The committee of the British Association to which the project was referred reported favorably on the suggestion, though it proposed some minor changes in the plan, mostly in the direction of greater inclusiveness both as to

<sup>4</sup> Annual Report of the Smithsonian Institution for 1851, p. 22.

<sup>5</sup> “. . . the hopelessness of attempting a work . . . which would require the united labors of a large corps of well-trained and educated assistants for many years, and the subsequent devotion of the whole available income for many years following, to complete its publication, was fully realized . . . and in 1854, Henry conceived the plan of taking up the more limited department of *American* scientific bibliography and by the persevering application of a fixed portion of the income annually for a succession of years, of finally producing a thorough subject-matter index, as well as an index of authors for the entire range of American contributions to science from their earliest date.” William B. Taylor. *Op. cit.*, p. 296.

<sup>6</sup> Royal Society of London. Catalogue of Scientific Papers. *Op. cit.*, v. 1, Preface: [3].

subjects listed and forms of publications included. During the next year (1857), the Royal Society became interested in the project and offered its cooperation to the British Association, whereupon a joint committee was appointed to go into the matter more thoroughly, especially as to costs.<sup>7</sup> This joint committee presented its preliminary report in June, 1857, recommending that the index omit monographic works entirely, confine itself to serials exclusively, and that both an author list and a subject index be prepared.

In spite of the favorable report of the joint committee, little or no action was taken on the matter for some months, so that finally the Royal Society decided to act independently. In 1858, therefore, after further study, the Royal Society made the decision to prepare a catalog of the natural sciences for its own use.<sup>8</sup>

This catalog was prepared under the direction of the Library Committee of the Royal Society, which arranged that four copies of the reference to each article be made; one remained in the Royal Society Library as a serials record and the other three were reserved for possible publication, should funds be provided for that purpose by the government. These three were to provide for an author list, a subject list, and a reserve set. By 1864, sixty-two manuscript volumes had been compiled, totalling

<sup>7</sup> *Ibid.*, p. iv.

<sup>8</sup> It should be stressed here that no thought of publication by the Royal Society was present at this time. "In resolving on this undertaking the Council did not propose to task the Society with more than the preparation of a Manuscript Catalogue for use in their own library . . ." *Ibid.*, p. v.

184,000 titles from approximately 1400 serials, and representing the years from 1800 to 1863. The total cost to the Society to reach this point had been about 1400 pounds, and the contemplated cost of preparing a subject index was 400 pounds more.<sup>9</sup> With the aid of a government subsidy the entire index was printed in six large quarto volumes; but because of financial difficulties, the Franco-Prussian War, and other impediments, the subject index was slow in being compiled. In the meantime other periodical articles continued to come off the presses, and a second cycle of author entries was prepared and printed, again with governmental aid. A decennial index for 1864-1873 appeared, then one for 1874-1883, and much later indexes to finish the nineteenth century. During all this period costs continued to rise, and therefore governmental subsidies grew to be more necessary, until finally neither the government nor the Society could undertake the work. The clamor for the subject indexes also continued, and eventually it was possible to prepare and distribute four volumes of indexes to the mathematical and physics articles contained in the *Catalogue*.

#### MAKE-UP OF THE ROYAL SOCIETY CATALOGUE

As described above, the Royal Society *Catalogue* is an author list, in four series, of the articles published from 1800-1899 in the transactions of the learned societies and in the scholarly journals.<sup>10</sup> As had every bibliographer

<sup>9</sup> Royal Society of London. Proceedings, 1866, p. 271, quoted in Murra. *Op. cit.*, p. 30.

<sup>10</sup> "The . . . Catalogue is intended to contain the Title of every Scientific Memoir which appears in the various Transactions and Pro-

before them, the Library Committee found it necessary to make some exceptions to their all-inclusive rule, and then to make some exceptions to their exceptions:

As the Transactions of many learned Societies contain both scientific and non-scientific matter, it was necessary to make a selection, and to exclude such papers as were merely literary, technical, or professional; and a similar course has been pursued with regard to Scientific Journals. It has not always been possible, or even advisable, to adhere strictly to this rule, which has been construed so as to admit rather than exclude any matter as to which there might be any doubt. Thus many Medical and Surgical Papers have been included on account of their containing Anatomical or Physiological matter.<sup>11</sup>

For each author there was given a list of all his articles in the titles indexed by the group, arranged chronologically in two arrays, first for those titles in which the man was the sole author and second for those in which he was joint author. The usual problems arose as to anonymous works, pseudonymous works, works of individuals who had changed their names, names in different languages, and the like. We can also detect a note of weariness in the statement in the Introduction that no pains have been spared to assign the right works to the right authors, but in spite of it the Committee is sure there are many errors.

The overwhelming majority of the articles were seen by the compilers for the Royal Society, using the facilities

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ceedings of Scientific Societies, and in the Scientific Journals published in the time that it comprehends; with the Reference, the Date, the Author's name, and the number of pages in the Memoir." Royal Society Catalogue. *Op. cit.*, Introduction, p. vii.

<sup>11</sup> *Ibid.*

of that library, the British Museum Library, libraries of special subjects in London and neighboring cities (for example, in medicine, the libraries of the Royal Medical and Chirurgical Society and the Royal College of Surgeons), and some university libraries. Where the articles were not actually seen by the compilers, this was noted by an asterisk or an obelus.<sup>12</sup> Throughout the four series of the *Catalogue*, foreign titles were given in the original language, except in the case of the Russian, Polish, and Hungarian, which were presented in translations in square brackets after the printing of enough of the original title to identify the work. A list of the 1400 periodicals indexed preceded the entire *Catalogue*, and individuals who possessed items marked as gaps in this list were requested to forward them to the Royal Society for inclusion in subsequent series.

The Subject Index for the greatest portion of the *Catalogue* never appeared, it is true; but plans were made for its compilation and publication, and it is instructive to examine them. The Subject Index was to be prepared after the compilation of the author list, and thus from the titles only, since any other system would have required a second handling of the pieces. What was proposed was "an alphabetical Index of the subjects of the Papers so far as they appear in the titles."<sup>13</sup> This method of preparing a subject index was being debated all the way down to 1897.<sup>14</sup> Richard Garnett, Keeper of Printed Books at the British Museum, in 1897 read a paper on the problem

<sup>12</sup> *Ibid.*

<sup>13</sup> *Ibid.*, p. vi.

<sup>14</sup> See also the discussion on Ploucquet in a previous chapter.

at a meeting of the Library Association, and he subsequently printed the paper in *Nature*, October 9, 1897, and in his *Essays in Librarianship and Bibliography*.<sup>15</sup> In this speech, entitled "Subject-Indexes to Transactions of Learned Societies," but which is almost entirely devoted to the *Catalogue* of the Royal Society, Garnett holds that the difficulty of making subject indexes to scientific periodicals has been greatly exaggerated.

I hope to point out, however, that so far as concerns the scientific papers . . . the difficulty has been over-estimated. . . As regards scientific papers, it appears to me that the only considerable impediment is the financial. . .<sup>16</sup>

According to Garnett, all that needed to be done was to transfer the entries from the *Catalogue* onto cards which would provide each entry "in a movable form instead of an immovable." Then some person need only write on the card the broad scientific division to which the title refers—say astronomy or geology or medicine—and file the card in a box or tray containing only that subject. A second subdivision would be necessary in most cases, but Garnett felt that the Royal Society could easily provide enough scientific men as volunteers so that each could be given his specialty to subdivide further. The technique of the second "cut" would be exactly the same as the first, and as many subdivisions as are necessary could be made. Of course, said Garnett,

Some preliminary concert among the scientific editors would, no doubt, be necessary, and finally revision in conformity with settled rules.

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<sup>15</sup> London, Allen, 1899, p. 225-233.

<sup>16</sup> *Ibid.*, p. 226.

## CHART I

*Growth of Periodicals  
1800-1908*

Date	Number of periodicals	Number added since previous record
1800	910	
1826	3,179	2,269
1866	14,240	11,061
1872	20,882	6,642
1880	25,901	5,019
1882	35,296	9,395
1901	59,057	23,761
1904	67,319	8,262
1908	71,248	3,929

But these are minor matters to Garnett, who was sure that they could be handled with little difficulty. It would be interesting to know why the Royal Society rejected these naive suggestions, but a search in *Nature* for 1898 does not bring any reply to Garnett's proposal.

The Royal Society *Catalogue* failed to continue into the twentieth century on its original plan and failed to publish subject indexes to the nineteenth century lists primarily because of the costs involved. One of the main costs, of course, was due to the increase in the periodical literature.<sup>17</sup> Chart I shows an exponential increase of over 1000 per cent in fifty-six years or 348 per cent in forty years. Both the chart and the logarithmic curve (Chart II) show that

<sup>17</sup> According to Iwinski (see p. 74) the total number of all periodicals published jumped from 910 in 1800 to 3179 in 1826 to 14,240 in 1866, to 20,882 in 1872, to 25,901 in 1880 to 35,296 in 1882, to 59,057 in 1901. (See Charts I and II.)

## NUMBER OF PERIODICALS PUBLISHED 1800 - 1910

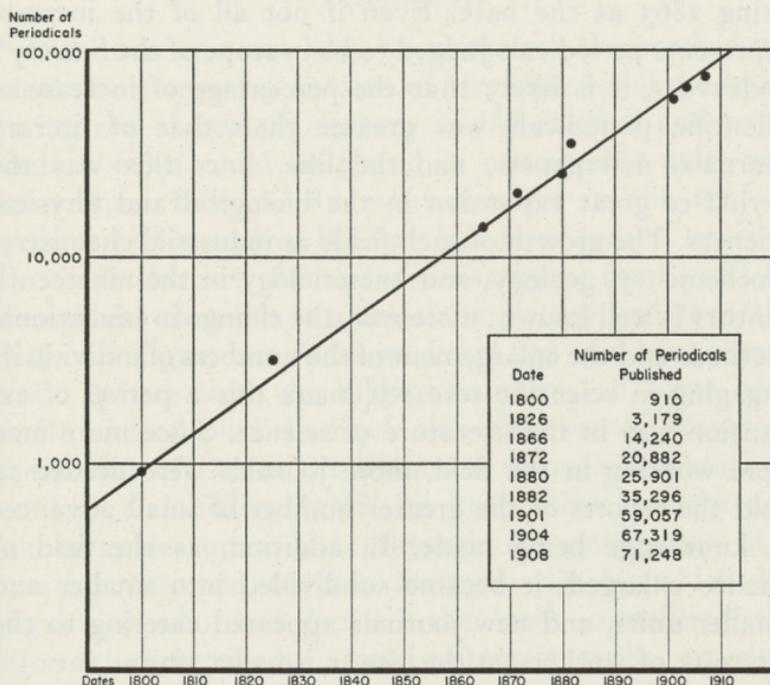


CHART II

the number of periodicals increased by a power of the original number, instead of by a simple arithmetical or geometric progression. Thus, if  $a$  number of journals were published in 1800,  $a^n$  journals were published in 1860, and  $a^{n^2}$  journals were published by the next period of time (1920). Such an enormous increase in the literature would naturally bring large problems in its wake. Between the 1860's, when the first series of the *Catalogue* was being prepared, and 1883, the date of the third series, the number of

available periodicals had increased 147 per cent or  $a^{n^3}$  using 1863 as the base. Even if not all of the increase represents periodicals judged to be in scope of the Society's endeavors, it is likely that the percentage of increase of scientific periodicals was greater than that of literary journals, newspapers, and the like, since this was the period of great expansion in the biological and physical sciences. The growth of such fields as industrial chemistry, biochemistry, geology, and bacteriology in the nineteenth century is well known; moreover, the change in educational methods and the enlargement of the numbers of individuals engaging in scientific research made this a period of expansion also in the literature of science. Since more men were working in the field, more journals were needed to hold the reports of the greater number of small advances in knowledge being made. In addition, as the field of science enlarged, it became subdivided into smaller and smaller units, and new journals appeared catering to the interests of workers in the newer, smaller units.

But a larger quantity of work to be done, when it reaches a certain point, brings with it a need for a qualitative change as well. The Royal Society was groping toward this way, in its indexing of a field by a group of relatively low-skilled workers working together in one place under the direction of a committee which used the resultant index for its own devices. As an interim step to the full program, worked out by Billings, it has significance. It showed the direction in which the new indexing must go, and by its very failure to achieve its goals, it made evident some procedures which needed to be followed.

## JOHN SHAW BILLINGS

(1838-1913)

The man who was able to work out the method by which the staggering amount of literature being produced during the nineteenth century in the medical and paramedical fields could be placed in manageable units was John Shaw Billings. By many workers in the field of medical bibliography, Billings has been judged entirely by his production of the *Index-Catalogue*; but it will be shown here that this is a one-sided picture and that the *Index-Catalogue*, the *Index medicus*, and the Interlibrary Loan System were, in Billings' concept, all parts of a single, unified plan. In brief, this plan was to provide a conspectus of the earlier literature through monumental catalogs and bibliographies, to keep these catalogs and bibliographies up to date through the publication of a monthly list, and to provide some way by which the physician, who had located the work containing the information he needed, could obtain it easily, expeditiously, and inexpensively. For this purpose Billings devised 1) the *Index-Catalogue* as the monumental work and arranged it partly by authors as well as by subjects; 2) the *Index medicus*, which he thought of as the quickly appearing work which would bring the *Index-Catalogue* up to date and which was to be arranged primarily by subjects; and 3) the system of personal and interlibrary loans, now so widespread in the United States. So long as both of the published indexes were prepared at the Surgeon-General's Office Library, this system worked out well; when the conditions changed so that the *Index*

*medicus* ceased to be prepared at the same place as the *Index-Catalogue*, the entire system began to break down. Since that time, no really unified plan has been presented to the world, and attempts at tinkering with the older method have been disappointing on the whole.

John Shaw Billings was born in Indiana, April 12, 1838 of poor parents. He studied at local schools and prepared himself for college by reading with a local clergyman. In spite of severe financial difficulties, he managed to receive his A.B. from Miami University at Oxford, Ohio, in 1857, and his medical degree from the Medical College of Ohio in 1860. An account of some of this life was published by Billings many years after the event, and gives us a picture of his living on eggs and milk for long periods of time in order to remain within the financial limit of 75 cents a week.<sup>18</sup> After his graduation from medical school, Billings was appointed demonstrator of anatomy, but when the Civil War broke out, he decided to enter the regular army. He therefore took the examinations for the army in 1861, passing at the top of the list. As a result he soon received his commission and saw field service. Later, orders were issued putting him in charge of a hospital near Washington. He did so well in this post that he was soon named Executive Officer of an army hospital near Philadelphia caring for thousands of sick and wounded. His administration of this hospital was characterized by the same efficiency and lack of fuss that he was to show in all the jobs he undertook to do.

<sup>18</sup> Billings, John Shaw. How Tom Kept Bachelor's Hall. *Youth's Companion*, Nov. 10, 1892, p. 598-599.

Soon after this, when the Surgeon-General wished to appoint an inspector of army hospitals maintained by the Army of the Potomac, Billings was chosen for the task. In this position he took part in many of the battles of 1864 and 1865, finally, in the summer of the latter year, being invalided back to Washington, where he was assigned to the Office of the Surgeon-General. Here he remained until 1895 when he retired from the Army.

During the first few years of Billings' appointment to the Surgeon-General's staff, he was busied with accounts pertaining to volunteer surgeons, veterans' affairs, and the like. Later he began to do research in fungi and unicellular organisms, and this interest in microscopy continued throughout his life. He also continued with work on statistical methods of studying diseases, and made several important reports, with suggestions on the collection of statistics, of various military medical matters. One of these, on sanitation in army barracks and hospitals, foreshadowed his later interest in the erection of efficient and healthful hospital buildings. Billings was actively engaged in planning for the tenth and eleventh censuses of the United States (1880-1890), in the course of which he proposed to Mr. Hollerith, of the Bureau of the Census, the punching of coded cards and the sorting of them electrically, which the latter took up and developed for census data and for other uses.<sup>19</sup> (In connection with this, it would be interesting to determine if Billings ever con-

<sup>19</sup> Pearl, Raymond. Some Notes on Contribution of Dr. John Shaw Billings to Development of Vital Statistics. *Bull. Inst. Hist. Med.*, 6: 387-393, 1938.

sidered the use of these punched cards for coding bibliographic data, and if he did, why he decided against the scheme.)

While attached to the Office of the Surgeon-General, Billings was detailed to the Marine Hospital Service (now the Public Health Service) to make a survey of the hospitals maintained by that section of the government. His recommendations on this subject, as well as on the sanitary conditions in Memphis, where he made a survey during the cholera epidemic of 1879, were gladly accepted by the administering bodies and were immediately put into effect. In 1875, moreover, with the approval of the Surgeon-General, Billings presented plans for the erection of the Johns Hopkins Hospital; these plans were adjudged the best of all the ones submitted, and he was put in charge of translating them into actuality. He was also instrumental in having Sir William Osler and Dr. William H. Welch appointed to the faculty of the new Johns Hopkins Medical School. His minor successes would make a respectable list in themselves—he was Vice-President of the short-lived National Board of Health, President of the American Public Health Association, President of the American Library Association, on the Board of Directors and Vice-President of the Carnegie Institution, on the governing body of the National Academy of Sciences, and in many other organizations.

After retirement from the Army in 1895, Billings became Director of the University of Pennsylvania's University Hospital, and within a year, Director of the New York Public Library, in which position he died on March

11, 1913, of complications following an operation for cancer of the lip.

All the biographers of Billings who knew him personally speak of his coldness, his imperiousness, and his impatience with those who quibbled over details. Yet all of them—Garrison, Lydenberg, Wilcox—come away with an admiration, even a love for the man. As Wilcox puts it:<sup>20</sup>

Billings was high-spirited and imperious in temper, and in later years the recurrent physical pain of which he never spoke added at times an edge to his words. His absorption in matters of large moment interfered with his enduring fools gladly; his army training developed an innate self-reliance and domination which to some were repellent; his achievements were not such as to split the ears of the groundlings; and his humor, at times somewhat grim, was not always understood by little men.

Garrison, for example, reports that he visited Billings' home only once in the many years during which the two worked together.<sup>21</sup> Yet, Lydenberg, who worked with Billings daily in his later years spoke of him as "the essence of all that was lovable in the man, engagingly affectionate, fatherly, brotherly, even sweet, if such a word can be applied to a man so emphatically virile and masculine."<sup>22</sup> It was this impression which Billings left

<sup>20</sup> Wilcox, W. F. [John Shaw Billings] (In: Dictionary of American Biography. N. Y., Scribner, 1929, v. 2: 269.)

<sup>21</sup> Johns Hopkins Historical Club. Special Meeting in Honor of John Shaw Billings. Bull. Johns Hopkins Hosp., 25: 244-253, 1914, especially p. 248.

<sup>22</sup> Lydenberg, Harry Miller. John Shaw Billings, Creator of the National Medical Library and Its Catalogue; First Director of the New York Public Library. Chicago, American Library Association, 1924, p. 78.

with the men who extolled him at the memorial meetings held in his honor at the New York Public Library, the Johns Hopkins Hospital, and the National Academy of Sciences. Librarians often take exception to Billings' obvious scorn for them as bibliographical workers (see, for example, his speech at the American Library Association meeting in 1878<sup>23</sup>), but it should be pointed out that Billings was talking before the specialty of medical librarianship had been instituted; indeed, before any professional librarianship with its emphasis on bibliographic knowledge had become firmly established. Certainly the impression Billings made on the people he wished to please—the physician, the large man of business, the young, impressionable disciple working under him, and the servant who would carry out his orders unquestioningly—was very great. Nothing about his personality, however, can detract from his credit in working out the scheme for making a large proportion of the medical literature published up to his time available to all.

We have shown in the case of Haller and Ploucquet what were the forces compelling them to prepare their bibliographies. Haller was interested in sparing others the great task of winnowing the grain from the enormous mountain of chaff in medical literature, a task which he had been obliged to do for himself. Ploucquet started out to make for his own use an index of the few facts he thought he would especially need to have handy. When this index had reached large proportions, he decided to share it with the workers who would be coming after him, and thus

<sup>23</sup> Billings, John Shaw. National Catalogue of Medical Literature. Lib. J., 3: 107-108, 1878.

save them the necessity of retracing his steps. Joseph Henry, on the other hand, was interested in indexes to the literature because he was unable to find what he wished to know in the publications then descending upon the scientific world. In the case of John Shaw Billings, a combination of the feelings of Henry on the one hand and Haller and Ploucquet on the other appears to have motivated him. As he himself noted:

In [my graduating] thesis . . . it was desirable to give the statistics of the results obtained from certain surgical operations as applied to the treatment of epilepsy. To find these data in their original and authentic form required the consulting of many books, and to get at these books I not only ransacked all the libraries, public and private, to which I could get access in Cincinnati, but for those volumes not found there (and these were the greater portion), search was made in Philadelphia, New York, and elsewhere, to ascertain if they were in any accessible libraries in this country.

After about six months of this sort of work and correspondence I became convinced of three things. The first was, that it involves a great deal of time and labour to search through a thousand volumes of medical books and journals for items on a particular subject, and that the indexes of such books and journals cannot always be relied on as a guide to their contents. The second was, that there are in existence somewhere, over 100,000 volumes of such medical books and journals, not counting pamphlets and reprints.<sup>24</sup> And the third was, that while

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<sup>24</sup> Iwinski [*op. cit.*] gives a total of 3,444,586 volumes on all subjects printed to 1828 and 7,299,807 volumes printed to 1887. If 5 per cent of these were medical, about 175,000 volumes of medicine were printed before 1828 and about 365,000 volumes before 1887. To this figure must be added the periodicals published—25,901 in 1880. Five per cent of this figure is 1,280 volumes. Even though, relatively speaking, Billings was very wrong in his estimate of the size of the medical litera-

there was nowhere in the world, a library which contained all medical literature, there was not in the United States any fairly good library, one in which the student might hope to find a large part of the literature relating to any medical subject, and that if one wished to do good bibliographical work to verify the references given by European medical writers, or to make reasonably sure that one had before him all that had been done or seen by previous observers or experimenters on a given subject, he must go to Europe and visit, not merely one, but several of the great capital cities in order to accomplish his desire.

It was this experience which led me when a favourable opportunity offered at the close of the war, to try to establish, for the use of American physicians, a fairly complete medical library, and in connection with this to prepare a comprehensive catalogue and index which should spare medical teachers and writers the drudgery of consulting ten thousand or more different indexes, or of turning over the leaves of as many volumes to find the dozen or so references of which they might be in search.<sup>25</sup>

It was this desire to do once, for the benefit of all, what would otherwise have to be done by each person for himself, which motivated Billings and most of the previous bibliographers. For Billings, a desire to know, for his own uses, the literature of his field, was a secondary motivating force. However, the great difference between Billings and the other bibliographers is that he conceived a way of using the work of the fairly abundant non-

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ture, the absolute values were small. Either 175,000 or 365,000 volumes are still manageable quantities.

<sup>25</sup> Billings, John Shaw. *The Medical College of Ohio Before the War*. Cincinnati Lancet-Clinic, n.s., 20: 297-305, 1888; Quoted in: Garrison, Fielding H., *John Shaw Billings, a Memoir*. N. Y., Putnam, 1915, p. 15-16.

medically trained labor force for accomplishing his purpose, thus making his program independent of the individual scholar. Finally, Billings had the extra motivating force of desiring to make the actual work available to medical men. Since he realized the uselessness of providing a guide to the literature and then forcing the potential reader to seek out the copies of the desired works where he could, Billings included in his plan a method for distributing the works indexed in his bibliography throughout the country.

There had been three catalogs of the Library of the Surgeon-General's Office published before Billings developed his plan. A manuscript catalog of 1840 listed 135 titles in 228 volumes; in 1864 a printed catalog was issued, which listed 1365 volumes; still another catalog appeared in 1865, showing that the library had grown to a total of 2253 volumes. At this point, an old Civil War Hospital Fund was turned over to the library, and from that time to 1871 the library expanded to 13,330 volumes.<sup>26</sup> The first catalog prepared under the direction of Billings is dated 1873. It is in three volumes, and is arranged by subjects, form of publication (e.g., lists of serials), and authors; in it the library is stated to contain 25,000 volumes and 15,000 pamphlets. The 1873 catalog was still a catalog of books and not an index to parts of works, but the seeds of the concept of an index-catalog must have been germinating at about that time. With the aid of his principal assistant, Dr. Robert Fletcher, Billings was working out a scheme for compiling and publishing a

<sup>26</sup> *Ibid.*, p. 213-214.

catalog which would list not only authors but also subjects; not only books but journals, pamphlets, serials, portraits, and so forth; giving for each the individual parts as well as the entire work.

Sometime around 1873 this scheme had been worked out sufficiently to begin to put it into execution.

In a majority of cases what [the physicians] want are the statistics of a given disease, operation, or remedy. The data for these statistics are for the most part contained in journals and transactions of societies. To make these available, a card catalogue of all important papers in such journals and transactions has been prepared.<sup>27</sup>

A specimen (called a "Specimen Fasciculus") of the suggested form for publication of this card catalog was printed and distributed in 1876 to physicians and librarians, who were asked to comment on the proposed form. It is a little difficult to determine what the physicians' comments were, since Billings' letter books for this period seem to have disappeared from the Armed Forces Medical Library, although some remarks are noted in published medical literature,<sup>28</sup> but the reactions of the librarians are available in the bibliographic publications of the time.<sup>29</sup> In general, the librarians praised the dictionary arrangement, though a few preferred classed

<sup>27</sup> Billings, John Shaw. *National Catalogue of Medical Literature*. *Op. cit.*

<sup>28</sup> For example, the note in *Amer. J. M. Sc.*, n.s. 22: 220-221, 1876 and n.s. 82: 243-245, 1881.

<sup>29</sup> See, for example, *Lib. J.*, 1: 121-122, 1876-1877, which contains a discussion of the *Specimen Fasciculus* by Cutter, Winsor, and Whitney, among others.

catalogs. All agreed that the subject headings chosen were adequate, so far as a layman could tell, and all complained about the size of the type, while admitting that the tucking of entries into small space by running the references together in paragraph form was bold but extremely valuable.<sup>30</sup>

Whatever was the reaction of the ultimate consumer of the work, Billings evidently felt sure enough of himself to make few changes in the arrangement of the volume when it finally appeared in 1880.

#### PLAN OF THE INDEX-CATALOGUE

The *Index-Catalogue* is a list of the monographs, pamphlets, and theses contained in the Library of the Surgeon-General's Office (later the Army Medical Library, and now the Armed Forces Medical Library) as well as the journal articles found in its periodicals. As has been pointed out by Garrison:<sup>31</sup>

It has been a common error to suppose that the Index Catalogue [!] contains, in addition to medical books and pamphlets, all the articles contained in the medical periodicals in the Library—now the largest collections [sic] of this kind in the world. This is, and has been wide of actual fact. In the period of inception (1865-1879), Billings personally checked all the periodicals in the library for indexing, a colossal undertaking, done at his

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<sup>30</sup> This is, of course, merely a regression to the printing style of the first bibliographies of medicine, where the space between entries was kept to a minimum. See the illustrations to Chapter I of this work.

<sup>31</sup> Partially unpublished memorandum in the files of the History of Medicine Division, U. S. Armed Forces Medical Library, Cleveland, Ohio, dated August 5, 1929.

home into the small hours of the night. After the arrival of Fletcher, he continued to do this up to his retirement from active duty in 1895, with the assistance of Fletcher when he was absent on leave or otherwise. The two men undoubtedly checked all the articles in the purely scientific periodicals, such as Virchow's or Pflüger's *Archiv*, and all the important articles in weekly and provincial medical periodicals, such as the *Lancet* or the *Lyon médical*. But there are curious omissions here and there. A random examination of Volume I. of the *Lancet* for 1868, for instance, shows the omission of fairly important clinical cases (printed nowhere else) on pp. 314, 315, 376, 558, 588, 589, particularly a case of acute rheumatism with autopsy by Sir William Jenner on p. 750, and a compound fracture treated by the Lister method on p. 786. Some omissions, e.g. of trite public addresses or of verbose articles with no tendency, are quite judicious and well considered. For the medical journals of third, fourth, or fifth rate type Billings showed little consideration, passing them by as if on Osler's view of the medical journals of Australasia in 1897—that they contain little except records of hydatids and snake-bite. . . In selecting material for the *Index Medicus*, Fletcher tended to include more, on the ground that current articles of any kind are apt to be of current interest to current readers, some of whom may find in them just the stimulating or factual statement they are after. With the better sort of medical journals, his slogan was "Take everything" . . . The *Index Medicus* is, therefore, more complete as a record of this kind than the *Index Catalogue*, which Billings aimed to make a repository of the very best and most select material, but of no other . . . [During the European War] in the *Index Catalogue*, the same exclusions became imperative, by reason of the enormous amount of duplication and repetition, even in the worthwhile literature. Thus the bibliography of Tuberculosis in Vol. XVIII. of the second series, occupying 418 double-column pages, mostly in needlepoint type, represents only about a third of the indexed literature on the subject on hand in the Library at that time. The rejects actually occupied cubic space equivalent to that of a cord of wood or a ton of coal.

In spite of the great mass of omissions, the *Index-Catalogue* contains more works on any given subject than did any previous bibliography of medicine. Indeed, as has been pointed out by Dr. Claudius F. Mayer, now editor of the *Index-Catalogue*,<sup>32</sup> there is some question as to the accuracy of Garrison's statements on the coverage of the *Index medicus*.<sup>33</sup> Because of the excellence of the medical collection brought together by Billings and Fletcher, even a small proportion of its contents would reveal hitherto unknown treasures. Over and over again the reviews of the first volumes of the *Index-Catalogue* stress the surprise of the reviewer who opened the first volumes and found 66 pages of references to aneurysms. (Compared to this, Ploucquet's few pages on the same subject shrink into insignificance.) And with a scientist like Billings choosing which journal articles to list, more than a mere random sample is offered the reader.

The methods worked out for handling this mass of specialized literature with untrained help<sup>34</sup> were, perhaps,

<sup>32</sup> [Letter to the Editor.] *Spec. Lib.*, 43: 224, 1952.

<sup>33</sup> While it is true that catalog cards were made for almost all the books and journal articles received in the Library, a selection was often made when the cards were published.

<sup>34</sup> "When Billings took charge of the Surgeon-General's Library, Government employees were not appointed by competitive civil service examination, but were simply pitchforked into the service through political preferment or as a recognition of their services in the Civil War. Most of the employees whom Billings selected for this work [the *Index-Catalogue*] came from this latter class, being old hospital stewards, one or two of whom had served with Billings in the field. With the exception of Mr. Edward Shaw, a Yale graduate, none of these men were educated beyond common schooling, but as old soldiers they had the dependability and reliability upon which Billings set the highest value. Given

the greatest contribution made by Billings to the technique of medical bibliography. After much controversy, Congress was persuaded in 1879 to appropriate the money for publication of the catalog. The project was successful largely because of the efforts of Dr. Abraham Jacobi of New York, who spent much of his time and money on the project. In 1880, therefore, volume one appeared, containing the portion of the alphabet from A through Berlinski.<sup>35</sup> Thereafter a new volume appeared approximately every twelve months until 1895, completing the alphabet. Books, pamphlets, theses, and titles of periodicals were listed in the *Catalogue* by author, by subject, and (in

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reliability, he reasoned, and I can, by intensive training, convert it into efficiency. . . . Like Emerson's cook who, by dint of cooking the same dinner over and over again, eventually obtained perfection, so these old employees, none of them linguists, soon learned the rudimentary technique of medical bibliography and by the publication of the first volume of the Catalogue, were already working at its details with reasonable proficiency. Apart from Dr. Fletcher and himself, the only linguists Billings had were a few industrious Germans of fair education." Garrison. John Shaw Billings. *Op. cit.*, p. 223.

<sup>35</sup> "We do all our work of catalogueing [sic] and indexing on cards and the catalogue is printed directly from these cards. . . . We endeavor to secure all medical journals of any importance published in any country or in any language; the only exceptions being merely popular periodicals, of which we only secure a volume or so to serve as sample.

"The printing of each volume of the Index-Catalogue requires from eight to nine months' work, and at least three months' work are required to arrange and consolidate the cards forming the manuscript of a volume; it follows that we issue but one volume of the Index-Catalogue a year." Unpublished letter from John Shaw Billings to H. A. Webster, Librarian, University of Edinburgh, dated February 4, 1881. See also Garrison, Fielding H. Sketch of Library of the Surgeon-General's Office. *Med. Lib. and Hist. J.*, 4: 211-216, 1906, especially p. 215.

the case of journals) by title; journal articles were listed by subjects and then alphabetically by author under the subjects. Unfortunately the articles were, for the most part, listed under only one subject heading, which cut down on the ease and perhaps usefulness of the entire work. As Garrison notes,<sup>36</sup> "In each case an attempt is made to find the true center of gravity of a given title, so that the card may be placed under the bibliographical heading to which it actually relates." Authors and subjects were interfiled alphabetically into one array. Special lists, such as lists of journals indexed, also appeared. In the early volumes special typographical devices were used to designate case histories or articles less than two pages long; throughout the entire work theses were noted by an asterisk before the author's name. Where possible, book authors' dates were also given.

With Billings' retirement from the Army in 1895 the work was kept up by Dr. Robert Fletcher, on whom fell the burden of the logical consequence of publishing an index to an ever-growing literature—the cyclical publication of supplements.<sup>37</sup> A new cycle of volumes was prepared, using the methods worked out by Billings, and although Billings originally estimated it would require only five volumes, it actually became twenty-one and

<sup>36</sup> *Ibid.*, p. 215.

<sup>37</sup> ". . . the work [the Index-Catalogue] will be one of immense service to all of us who profess to *study* as well as to *practice* our profession. The only possible drawback is one inseparable from the material, which will necessarily supersede, or at least render incomplete, the earlier vols. [sic] before the later ones are published." Unpublished letter from Dr. W. Gairdner of Glasgow, Scotland, to Billings, dated 12 October 1880. See also Ploucquet's remarks on this subject.

took until 1916 for completion. By the time the third series of volumes was half completed, it was apparent that it would not be possible to continue the publication on the scale set up for it formerly. The later volumes, therefore, omitted subject entries for some articles indexed in the *Quarterly Cumulative Index Medicus* (for details of this publication, see the next chapter),<sup>38</sup> and the avowed purpose was to end the work with the publication of the Z volume of the third series. Because of pressure put on the Library in the 1930's,<sup>39</sup> however, this decision was reconsidered and a fourth series begun on even wider principles than had been laid out for the *Index-Catalogue* by Billings. The tremendous growth of the literature soon bogged down the fourth series, which managed to publish ten volumes before a decision was again made to discontinue publication.<sup>40</sup> In each case one of the primary reasons for the proposed discontinuance of the *Index-Catalogue* was its cost. In 1876 Billings computed<sup>41</sup> that it would

<sup>38</sup> See Preface to *Index-Catalogue*, 3d series, v. 6 (1927). "Subject titles omitted from this publication can be found in the *Index Medicus* for 1926 and in the *Quarterly Cumulative Index Medicus* for subsequent years."

<sup>39</sup> See, for example, the resolution passed by the Medical Library Association in 1936. (*Bull. M. Library A.*, 25: 12-13, 1936/37) and also the Preface to *Index-Catalogue*, 3d series, v. 10, 1932. "As stated in earlier volumes; it was at one time planned to close the *Index-Catalogue* with the third series, which was to include nothing appearing after 1926. In response to a very general demand by libraries and research institutions, that plan has been changed and work on the Fourth Series will be begun at once."

<sup>40</sup> Rogers, Frank B. and Adams, Scott. *The Army Medical Library's Publication Program*. *Texas Rep. on Biol. & Med.*, 8: 271-300, 1950.

<sup>41</sup> *Lib. J. Op. cit.*

cost \$12,500 to print 3000 copies of the *Index-Catalogue*, or \$4.16 per volume; yet the price at the Office of the Superintendent of Documents was set at \$2.00 per volume. The cost of preparing the later volumes (including printing) rose as high as \$33.00 per volume, but the official price then was only \$2.50 to \$4.50 per volume.<sup>42</sup>

In the early days Billings himself marked with a soft pencil those articles he wished copied; the next day his copyists at the Library made the necessary cards. Then he and Fletcher pencilled in on the card the subjects under which the articles were to be placed. These headings were again considered when the articles were ready to go to the printer, but only for the purpose of making them consistent with each other, and not to determine if the wrong headings had been attached to the articles in the first place.<sup>43</sup> By this method Billings used the talents of all the team he had collected—the most skilled member chose the articles to be indexed, the unskilled worker manually copied the bibliographic entries from the articles and in-between someone with education and training not as good as one group and not as poor as the other worked at an intermediary level. This division of labor took from the skilled worker the drudgery hitherto associated with the compiling of bibliographies; moreover, it was so standardized that learning time was small for the majority of the workers. Because of the standardization, also, the work of any individual connected with the *Index-Catalogue* could be used interchangeably with the work of any other person. Nothing was left to the imagina-

<sup>42</sup> *Index-Catalogue*, s. 4, v. 1: V, 1936.

<sup>43</sup> Garrison. *Sketch of Library . . . Op. cit.*

tion of any of the workers except in the case of the top few who put the standardized parts together.<sup>44</sup> For the others there was no "intellectual potency" and no ownership of the finished product, only part of which they had produced.

One of the facts which is frequently overlooked in any discussion of the methods used by Billings, is that he provided a scheme whereby the standardized parts could be put together in varying ways for various purposes. It is true that the main purpose of his scheme was to put together the *Index-Catalogue*, but it is also true that part of his scheme was to prepare a monthly index—the *Index medicus*—using the materials already prefabricated for the other work.<sup>45</sup> Although the *Index medicus* was never a governmental venture, the same cards which were used to prepare the manuscript *Index-Catalogue* were used by Fletcher for the *Index medicus*, being copied

<sup>44</sup> See, for example, the unpublished rules laid down by Billings for his copyists, at the History of Medicine Division, Armed Forces Medical Library.

<sup>45</sup> "It has often been suggested that it is highly desirable that such a catalogue [the *Index-Catalogue*] should be supplemented by some current publication, which should show all recent works, together with articles in periodicals *arranged by subjects*, but until quite lately no proper means have been available for such an undertaking. Now, however, Mr. F. Leyboldt of N. Y., proposes to undertake the publication of such a current medical bibliographical serial, upon the condition that the manuscript for it be furnished of the requisite completeness and accuracy, and this last I have undertaken to supply, so far as the means of information at my command will permit . . ." Preface to Vol. 1 of *Index medicus*. New York, 1879.

a second time for this work.<sup>46</sup> Not all the references were identical, however; some articles not selected for the larger, more monumental work, were used for the monthly list while some citations used by the *Index-Catalogue* never found their way into the *Index medicus*. (It is this system, of course, which was attempted in the publication of the first few volumes of the *Current List of Medical Literature*; the difference lay in the fact that whereas the same man handled both the *Index-Catalogue* and the *Index medicus*, two different groups handled the raw material for the later *Index-Catalogue* and the *Current List*.)

#### INDEX MEDICUS

The *Index medicus* was a private, monthly publication under the editorship first of Billings and Fletcher, and then of Fletcher alone, from 1879 to 1898 and, under various editors from then to 1927. It indexed the contents of the journals, books, and pamphlets received by the Army Medical Library, arranged by subjects according to a modification of the system of nosology worked out by the Registrar-General's office in London.<sup>47</sup> No articles on chemistry, pharmacy, veterinary medicine, and dentistry *per se* were admitted, but articles in journals in these fields which were on pathology or therapeutics were selected. In addition to the monthly parts, which

<sup>46</sup> These cards were "farmed out" to the wives and families of the Library staff for copying. See Garrison's obituary of Billings in the 1913 volume of the *Index Medicus*.

<sup>47</sup> *Index medicus*, 1: 3, 1879.

contained no indexes, an annual author and subject index was sent to subscribers.

This periodical continued with increasing financial difficulties until 1898, when Fletcher felt constrained to give up his connection with it. Although the price had been raised from \$3.00 to \$25.00 per year, the cost of producing the volumes was too great for any publisher. For a while Fletcher had taken on the publishing as well as the editing of the work; but by the turn of the century he also had to admit defeat. For three years, therefore, the journal was suspended, while a French firm attempted to bring out a similar work.<sup>48</sup> Their results were even more disastrous than Fletcher's, but in 1903 the Carnegie Institution was persuaded by Billings, then on the Board of Directors, to come to the financial rescue of the journal. The third series, starting in 1921, was reconstituted on a quarterly basis, arranged alphabetically by subjects with an annual author index, and continued until 1926-1927, when it merged into the *Quarterly Cumulative Index*, published by the American Medical Association.<sup>49</sup>

<sup>48</sup> *Bibliographia medica (Index medicus)*. Paris, v. 1-3, 1900-1902.

<sup>49</sup> "The fusion of the *Index Medicus* with the *Cumulative Quarterly Index* [sic] of the American Medical Association obtained for self same reasons, viz., the prospect of ultimate inadequacy or actual lack of funds and (more important still), the wearing down and dying out of the kind of personnel formerly available for carrying on this work. Preparation of such quarterly numbers as those in the final volume of the *Index Medicus* (1926-27), or of the author and subject index in the earlier series, was drudgery of the most devitalizing kind, ruinous to the eyesight, with consequent impact upon the nervous system, and wearying to the flesh. Some upstanding people 'slammed down their tools' and declined to go on with such work, on the ground that it was harder and

At least two reasons are given for the production of the *Index medicus*. Billings himself says in the Preface to the first volume of this work that he hopes for contributions from medical writers who wish to see their works indexed, and that these contributions, placed in the Library after indexing, will aid in building up that collection beyond what can be supplied from the "limited fund provided by the government for its support." In replies to letters asking for aid in locating literature, however, Billings frequently remarks that the earlier literature can be found listed in the *Index-Catalogue*, but that the *Index medicus* is aimed at bringing this up to date and furnishing the physician with the latest material on medical subjects.<sup>50</sup>

The third part of Billings' scheme for making the literature of medicine available to those who needed it was his interlibrary loan system. (Although not strictly medical bibliography, this subject must be discussed briefly here, to give a complete picture of Billings' concepts.) To know that the information desired is in a particular work and then not to be able to obtain that work was the original frustration which caused Billings to decide that he would collect a medical library for American medicine, if this

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less remunerative than a coal-heaver's (the financial compensation was niggardly). Moreover, as an eminent authority (Mr. Herbert Putnam, Librarian of Congress) observed to Col. Ashburn, enthusiastic workers of this kind are no longer to be found among the male sex. The obvious solution was the Chicago-idea—a large and efficient female personnel." Garrison, Unpub. memo., *op. cit.*, p. 4.

<sup>50</sup> Unpublished letter books dated in the 1880's in the History of Medicine Division, Armed Forces Medical Library. Unfortunately only a few of these books appear to have been preserved.

were at all possible.<sup>51</sup> For this reason, Billings agreed to lend books and journals to physicians at a distance who would either 1) arrange for a neighboring library to consent by a vote of its governing body to be responsible for the work, or 2) who would deposit with the Library of the Surgeon-General's Office an amount of money equal to the value of the book, which deposit would be returned when the book was returned safely. Both the letter books of the library and the reviews of the *Index-Catalogue*<sup>52</sup> reveal that much use was made of this system.

It is constructive to compare the *Index-Catalogue* with the contemporary works available to the physicians. A characteristic attitude is expressed in a letter to the Editor of *Lancet* by Dr. John Chatto, Librarian of the Royal College of Surgeons.<sup>53</sup>

How such an index will be valued and consulted can only be judged of by those who have observed the warm appreciation that has attended the publication of Neale's 'Medical Digest',

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<sup>51</sup> See p. 112 and also Washington Evening Star for May 5, 1883, which quotes Billings as follows: "... in the Preface to the Catalogue of 1872," replied the Doctor, "... the need of the United States for a large medical library was stated to be shown by the fact that were all the medical libraries of the United States put together, it would not be possible to verify from the original authorities the references given by standard English or German authorities. No complete collection of American medical literature was in existence, and the most complete was in private hands and not then accessible to the public..."

<sup>52</sup> Collection of Notices, Reviews, etc., in Relation to the Index-Catalogue of the Library of the Surgeon General's Office, Washington, D. C., 1875-1889-1891, vol. 1, preserved in the History of Medicine Division, Armed Forces Medical Library.

<sup>53</sup> *Lancet*, 1: 970, 1881.

which yet embraces less than a dozen English periodicals. The periodical and serial publications of all times, and in all languages, which come within the grasp of the 'Index-Catalogue', are numbered not by hundreds, but by thousands. . .

### RISE OF ABSTRACT JOURNALS

Billings' bibliographies were not the only ones published in the nineteenth century, <sup>54</sup> and his method for controlling medical literature was not the only plan put forth. One other still important method for controlling scientific literature arose about this time: the abstract journal. This method accepted two facts: 1) that the literature had become so vast it was impossible for any scholar or any library to possess it all, or to scan it if available, and 2) that the literature on any portion of the entire field was likely to be so scattered a person had to examine the total literature to be sure that he was getting all pertinent information. The abstract journal aimed at bringing together from diverse sources a large portion of the literature on the subject it represented and it had the further aim of allowing the reader to learn the contents of the literature without reading the originals.<sup>55</sup>

<sup>54</sup> See the Bibliographical Appendix on p. 194-211.

<sup>55</sup> The most sweeping statement about this was made by the Springer Verlag, publisher of the largest group of such abstracting tools in medicine, in 1930. "The Zentralblatter [sic] are meant to make it superfluous, at least for German readers, to subscribe to foreign publications. Special efforts will be made to have the important foreign articles carefully abstracted in detail so that it will be generally unnecessary to look up the original articles." Purpose and Organization of the Medical Reference Journals Published by the Firm of Julius Springer in Berlin. Bull. M. Library A., 20: 173, 1930.

Probably the earliest abstracting journal in the sciences was the *Pharmaceutisches Centralblatt*, the predecessor of *Chemisches Zentralblatt*, which began publication in 1830. This so obviously filled a need that four years later, in 1834, Karl Christian Schmidt brought out the first volume of the famous *Schmidt's Jahrbücher der in- und ausländischen gesammten Medicin*, which published 336 volumes before it ceased its existence in 1922.<sup>56</sup> Following Schmidt's lead many such abstract journals were produced for the sciences, until the beginning of the first World War, when most had to be suspended. The more important ones resumed publication between the two world wars, but because of their high price, the increase in available literature resulting from the war, and the founding of many new medical libraries, and possibly because of the greater adequacy of the indexing tools, they never regained their former importance. For some years after World War II, most of the old abstracting journals which attempted to cover the medical literature comprehensively found it extremely difficult to exist, while the newly founded ones tended to run into financial difficulties.

The reasons for the decline of the earlier abstracting journals are varied. For one thing, English came in to

<sup>56</sup> Karl Christian Schmidt was born in Germany in 1792 and died June 13, 1855 in New York of osteomyelitis. He not only founded the first medical abstract journal, but he edited the *Encyclopädie der gesammten Medicin* (Leipzig, Wigand, 1841-1845, 10v.) and (with F. L. Meissner) the *Encyclopädie der medicinischen Wissenschaften, nach dem Dictionnaire de Médecine frei Bearbeitet* (Leipzig, Fest, 1830-1835, 13v.). Practically nothing else is known of him. See Hirsch, *op. cit.*, v. 5: 94, and Dechambre, *op. cit.*, 3 s., v. 7: 477.

supplant German as the language of science after World War II; for another, few English speaking physicians learned to read German with the ease with which earlier physicians had read it. Therefore, by the time the German abstracting journals resumed publication, much of the market of international subscribers had been lost to them. The English-language abstract journals, which had arisen during the period when the German Zentralblätter were *hors de combat*, were, for the most part, not as good in their coverage as the older ones. The best of these were probably *Excerpta medica* and *Abstracts of World Medicine*, but even these had serious weaknesses at first in coverage, method of abstracting, indexing, and speed of publication. (A further discussion of these journals will be found in the next chapter.)

Perhaps one of the factors which will determine whether this form of publication will again have its earlier importance is the change in medicine itself. At the end of the nineteenth century and the beginning of the twentieth, the trend in medicine was toward specialization and compartmentalization. In the middle of the twentieth century, on the other hand, there is a tendency for scientists from several specialties to work together on a research project as a team. In such a set-up, it is more difficult to define specialties and to provide abstracts of all pertinent publications; such research teams, moreover, require more wide-spread coverage of the literature than did the earlier clinician. At present it is impossible to say whether the abstract journal will ever again enjoy the popularity it had during the first quarter of the twentieth century; the

fact that so many attempts are made to publish abstract journals seems to indicate a demand, if not a need for them.

The typical German abstract journal-plan required three kinds of publications for its complete coverage. The first was a frequently appearing abstract journal, usually called *Zentralblatt* or *Berichte*, which provided signed informative abstracts of each article listed, and which had excellent author and subject indexes. It was usually arranged by some classification scheme. As an index to this publication, there usually appeared a yearly compilation, frequently called *Jahresbericht* or *Jahrbuch*, which annually listed the totality of the literature, some with semi-critical annotations, and some referring back to the original *Zentralblatt* or *Berichte* by key numbers. Finally there was a review journal, often called *Ergebnisse*, which contained reviews of a few important subjects in the field with extensive bibliographies.<sup>57</sup>

Although non-German literature contained examples of all these types of abstract journals, they were never tied together, in groups of three, as were the German publications. For example, although *Physiological Abstracts*, *Annual Review of Physiology*, and *Physiological Reviews* have all been bona fide publications, they were each published by a separate group and did not have internal tie-ins of citations. But the *Berichte über die gesamte Physiologie* and *Jahresbericht Physiologie* published the same material, and the *Ergebnisse der Physiologie* also

<sup>57</sup> Trelease, Sam. F. *The Scientific Paper* . . . 2nd ed. Baltimore, Williams, 1951, p. 10-22.

considered the same articles, though in a different form.<sup>58</sup> Finally because of the expense of purchasing the German tools, only libraries (and later, when the prices rose greatly, only the larger libraries) found they could afford these works. This further cut into the number of subscribers available to these publications after World War II.

### CONCLUSIONS

Because of the growth of the medical literature in the nineteenth century, particularly because of the increase in numbers of periodicals produced, a system for bibliographic control had to be devised which would use the services of many individuals working at different tasks, but working under a master plan in a standardized way, so that the results could be combined variously. This system was able to give a conspectus of so much of the literature being produced in medicine at the time that it looked as if bibliographic control had finally been achieved in the field. What was not apparent at the time was that this literature was increasing at an exponential rate, so that any system devised would have to take into account an infinite number of periodicals and the production of an infinite number of building stones. Already at the end of the nineteenth century it was apparent that, economically speaking, if in no other way, the system had been outgrown by the explosive expansion of the literature.

<sup>58</sup> The nearest thing to this system in the English language literature appears to be the publications of the H. W. Wilson Co., which uses the same articles in several of its specialized indexes.

Two possibilities were inherent in such a situation if it were to be controlled. Either a system had to be devised which would admit of infinite expansion, or else the material being indexed must be broken up into smaller, more manageable units. This latter course would, of course, recapitulate the history of science and bibliography in general, for general science and general bibliography had also gone through a stage of growing large and dividing into smaller units. But such a solution would only be a temporary one, since presumably the same curve of growth would be observable in any portion of the whole as in the whole. In the late nineteenth century and the early twentieth century, however, this scheme of breaking up the field was the method used for controlling medical literature. Indexes to special subjects (e.g., the German *Zentralblätter*, *Jahresberichte*, and *Ergebnisse*, each devoted to a special subject) were published, or else selected portions of the entire literature were taken for complete indexing, as was done by the old *Quarterly Cumulative Index*. (This point will be discussed more fully in the next chapter.)

That this was less than perfect is shown by the fact that, beginning with the second third of the twentieth century, the emphasis switched from dividing up the field of medical (or chemical, physical, or other scientific) literature into smaller and smaller units for indexing to devising a system which would more nearly approach the ideal of handling an infinite amount of data. These systems generally made use of the newer punched-card techniques, electrical devices of one kind or another,

and photographic means of recording and scanning material. Such methods were generally based on the use of a machine, and in the next chapter an attempt will be made to describe some of the more common machines proposed for bibliographic control and to show in what respect they have not been successful in solving the problem.