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BIOGRAPHICAL MEMOIR

OF

JOHN SHAW BILLINGS

1838-1913

BY

S. WEIR MITCHELL

WITH

THE SCIENTIFIC WORK OF JOHN SHAW BILLINGS

BY

FIELDING H. GARRISON

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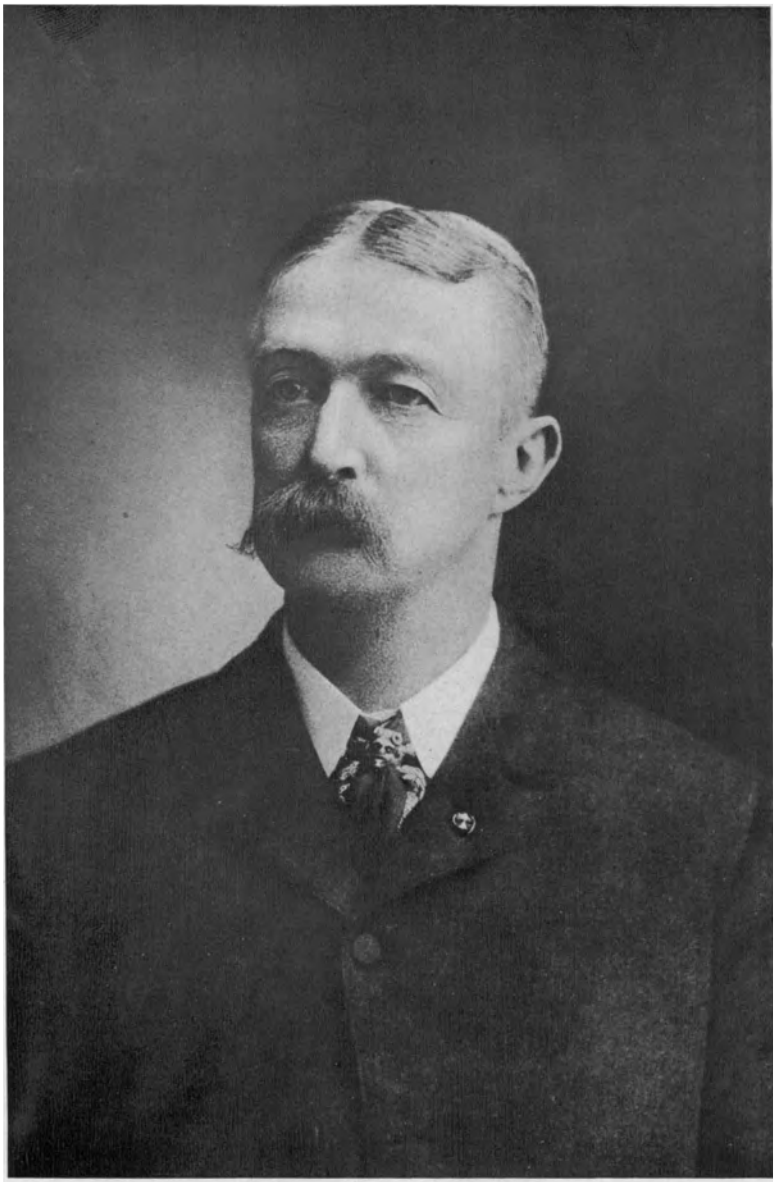

Very truly yours.
J. S. Billings.

MEMOIR OF JOHN SHAW BILLINGS

BY S. WEIR MITCHELL.

It has been the custom of the National Academy of Sciences to commemorate in memoirs those whom death has removed from its ranks. Since the lives of men of science are little known except to those engaged in their own lines of research, some record is the more to be desired of one who illustrated the fact that scientific capacity may exist with varied ability for the conduct of large affairs. This combination of talents has been often found in the ranks of the Academy, although, in the belief of the public, the man of science is presumed to be incapable of the successful management of commercial business.

The many tasks to which his life of work summoned the subject of this memoir have become, since his death, for the first time so widely known that it is unnecessary for me to do more than to put on paper a brief summary of his career and the reasons for his election to this distinguished body of men of science, where from 1887 to 1899 he rendered efficient service as our treasurer and served on eight important committees or as a member of our council. The life of our fellow member in fact needs less restatement from us because since he died at least a half dozen men of importance have recorded their opinions of this attractive and much-loved man and of what he effected during his ever busy existence. Moreover, a full and competent biography has been undertaken and will, I am sure, do ample justice to one who owed nothing to newspaper notoriety. Through his modest life of the labor he loved he accepted grave burdens and whatever duties, official or other, fell to him, apparently indifferent to praise or popular reputation, while he dealt victoriously with tasks so various in their nature that any one of them would have sufficed to tax the technical competence of the most able man.

JOHN SHAW BILLINGS was born in Switzerland County, Indiana, April 12, 1838. From the time he went to college until after the end of his medical studies he was almost entirely

without exterior aid. He was graduated from Miami University in 1857; A. M. in 1860. His personal struggle for a college education and the sacrificial privations by which he attained his medical degree in 1860 from the medical college of Ohio will, I trust, be told in full elsewhere. He won his way unhelped by taking charge of the dissection rooms and for one entire winter, as he assured me, lived on seventy-five cents a week, as he believed to the serious impairment of a constitution of singular vigor.

Hospital service gave him what the imperfect medical teaching of that day did not give, and, as demonstrator of anatomy, he prepared himself for surgical practice, which was to find its opportunities in the clinics of the battlefield.

In the year 1861 came one of the many periods for decisive choice he was to encounter as life went on. A certain career as assistant to a busy surgeon was offered him. His strong sense of duty to his country made him decline the tempting opportunity and he entered the regular army first of his class in a competitive examination and was commissioned Assistant Surgeon, U. S. A., April, 1862.

To deal briefly with his army career, he became Surgeon-Captain in 1866, Surgeon-Major in 1876, and Colonel and Deputy Surgeon-General in 1890. He was retired from active service in 1895 by President Cleveland at his own request and through the influence of the University of Pennsylvania, which at this time offered him the place of professor of hygiene.

During the war he was breveted Major and Lieutenant-Colonel for faithful, gallant, and meritorious service. Dr. Billings won in the field a high reputation as a very skillful and original operative surgeon, and a character for courage and resourceful administrative ability on many occasions, but especially when after the disastrous battle of Chancellorsville he conducted the retreat of the wounded, and when later he was actively engaged in perilous service during the battle of Gettysburg.

During his army service he began very early to exhibit his constructive talent in altering or building hospitals, and his remarkable power of administrative command in these vast homes of the sick and wounded.

Without dwelling too much on this part of his career, I may say that there were many months of service in the field and also as an Acting Medical Inspector of the Army of the Potomac. Dr. Billings' war service with the army ended when, in December, 1864, he was ordered to Washington, where he had charge of the Invalid Reserve Corps, of matters relating to contract surgeons, and a variety of other business.

Some time in 1864 he was sent by the President with others to the West Indies on an errand connected with the futile plan for deporting some of our recently made freedmen to an island. This scheme appears to have failed, as might have been expected, and probably the expedition in which he was included was meant to bring back the men previously thus deported. It was a somewhat fantastic scheme, and I do not find any account of it in the histories of the war. Probably Dr. Billings had an important share, for here, as elsewhere, no matter what his relation was to a body of men and officers, his peculiar talents soon found their influential place.

It becomes clear from what I have already said that his capacity to turn with ease from one task to another must have become by this time very well known to his superiors. His own desire was to return to the field, but the promise to so indulge him probably failed owing to the somewhat abrupt termination of the war. Meanwhile he was required to deal with the voluminous medical reports sent in by the medical staff of the Army of the Potomac. The records of this work and of his other more individual surgical contributions are scattered through the voluminous medical and surgical history of the war. Here, as elsewhere, he left in these papers his mark as a man of many competencies.

Some of the duties to which he was assigned before his retirement were curiously outside of the work of a military surgeon, and he seems to have been lent by the War Department for a variety of governmental services. Thus while busy with the early work in connection with the museum and library, he was also occupied with the organization of the United States Marine Hospital Service in 1870. In 1872 he was Vice-President of the brief-lived National Bureau of Health, and was for a long period in charge of the division

of vital statistics of the eleventh census of the United States. During his career as a surgeon in the years before 1895 he became an authority on military medicine and public hygiene and revived his interest in hospital construction, to which he had given a great deal of thought. He was one of five who submitted in 1875 by request plans for the construction of the Johns Hopkins Hospital. His careful study of the conditions required in a hospital were accepted. They included many things novel at that time which it is not needful for me to dwell upon here, but some of them were very original changes from the organization and construction to be found in hospitals at that period.

During these years he went to Baltimore from time to time and lectured on the history of medicine and on hygiene. He also supervised the planning and construction of the Barnes Hospital of the Soldiers' Home, Washington, D. C., and later the buildings needed for the Army Medical Museum and the Surgeon-General's library. His final constructive work late in life was his connection with the plans for the Brigham Hospital in Boston and during many years he was continually consulted by institutions or cities in regard to hospitals and hygienic questions of importance.

The great work of John Shaw Billings which gave him finally a world-wide repute began at some time after 1864, when he was asked by the Surgeon-General to take charge of the Army Medical Museum created under Surgeon-General Hammond by the skillful care of Surgeon John H. Brinton. His formal assignment "in charge of the Museum Library Division and as curator of the Army Medical Museum" dates from December 28, 1883, but he had been informally librarian for many years before that time. It is quite impossible here to enter into any detailed account of the ingenuity and power of classification which has made this museum the greatest presentation of the effects of war on the bodies of men. It is, however, essential to say a few words about the varied capacities which built up and made finally available to scholars the library of the Surgeon-General, now the most completely useful collection of medical works in the world.

In some reminiscences of his younger days he speaks of his student aspiration "to try to establish for the use of American physicians a fairly complete library, and in connection with this to prepare a comprehensive index which should spare medical teachers and writers the drudgery of consulting thousands or more indexes or the turning over the leaves of many volumes to find the dozen or more references of which they might be in search." The opportunity he craved when young came now by singular good fortune into his possession. When he took hold of this work the Surgeon-General's library contained a little over a thousand volumes and all interest in its increase had been long at an end. Fortunately, as I so understand, at the close of the war there fell into the hands of the Surgeon-General some eighty-five thousand dollars, the result of hospital savings during the great contest. He was allowed to use this money for the building up of the museum and of the library, which was an essential adjunct to the collection. It was a vast piece of good fortune that this task fell to the man who had craved such a chance since his youth. He brought to it powers which are rarely united in one man and an amount of knowledge of books, medical and non-medical, which few possess. When he was nominated for membership in the National Academy of Sciences his claim to this high distinction was judiciously founded by his friends upon his application of skill in the scientific classification of books and of the medical knowledge of our profession through the centuries. No medical librarian who ever lived had, up to that time, shown such an almost instinctive capacity for the scientific classification of knowledge so as to make it readily available. It was eminently a scientific gift and of incredible usefulness in its results to the scholarship of medicine throughout the world.

When he gave up this charge at the time of his appointment to the chair of hygiene in the University of Pennsylvania, he received from the physicians of Great Britain and America at a dinner given in his honor a silver box containing a check for ten thousand dollars, as a material expression of gratitude for the labor-saving value of his catalogue.

The surplus of this fund enabled his friends to present to the Surgeon-General's library an admirable portrait of John Billings by Cecelia Beaux.

The library as he left it contained 307,455 volumes and pamphlets and 4,335 portraits of physicians. At the present day in the skillful hands which took up his task it has reached over half a million volumes and over five thousand portraits and has a unique collection of medical journals quite matchless elsewhere.

He went about the preliminary measures for the catalogue with cautious care and in 1876 prepared a specimen fasciculus of the proposed catalogue of the library, consisting of a combined index of authors and subjects arranged in dictionary order, and submitted it to the profession for criticism. In this he was aided by his able assistant, Dr. Robert Fletcher. In the first series of the index catalogue, 1880-1895, the material was selected and a scientific classification made by Billings. The future of the library has been entirely in the hands of men at first chosen by him and always ever since by medical officers of distinction. As a monthly supplement to the index catalogue, the *Index Medicus* was begun by Dr. Billings and Dr. Fletcher in 1879 as an extra official publication. When, in 1903, the second series of the *Index Medicus* was started it was seen that there was a risk of failure in this invaluable publication through want of means, but at this time by his influence through the aid of the Carnegie Institution of Washington, it was permanently established at the cost of some twelve thousand dollars a year and continues to be a helpful aid to scholarly physicians all over the world.

It was here that Dr. Billings got his training for the still larger task which awaited him when he was chosen as librarian of the Astor-Tilden-Lenox Library in New York. There at once this great enterprise found in him all the varied qualities which were needed in the construction of the building, the classification of its contents, the efficient administrative grasp on the forty outlying libraries of New York connected with the triple library, and in his singular power of uniting strict discipline with a capacity to attach to him those under his control.

Throughout his life he was a busy writer of essays on hygiene, hospital construction, and administration, the statistics of war and addresses or essays such as his history of surgery, perhaps the best presentation of this subject ever made.

To comprehend the character of a man, he must have been seen in his relation to the various duties which test the qualities of both heart and head. The charge of suffering, crippled, wounded soldiers is a trial to the surgeon and here he showed the man at his best. He was patient with the impatient, never irritable with the unreason of sufferers, never seeming to be in a hurry, and left at every bedside in the long, sad wards the impression of being in earnest and honestly interested.

It was thus I first knew John Billings when in the crowded wards wearied, homesick men welcomed his kindly face and the almost womanly tenderness he brought to a difficult service.

My own personal relations with John Billings began early in the Civil War, when he had for a long time the care of my brother, a medical cadet, during a mortal illness contracted in the Douglas Hospital, Washington. I saw then how gentle-minded was this man and how he realized the pathetic disappointment of a highly gifted young life consciously drifting deathward. I saw thus a side of John Billings he rarely revealed in its fullness. Generally a rather silent man, he was capable now and then of expressing in eloquent brevities of speech the warmth of his regard for some one of the few he honored with his friendship. In the last talk I had with him he said to me some things which remain as remembrances of this rather taciturn and reserved gentleman. I had asked him how many degrees and like honors he had received and, considering these notable recognitions, I remarked on the failure of popular appreciation. He replied with a jesting comment and then said, after a brief silence, that he was far more proud of his capacity to win the friendship of certain men and of the service he had been able to render to science in his connection with the Carnegie Institution of Washington. There, indeed, his always wise and broad-minded interest will be greatly missed. I served with him from its foundation on the distinguished executive committee of this body. Here, among men he liked and trusted, we saw him at his familiar best. Always

a patient listener, his decisions as chairman were expressed with his quiet, courteous manner, and many times his large knowledge of the science of the day left me wondering how it could have been attained amid the amazing number of occupations which had filled his time. But in fact he was intellectually sympathetic with *every* form of scientific research—a somewhat rare characteristic among investigators. I ought also to say that the men of our committee and of the board of trustees felt at times a little surprise at the shrewdness, the common sense, and the commercial insight he brought to the critical financial consideration of this immense money trust. Not elsewhere was he better seen or understood as conveying the sense of character, and nowhere else was he better loved.

Numberless presidencies of societies fell to his share, and the list of his honorary titles from all of the greater academies and universities at home and abroad served at least to show in what esteem he was held by men of science. These recognitions gave, I suspect, more pleasure to his friends than to this retiring and singularly unambitious scholar.

On public occasions his personality stood for something in the estimate of the man. Tall and largely built, he was as a speaker in the after-dinner hour or when addressing a body of men a commanding presence, with flow of wholesome English, ready wit and humor such as rarely came to the surface in his ordinary talk. The figure of athletic build, the large blue eyes, a certain happy sense of easy competence, won regard and held the respectful attention of those who listened. For me there was always some faintly felt sense of that expression of melancholy seen often in men who carry through a life of triumphant success the traces of too terrible battle with the early difficulties of their younger days.

What was most exceptional in this man was the unfailing fund of energy on which he drew for every novel duty, and an industry which never seemed to need the refreshment of idleness. He had that rare gift—the industry of the minute. When once I spoke of the need for leisurely play and the exercise of open-air sports, he said that he obtained recreation by turning from one form of brain use to another. That was play enough. I ought to add that he found pleasure in read-

ing novels, saying that one or two of an evening late were agreeable soporifics. But these, like more serious books, he devoured rather than read as most men read, and what he read he seemed never to forget. His memory was like a good index of a vast mental library.

Until his later years Dr. Billings possessed the constitutional vigor which befriended him earlier as he responded to the call of a succession of military and civic duties. Of late years he was obliged to undergo several surgical operations of serious nature. He went to them with confidence and courage, but before the last one he said to me, "I am for the first time apprehensive." He went on to add, "It is a signal of age; and of late, as never before, any new project, any need for change in the affairs of the library, I find arouses in me an unreasonable mood of opposition. This, too, is, I know, a sure evidence of my being too old for my work. I shall, I think, resign my directorship of the library." It was our last intimate talk. He died of pneumonia after the operation, on the eleventh of March, 1913.

The scene at his burial in the military cemetery at Arlington brought together many men of distinction, a much moved group of army men and the great library officials. We left in the soldier burial ground all that was mortal of a man who combined qualities of head and heart such as none of us will see again.

Dr. Billings married Miss Kate M. Stevens in September, 1862. Their children are: Mary Clure, Kate Sherman, Jessie Ingram, John Sedgwick, and Margaret Janeway.

Science is forever changing. The work of today is contradicted tomorrow. Few, indeed, are so fortunate as to leave in the permanent remembrance of science conclusive work. The man whose loss we regret left to medicine in his catalogue of the Surgeon-General's Library a monumental labor which none will ever better and to which he gave continuity of vigorous life.

THE SCIENTIFIC WORK OF DR. JOHN SHAW BILLINGS

BY FIELDING H. GARRISON, M. D.

JOHN SHAW BILLINGS, perhaps the most versatile American physician of his time, achieved excellence and gained distinction in no less than six different fields—in military and public hygiene, in hospital construction and sanitary engineering, in vital and medical statistics, in medical bibliography and history, in the advancement of medical education and the condition of medicine in the United States, and as a civil administrator of unique abilities.

Shortly after receiving his medical degree from the Medical College of Ohio (1860), Dr. Billings prepared to enter upon surgical practice in Cincinnati, where his prospects were excellent, but the outbreak of the Civil War turned his mind to the larger service of his country, and, in September, 1861, he passed his examination before the examining board for admission to the Medical Corps of the United States Army and was duly commissioned First Lieutenant and Assistant Surgeon on April 16, 1862. As an army surgeon his services were continuous and included some twenty-one months' work in hospital and a full year of roughing it in the field. He long afterwards described this experience as his postgraduate course in surgery, "with its service in camps and hospitals, with battlefields for the great clinics—a long, weary course." During the Civil War his reputation for courage and ability was of the best, and the end of the great struggle found him one of the medical inspectors of the Army of the Potomac, with a brevet of Lieutenant-Colonel "for faithful and meritorious services" (1865). Being in charge of Cliffburne Hospital, near Georgetown, July 3, 1862, assisted by fifteen Sisters of Charity, he took care of many Union and Confederate wounded from the seven days before Richmond, and did nearly all of the operating. At Chancellorsville, he and his assistants worked night and day, under artillery fire, in feeding and taking care

of the wounded; at Gettysburg, his experiences were the same, and in both battles he did an enormous amount of surgical work. During the war he performed nearly all the major operations done in the pre-Listerian period, and he was the first surgeon in the war to attempt the rare operation of excision of the ankle joint (January 6, 1862), which had been done only two or three times before in the history of surgery, and was completely successful in his case. Lister's classical paper on excision of the wrist, a landmark in the surgery of the joints, was not published until 1865.

On August 22, 1864, having been disabled during the long siege of Petersburg, he was relieved from duty in the field and assigned to the Washington office of the Medical Director of the Army of the Potomac, where he assisted in the redaction of the field reports, which were subsequently embodied in the Medical and Surgical History of the War. On December 27, 1864, he was transferred to the Surgeon-General's Office of the War Department, where he was to remain for thirty years, up to the date of his retirement from active service in the army, October 1, 1895. Here his real life work began. Prior to this period his only contribution to scientific literature was a graduating dissertation on epilepsy, already notable for clear-headed common sense and a certain quaint vein of humor. His most important contributions to medical science were made during the thirty years of his incumbency as librarian of the Surgeon-General's Office.

Upon assuming his new duties at the beginning of 1865, Billings threw himself into the dry details of departmental routine in his cool, imperturbable way, and during the next five years he was principally occupied with the official drudgery connected with the business of disbanding the great body of acting assistant surgeons of the war, dismantling the military hospitals, and winding up the financial accounts of both. In this period he read assiduously, wisely, and well, and applied himself with zest to microscopic work, which was then coming into fashion in this country. After casting about in various directions, he settled down to the investigation of the minute fungi, of which he published two studies in the *American Naturalist* in 1871, and at the same time made a valuable

private collection, which he long after presented to the New York Botanical Garden in 1902. Meanwhile, in 1869, he had collaborated with his army colleague, Dr. Edward Curtis, in a special report on the possible cryptogamic origin of the Texas fever and pleuropneumonia of cattle. The object of this research was to ascertain if the so-called cryptogamous diseases of cattle were caused by the "micrococcus of Hallier." The findings were negative and the investigation is null today. Significant, however, is the prophetic statement that, in establishing a causal relation, the lancet and injection tube would probably accomplish more than the microscope and culture apparatus.

About this time Dr. Billings entered upon his career in public and military hygiene. During 1869-'74 he was detailed, under the Secretary of the Treasury, to inspect and report upon the status of the Marine Hospital Service, which was then sadly in arrears on account of the poor administration incident to bad political appointments. In this relation, Billings traveled over the length and breadth of the country. His recommendations, based upon what he saw during his tours of inspection, were adopted and the value of his services acknowledged by the Secretary of the Treasury as follows: "The condition of the marine hospitals has been improved during the past year. This result is largely due to Dr. J. S. Billings, of the Surgeon-General's Office, who has visited nearly all of them, and through whose advice many important changes have been made."[1] The principal thing he did for the service was to take it out of politics and give to it the military methods of organization. Known as the Public Health Service since 1912, this branch of the Government now works hand in hand with the medical establishments of the Army and Navy in the advancement of preventive medicine.

In 1870 and 1875, Dr. Billings made two reports to the Surgeon-General upon barracks and hospitals and upon the hygiene of the United States Army. These became classical, at least as far as our own military establishment is concerned. In the first monograph, now known as Circular 4, he collated

[1] Rep. Sec. Treasury, Washington, 1870, p. xii.

and edited some 527 pages of reports from medical officers on the barracks and hospitals of "the best fed and worst housed army in the world." His criticism of these hospitals is drastic and was the basis of his future work as a hospital constructor. He describes the pictures of U. S. Army hospitals in the report as "simply inserted as ingenious modes of 'how not to do it'"; but he recognizes that, in a country of such wide extent as ours, hospital plans must suit the climatic exigencies of "the burning mesas of Arizona and the bleak north Atlantic coast." His main contention throughout is against the false economy which results in "a saving in boards and brick at the expense of the health of the soldier." Circular No. 8, Dr. Billings's report upon the hygiene of the United States Army, is, in effect, a strong brief in aid of improving the health and personal well-being of the enlisted man. Bath tubs and shower baths, abundant space and good ventilation in quarters, a ration at least twenty-five per cent in excess of what is required, plenty of ice at Southern posts, lime juice and baking powder for scouts, canned tomatoes where fresh vegetables are not available, are recommended as novelties; and it is especially urged that the chief cook at a post should be a permanent detail, in place of the then custom of changing company cooks every ten days; that schools for instruction of cooks should be established at recruiting stations and a manual of cookery, with dietetic tables and culinary directions for all climates and seasons, prepared. The report concludes with timely observations on the ventilation, hygiene and avoidance of infection in the military hospitals. As part of Billings's work in military medicine should be mentioned his "Notes on Military Medicine in Europe" (1882), his report to the International Medical Congress at Berlin on international uniformity in medico-military statistics (1890), and his address on "The Military Medical Officer at the Opening of the Twentieth Century" (1903). Shortly before his retirement from the army, Dr. Billings became professor of military hygiene in the newly established Army Medical School at Washington (1894).

About 1874, Dr. Billings began to be active in the affairs of the American Public Health Association, of which he was made president in 1880. To its annual reports he contributed

papers on the effect of mountain climate upon health (1874), on hospital construction (1874), on medical topography (1875), on a plan for a systematic sanitary survey of the United States (1875), on community rights, duties, and privileges in relation to public health (1876), on a sanitary survey of Memphis, Tennessee (1879), and others. These titles all connote pioneer hygienic work of the most advanced type, for it must be remembered that there were no uniform quarantine regulations in the United States before 1893, and that before 1901 only ten States of the Union had even a satisfactory system of vital statistics. The truth is that until recent times the advancement of public hygiene in all countries and at all periods of the world's history has been fitful and capricious, always lagging behind the general trend of progress and usually following in the wake of some devastating epidemic disease. The despised Middle Ages, for instance, had a really impressive array of municipal laws and ordinances, hastily improvised against the scourges of pandemic leprosy, bubonic plague, and syphilis, as we have only just begun to learn through the extensive historical researches of Haeser and Sudhoff. Modern Europe was awakened to an interest in preventive medicine through the great cholera epidemic of 1830 and the three visitations of the same disease which followed successively upon each other during the decades 1840-'70. The splendid system of sanitary legislation of England, the best and most progressive in the modern world, started with the cholera epidemic of 1840-'50, which also occasioned the first sanitary survey in America—that of the State of Massachusetts in 1849. In Billing's time the immediate incentives to progress in sanitation were the yellow fever epidemics of 1878 and 1879. These occasioned, among other things, the foundation of the short-lived National Board of Health (March 3, 1879), an attempt at a Federal organization of which Dr. Billings was appointed vice-president at the start, and which died out through lack of congressional appropriations in 1886. Its powers had been enlarged by the National Quarantine Act of 1879; its personnel included some of the best men of the time, its transactions give abundant evidence of good and arduous work, but such an infantile organization, described by

Billings himself as "a premature birth," could not survive the inevitable struggles with the State authorities as to local quarantine, and its place has been very adequately taken by the present U. S. Public Health Service. The scientific work of the National Board of Health included the investigation of yellow fever in Cuba by Sternberg, Guiteras, Chaillé and Hardie, Professor Ira Remsen's investigation of organic matter in the air, the sanitary surveys of New York harbor and Memphis, Tennessee, and Billings's reports on nosology, the proper nomenclature of diseases in relation to the registration of vital and medical statistics. This matter, which was the starting point of Billings's remarkable labors on the United States census, as also of his classification of diseases in the Index Catalogue and Index Medicus, occupied his time and attention for many years. It was one of his main ambitions to establish a definite system for the registration of deaths and diseases in this country and to have it standardized in the several States, because he saw clearly that this would be the first step towards standardizing the status of physicians who might presume to make certificates as to the cause of death and the nature of the disease in each case. At the International Medical Congress at London in 1881, and again at the annual meeting of the British Medical Association at Brighton in 1886, he spoke in a very definite and decided way of this crying deficiency in our national medical legislation. In 1881, the criteria for determining the ethical, professional, and scientific status of (sometimes self-styled) "physicians" were established in Illinois by the State Board of Health, and in Alabama by the State Medical Society, which also officiated as the State Board of Health. In relation to the subsequent advances which have been made by the American Medical Association and other bodies in elevating the status of physicians, of the medical schools which educate these physicians, and of the medical periodicals which are their organs of opinion, the early propagandism of Billings sould be remembered. In his own day he was as one crying in the wilderness, for the tendency of the medical politicians of the time was not to level upward to a higher standard, but inevitably downward.

Another project which Billings had very much at heart was

the possibility of making a searching sanitary survey of the whole United States as the first step towards establishing a perfect system of sanitation in its different cities and communities, according to their special needs. This idea, to diagnose or blue-print the diseases of a community or country before attempting to treat or prevent them, originated with Hippocrates, the Father of Medicine, who, in his excursus "On Airs, Waters, and Places," was the creator of medical topography. In his "Remarks on Medical Topography," read before the American Public Health Association in 1875, Billings gives a history of the subject in this country. In 1672, the Welsh physician, Charles Clermont, had essayed a medical topography of England along the old Hippocratic lines. The first treatise of this kind relating to the United States was Lionel Chalmers' "An Account of the Weather and Diseases of South Carolina" (London, 1776); but the real pioneer of medical topography in America was the celebrated Daniel Drake, in his "Picture of Cincinnati and the Miami Country" (1813), which was the foundation of his great work "On the Principal Diseases of the Interior Valley of North America" (1850-'54). In this vast treatise, now a classic, Drake triangulates the whole Mississippi Valley as to topography, climate, meteorology, natural history, population, and diseases. In 1843, the medical section of the National Institute at Washington had prepared and circulated a schedule of inquiries in aid of collecting data of this kind, but the committeemen, sent from this body to the American Medical Association upon its foundation in 1847, reported failure in their efforts for the following significant reasons:

"First, the general apathy existing even in the minds of medical men on the subject of hygiene; and, second, the favorable opinions entertained by almost every one addressed by the committee of the healthfulness of his own locality. * * * The United States may be considered as a country in which no legislative enactments exist regulating its sanitary condition. For, with the exception of some municipal regulations forced from the necessity of circumstances upon the large cities, and a few of the first steps of legislation in one or two of the States, each individual is permitted to exercise his own free will in regard to hygienic measures, too frequently at the expense of great sacrifices of human life."[2]

[2] Repts. and papers Amer. Publ. Health Assoc., 1874-'5, N. Y., 1876, ii, 41.

In 1848, the Committee on Public Hygiene of the American Medical Association drew up a schedule of questions similar to the above and some interesting papers, by way of reply, were obtained from the larger cities of the country. Some of the State medical societies, particularly that of Pennsylvania, in 1855 also undertook to collect medico-topographical data through the county medical societies. But, as Billings remarked, it needed "but a brief examination of these records to prove that a comprehensive sanitary survey of a State will probably never be accomplished by a State medical society." "The most valuable contributions to medical topography in this country," he adds, "so far as regards completeness and as affording data for a science of the etiology of disease, are the reports made by the medical officers of the army descriptive of their several posts. * * * This is due to the fact that these reports give the statistics of disease and the meteorology of each post upon a uniform plan, and thus afford the means of comparison between different localities." Upon such a plan Billings, as chairman of the Committee on a Sanitary Survey of the United States (American Public Health Association, 1875), caused his experts to draw up a *questionnaire,* comprising upwards of four hundred searching queries bearing upon the geographical locale, climate, population, water supply, drainage, habitations, schools, hospitals, and prisons, cemeteries, public health and quarantine regulations, diseases and other features of a given community; and these were to be submitted to some 325 American cities and towns of 5,000 inhabitants or more. This plan, which Billings regarded as sufficient to establish "the foundations of a national public hygiene in this country," as setting in motion the machinery for a perfect system of sanitation, was tried out in two or three cities, but it was found that, by reason of the large number of leading questions and the difficulty of getting physicians to answer them, not to mention the expensive alternative of employing experts for this purpose, the project had to be abandoned, as in the initial attempt made in 1845-'7. The sentences in which Billings urges this project upon physicians and legislators are pregnant with meaning, expressive of his strong character and of the spirit in which his incisive mind

was to apply itself in its future grapplings with the deficiencies of the United States census.

"It has been an article of professional as well as popular belief since the days of Hippocrates that the study of prevailing diseases of different places, with reference to their local causes, is of great value, and that all work in this direction should be encouraged as much as possible. Many books and essays have been printed under the title of Medical Topography; and, to judge from the bibliography of the subject only, we might fairly suppose that a large amount of data—scattered and disconnected, it is true—has been obtained and recorded. But when we come to examine these papers in detail it will be found in most cases that, while topographical data are given, the medical part has been left out; that the majority of them refer to but one form of disease—the malarial—and to the conditions which affect its prevalence, and that the information in regard to this is vague and general. Even the most complete and satisfactory essays, with the exception of the army reports, rely upon mortality statistics alone; and these, no matter how complete, will not furnish the information necessary for a satisfactory investigation into the causes of disease, which is the one great object of medical topography. We want to know how many of a given populations have been sick, of what disease, and for how long. For this purpose the statistics of all diseases are not of equal importance, for we can expect no special advantage from knowing how many cases of venereal or delirium tremens occur in a given square; but we must, of course, record many facts for the same reason that the pearl-diver collects many oysters—because we do not know whether they are valuable or not. For instance, most persons would say that topography has no relation to cancer, and yet there are some curious coincidences with regard to its prevalence in limited localities. * * * These statistics can, of course, be obtained only by the aid of physicians; but to induce physicians to undertake such a task as this some sufficient motive must be presented.

"It must be remembered that the art, or the so-called practical part of public hygiene, does not specially pertain to the medical profession. Medical men have been foremost in urging attention to the prevention of disease, both on the part of individuals and the public, not because it is specially to their interest to do so, but because their sympathies are daily and hourly appealed to by the spectacle of human suffering which they know might have been prevented, but which they find difficult or impossible to relieve.

"Medical men see more or less distinctly that a properly organized system of State medicine or public hygiene would require from each of them a certain—and from many a considerable—amount of labor in keeping records and furnishing information, while no corresponding recompense is proposed. They are naturally unwilling to furnish information to and co-operate with persons in whose selection for the

position of health officer they have had no voice, and for whom they often have little respect; and this will continue so long as the medical profession is not consulted in the selection of State and municipal sanitary authorities. To undertake to ascertain for a large city the number of cases and the results of each form of disease is practically impossible. It is hard enough to obtain the statistics of causes of death with any reasonable degree of accuracy, since physicians, like other people, are not addicted to doing steady work without some compensation; but if, instead of all diseases, we devote our attention to a few, the prospect is not so hopeless. * * *

"By the comparison and study of the daily bulletin maps of the Signal Bureau we have learned somewhat of the paths, rate of travel, and phenomena of the air-whirlpools, and it is not impossible that we may yet, in like manner and by somewhat similar means, become acquainted with the course of certain diseases, and, if not able to prevent, can at least warn and avoid. * * *

"A satisfactory medical topography should have reference not only to the causation, but to the prevention and cure of disease. Change of locality, as a therapeutic agent, is coming more and more into use, especially as regards diseases of the lungs, rheumatism, etc.; but as yet physicians have no sufficient data to guide them in recommending given localities to their patients. * * *

"We must endeavor to ascertain what the French call 'the medical constitution of a place,' the results of epidemic influences which are not yet epidemics, and the modifications which these undergo in different localities. * * *

"In medical topography as a science there has been little advance for a thousand years, and so long as the present methods are pursued no great additions to our knowledge in this direction can be expected. Vague generalities and opinions must be replaced by specific information, and from square miles we must come down to square feet. The results which we now have can best be compared to those obtained by the young chemist who made an analysis of a rat—putting the entire animal into his crucible. The importance to a State or government of a complete topographical survey of its possessions has long been recognized; and much as has been done in this direction, it is now urged, by those most familiar with the subject, that in all of the States of this country a careful survey, with the preparation of maps on a large scale, similar to the work which has been done in England and Switzerland is necessary, and must sooner or later be effected. And it can hardly be doubted that in such surveys the prevailing diseases of each locality should be recorded as carefully as its geology, botany, or zoölogy."[3]

The address which Billings delivered as president of the American Public Health Association at New Orleans (Decem-

[3] *Ibid.*, pp. 50-53.

ber 7, 1880), was charged with the same sagacity and humor as the above and made a deep impression. In relation to the stationary character of the legal mind and the intrigues of medical politicians, he urges his fellow sanitarians to persevere bravely, even though "like Saul, the son of Kish, they go forth to find their father's asses, and they don't have to hunt long."

In November, 1879, Dr. Billings, in co-operation with Dr. Charles F. Folsom, Col. George E. Waring, Jr., and other members of the National Board of Health, made a sanitary survey of Memphis, Tennessee, following the epidemic of yellow fever in the city in the summer of that year. His recommendations were adopted and carried out at the instance of the original committee of fifteen appointed by the city itself, and his visit was described as "a moral tonic" in the local newspapers. He summed up his views of yellow fever in a remarkable article in the *International Review* of January, 1880. In this he points out that the probable cause of the disease is "a minute organism somewhat like the yeast plant, or it may be the product of such an organism, like alcohol"; that the clinical phenomena resemble those of snake bite; that yellow fever occurs near old wharves, piers, ships, wooden pavements, and other structures of decaying wood or in connection with huge piles of decaying seaweed, dead fish, etc., on the Gulf coast; that clouds of smoke from the burning of infected bedding in the streets are as the very wings of pestilence in conveying the infection, and that exposure and shaking of textiles in cold weather for three or four nights will avail to disinfect them. His citation of the old farmer's adage that "yellow fever can't go anywhere unless yer tote it," shows how close he was upon the theory of convection of yellow fever by mosquitoes.

During the twenty years preceding his retirement from active service in the army (1895), Dr. Billings was regarded as the leading authority on public hygiene in this country, and his services and advice were in request everywhere. During 1879-'83, he published in the *Plumber* and its successor, the *Sanitary Engineer,* a series of "Letters to a Young Architect on Ventilation and Heating," which were the basis of his "Principles of Ventilation and Heating" (1884), and were republished in enlarged form in 1893. In 1879, he furnished the in-

troductory chapter on hygiene and its jurisprudence to A. H. Buck's treatise (Ziemssen's *Handbuch*), which was the germ of two separate treatises on hygiene published in William Pepper's System of Medicine (1885, 1893). In connection with his general sanitary work, he wrote a large number of papers for the medical periodicals bearing on all aspects of the subject, *e. g.*, those on vaccination (1882), house sanitation in large cities (1882), heating and ventilation of a school building (1882), sewage disposal in cities (1885), water supply for small towns (1889), house drainage, a paper of great practical value for householders and housewives (1889), public health and municipal government (1891), municipal sanitary defects in American cities (1893), and studies of municipal sanitation in Washington and Baltimore (1893), New York and Brooklyn (1894), Boston and Philadelphia (1894). During 1876-'82, he gave expert opinion on the ventilation of the hall of the House of Representatives; his letter books reveal a vast amount of correspondence in which his unique knowledge and experience as a ventilating engineer were in constant evidence, whether for a private club in Baltimore or in the construction of a large hospital laboratory, museum or library. His early dream of making a sanitary survey of the United States was occasionally realized in such isolated cases as those of Memphis (1879-'80) and St. Augustine, Florida (1892).

During the late eighties, Dr. Billings was lecturing on hygiene at the School of Mines, New York, and, in 1889, he signed an agreement with the University of Pennsylvania to assume the directorship of the University Hospital on January 1, 1890, to prepare plans for a laboratory of hygiene after studying the best hygienic laboratories in Europe, and to assume the professorship of hygiene in the university. His lectures on hygiene and vital statistics began during the academic session of 1891-'2, the subject of bacteriology being treated by Dr. A. C. Abbott. Upon his retirement from active service in the army in 1895, he became full professor of hygiene at the university, continuing his lectures until June 1, 1896, when he became director of the New York Public Library. During his Philadelphia incumbency, he planned and

opened the Laboratory of Hygiene of the University (1892) and the William Pepper Laboratory of Clinical Medicine (1895). Among the memoirs of original investigations made in the Laboratory of Hygiene, which were presented to the National Academy by Billings, were the study of his pupil James Homer Wright on the bacteria of the Schuylkill River (1894), which led in some measure to the construction of the great Belmont filtration plant in Philadelphia; and the researches made by Miss Adelaide Ward Peckham on "The Influence of Light upon the Bacillus of Typhoid and the Colon Bacillus" (1894) and "On the Influence of Insolation upon Culture Media and of Desiccation upon the Vitality of the Bacillus of Typhoid, of the Colon Bacillus and of the Staphylococcus Pyogenes Aureus" (1894). Two other memoirs, published by the Smithsonian Institution, were "The Influence of Certain Agents in Destroying the Vitality of the Typhoid and of the Colon Bacillus," by Miss Peckham (1895) and "The Composition of Expired Air and Its Effects upon Animal Life," by Billings, Weir Mitchell, and D. H. Bergey (1895). Billings was in actual residence at the University of Pennsylvania for a period of eight months only. During his earlier career in hygiene he had belonged to the older or philosophical school of sanitarians, of whom Pettenkofer was the type, but the work done under his direction during his short Philadelphia period shows that he fully appreciated and understood the advances made by the newer or "bacteriological" school.

From the time of his celebrated report on the barracks and hospitals of the United States Army (1870), Billings had been specially interested in the subject of hospital construction. His real career as a practical expert and authority in this field, in which he made an epoch, began in 1876, when he was selected by the trustees of the Johns Hopkins Fund to be their medical adviser in the planning and construction of the hospital specified in the will of Johns Hopkins himself. On March 6, 1875, the trustees sent out a circular letter to five experts on hospital construction in the United States requesting plans for the proposed structure, and of these plans that of Dr. Billings was selected as the best, combining as it did the advantages of a central pavilion with detached buildings as hospital units, in-

cluding first-class physiological and pathological laboratories, a separate dispensary for out-patient relief and instruction of students, two pharmacies, and a training school for nurses. It was specified that the administration should be upon the military or railroad plan, under one head and one only; that clinical instruction should be given usually in the wards and out-patient department and not in any clinical amphitheater, except in the surgical unit; that medical cases should not be brought from beds to an amphitheater; that there should be graded accommodations for pay and private patients in rooms or suites of rooms; that a perfect system of records, financial, historical, and clinical should be kept, and that annual volumes of reports, made up of original scientific work, should be published. All these were absolutely new ideas in hospital construction and administration in this country, a fresh departure from the many-storied block hospitals of the past and the detached rambling wooden pavilions of the Civil War. The administrative ideal was not only the proper care of the sick poor, but graded accommodations for patients of different means and stations and, above all, the scientific education of physicians and nurses and the promotion of "discoveries in the science and art of medicine" and their publication. For some seventeen years, up to the opening of the Johns Hopkins Hospital on May 7, 1889, Billings labored over the revision and perfection of his original plans, frequently visiting the best European hospitals during his trips abroad, lecturing and advising with the trustees and university authorities as to ways and means of finance and administration, and conferring with President Gilman and Professors Welch, Remsen, and Newell Martin as to the curriculum of the future medical school. It was Billings who advised the selection of Welch and, five years later, of Osler as leaders of the medical faculty. The hospital, when completed and opened, was recognized everywhere as the finest in existence at the time. A full account of it will be found in Billings's "Description of the Johns Hopkins Hospital" (1890), which became a sort of text-book on the subject of hospital construction and ventilation, and is still used and consulted. In addition to the Johns Hopkins Hospital, Billings supervised the planning and construc-

tion of the Barnes Hospital of Soldiers' Home, D. C. (1873), the Army Medical Museum (1887), the Laboratory of Hygiene (1892) and the William Pepper Laboratory of Clinical Medicine (1895) in Philadelphia, the New York Public Library (1911) and the Peter Bent Brigham Hospital at Boston (1913). In the science of hospital construction he was entirely self-taught, as also in the complex details of sanitary engineering, in which his expert knowledge and skill were of the best order. He had a wonderfully keen eye for detecting the strong and weak points in any new set of plans and specifications just set before him. One stenographic report of his off-hand discussion of the plans proposed for the new City Hospital at Memphis, Tennessee (1897),[4] is a remarkable example of his quickness in this regard. Of this phase of Billings's talents President Woodward of the Carnegie Institution (Washington) has remarked that "few engineers and few architects whom I have had the good fortune to meet could more quickly read a set of plans and specifications and hit upon the critical points to be considered."

Billings was one of the most accomplished statists of modern times, and with the late Gen. Francis A. Walker, who was superintendent of the ninth and tenth U. S. Census, perhaps the leading American authority on statistics in his day. On October 15, 1878, Billings transmitted, through Surgeon-General J. K. Barnes, a letter sent to the Honorable S. S. Cox, chairman of the Committee of the Census of 1880, in which some very valuable suggestions were made as to the advisability of including medical statistics, particularly those of disease-incidence, along with the data usually given as to births and mortality. He cites the experience of the Royal Sanitary Commission of England that, "however complete the registration of deaths may be, it cannot give a fair estimate of the sickness which is not fatal, it cannot indicate where or how these are to be prevented, it cannot tell the cost which is worth incurring for their diminution." At this time, it appeared that the only countries which attempted to obtain a registration of disease in connection with the national census

[4] Memphis Med. Monthly, 1897, xvii, 193, 249, 309.

were Ireland, where a record of diseases with which individuals might be suffering on the day of the count was made in the patient's own words, often in Irish; and Portugal. The chief obstacle to the making of such records was that the questions had usually to be put and answered by unprofessional men. Billings suggests a series of questions eliciting information as to the number of days the person is unable to follow his avocations or attend school through the year on account of disease or injury, the disease or injury from which the person might be suffering on the day of the count, the mode of treatment, whether private, public (charitable) or in hospital, the particular incidence of specific infectious diseases during the year, if any, and data as to loss of wages and cost of medical attendance, medicines, and nursing. From this time on (1878-1912), Billings was active and prominent in the supervision of the vital statistics of the Tenth, Eleventh, and Twelfth Census of the United States (1880-1900). Of this phase of his work a competent reviewer in the London *Times* (July 22, 1915), states that: "Before 1880, when Dr. Billings took charge of the vital statistics of the United States Census, they were worse than worthless. For three decades—the Tenth, Eleventh, and Twelfth Census—Dr. Billings was a volunteer worker in this field of statistical inquiry, and from a state of chaos he brought the vital statistics of the United States to their present satisfactory condition."

Billings's reports on the mortality and vital statistics of the Tenth Census (1885-'6) consist of two stout volumes, with an atlas of plates and diagrams. In these reports, the figures furnished him were subjected to modern methods of analysis and interpretation and new data as to racial equation and race-incidence in disease were elicited by processes of statistical induction. Some of these data have been uniformly quoted in modern text-books on practice of medicine. In 1880, Billings had suggested that the various statistical data of the living and the decedent "might be recorded on a single card or slip by punching small holes in it, and that these cards might then be assorted and counted by mechanical means according to any selected group of these perforations."[5] This suggestion was

[5] Proc. Amer. Assoc. Adv. Sc., 1891, Salem, 1892, xl, 407-409.

taken up and applied by the inventor, Mr. Herman Hollerith, in the electrical counting and integrating machines which are now employed by the United States Census. Billings also introduced new wrinkles as to the modes of tabulation of vital statistics and the use of circles with multicolored sectors to represent various aspects of mortality and disease incidence. At the Tenth International Congress at Berlin (1890), he proposed a definite scheme for securing international uniformity in medico-military statistics. In connection with the Eleventh Census (1890), he made valuable special reports on the vital statistics of the Jews in the United States (1890), the social statistics of cities (1891), the vital statistics of the District of Columbia and Baltimore (1893), New York and Brooklyn (1894), Boston and Philadelphia (1895), and the special statistics of the insane, feeble-minded, deaf, dumb, and blind (1895). To the Twelfth Census he contributed an analysis of its vital statistics (1904). To the theory of vital and medical statistics he made three separate contributions, viz., a series of papers published in the Sanitary Engineer (1883-'5), his Cartwright Lectures, delivered before the College of Physicians of New York in 1889, and a memoir published as part of the prolegomena to Sir Clifford Allbutt's System of Medicine (1896). In all these his familiarity with the mathematical methods employed by Farr, Rumsey, Körösi and the other writers before Karl Pearson is evidenced, and the conclusion of his Cartwright Lectures shows that he understood the fallacies and inadequacies of the older methods and saw clearly the need of the "correlations" subsequently employed by Pearson.

In his presidential address before the Seventeenth International Congress of Medicine at London (August 6, 1913), Sir Thomas Barlow, in naming the eminent physicians who had been prominent at the London Congress of 1881, referred to Billings as "prince of medical bibliographers." In this field Billings with his colleague Fletcher were, indeed, the successors of Haller, who catalogued the literature of anatomy, surgery, internal medicine, and botany up to the last quarter of the eighteenth century, and Callisen, who indexed the entire medical literature of the last half of the eighteenth century and the first third of the nineteenth. Billings's achievement in

this matter is a wonderful lesson in the utilization of opportunities as they come and was the fulfillment of a dream of his youth. In his reminiscences of his old medical alma mater, read in 1888, he has described his almost futile attempts to obtain complete statistics of operations for his graduating dissertation on epilepsy from the then medical libraries of the country (1861), and his realization of the fact that, while there was not a library in the world containing all the literature of medicine, there was not even a fairly good collection of such literature in the United States, so that exhaustive research in this field would require a visit to several libraries in Europe. "It was this experience," he says, "which led me, when a favorable 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." [6]

Prior to 1836, there existed in the Surgeon-General's Office at Washington a small departmental outfit of medical books which had been gathered for the official use of Surgeon-General Joseph Lovell (appointed 1818). When Billings was assigned to duty in this office on December 31, 1864, the collection, which had been increased at intervals by Surgeon-General William A. Hammond and his successors, amounted to some 1,365 volumes. To Billings was assigned, among other things, nominal, if not official, care of this collection. Small printed catalogues of this tiny medical library had been issued from time to time, that of October 23, 1865, showing 2,253 volumes. At the close of the Civil War there existed a considerable "slush fund" turned in from the army hospitals and derived "from the sale of bones, fat, stale bread, slops, flour barrels, straw, manure, waste paper, old newspapers, etc., and from the tax on the sutler." [7] This slush fund, amounting to

[6] Cincinnati Lancet-Clinic, 1888, n. s., xx, 297.

[7] Med. & Surg. Hist. War of Rebellion, Washington, 1888, Med. Vol. iii, 959.

about $80,000, Billings was permitted to use for the purchase of books for the Surgeon-General's Library, the subsequent catalogues of which made a showing of 6,066 volumes in 1868 and 13,330 volumes in 1871. In 1873, Billings issued a three-volume author catalogue, with some subject entries, showing a quota of about 25,000 volumes and 15,000 individual pamphlets. In 1876, he utilized his studies in nosology in the publication of a "Specimen Fasciculus of a Catalogue of the National Medical Library under the direction of the Surgeon-General, United States Army," consisting of a specimen index of authors and subjects arranged in dictionary order in a single alphabet, which was submitted to the medical profession for criticisms and suggestions. At this time, the library contained some 40,000 volumes and about the same number of pamphlets. The Specimen Fasciculus was regarded with great interest and favor by the profession, and received enthusiastic commendation from Dr. Oliver Wendell Holmes in his dedicatory address at the opening of the Boston Medical Library on December 3, 1878. Meanwhile Billings had acquired the necessary appropriation from Congress for increasing and completing his collections and on September 1, 1876, gained the valuable assistance of Dr. Robert Fletcher, of Bristol, England, an army surgeon of the Civil War, who was to be his faithful coadjutor in this work for the next twenty years and his successor for seventeen years afterward. In 1880, he at length obtained the necessary Congressional appropriation for printing a complete Index Catalogue of the library, and the first volume of this publication, a stout quarto of 888 pages, covering the literature by authors and subjects from A to Berlinski, was issued in the same year. Similar volumes of the same dimensions were issued annually up to the completion of the first series in 1895, when Dr. Billings was retired from active service in the army. The second series (volumes I-XVII) was carried on by Dr. Fletcher up to the day of his death (November 8, 1912), and is now complete in 21 volumes (1916), the two series comprising 37 volumes. In this publication, the entire literature of medicine and its collateral subjects from the earliest times down to the year 1916 is indexed in alphabetical order by authors and subjects, the latter indicated by appropriate

rubrics in bold-faced type, with abundant cross references. When we realize that most of the important literature of nineteenth and twentieth century medicine is buried in the files of medical periodicals, the magnitude and importance of the task of indexing it *seriatim* is plain. Of this work Billings was not only the organizer and promoter, but for thirty years he selected and bought the literature from publishers' and antiquarian catalogues, checked for indexing all the periodicals as they came in, devised the system of subject classifications and cross references and read the final revises of the proofs, to the galley sheets of which Dr. Fletcher gave his rare scholarship and critical acumen. In the earlier days, bound periodicals by the vanload were left daily at Billings's residence for checking, the work sometimes occupying him until the small hours of the night. The day was spent in administrative duties and in training the clerical force (most of them old hospital stewards) in the details of indexing, preparing copy and other library work. After Dr. Billings's retirement the classification, redaction and proof-reading of the second series of the Index Catalogue was superintended by Dr. Fletcher up to the time of his death (1896-1912). The Index Catalogue was an unusual thing to come out of a new country, but its enormous value to the medical profession and to librarians was soon recognized all over the world. The copies on hand in the larger medical libraries have frequently to be rebound on account of constant handling and Sir William Osler has related how worn and much bethumbed are the copies in European libraries. As a monthly supplement to the Index Catalogue, the Index Medicus, an extra-official publication giving a classified record of the current medical literature of the world, month by month, was begun by Dr. Billings and Dr. Fletcher in 1879, the redaction of this publication being principally in the hands of Dr. Fletcher. The annual index of the twelve monthly numbers comprises a complete conspectus of the author entries in alphabetical order and a minutely subdivided subject index which is, in respect of classification, a sort of annual Index Catalogue *en miniature*. The first series of the journal ran through 21 volumes (1879-99), when it died out from lack of financial support. In 1903 the Index Medicus

was revived under the financial patronage of the Carnegie Institution of Washington, with Dr. Fletcher as editor-in-chief (1903-1911) and is still current.

In building up his unique collections which, under Col. Champe C. McCulloch's administration, now number 226,128 volumes, 337,110 pamphlets, and 5,249 portraits of physicians, Billings did not rest content with Congressional appropriations, but in his restless indefatigable way aimed to complete his periodical files and fill up lacunæ as far as possible by a resolute *faire flèche de tout bois*. To this end, he kept on hand large quantities of duplicates, which he personally fostered for exchange purposes, sent out endless trains of letters to secure public documents and accessions by gift, where possible, and ransacked all private collections which were thrown open to him for rare items. Dr. Holmes has humorously described how Billings entered his private library at Cambridge and immediately swooped down upon the most valuable things on his shelves. "Why, sir," he said, "Dr. Billings is a bibliophile of such eminence that I regard him as a positive danger to the owner of a library if he is ever let loose in it alone." In still hunts of this kind, his right-hand man was the late Thomas Windsor, an ophthalmic surgeon, of Manchester, England, who died in 1910, leaving the most valuable items in his collection to the Surgeon-General's Library. Windsor was an eccentric, who, like Landor, would give away any book about him if it suited his whim, but would stickle to the last farthing in the adjustment of his accounts with a public institution. Eccentric were the provisions of his will, which stipulated that his executors should spend as little as possible on his funeral, invite no one to it, and insert no notice of his death in the newspapers, while some £20,000 of his estate were to be used for the relief of suffering in any way, provided that nothing should be given to any hospital, dispensary, medical society or institution, nor to any church or any charity subject to a religious body or sect. Yet he was a bibliophile of rarest talents and enthusiasm. From his country seat, "The Polygon" (Ardwick), letter after letter went out in quest of rare items for the Surgeon-General's Library, the historical collections of which he did much to complete, early and late. He had a kind

of supernatural *flair* for locating rare items in antiquarian book shops. When in Washington he would smilingly extract such things from the shelves of the local establishments like rabbits from a conjurer's hat.

Through his lectures and writings on the history of medicine, Billings was one of the original prime movers in the development of its study and investigation in the United States. From the date of the earliest contribution to the subject made in this country, the "Medical Discourse" of Dr. Peter Middleton (New York, 1769), little had been done until Dr. Oliver Wendell Holmes, in 1842, began to write those brilliant, witty, and learned papers which eventually made up his "Medical Essays" (1883), the most important American work dealing with medical history in its day. In 1876, Billings published his centennial survey of American medical literature (noticed below), which was just and critical even to the point of *nil admirari*. In 1881, he was asked to deliver one of the general addresses at the International Medical Congress, choosing as his subject "Our Medical Literature," a genial, if critical, examination of the world's medical literature at the time. This discourse, replete with wit and wisdom, made a deep impression, is still remembered and read and ranks with the earlier essays of Holmes and Toner, Weir Mitchell's history of instrumental precision in medicine and the later studies of Osler, Welch, Jacobi, Fletcher, and Kelly, as among the few contributions of permanent value made to the subject of medical history in this country. Worthy of especial mention are Billings's history of medical libraries in the United States (1876), his addresses on "Medical Bibliography" (1883) and on "Methods of Research in Medical Literature" (1887), which, in connection with his model bibliographies of cholera (1875) and alcoholism (1894), became, as it were, texts and reference manuals among the medical librarians; his "National Medical Dictionary" (1885), a collaborative work giving all the medical *termini technici* in English, French, German, and Italian; his alumni address on "The Medical College of Ohio Before the War" (1888); his bantering consideration of "American Inventions and Discoveries in Medicine, Surgery, and Practical Sanitation," read at the bicentennial of the American patent

system (1891); his contribution to the history of the Smithsonian Institution (1897); his survey of the "Progress of Medicine in the Nineteenth Century" (1900); and his "History of Surgery" (1895), which still remains the best work on the subject in English. In 1877-8 and some years after, Billings gave a regular course of lectures on the history of medicine at the Johns Hopkins University. Another course was delivered at the Lowell Institute in 1888. These were never published, with the exception of the introductory Lowell lecture on medical folklore, which is highly original. He was one of the founders of the Charaka Club in New York City (1898), and in 1906 read before it a suggestive paper on "The King's Touch for Scrofula."

In the advancement of medical education and in the improvement of the general condition of medicine in this country, Billings played a leading part for at least thirty years. The secret of his influence lay partly in his character, which was forceful, aggressive, firm, self-reliant, but mainly in the quality of his mind, his cool detachment, his wonderful sagacity and insight. In this relation, he early made his mark in his absolutely straightforward advice and suggestions to the Johns Hopkins Hospital trustees in regard to the best needs of the future medical school. These were delivered in a way which proved absolutely convincing through their blunt honesty and transparent sincerity, as of a man laboring under no illusions. Thus Billings soon gained the highest reputation, at home and abroad, for that rare virtue, unfailing reliability of character and judgment. His lectures on medical education (1878) and his "Condensed Statement" of the requirements of the principal European universities for graduation in medicine (1893) were, with a letter sent by the late Sir Henry Acland to the hospital trustees in 1879, of greatest value to the Johns Hopkins University and other American institutions. Through his later life he continued to stimulate interest in the subject through various wise discourses, such as those on "Ideals of Medical Education" (Yale, 1891), on "Hygiene in University Education" (Oxford, 1894), his address to the graduating class of Bellevue Hospital Medical College (1882), which is a delightful burlesque of the platitudes usually delivered by the

valedictorian and the tender of diplomas, and his speech before the Harvard Medical Alumni Association (1894). On the general advance of medicine in the country the influence of his critical, humorous, sagacious spirit was no less remarkable. In 1876, Billings published, in the volume *A Century of American Medicine,* a centennial survey of the medical literature and institutions of the United States which, in its extremely critical tendency, marked a great advance upon the laudatory and lapidary expressions of our earlier writers upon this theme. In this regard, the very titles of some of our earlier (and happily short-lived) medical periodicals—*The Granite State Medical Revolutionist and Hygienic Advertiser, The Georgia Blister and Critic, The St. Louis Probe, The Indiana Scalpel, The Drug Mill, The Medical Waif, The Quarterly Review of Narcotic Inebriety, The Dental Jairus*—speak for themselves. The writers of the time, in the expressive words of Holmes, "chewed the juice out of all the superlatives in the language in Fourth of July orations," and this florid, stilted, uncritical spirit was not confined to the vulgar, indeed attained its apogee among the learned in the otherwise admirable discourse on "Silver Sutures in Surgery" (1857), by Marion Sims, the founder of modern operative gynæcology. Billings was at no time inclined to wear "the foolish face of praise." His strictures upon the status of our medical literature, just but kindly meant, gave considerable offense in certain quarters. But nothing was more needed at the time and this critique, with its dignified message of hope at the end, established certain norms of excellence which have made for good work ever since.

The address which Billings delivered at the International Medical Congress in 1881 was reprinted and translated in most of the medical journals and made him known all over Europe. His work on the Johns Hopkins Hospital, on the Index Catalogue, on the U. S. Census and his many publications brought him all the more in the public eye in this country and made him in every sense of the word a leader of the medical profession. In 1886, he was asked to represent the United States by delivering the annual address in medicine at the meeting of the British Medical Association at Brighton, England. In this address, he reviews the deficiencies in our medical organization

in a cheerfully critical way, showing that even in 1883 there were "90,410 persons calling themselves physicians" in the United States and Canada, or one to every 589 persons in the United States, and that the proportion of these is generally lowest at the South and in the Southwest. In explanation of this fact, he produced shaded maps showing that it was in just these regions that malarial and yellow fevers were most prevalent, advanced the general theorem that "malaria and science are antagonistic," and insisted that neither "penal nor restrictive legislation" could induce highly educated physicians to settle in such localities. While all this was meant as a joke, since Billings himself admits that "it was within the limits of this malarial shadow that the foundation of modern gynæcology was laid by Marion Sims, of abdominal surgery by McDowell, Battey, and Gross, of an important part of the physiology of the nervous system by Campbell," nevertheless the bantering was misinterpreted as an expression of sectional prejudice by Southern medical editors, particularly in connection with the curious affair of the approaching International Medical Congress at Washington in 1887, in which Billings and the other committeemen, appointed at Copenhagen in 1884, were unjustly thrown out of their original positions by the American Medical Association at the New Orleans meeting, May 8, 1884. Discussion of this imbroglio has no place here; but inasmuch as the trait of baiting the South had become the fashion among our superficial people during the Reconstruction period and after, the natural attitude of the Southerner himself towards the old South being touchy and sentimental, like that of the Catholic nobles toward Mary Stuart—

> "The Queen of Scots lived gently in repute,
> She has much wrong,"

Billings's address was regarded by some as a tactical blunder. His strictures really stimulated the South to better efforts; his apparently hopeless view of its case in science was intended as a spur and an incentive; and, at the conclusion of his address at the opening of the new Army Medical Museum in 1887, he urged that "the museum specimens, coming as they do from the sick and wounded of both armies, and contributed by both

Union and Confederate surgeons, enforce the lesson of the unity of the profession and of its interests, as well as that of our country." As a matter of fact, the ancient Athenian civilization was developed in the same parallel of latitude (38° N.) as the once malarial Washington, and, although many writers assert that the downfall of Greece and Rome was due to the introduction of malarial fever, yet the splendid work of the Indian Medical Service in the peninsula of Hindustan, or of such southern Americans as Walter Reed and Gorgas in Cuba and Panama, shows that preventive medicine is fast overcoming the restrictions of climate and of tropical diseases upon scientific productivity. In 1900, Billings spoke feelingly of the work of Walter Reed, who, during the last week of his life, became one of his successors as librarian of the Surgeon-General's Office.

On June 1, 1896, Billings resigned his professorship of hygiene in the University of Pennsylvania to become director of the New York Public Library, in connection with the proposed consolidation of the Astor, Lenox and Tilden foundations. Here his unique administrative abilities were to find widest scope. In the complex legal and political details of selecting and securing a proper site for the proposed new building and the proper appropriations for its maintenance, he played an important part, and the original plan of the structure, which was but little modified in the end, was sketched out with his own hand at Atlantic City on April 5, 1897, and exists in two states and a facsimile reproduction.[8]

"In essence the plans there set down are those of the building as it stands today, the stack at the rear, main reading room on top, other rooms and offices grouped around the two courts. From the issue of preliminary notice to the competitors until the building was finished and opened fourteen years later the hand of Dr. Billings followed closely every development of plan on the architect's drawing board and every translation of it into the brick and mortar, iron and wood of the workman. To him more than to any other individual must be given credit for the plan and arrangement of the present building, this in no way detracting from the credit due to Messrs. Carrère and Hastings for their able services as architects.[9]

[8] For which see Library Journ., N. Y., 1911, xxxvi, 238.

[9] H. M. Lydenberg, Bull. New York Pub. Library, 1913, xvii, 310.

At the laying of the corner-stone, November 11, 1902, Mr. John Bigelow, President of the Board of Trustees, said: "I should fail of my duty if I did not here, on behalf of the Board of Trustees, publicly recognize our incalculable obligations to Dr. J. S. Billings, who seems to have been providentially sent to conduct the executive affairs of the new corporation." On May 23, 1911, the new building, one of the finest and best appointed of modern public libraries, was formally opened to the public. As Mr. Edwin H. Anderson, the present Director of the New York Public Library, has said, Dr. Billings was "in a very real sense its creator." Of the gigantic administrative achievement which is to be credited to Billings during the seventeen years of his directorate of this library, there is no better account than that given by its Reference Librarian, Mr. H. M. Lydenberg:

"In those days both the Astor and the Lenox buildings closed at three or four o'clock in winter and at five or six during the rest of the year; each closed for three entire weeks in the summer. The combined staff numbered but forty people. Neither library had a complete general catalogue or a shelf list. The new library had no provision for home use of books, this work being carried on by some dozen independent agencies.

"Acting on the recommendation of Doctor Billings when he took active charge of the work in the summer of 1896, the trustees enlarged the staff, put electric light in both buildings, extended the hours of closing to six o'clock throughout the year.

"The combined collections contained about 350,000 volumes, classified by fixed location and incompletely catalogued. A system of relative classification was devised by Doctor Billings and under his direction applied to the entire collection. A uniform system of cataloguing was adopted for both buildings; for each a public catalogue was provided in dictionary form on standard size cards. With these catalogues were combined as rapidly as possible the catalogues previously existing, some of which were printed in book form, some in manuscript on standard cards, some in manuscript on large cards and some on small cards.

"As executive officer of the trustees he arranged a system of co-operation with the other large libraries of the city, a limitation of the field of each, a prevention of useless duplication of effort. With the place of The New York Public Library thus defined he threw his extensive experience in the book trade, his widespread and minute knowledge of books and his boundless physical and mental energy into the work of extending and completing the collections of the library. Subscriptions to current periodicals were doubled and trebled, the con-

tents of the important magazines were represented in the public catalogue by index cards, a co-operative indexing of the less popular magazines was begun in connection with four or five other large reference libraries.

"The activities of the library were enlarged in many ways. Departments of maps, music, manuscripts, and prints were established and put on firm basis. A system of staff meetings were begun for informal discussion of questions of policy and administration, for improving the acquaintance of the members of the staff, for increasing the loyalty and solidarity. A monthly 'Bulletin' was started as a medium of information about the work of the institution, its growth and progress, the help it offered students and scholars.

"The first five years of his life with The New York Public Library saw the staff well organized, the usefulness of the institution increased many fold, its collections more than doubled, their use intensified, new life and energy in every member of the staff.

"His next achievement was the consolidation of the New York Free Circulating Library with its eleven branches, the establishment of the circulation department, the securing of the gift of $5,200,000 from Mr. Carnegie for circulation branches, and the union of practically all the circulating systems in the city." [10]

In his work of upbuilding The New York Public Library, Billings was materially assisted by the sagacious counsel of his friend Mr. John L. Cadwalader, late president of its board of trustees, and by the loyal support of his co-workers in the institution. The report of the library for 1916 shows that it now contains 2,459,996 books and pamphlets; that it has, besides its monumental central building, 43 branch libraries (37 of which were erected from funds supplied by Mr. Carnegie), 32 in the Borough of Manhattan, 7 in the Bronx, and 4 in Richmond, and that the total number of its employees has increased from 732 in 1910 to 1,224 in 1916. In his selection of Mr. Anderson, as his successor in this library, Billings showed as everywhere his keen surety of judgment in estimating the moral and administrative capacities of men.

Dr. Billings was one of the original incorporators of the Carnegie Institution of Washington (January 4, 1902), vice-chairman of its Board of Trustees up to December, 1903, after which he was chairman until his death and a member of the executive committee. He missed only one meeting of the Board

[10] *Ibid.*, 309-310.

of Trustees and attended all but thirteen out of ninety-nine meetings of the executive committee (1902-13). During this period, Dr. Billings secured the revival of the *Index Medicus*, with Dr. Fletcher as editor-in-chief (1903), was a strong supporter of the Nutrition Laboratory (erected in Boston, 1907-8), the Solar Observatory (erected 1905-6), the Department of Meridian Astrometry, the Department of Historical Research, the Department of Experimental Evolution and the Index to State Documents. In his advisory relation to the institution he had, as President Woodward has testified, the necessary sense of humor and proportion, the breadth of learning, the high courage and fearless detachment of mind which availed to make his services of incalculable value to the institution during its formative and experimental period. The early experiences of his rugged and self-denying youth had made him perhaps a little too considerate of the "sincere but deluded enthusiasts," the self-appointed genii from "the long grass and the tall timber," who pester and bullyrag the institution with their importunities and "inventions," but, in the main, he sat securely in his judgments, and he was loyal and consistent in his conviction that the benefits conferred by the scientific grants of the Institution should never be of the eleemosynary kind.

In acknowledgment of the value of his work in science, Dr. Billings received honorary degrees from the universities of Edinburgh (LL. D., 1884), Harvard (LL. D., 1886), Oxford (D. C. L., 1889), Munich (M. D., 1889), Dublin (M. D., 1892), Budapest (M. D., 1896), Yale (LL. D., 1901), the Johns Hopkins (LL. D., 1902), and was an active or honorary member in many medical and scientific societies. On April 17, 1883, he was elected to membership in the National Academy of Sciences. His name was proposed and his election passed upon mainly on the strength of his work in upbuilding the Surgeon-General's Library and its Index Catalogue, which Sir William Osler has pronounced his "float down to posterity," which Professor Welch has defined as the most important contribution to American medicine (as distinguished from laboratory and clinical contributions to the different branches of medical science) in the nineteenth century, and which Professor Adami, of Canada, has declared to be the outstanding produc-

tion of American medicine in the eyes of Europe. He was treasurer of the Academy from 1887 until 1898, a member of the council (1896-1907), of various committees, such as that on publications (1888-'99), and one of the trustees of the Barnard Medal Fund (1900-1908). During the last years of his life (1906-1912), he was active on various committees for enlarging the scope of membership to include anthropologists, psychologists, philologists, etc. In 1885, he presented (with Washington Matthews) memoirs on composite photographs of skulls; in 1894-'5 the researches made by his pupils in the Laboratory of Hygiene, and contributed biographical memoirs of Joseph Janvier Woodward (1885), Spencer F. Baird (1889), and Francis A. Walker (1902).

In public and military hygiene, in hospital construction and sanitary engineering, in the mathematical methods of vital and medical statistics, Billings was an actual and accomplished worker in applied science, using the term in the restricted sense of man's attempt to understand natural and physical phenomena in order to predict and control their consequences. In relation to the loose aggregation of sciences which goes under the name of medicine, he was essentially the masterful pioneer, organizer, and administrator, and no fair-minded and discriminating historian of medicine in the future can fail to recognize him as the man of his generation who did most to advance the cause of higher medical education and of the general literary status of scientific medicine in this country. Withal he was a man of singular versatility, widely read in all branches of secular and scientific literature, particularly in such subjects as the minute fungi and the mystic and theosophic lore of the far East. His quaint sympathy with self-deluded "inventors" may perhaps have been due to the fact that he was an inventor of no mean capacity himself. In 1870, he devised a ventilating double-fireplace for army barracks; in 1881, he suggested the possibility of obtaining telegrams and phonograms from the heart, which was brilliantly realized by Waller, Einthoven, and others during 1889-1903; in 1884-'5, he devised (with Major Washington Matthews) a method of taking composite photographs of skulls; in 1880 he suggested the general plan for the Hollerith electrical counting and integrating machines, which

are now used by the United States Census; he devised some of the tabulating methods employed in vital, medical, and military-medical statistics, and he originated the methods of bibliographic technique employed in the Surgeon-General's Library and the New York Public Library. As an organizer and administrator, he carried every one along with him by the force of his Viking personality, but to his personal friends and to his coworkers, whom he bound as with "hooks of steel" to himself, he was a good example of the poet's "great individual, fluid as nature, chaste, affectionate, compassionate, fully arm'd." All along the line he upheld the honorable Saxon belief that the game of life must be played according to its ethical rules; but certain traits of aggression which produced the superficial impression of hardness were known to his intimates to be due to the effects of internal disease, to the fact that "calculus racked him," and that he was a life-long sufferer from the cancerous diathesis. He was eight times on the surgeon's table—four times for major operations—but, as in the case of a fracture of the ribs occasioned by the jolting of a railroad car, he treated all this lightly and tried to conceal it from his wife and family. In this he showed the *Tragemot,* the superb courage in endurance, of his Scandinavian ancestors. His friend, the late Sir Lauder Brunton, said:

"As his name shows, he was of Scandinavian ancestry, and he retained the overpowering strength and energy by which his Berserker forefathers carried everything before them. But he concealed them under such a quiet, unassuming, courtly exterior that those who had only a casual acquaintance with him could hardly suspect the enormous latent energy he possessed. Though his learning was stupendous, he never obtruded it, but along with an easy flow of language and a quiet vein of humor it made him an excellent speaker and an agreeable companion, while his strong nature, affectionate disposition, and kindly ways rendered him at the same time beloved and trusted by those whom he honored with his friendship."

To the discriminating, in England and America, Billings seemed, in personality, a great (in the sense of an absolutely reliable) man. Dr. Welch said: "He was the wisest man I ever knew." Colonel Walter D. McCaw (U. S. Army) said: "He undoubtedly had the making of a great soldier. He would

have made a great general. He would have made a most able prime minister, and he would have had his own way. He would undoubtedly have made a great ruler, probably an easier position to fill." Mr. J. Y. W. MacAlister, librarian of the Royal Society of Medicine, said: "He was a *great* man in every sense of the word, * * * and *we* are not likely to look upon his like again." Of his position among his medical colleagues, Dr. Jacobi, the Nestor of our American profession, wrote:

"He was not really 'one of us,' no practitioner, no consultant, not often seen in medical societies. I believe there are many of the younger men who never saw him. But all knew him, knew he was above us. His superior position was recognized by every one. Everybody knew he had rendered and was constantly rendering services unique and such as nobody else could render or imitate."

And again, in the spirit of the inscription over the French Pantheon, *"Aux grands hommes la patrie reconnaissante,"* Jacobi said:

"We trust that it is not probable that the light-heartedness and forgetfulness of an ungrateful republic will deal with his memory as with that of lesser men. It is by him that the combination of American idealism and creative constructiveness is best represented, an example to be emulated by all men, both great and small, in all countries. * * * His life itself, ever vigorous, ever modest, ever bountiful, is his eulogy."