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BIOGRAPHICAL MEMOIR GEORGE LINCOLN GOODALE

1839-1923

BY

B. L. ROBINSON

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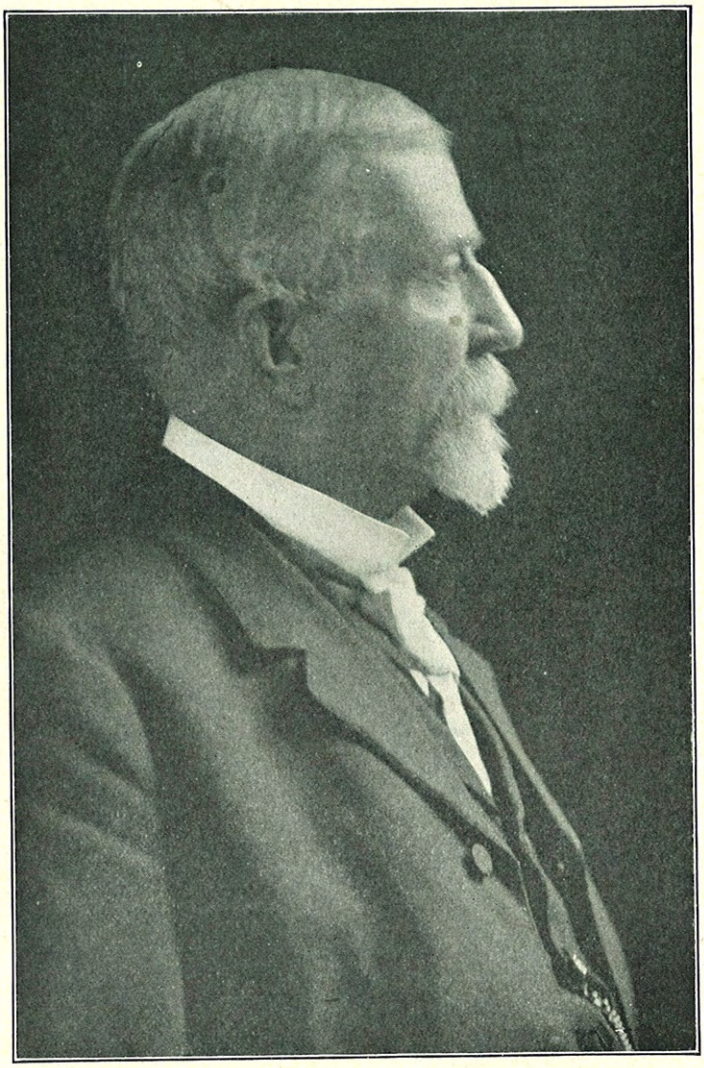

F. L. Goodale

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In reviewing a scientific career, its time and place become factors of the first importance. So rapid has been the advance of knowledge, so swiftly has effort passed to new fields, so intensive has specialization become, that a retrospect even of half a century has grown surprisingly difficult. To form a just estimate of personal achievement it thus becomes necessary to grasp the difficulties of the epoch and to bear carefully in mind the limitations of the environment. Only in this way is it possible to perceive the true nature of the obstacles surmounted, to measure the advance attained, and to appreciate the individual contribution to progress.

George Lincoln Goodale was born at Saco, Me., August 3, 1839, the son of Stephen Lincoln and Prudence Aiken (Nourse) Goodale, and died in Cambridge, Mass., April 12, 1923. His father was a man of energy and rare ability. A pharmacist by early training and profession, he brought his knowledge of chemistry, excellent for the time, to bear upon many problems of economic importance, and his activities in this direction ranged from the preservation of food products to the manufacture of commercial fertilizers. He took a great interest in fruit growing and arboriculture in general. He became a person of importance in his State, and as secretary of the Maine Board of Agriculture for many years edited their copious and well-known reports. In his own publications he dealt with the animal as well as the plant side of agriculture and his Principles of Breeding was a highly regarded treatment of the subject.

His son therefore grew up in an atmosphere charged with intellectual interests and had constantly before him the example of endeavor in the field of applied science. His early attention to chemistry, his choice of medicine as a profession, his attraction to the physiological aspects of plant life, his breadth of scientific interest, and his enduring sympathy with the applied aspects of science, all can be with fair certainty traced to paternal example and training.

In boyhood he spent a year in his father's pharmacy. Then entering Amherst College in 1856 he took the usual prescribed course of the period, coming under the instruction of Prof. Edward Tuckerman in botany and Prof. Edward Hitchcock in geology. He received his A. B. in 1860. For a year thereafter he remained at Amherst as assistant in chemistry. There he began his medical studies, which in the succeeding year were continued in the Portland School for Medical Instruction and later at the Harvard Medical School, where he took his M. D. with distinction in 1863, receiving the same degree the same year from Bowdoin College.

Soon after his graduation at Amherst and during his medical studies he was selected to coöperate in a scientific survey of Maine, an ambitious project which had received the indorsement and support of the State legislature. In this work his duties included botany, chemistry, and some geology, and in 1862 and 1863 he published several reports upon its progress. In these he dealt with the flora of newly explored regions and the chemical analyses of waters from various springs. He held at one time the position of State assayer and also prepared some unpublished geological maps mentioned in the official reports of the survey. These diverse activities were in several ways significant in his career. They brought him into coöperative relations with a notable group of young scientific men destined to make good and become widely known in their respective fields, as, for instance, with C. H. Hitchcock, the geologist, and A. S. Packard, the entomologist, and, what was still more important, his botanical work brought him into correspondence with Dr. Asa Gray. The survey itself lasted but two years and then succumbed to the disturbed conditions of the war time, but even in the few months of its active prosecution attained creditable results and prepared the ground for more intensive cultivation at a later period.

Doctor Goodale's medical practice, though extending through only three years, brought considerable diversity of experience, for, in addition to private practice, he held several official positions, being city physician in Portland, examining surgeon in the Navy, and contract surgeon in the Army. He also taught in the Portland Medical School.

In 1866, being in ill health, he made the first of his longer journeys, going to California by the Panama route, thus gaining his first view of tropical vegetation. His health was soon restored and he extended his journey to several of the Western States.

On his return to Maine he married Miss Henrietta Juell Hobson, to whom he had for some years been engaged and who through a long life was his devoted and sympathetic companion.

Doctor Goodale was in 1868 appointed to the Josiah Little professorship of natural science at Bowdoin College and there taught both in the medical school and in the collegiate work, giving in the latter instruction in chemistry, mineralogy, botany, and zoology, for about four years. In 1872 he was called to Harvard as university lecturer and instructor in botany. In the following year he was advanced to assistant professorship, and in 1878 to full professorship in this subject.

It was his privilege, as well as one of his considerable contributions to science, to relieve Dr. Asa Gray of much routine work in instruction, thus freeing Doctor Gray's time for his long-projected Synoptical Flora of North America, toward which he had been gathering during many years an overwhelming mass of material that only his trained judgment could have treated to equal advantage.

Doctor Goodale's first work at Harvard was his general introductory course in phanerogamic botany, developed chiefly along the lines of gross morphology with ideals similar to those of Eichler, of Sachs's Textbook, and of Gray's lucid Structural Botany. To morphology of such nature he added much of a physiological and an anatomical character dealing effectively with the different vegetable tissues and their component elements, with assimilation, respiration, transpiration, germination, growth, and plant movements, as well as with reproduction, variation, and evolutionary problems.

He was a finished lecturer. Dignified in presence and agreeable in voice, he had an impressive manner which gave weight to the information he imparted. He was never hurried, but chose his words with great care and passed logically from point to point. He was a good extempore draftsman, often sketching on the blackboard in a few well-placed strokes the plant structures or anatomical details he was describing. Each drawing was done with a fine definiteness and the minimum of erasure and correction. He never hesitated to employ the now perhaps too generally discarded method of precise definition of terms or structures. Had this been done with less skill it might easily have tended to the dogmatic, but this effect he cleverly avoided. His auditors were carried away by the clearness of his presentation. He was never tedious, never discursive, though, in a dignified way, often humorous. He had his matter well in hand and there was no repetition, no talking against time, no pause to assist memory. Not given to much theorizing nor to philosophic generalization, he stayed close to concrete facts and in stating them never confused his hearers by over-emphasis of doubts or exceptions. Hundreds of students recall his lectures with gratitude and admiration. It is to be remembered too that these students were the same who daily listened to such teachers as Norton, Shaler, Francis Child, William James, Farlow, Palmer, and Royce, all of them men of great originality and force, distinguished stylists in their respective fields.

In the laboratory Doctor Goodale was less successful than on the platform. He was always kindly and exceedingly courteous to his students, but a trifle impersonal, guiding their work with rather general directions, which often left them in some vagueness as to his wishes. Research in the concrete sense in which it had taken form in the laboratories in France and Germany had scarcely been transplanted to American botanical laboratories beyond the field of taxonomy, and student publication of merit was exceptional before the middle eighties. The elective system had not long been in vogue and was still in its youth. Laboratory equipment was as yet scanty and very imperfect. Its use was chiefly to demonstrate known facts and processes, and almost never for student research. Graduate study was rare and little organized. There was much to change and to develop.

Doctor Goodale was keenly alive to the need of improvement in apparatus, increase of equipment, larger and better laboratories, more commodious auditoriums, and vastly increased and diversified collections of illustrative material. Toward these ends he planned and worked patiently for years. He early realized the importance of publicity for scientific work, and with his special gift as a speaker did much by popular lectures to stir the public to interest in and cordiality toward scientific work and ideals.

He gave several courses of lectures, at the Lowell Institute in Boston, at the Cooper Union in New York, and elsewhere. They were well attended and aroused enthusiasm. Vegetable physiology was in the seventies, eighties, and early nineties essentially novel in America and Doctor Goodale had much skill in demonstrating and explaining, even to popular audiences, the leading facts and fundamental principles of this subject. He was ingenious in devising effective illustrations and was one of the first to give successful lantern projection to moving objects such as currents in protoplasm, the escape of oxygen during the assimilation of aquatic plants, etc. Such vital processes, shown in action upon the screen, naturally attracted no small interest in days when the electric lantern was still unknown and the cinema a thing undreamed of.

Doctor Goodale was a very successful teacher in the Harvard summer school, and through its medium exercised a wide influence upon the methods and ideals of many alert teachers, both men and women, young and middle aged, who took back to their own work greatly increased enthusiasm from a few summer weeks thus spent under his stimulating instruction. They spread his fame in remote parts of the country, and others came to seek like opportunity.

In 1879 Doctor Goodale consented, at the solicitation of Dr. Asa Gray, to undertake the oversight of the Harvard Botanic Garden, and was appointed its director by the president and fellows of the college. This was a task which for several reasons had much difficulty. The garden was unendowed. Its expenses were constantly increasing. The rapid deterioration of the then wooden-framed conservatories, the adverse influences of dust and smoke from a growing city; the carelessness and occasional vandalism of visitors; the scarcity of trained gardeners; the often conflicting ideas of the university boards, of botanical and horticultural colleagues, as well as of the visiting public, regarding the appropriate aims for such an establishment and the lines of development it should be given; the proper adjustment of its functions to instruction, research, experimentation, and acclimatization; its relations to the laboratories and museums; the demands upon the available supplies of plants and flowers for decoration on occasions of academic celebration—all these problems were superimposed upon the inherent difficulties of keeping a host of delicate and costly exotics healthy in cramped space and unfriendly climate. Doctor Gray, who had long experienced such trials, once characteristically remarked that he did not wonder that Adam fell if he had to live in a garden.

With great patience, tact, and evenness of temper Doctor Goodale discharged for many years the duties of this exacting position. The garden under his directorship was kept at a high level of efficiency. It functioned notably as an object lesson in the great diversity of plant life. No less than 7,000 perennial species were often in cultivation there at the same time, as well as a varied assortment of annuals. The conservatories were enlarged and improved. The planting was given a variety of horticultural features to attract the public. Drainage and grading were bettered. An endowment was started. A skilled, Kew-trained gardener was secured, and a liberal policy inaugurated in supplying material not only for the diverse botanical activities in the university but often to neighboring institutions as well.

In the later seventies and early eighties Doctor Gray, relieved of his teaching by his energetic younger colleagues Goodale and Farlow, and of his curatorial routine by the extraordinarily industrious and methodical Sereno Watson, projected an ambitious collaborative work which in four volumes was to summarize the science of botany. Viewed in retrospect, this undertaking can be clearly seen to have involved well-nigh impossible difficulties, and there can be no surprise that it remained unfinished. The first volume was a restatement of external plant morphology by Doctor Gray himself. This subject was fairly concrete. It had already been treated several times by Doctor Gray, whose masterly lucidity and good sense of proportion had long been recognized in Europe as well as America. Furthermore the

subject, though by no means completely investigated, had long been pursued and was relatively well matured. Thus, without inordinate difficulty, Doctor Gray was able to bring out his Structural Botany as the first volume of the proposed series.

The second volume, which devolved upon Doctor Goodale, was to give similar summary of the anatomical and physiological aspects of the flowering plants. Here the conditions were very different. Instead of arranging a selective presentation of subject matter which had in a measure become definite, if not actually static, it was necessary to give, so to speak, an instantaneous view of a host of facts, interpretations, processes, and theories, which were at the time themselves moving, changing, being multiplied, and rearranged with astonishing rapidity.

Plant morphology, the subject treated by Doctor Gray, was in great measure an independent one. Not so plant physiology, where investigation is intimately bound up with chemistry and physics, and its success or failure may depend upon concurrent research in some remote field such as optics or crystallography, the perfection of staining reagents, or unexpected discoveries regarding electrical phenomena.

Doctor Goodale wrote his volume and it appeared in 1885. In the space of about 500 pages he compressed a vast amount of matter, summarizing his subject probably as well as its nature permitted at that time.

There can be little doubt that the work proved disappointing to its author. It was rather too compendious for a laboratory guide, and in the rapid advance of plant anatomy and physiology could not long hold its own as a work of reference. Nevertheless it had some years of great usefulness, and there can be no doubt whatever that it was at its date by far the best work on its subject which had appeared in America. Furthermore, its influence upon subsequent educational works in its field has been considerable.

It has been a matter of widely felt regret that the third volume in the series, which was to have been an introduction to cryptogamic botany by Dr. W. G. Farlow, was never completed.

It is less generally known that a fourth volume was also projected, which Doctor Gray described as "a sketch of the Natural Orders of Phænogamous Plants, and of their special Morphology, Classification, Distribution, Products, &c." This, by his own statement, it was his hope rather than his expectation to draw up himself.

On the completion of his Physiological Botany, as his volume was generally called, Doctor Goodale turned his attention largely to certain pressing matters somewhat euphemistically termed "organization." To those who work in institutions supported by governmental, State, or municipal appropriations, it can scarcely be realized what complications arise in partially endowed institutions ambitiously expanding and constantly forced to take on functions and maintain establishments of increasing expense. To finance such undertakings it is necessary to secure the interest of persons of substance inclined to constructive liberality. The matter is one requiring consummate tact. There must be the ability to attract favorable attention, to present specific needs clearly, to command respect, and to inspire confidence.

In all these requirements Doctor Goodale was exceptionally gifted, and he secured the cordial interest of an extended group of persons, who repeatedly aided his undertakings with liberality and remained throughout life his devoted friends. His soliciting always had a fine dignity. It was clear that it was impersonal in nature, for high purpose and unselfish ends. His largest single undertaking of this nature was to secure the needful funds to build the botanical section of the university museum. This was to furnish quarters appropriate to the existing needs and immediate expansion of the department of botanical instruction, both as to laboratories and lecture rooms. It was to have rooms also for private offices, library, cryptogamic collections, and ample space for museum exhibits of illustrative botanical material which had long been accumulating at Harvard in a somewhat desultory manner, and which, though already including many objects of rarity and value, had never had proper organization. To this material it was Doctor Goodale's ambition to add objects far more attractive to the public.

This building enterprise, of considerable magnitude for its period, was carried through by Doctor Goodale in a surprisingly short time, and was completed in 1890.

It provided for botany at Harvard quarters coordinate with those previously erected for zoology and ethnology and subsequently added for geology and mineralogy. It thus gave the science its proper place in the comprehensive scheme initiated by the Agassizes. The building is of impressive dimensions and has many excellent features. It is a serious businesslike structure in which architectural embellishment has been completely eliminated and the ends sought have been simplicity, space, and durability. It was "mill built." It was a notable advance upon what had previously existed. It must not be judged by standards of construction only at a later date rendered possible by unexpected advances in steel framing, reinforced concrete, electric devices, or metal furnishing.

Having thus secured for the university the needful housing for a botanical museum, Doctor Goodale set himself seriously about the task of assembling exhibits appropriate to popular illustration of his science.

In this task he encountered difficulties of a general and psychological nature as well as those of concrete detail. He was well aware that previous attempts to make a botanical museum a thing of popular interest had met with little success. Plant life itself lacks much of the human appeal which can be aroused by the clever preparator who stages a pair of nesting birds, a beaver diligently engaged in feats of surprising construction, a serpent charming its prey, or an insect astonishingly obscured by protective mimicry. Nor do dried plants compare as museum objects with varied minerals, precious stones or meteorites, nor yet with models of canyons, volcanoes, atolls, and other surprising geological phenomena. Still less are they comparable in popular interest with archeological exhibits depicting primitive humanity in its homely occupations. It was clear that a botanical section in a general museum, if it was to hold its own, must include objects of much greater esthetic appeal than wood samples, fibers, gums, or grains, and far more immediate interest than dried fruits, nuts, or cones. Models would have to be constructed which would give lifelike representation of the plants themselves with details of form and color. This ambition was not a new one, but the results attained, up to that date, in plaster, wood pulp, or wax had been either extremely crude and clumsy or else of a perishable nature.

While seeking a practicable solution of this problem, Doctor Goodale was attracted about, 1885, by some exceptionally lifelike models in glass of marine invertebrates made by Leopold and Rudolph Blaschka. Conceiving that the unusual talent thus shown might attain the desired ends, if directed to plant structures, Doctor Goodale entered into correspondence with the Blaschkas and not long after visited them at their home in Meissen, near Dresden. They were at first reluctant to undertake subjects so remote from their previous experience, but were soon induced to prepare some sample models of flowers and plants.

These were forwarded to Cambridge, but were shattered in transit. Undiscouraged, Doctor Goodale saw even in the fragments such evidence of ability on the part of the artists that he showed the pieces to several influential friends. Among these were Mrs. Elizabeth C. Ware, of Boston, and her daughter, Miss Mary Lee Ware, who took an immediate and gratifying interest in the undertaking and promised it their support. Business details were arranged and the Blaschkas, father and son, entered upon a contract extending through a number of years and securing to the Harvard Botanical Museum their entire output.

The notable, indeed unique, collection of glass models of plants, flowers, fruits, vegetable structures, and anatomical details is too well known to need description. It was entirely and very liberally financed by Mrs. and Miss Ware as a memorial to their husband and father, Dr. Charles E. Ware. Its success as a popular and drawing exhibit was immediate. Within a few weeks of its installation the attendance at the museum greatly increased and at times was more than doubled.

With a central feature so notable, it was then possible to group attractively and with telling effect in adjacent rooms exhibits of much cleverness to inform the public regarding a great variety of vegetable structures and products. To the most telling disposition, protection, and labeling of these Doctor Goodale gave painstaking attention.

During his professional career Doctor Goodale traveled much. He visited Europe nine times and, for a man who had not been educated there, came to have a very unusual familiarity with the foreign laboratories and museums. He was a linguist of ability and acquired a broad knowledge of foreign literatures, public affairs, trade relations, colonial enterprises, tropical agriculture, and a host of matters contributing much to his powers as a broad administrator of a museum.

In 1890 and 1891, in company with a cousin, Capt. (later brigadier general) Greenleaf Austin Goodale, he made a journey of great length visiting Egypt, Ceylon, Australia, Tasmania, New Zealand, Java, and the Straits Settlements, as well as several points in China and Japan. His primary object was personally to view the notable botanical establishments at places like Peradeniya, Buitenzorg, Melbourne, Syndey, and Tokyo, to establish friendly relations with their directors, and to secure by purchase or exchange a choice selection of objects suitable to the further development of the Harvard Botanical Museum and Garden. In these matters he met with gratifying success. Among the exhibits obtained many were unusual and several—such as a living specimen of the fern *Todaea barbara* (*T. africana*) and a gigantic rata log, a lignified aerial root some 5 feet in diameter—were doubtless at their time unique in America.

More and more Doctor Goodale turned his attention to the economic side of botany and took much interest in the problems of tropical agriculture. Among these was the improvement of the sugar cane. To further experimental work in this field the Harvard Botanical Garden was able to establish, through the influence of Doctor Goodale and with the generous financial support of Mr. Edwin F. Atkins, of Boston, a tropical garden and experiment station in Cuba, at Soledad, near Cienfuegos.

Here not only many sugar canes, but a variety of other tropical plants of economic importance, were brought together for observation and experimental purposes. Doctor Goodale made several journeys to Cuba in the interests of this enterprise, which is now being further developed and already forms a notable instance of North American scientific effort brought to bear upon tropical economic problems.

Doctor Goodale was a member of many societies both scientific and social. He was a presiding officer of unusual ability, managing business with smoothness, speaking little himself, but directing cleverly the discussions of others. His good judgment, ready and sympathetic interest, and his uniform courtesy made him a valued member on many committees. He was in 1889 vice president of the American Association for the Advancement of Science, and the following year its president. His retiring address, delivered at Washington, was entitled "Useful plants of the future." He was vice president of the Boston Society of Natural History from 1887 to 1890, and its president during the year 1891–92. He was one of the founders of the New England Botanical Club and was its president from 1897 to 1899. He received the honorary degree of A. M. from Bowdoin in 1869, and of LL. D. from Amherst in 1890, from Bowdoin in 1894, and from Princeton in 1896.

With manifold duties of instruction and administration, the care of the botanic garden, financing and development of the museum, with wide professional correspondence and constant attention to the improvement of working conditions in his science, Doctor Goodale had little opportunity for personal investigation. It is probable he was right in judging that his special talents could be most effectively turned to other ends. However, he had a sympathetic interest in the research of others, and many of his publications took the form of appreciative reviews to give wider publicity to their results.

His writings, though numerous, were for the most part brief. Except for his Physiological Botany, already discussed, he published but one work of size, namely, The Wild Flowers of America. His part in this was to supply appropriate letterpress of a popular scientific nature to accompany 50 colored plates painted by Isaac Sprague, the leading American botanical artist of the period. The task had no great scope, but was conscientiously performed, and the resulting work has been highly prized by many flower lovers and, long anticipating the nature-study publications of the present day, gave popular instruction to many readers who could enjoy its clearly written text and striking, colored plates, though they would have been unlikely

to make use of any work of more technical character. The undertaking well illustrates Doctor Goodale's confidence that science, for its own advancement and best interests, must make popular appeal.

His early writings covered a wide range of subject matter—chemical, medical, pharmaceutical, horticultural, and agricultural, as well as botanical. In later years his publications were mostly reviews, synopses for class use, official reports, and addresses.

From 1888 to 1920 he was an associate editor of the American Journal of Seience, and to this he contributed notes and reviews in considerable number. Many of his early writings were printed in newspapers or in popular journals of a transient nature, and in later years it is believed that he from time to time contributed by request to the unsigned editorial matter of several periodicals, including the Nation.

For these reasons it would be well-nigh impossible at this date to form a complete bibliography of his writings. Happily Prof. Robert Tracy Jackson, while preparing his excellent sketch of Doctor Goodale for the Harvard Graduates' Magazine, took great pains to familiarize himself with his published output and to this end drew up a very full and as yet unprinted list of his writings. This he has generously contributed for use in the present memoir and, with slight emendations, it is here appended. The portrait accompanying this memoir is here reproduced by courtesy of the editorial board of Rhodora.

In 1888 Doctor Goodale was appointed to the Fisher professorship of natural history, a chair long held by Doctor Gray. In 1909, after 38 years in the service of Harvard University and no less than 36 years as professor, Doctor Goodale resigned and was thereupon appointed, by the president and fellows of Harvard College, Fisher professor emeritus and honorary curator of the botanical museum. To the extent that declining health permitted he continued to give the museum his care and thought for more than a decade thereafter, directing its growth, conducting its correspondence, and exerting influence toward its financial support.

With social gifts of an exceptional nature, Doctor and Mrs. Goodale early gained an acquaintance of unusual extent and were able to make their home one of delightful hospitality, where the guest at once felt breadth of sympathy and where conversation naturally turned to matters of importance and themes of interest. They had five children, of whom only two reached maturity, namely, Joseph Lincoln Goodale, who has for many years been a distinguished surgeon of Boston, and Francis Greenleaf Goodale, a lawyer of Weston, Mass., practicing in Boston.

Doctor Goodale's final illness was of a gradual and at times painful nature, but was borne patiently and referred to, if at all, with characteristic humor.

It would be impossible to summarize in a few words the achievements of a life so full of varied activities. It was one of devoted and patient service to science. Its ends were neither spectacular discovery, nor detailed investigation, nor yet the production of technical treatises. Its guiding motives were to improve the conditions of the student, to extend the opportunities of the investigator, and above all to convey to a wider public important messages of scientific truth.

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