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DOUGLAS HOUGHTON CAMPBELL

1859—1953

A Biographical Memoir by

GILBERT M. SMITH

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DOUGLAS HOUGHTON CAMPBELL will long be remembered for his basic contributions to the morphology of bryophytes and pteridophytes. Although the results of many of his investigations were published nearly a half-century ago they are still extensively cited by present-day students of the morphology of these plants. His name is also well known to many others by the frequent appearance of "From Campbell" in the legends accompanying the figures in various textbooks of botany.

Professor Campbell was born in Detroit, Michigan, on December 16, 1859, and died at his home on the campus of Stanford University on February 24, 1953. He was the next to the youngest of the six children of James Valentine and Cornelia (Hotchkiss) Campbell. His father, a judge of the Supreme Court of Michigan, named the son after his long-time friend, the eminent geologist Douglas Houghton. Professor Campbell never married. A few years after coming to Stanford he and the later Professor Robert E. Allardice built a home on the Stanford campus. After the death of Professor Allardice in 1928, Campbell lived there alone except for a Chinese servant.

From earliest childhood Douglas Campbell had a keen interest in natural history and as a small boy assiduously collected insects and flowers, especially during the summers spent on Grosse Isle in the Detroit River. Unlike most other boys making collections, he

read about them in such books as were available in the home library. He also read such general books on natural history as were in his father's library and one of them, Wallace's *Malay Archipelago,* stimulated an interest in the tropical flora that was to continue throughout his lifetime.

After graduating from the Detroit High School in 1878, Campbell entered the University of Michigan. At that time the work in botany in American universities was almost exclusively devoted to the taxonomy of vascular plants. The botanical curriculum at Michigan was somewhat broader than that at many other American universities and the introductory course given by Professor Volney Spalding covered the entire plant kingdom. In this course Campbell used a microscope for the first time, and study of the lower plants introduced him to a wholly new world. It is very probable that Professor Spalding's "Special course for advanced students" was the basis for Campbell's writing (1925): "Doubtless many can recall certain books which have greatly influenced their lives, and in my case one stands out especially—a translation of Hofmeister's epoch-making treatise on the comparative morphology of the archegoniate plants. This book, studied while an undergraduate at the University of Michigan, was undoubtedly the most important factor in determining the trend of my botanical investigations for many years."

After receiving the master's degree in 1882, Campbell became an instructor in botany at the Detroit High School. Here his schedule was so arranged that he could teach in the morning and continue graduate work at the University of Michigan in the afternoon. Even before receiving the doctorate from Michigan in 1886 he began plans to obtain further training in his chosen field of investigation. By living at home and saving his salary he accumulated sufficient funds for two years' study in Europe. There, especially in the laboratory of Strasburger at Bonn, he learned methods not used by botanists in the United States. At that time zoologists had just devised the technique of embedding material in paraffine and

cutting it into serial sections. Campbell saw the value of this method and was one of the first, if not the first, to utilize it for the study of plant material. Always willing to share his knowledge with others he wrote (1888) a full description of this technique for the benefit of botanists. His work in the laboratory of Pfeffer at Tübingen resulted in one of the pioneer investigations based upon the use of vital stains.

Upon returning to the United States in 1888 Campbell became Professor of Botany at Indiana University. Here, as at Michigan and while in Europe, his primary field of research was on the morphology of the gametophyte generation of pteridophytes.

When Stanford University was assembling its first faculty, Campbell was the man selected to head and to organize the Department of Botany. On reaching Palo Alto late in the summer of 1891 he found a university with but few buildings completed. His laboratory was as yet unfinished, but this did not matter. Setting up microscope and microtome on empty packing cases he was hard at work within a few days after arriving in California. When regular instruction began he established a routine that was followed until his retirement in 1925. Arriving at the university promptly at 8 o'clock he went into his combined office and laboratory, shut the door, and was not to be disturbed by students or colleagues until noon. When not busy with classes in the afternoon he was available for consultation, but when visitors' questions had been answered they were not encouraged to linger and chat.

Realizing that Professor Campbell used every possible moment for research, President Jordan deliberately abstained from appointing him to the time-consuming duty of service on university committees. Further time for research was saved by his colleague Professor George J. Peirce who took over routine administration of departmental affairs, although Campbell remained head of the Department of Botany until his retirement in 1925.

Trained in an era when all sections for study under the microscope were cut freehand, Dr. Campbell possessed great skill in this

now-neglected art. His nearsightedness enabled him to section smaller pieces of material than can the ordinary person. For the same reason he was able to trim down fixed material to small critical pieces before embedding in paraffine and sectioning on the microtome. Thus a slide that he prepared contains more serial sections under an inch-square cover glass than do half a dozen slides prepared by many others. Although fully aware of modifications introduced into the paraffine method from time to time, Dr. Campbell preferred following routines that had given good results in the past. An example of this was his continuing the use of bergamot oil for dehydrating and clearing, long after other materials had come into use for these purposes. As a result his laboratory was generally perfumed with the pleasant odor of bergamot oil.

Campbell was not an orderly housekeeper in his office-laboratory. His work table was so cluttered with bottles and dishes that there was scarcely room for his microscope and microtome. Books were crowded onto the shelves any which way. The floor, the two remaining tables, and all except one of the chairs were stacked with piles of reprints and unbound numbers of journals. However, his memory was such that when he desired to consult a particular reprint he knew the pile in which it was to be found and its approximate position in the pile.

Since practically all of Campbell's scientific life was spent at Stanford his reaction when first arriving there is of interest. This is best told in his own words (1938):

"When I arrived in California to join the faculty of the New University which opened in October, 1891, it was near the end of the dry season and probably no rain had fallen for three or four months. . . . A month later, however, there was a magical transformation. With the advent of the autumn rains the whole country quickly turned green, and a profusion of liverworts such as I had never before seen, appeared on the open ground where it had not been recently broken, and on the shaded roadside banks. I soon realized that right in my own back yard, so to speak, was a

wealth of material such as I had never imagined would be my good fortune to encounter. Here were gathered together representatives of all the main groups of liverworts, not only in great numbers, but practically all fertile individuals. . . . Such an invitation to make a comprehensive study of the structure and development of liverworts could not be resisted."

With his continued interest in pteriodophytes and newly aroused interest in bryophytes it is only natural that he took the opportunity to see something of the rich bryophytic and pteridophytic flora to be found in the tropics. Hence it is quite understandable why he went to Hawaii after the close of the first academic year. This was not a vacation trip, but was one in which a wealth of material was gathered for study and for teaching purposes after his return to Stanford.

Research on liverworts led to a desire to write a treatise on bryophytes and pteridophytes in which primary emphasis is given to the structure and development of the gametophytic generation. Numerous original drawings were made in anticipation of writing such a treatise, but library facilities at the new university were wholly inadequate for a comprehensive survey of the literature. President Jordan was in sympathy with the project and Professor Campbell was granted a year's leave of absence for this specific purpose. Because of its unexcelled library, the British Museum of Natural History was selected as the most desirable place to do this. Assigned a table at the Museum, and with all the necessary reference material at hand, Campbell immediately began on the first chapter. Then, as always, he wrote rapidly and once having written did not spend much time rephrasing the manuscript. The task of writing *The Structure and Development of Mosses and Ferns* was essentially completed the year he was in London. At the suggestion of his friend Professor F. O. Bower the manuscript was submitted to Macmillan who immediately accepted it and the book was published in 1895. This treatise, immediately becoming the authoritative work on morphology of bryophytes and pteridophytes, firmly established

Campbell's reputation as one of the leading botanists of the United States. For the past fifty years or more practically every student majoring in botany has used it or the revisions published in 1905 and 1918.

Research activities during the years immediately following publication of *Mosses and Ferns* resulted in numerous papers on bryophytes and pteridophytes, together with several on a new field of investigation—the gametophytic generation of flowering plants. The shift to this additional field may be explained by Campbell's broad interest in phylogeny and his belief that the gametophytic generation is of great value as a phylogenetic index.

Material for the foregoing and for subsequent investigations was collected personally from all over the world. Two sources are available for determining the numerous collecting expeditions that he made. One is the published record. This includes the general accounts of vegetation in many different parts of the world, each account being written shortly after return home. Additional information may be gained by noting the source of material in papers recording the results of his investigations. The second, and far more interesting, source of information is the series of very excellent water-color sketches made while on his voyages. He considered them a substitute for a diary in helping recall places visited and each sketch was labeled with place and date. These sources record the places visited after 1895: Jamaica in the summer of 1898; another year in Europe in 1899-1900; New Zealand and Australia in the summer of 1903; a year spent going around the world via Europe, South Africa, the East Indies, and Japan in 1905-1906; the West Indies again in 1908 and the Mediterranean area in 1910; again around the world in 1912-1913, this time via the West Indies, Europe, the Suez Canal, numerous islands of the East Indies, and home by way of Japan. To continue the list, it was again Hawaii in the summer of 1917; and again New Zealand and Australia in 1921. Several voyages abroad were also made after 1925 but these will not be listed because relatively little material was collected on them.

Each voyage to tropical lands was planned so as to visit areas where specific endemic pteridophytes, especially eusporangiate ferns are to be found; and when the proper locality was reached a careful search was made for the almost invisible gametophytes. Liverworts were not neglected when on such expeditions and fertile material was fixed in the field for study on return home. Of all the places where Professor Campbell worked in the field, his favorite collecting region was (to use the old names) the vicinity of the mountain laboratory at Tjibodas maintained by the Botanical Garden at Buitenzorg, Java. Here he found the flora unusually rich in the type of material he desired. A return to Stanford from any trip did not mean that the collections were placed on the shelf in the hope of studying them at some future date. Within a short time much of the material was embedded, sectioned, and ready for study. For example, within less than two years from the trip around the world in 1905-1906 several papers were published dealing with Anthocerotae and Ophioglossaceae collected in Java.

The foregoing emphasis on Campbell's researches on bryophytes and pteridophytes may have left the impression that he was a narrow specialist without interest in other plants or in other phases of botany. This is far from the case. Wherever he went he was interested in the entire flora and, as already noted, he often published a general account of the flora after returning home from a voyage to some area abroad. These essays form the basis of the *Outline of Plant Geography* published in 1926. The somewhat unfavorable reception this book received was due to a misinterpretation of the author's purpose in writing it. The book was not an attempt to synthesize the views of professional plant geographers concerning the earth's flora. Instead, it was primarily about the features of the vegetation that impressed a botanist on his visits to practically all portions of the globe.

The problem of phylogenetic relationships was one that interested Campbell throughout his entire life. Beginning in 1891 and ending with his last published paper in 1947, numerous articles were written

on this subject. These range from relationships of single genera or families to relationships between broader groups of plants. They also include the problem of the origin of floras of certain regions. During the last decade of his life he became interested in the Wegner hypothesis of continental drift and thought that it offered an explanation for similarities in the floras of South America and Africa. He became an ardent advocate for the hypothesis, and one could always be certain of a lively debate when he discussed the subject with his good friend the geologist Bailey Willis, another octogenarian, who strongly opposed the idea.

Although devoted to research, Campbell did not neglect his duties as an instructor. It is only natural that he was most interested in the special courses that he gave on bryophytes and pteridophytes. When giving them nothing was delegated to an assistant and all work in the laboratory was personally supervised. In these courses there were no elaborate syllabi outlining the work to be done in the laboratory. The laboratory period started off with verbal directions covering what the student was to work out on the slides and the preserved or living specimens that had been brought into the laboratory. The assignment was always more than a student could cover in the laboratory period but he was expected to work overtime until everything had been completed. If material was to be sectioned for examination under the microscope the student was held rigidly to task until proper freehand sections had been cut. The student was on his own as to the manner in which the material should be worked up, but he was expected to have an adequate series of carefully prepared series of drawings after completing the assignment. Going from student to student, Campbell queried each about the work in progress and he was often impatient and sharply critical with the student doing slipshod work. The final day in these courses was devoted to a three-hour examination. The class, which usually numbered about half a dozen students, was seated in a semicircle facing the instructor and questions were fired in rapid succession to one after another. The student was expected to give a correct answer immediately. If

there was not an immediate answer or the answer was incorrect the question was passed to the next in line. The gamut of questions ranged from those of a factual nature to those covering matters of comparison or interpretation. By the end of this period of staccato give and take practically all of the lecture and laboratory material had been covered, and the instructor had a basis for estimating each student's comprehensive grasp of the subject.

Part of Campbell's ability to work so strenuously day after day resulted from keeping himself physically fit. For many years he kept a horse and every day, after leaving the laboratory late in the afternoon, he went for a ride. Evenings were spent in general reading of a non-botanical nature, or if there was a concert one could be certain that he would be in the audience. His social contacts were limited to a small circle of friends, but he thoroughly enjoyed being with them. One event that he looked forward to was the weekly trip to San Francisco on Thursdays to lunch with a group of cronies at the University Club.

Campbell became personally acquainted with many foreign botanists during the course of his numerous trips abroad. On the other hand, when traveling in the United States he never made a practice of visiting botanical laboratories in other universities. Thus, to most of the present-day generation of American botanists he was known only through his writings.

Professor Campbell was elected to the Academy in 1910. He was a foreign member of the Linnaean Society of London, the Royal Society of Edinburgh, the Deutschen botanische Gesellschaft, and the International Association of Botanists. In the United States he was a member of the American Philosophical Society and the American Academy of Arts and Sciences. In 1903 he served as chairman of Section G and in 1930 as president of the Pacific Section of the American Association for the Advancement of Science. He also served as President of the Botanical Society of America in 1913.

KEY TO ABBREVIATIONS

Am. Fern J. = American Fern Journal
Am. J. Bot. = American Journal of Botany
Am. Nat. = American Naturalist
Ann. Bot. = Annals of Botany
Ann. Bryol. = Annales bryologici
Ann. Jard. Bot. Buitenzorg = Annales du Jardin botanique de Buitenzorg
Ber. deutsch. Bot. Ges. = Berichte Deutsche Botanische Gesellschaft
Bot. Gaz. = Botanical Gazette
Bull. Torrey Bot. Club = Bulletin, Torrey Botanical Club
Carnegie Inst. Wash. Pub. = Carnegie Institution of Washington Publications
Jahrb. Wiss. Bot. = Jahrbücher für Wissenschaftliche Botanik
J. Linn. Soc. Bot. = Journal of the Linnean Society (Botany)
Mem. Boston Soc. Nat. Hist. = Memoirs, Boston Society of Natural History
Mem. Torrey Bot. Club = Memoirs, Torrey Botanical Club
Naturwiss. Randschau = Naturwissenschaftliche rundschau
New Phytol. = New Phytologist
Philippine J. Sci. = Philippine Journal of Science
Pop. Sci. Mo. = Popular Science Monthly
Proc. Am. Acad. Arts & Sci. = Proceedings, American Academy of Arts and Sciences
Proc. A. A. A. S. = Proceedings, American Association for the Advancement of Science
Proc. Calif. Acad. Sci. = Proceedings, California Academy of Sciences
Proc. Nat. Acad. Sci. = Proceedings, National Academy of Sciences
Qt. Rev. Biol. = Quarterly Review of Biology
Rep. Brit. Assn. Adv. Sci. = Report, British Association for the Advancement of Science
Sarawak Mus. J. = Sarawak Museum Journal
Sci. Mo. = Scientific Monthly
Scottish Bot. Rev. = Scottish Botanical Review
Stanford Univ. Publ. Biol. Sci. = Stanford University Publications—Biological Sciences
Untersuch. Bot. Inst. Tübingen = Untersuchungen Botanisches Institut, Tübingen

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