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PREFACE

This year the *Annual Review of Entomology* goes to press with eighteen chapters that deal, as is customary, with topics from the many subdisciplines in entomology. Continued is the policy of having a biographical chapter on some outstanding entomologist; in this volume it is on the Comstocks. We hope that the present volume will be as well received as the twenty previous Reviews.

We do have one note of sadness. On May 23, 1974, when still a few months short of sixty years of age, Brian Hocking died after a year of operations, recoveries, and relapses. Born and educated in London, he spent eight years in India before coming to Alberta in 1946. Through the years, he gained a fine reputation as a scientist, teacher, administrator, and humanitarian. His counsel was widely sought, and the *Annual Review of Entomology* has profited from his advice many times—indeed, as has the entire field of entomology. G. E. Ball spoke for all of us at the memorial service for Brian: "We can but temper our sorrow at his passing with gratitude for his life."

We want to thank the guests who helped us select topics and authors at the 1973 meeting of the Editorial Committee, as well as the numerous entomologists who made suggestions. Again, we would like to remind all readers that we welcome suggestions of topics for review (preferably with names of persons who might be able to prepare the reviews). Please send suggestions to Annual Reviews Inc. in Palo Alto or communicate them directly to one of the Editors or Editorial Committee members.

Our former Assistant Editor, Jean McComish, has been succeeded by Louise Libby, who has had the responsibility of processing the present volume. To her and to the compositors and printers we express thanks for their contribution, which is second only to that of the authors of the various chapters.

THE EDITORIAL COMMITTEE

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THE COMSTOCKS AND CORNELL: IN THE PEOPLE'S SERVICE

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John Henry and Anna Botsford Comstock, as a husband-wife team, served Cornell University for over 50 years. Their labors together added two new dimensions, entomology and nature study, to the disciplines under study at the university. Their influence was extended to thousands of students not only in the classroom but also through the hospitality of their home.

Their period of service commenced almost with the founding of the university. They and the university grew and matured together, the impulses of their intellect being in harmony with the spirit of the new center of learning. The university in turn was founded in response to the educational aspirations of a growing nation. The social, scientific, and economic climate of the times is mirrored in the character of these individuals and in the institution that so completely captured their loyalty and devotion.

Because the development of the individuals and the institution are so intertwined, I first consider the Comstocks' contribution in the context of the growing institution and the times that gave rise to it and, secondly, seek from their formula for achievement some guidelines that might be useful in our present way of life.

For information on the Comstocks, we turn first to Anna Comstock's autobiography, *The Comstocks of Cornell* (21). This provides glimpses of their background and early life at Cornell and illuminates, in a personal way, their tribulations and victories. There are several sources by individuals who knew them well—Needham (80), Herrick (73), and Howard (74), all students and colleagues of the Comstocks. These are written with personal warmth and admiration. In addition to these firsthand sources, Comstockian threads run through histories of the institution and its founders (1, 3, 12, 86, 89, 92). There is also material in the Department of Manuscripts and University Archives of Cornell University (not all of which was studied in the preparation of this report).

The contribution of Howard E. Evans to the program commemorating the centennial of entomology at Cornell is acknowledged as a particularly useful source.

His report, "The Comstock Heritage," appeared in full in the departmental publication, *Comstock Comment* (64b) and in abridged form in the commemorative volume (85).

LIFE IN THE EARLY AND MID-1800s

The Comstocks were products of the culture of America in the early to mid-1800s. This was a period of intellectual restiveness and economic austerity. Life was not easy in those times. Ill health was common, with infectious diseases still taking a heavy toll. Religion had a major influence on the general outlook. It offered the prospect of salvation from sin and heavenly reward for those who obeyed the rules; the work ethic of toil, endurance, and suffering, was glorified. Such annoyances as fleas and bedbugs were among life's normal vicissitudes.

Despite the drabness of the daily routine, people believed in the ultimate goodness of man, that enlightenment would conquer evil, and that science would provide the means of ordering the universe and bending it to human ends. One particularly interesting paradox of that era, cited by Bishop (4), is that artistic beauty was rejected whereas esthetic appreciation of natural beauty was accepted. Austerity characterized the decorations of homes and churches—beauty being an instrument of evil—but the beauty of nature was generally appreciated and condoned. Certainly the poets found it an apt object for their expression.

The national culture of the early 1800s reflected a growing appreciation of science, and intensified the conflict between science and theology. People believed that science had utilitarian value in improving the economic capacity of the nation and were eager to sever their dependence on the European centers of science and education and to assert control of their own destiny. One of the foremost centers of such thought was Albany, New York, the state capital. Its influence was felt upon men of government, science, and education, including Ezra Cornell and Andrew D. White.

Recent developments, such as the steam engine, the harnessing of electricity, and the telegraph, provided a preview of science and technology being adapted to useful ends. Men of vision saw prospects of harnessing the vast resources of the country on a scale unprecedented in human history. This excitement inspired efforts to take stock of natural resources, to advance science and technology, and to educate the people. The founding of the Smithsonian Institution, the National Academy of Sciences, and various new colleges was evidence of these national aspirations.

Having savored the flavor of their times, let us now return to the Comstocks.

BACKGROUND AND YOUTH

Ebenezer Comstock moved from Massachusetts to Stephentown, New York, as a young man to seek his livelihood as a teacher. In 1847 he married Susan Allen, believed to be a descendent of Ethan Allen, the famed Revolutionary War leader. Shortly thereafter, Ebenezer heeded the dictum popularized by Horace Greely—"Go west, young man, go west!"—and migrated to Wisconsin to establish a farm.

Their son, John Henry, was born there on February 24, 1849 (22). Then came exciting news of the discovery of gold in California, and Ebenezer joined the gold rush. He died of cholera en route. Back on the farm things went badly for Mrs. Comstock. She lost the farm and began the eastward trek to rejoin her people in New York. Here she earned her livelihood as a housekeeper and nurse. Young Henry was placed in an orphanage and with relatives; at the age of 11 his wanderings brought him to the home of Lewis and Rebecca Turner. Turner was a captain of schooners on the Great Lakes and his three sons had followed him as sailors. The sons had left home before Henry's arrival, and the boy profited from the kindly atmosphere of the home. The Turners provided him a home, and in return he performed chores around the house and farm. These were staunch people, with active minds and an uncommon capacity for lighthearted diversion and activity—perhaps a special need of sailors. Recognizing that the little fellow was too frail for deck duty, Mrs. Turner taught him to cook. At age 15, he began his career as a sailor, serving as cabin boy and cook. The winter season provided him an opportunity for formal schooling, and while aboard ship he had an opportunity to read whatever books were available to him.

Throughout his childhood he corresponded with his mother, and his letters expressed his deep longing for her, even in the congenial setting of the Turner home. Although he saw her but rarely after the age of four, she continued to be a guiding influence in his life. He shared with his mother his goal to pursue a profession and to achieve. The prevailing religious and social attitudes toward austerity, good works, and perseverence became part of his philosophy.

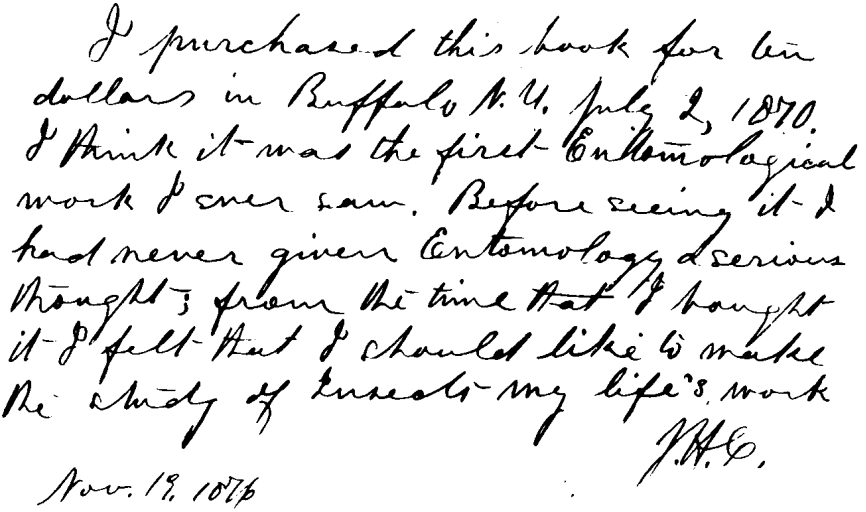
Young Henry was keenly interested in the issues of the Civil War. At 14, he tried to enlist in support of the Union cause but was rejected because of his age and small stature (23).

Comstock's industriousness and capacity for learning were noted by his teachers, and he was encouraged to prepare himself for college. He attended Falley Seminary, a college preparatory school, and in 1869, at the age of 20, he completed his preparation for college. His training was strongly oriented toward the classics, with attention also given to art and music. He had found languages difficult but liked mathematics and all of the natural sciences.

Comstock had been undecided about a career, although he considered medicine and the ministry. His choice of entomology was apparently decided by a chance incident. While in port at Buffalo he went to a book store seeking a botany book, this quest having been stimulated by his interest in the plants of the Great Lakes. He found no botany books but found instead Harris' classic *Insects Injurious to Vegetation* (71). This book, now in the library of the Department of Entomology at Cornell, bears Comstock's inscription[1] (see following page).

Anna Botsford was born September 1, 1854, in Otto, Cattaragus County, New York, the only child of Marvin and Phoeby Botsford. Her parents were well estab-

[1]"I purchased this book for ten dollars in Buffalo, N.Y., July 2, 1870. I think it was the first Entomological work I ever saw. Before seeing it I had never given Entomology a serious thought; from the time that I bought it I felt that I should like to make the study of insects my life's work. Nov. 19, 1876, J.H.C."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J. H. C.

Nov. 19, 1876

lished and active in the cultural and intellectual life of the community. Mrs. Botsford, a gracious and industrious lady, shared with her daughter a keen interest in nature; their field trips together were a source of great pleasure.

Anna attended the local schools and spent two years at Chamberlain Institute and Female College, a Methodist school at nearby Randolph, before enrolling in modern languages and literature at Cornell in 1874. She was of a liberal mind, perhaps because of her father's liberal bent, which was evidenced by his rebellion against the religious dogma of his parents.

This brief review serves to establish similarities and differences between the two at the point of young adulthood. The contrasts are striking. Henry, five years her senior, small in stature, and in poor health, had been a child of misfortune. He was nervous, serious, and grimly determined to make his way. By contrast, Anna had been reared in a secure home in an atmosphere of intellectual stimulation. She had a vibrant spirit, pleasing personality, and attractive appearance. Both had inquiring minds and both were given to questioning the status quo, particularly as it related to theology.

THE EMERGENCE OF ENTOMOLOGY AS A SCIENTIFIC DISCIPLINE

With the Comstocks at the threshold of adulthood and university training, and Cornell University about to open its doors in 1868, let us consider the status of the study of entomology. We tend to forget how young is the scientific method and the discipline of entomology.

The essential biological concepts had been provided by seventeenth, eighteenth, and early nineteenth century European workers. The microscope had extended the

power of observation, the printing press had aided communication, and the species concept had been proposed. Linneaus had provided the binomial system of nomenclature in 1758 (77a); analogy and homology were recognized. There was some grasp of the relationship of anatomy and physiology, genetics, etc. And in 1859, Darwin's *Origin of Species* (64a) provided a framework into which biological principles could be fitted.

The environment in the United States was favorable for the establishment and expansion of the emerging scientific concepts. In 1812, the Academy of Natural Sciences of Philadelphia was formed with an interest in descriptive work. From this early effort came Thomas Say's classic, *American Entomology, or Descriptions of the Insects of North America* (87a). W. D. Peck published on the injurious insects of the New England states and taught at Harvard in the early 1800s. Dr. T. W. Harris, a student of Peck's at Harvard, published a series of papers on life histories of insects and their economic importance which culminated in his 1841 *Report on Insects Injurious to Vegetation* (70a). This classic earned for him the designation as founder of applied entomology in America, and, as we have seen, had a direct influence on Comstock. A. J. Cook began teaching entomology at Michigan Agricultural College about 1867.

In 1846, Louis Agassiz arrived at Harvard, bringing with him a grasp of the natural history of Europe, and there embarked upon his great task as advocate and promoter of natural history in North America. The influence of this charismatic leader was to be felt throughout the land and in a special way at Cornell.

In New York, the state legislature appropriated funds for investigation of insect losses. Dr. Asa Fitch headed the effort from 1854 to 1872 and is generally regarded as the first state entomologist. Workers in other areas, including B. D. Walsh in Illinois, C. V. Riley in Missouri, A. R. Grote in Buffalo, and E. T. Cresson in Philadelphia were gaining recognition. A. S. Packard, a student of Agassiz, published *A Guide to the Study of Insects* in 1869 (84a). The "Missouri Reports," by C. V. Riley, began in 1869.

In the federal government the Bureau of Agriculture was established in 1853 with Townsend Glover as entomologist. Efforts in the United States were enhanced by the pioneering work in Canada by Rev. C. J. S. Bethune and Dr. William Saunders and by the establishment of the Ontario Entomological Society in 1870.

Thus by 1869, when Comstock arrived at Cornell, the prerequisites for the emergence of entomology as a discipline had been met. Comstock was to come under the direct influence of the work and personalities of most of the individuals cited. He was to devote the rest of his life to synthesizing and recording this accumulated knowledge of insects.

THE INSTITUTIONAL SETTING

Higher education in the early to mid-1800s had been in the doldrums, becalmed on the sea of tradition and religious dogma but with clear signs of storms ahead. Following the Civil War, there was a great surge of national aspiration, which had

its roots in the idealism of the founding fathers, the desire to "bind up the wounds," and the pragmatic need to move from an agricultural to an industrial society.

The idealism espoused by Franklin and Jefferson was gaining popular support. They believed in a free society in which the search for truth should proceed unfettered by civil and ecclesiastical control; they further believed that the utility of knowledge, together with its acquisition and dissemination, was an appropriate concern for a university.

These national stirrings were reflected in the concept of a new kind of college: a college in the people's service. The plan had a vigorous proponent in Congressman Justin S. Morrill of Vermont, the able son of a blacksmith and himself a man with little formal education. In 1862, the Morrill Land Grant Act was passed providing funds for "at least one college where the leading object will be, without excluding the other scientific and classical studies, . . . to teach such branches of learning as are related to agriculture and the mechanic arts, . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life." (5) It is interesting to note that this legislative landmark came at a low point in the national outlook: the country at that point was locked in the bloody conflict of the Civil War. At last legislation was provided through which the classical educational tradition could be broken.

The Land Grant Act provided the stimulus for the founding of Cornell. Its founders were an unlikely team: Ezra Cornell and Andrew D. White. Cornell was a self-made, shrewd business man, as well as a farmer, developer, and politician. His early partnership with S. F. B. Morse in developing telegraph lines led to financial success. His wealth weighed heavily on his social consciousness. He had the will, resources, and vision to support the university concept but not the intellectual endowments to lead it. These were provided by Andrew D. White, a colleague in the state senate. The son of affluent and educated parents and a graduate of Yale, White was in many ways Cornell's opposite. He had traveled widely to the European centers of learning and had the advantage of experience as a faculty member at the University of Michigan. For a number of years, he had contemplated the organization and philosophy of a new kind of university.

Both White and Cornell were distrustful of clerical control of the university. Of this controversy White said, "More and more I saw that it was the conflict between two epochs in the evolution of human thought—the theological and the scientific." (95) In addition to freedom from clerical control, White and Cornell wanted university training to be available to all who desired it and to provide studies relevant to practical needs.

In October 1868, the new university opened its doors, with Cornell its founder and White its president. Leaders of the arts and sciences assembled to give their blessing to this unorthodox undertaking. The essence of the Morrill Act is reflected in the remarks of Cornell at the dedication.

> I hope we have laid the foundation of an institution which shall combine practical with liberal education, which shall fit the youth of our country for the professions, the farms, the mines, the manufactories, for the investigations of science, and for measuring all the

> practical questions of life with success and honor . . . Finally, I trust we have laid the foundation of a university—an institution where any person can find instruction in any study.

White followed, stating the ideals he held for the university:

> The close union of liberal and practical education.
>
> The principle of unsectarian education.
>
> A living union between this University and the whole school system of the State.
>
> Equality between different courses of study. . . .

Louis Agassiz, the most influential man in natural history in North America, added his benediction (6):

> I hope I shall live to see the time when all the old colleges will draw fresh life from this young university, when they will remodel their obsolete methods and come up to the mark.

The spirit and zeal of the founders for this enterprise was in sharp contrast to their attitude to earlier educational philosophies, which White had termed "as stagnant as a Spanish convent and as self-satisfied as a Bourbon duchy" (7).

The resident faculty consisted of a handful of outstanding young individuals recruited by White. These were backed by a nonresident faculty of distinguished leaders in the arts and sciences. White soon learned that the few established scholars sympathetic to his concept could not be lured by money from their assignments to join his effort. He therefore arranged for a nucleus of these individuals to serve as nonresident professors, to offer lectures and stimulate the young faculty and students. Of this arrangement White (93) commented, ". . . the former [nonresident faculty] shook the bush and the latter caught the birds."

White sought the advice of Agassiz, one of the nonresident faculty members, on a leader for natural history. Agassiz recommended his student, Dr. Burton G. Wilder, a graduate of the Lawrence Scientific School and Harvard Medical College. Wilder had served as a surgeon in the Civil War. His broad training and interests included zoology, entomology, physiology, anatomy, and hygiene. He was a superb lecturer and stressed the value of laboratory and field work, at that time a novel approach to training. By education and temperament, he was well adapted for such a leadership role.

White and other early founders felt a great debt of gratitude to Agassiz. This was acknowledged in part by the tablet erected in 1884 in the Cornell Memorial Chapel, which bears the inscription:

> To the memory of Louis Agassiz, LL.D. In the midst of great labors for science, throughout the world, he aided in laying the foundations of instruction at Cornell University, and, by his teachings here, gave an impulse to scientific studies which remains a priceless heritage . . . (94).

EARLY YEARS AT CORNELL

Comstock entered Cornell in 1869, a year after its founding. Several features of the new school met his needs: the freedom from clerical control, the stress on natural history, the chance to elect the courses he wanted, and the opportunity to work to defray expenses.

In 1871, Comstock was chosen by Dr. Wilder to be his assistant. Wilder wrote of his first meeting with Comstock (24):

> . . . as if in answer to my prayer, suddenly there appeared a brown haired, blue eyed youth, a little older than the average freshman, with an expression both serious and alert. He introduced himself as John Henry Comstock, newly admitted to Cornell, wishing to become a naturalist, and willing to help himself by work. His aspects and desires appealed to me. Few words were needed for him to appreciate the conditions and their remedies. He hung up his coat, found water and utensils, and attacked the situation like an inspired anthropomorphic squirrel, bringing order out of chaos in a surprisingly brief period.

In Comstock's role as assistant to Dr. Wilder, he had an opportunity not only to be exposed to Wilder's methods and views but to become acquainted with the great minds in natural science, the physical sciences, and the arts that were attracted to the growing university. His interest in maintaining contact with the full stream of intellectual thought on campus was a hallmark throughout his career. He formed fruitful associations with intellectual leaders of the campus. Years later, in speaking of his associates, Mrs. Comstock's greatest accolade was reserved for Wilder (25): ". . . Henry's special patron saint, always at hand to help, to offer suggestions, and to give encouragement."

In 1872, with a professor in entomology still not engaged, a petition was submitted to the natural history faculty by 13 students, who requested that "permission be given to J. H. Comstock to deliver a course of 10 or 12 lectures during the present trimester upon Insects Injurious to Vegetation" (26). It is interesting to note that the title of the lecture series was identical with the title of Harris's book. Thus, the first entomology offered at Cornell was economic entomology. Among the students signing the petition was David Starr Jordan, who later became president of Stanford University and engaged the support of the Comstocks in establishing programs there.

Dr. Wilder encouraged Comstock to study with H. A. Hagen at Harvard during the summer of 1872. This proved to be a memorable experience and broadened his perspective. The Harvard and Hagen influence on Comstock has been debated. The exposure was of relatively short duration and he also studied at Yale in 1875. Comstock himself said of the experience (75), "And it was a wonderful course. Years afterwards when I gave a course of lectures on insect morphology myself I would go back for data to my notes on these lectures."

The success of Comstock's informal lectures led to his appointment as instructor of entomology in 1873. In June 1874, Comstock was graduated with a Bachelor of Science degree, the only degree he ever received. He was among the 70 out of 300 entering freshmen to finish. In 1876, he was appointed assistant professor.

The spirit prevailing at the young university was described by David Starr Jordan (8):

> The early years of my Alma Mata, though relatively crude and cramped, were enriched by an enthusiasm hard to maintain in days of prosperity. And the pioneer impulse far outweighed to our minds, any deficiency in coordination, equipment or tradition. At that time we were all young together, freshmen students, freshmen professors, freshmen president, without experience or tradition to guide or hinder.

Not only did Comstock have the support and encouragement of Wilder and others, but also of President Andrew D. White. Years later Mrs. Comstock wrote of White's influence (27):

> President White's most remarkable quality, the sign and seal of his genius, was his equal vision in the various fields of thought and education. His training had not been in the sciences and yet, far more than most scientists, he foresaw what a part their work was to play in the development of the world. Thus it was that he, in those days of beginnings, was the sympathetic helper and the inspiration of every man teaching science in Cornell. It was his vision that planned for the teaching of economic entomology at Cornell, although at that time this science was scarcely known.

In February 1875 Anna Botsford enrolled in Comstock's class. They became well acquainted through meals shared at Sage College and began to take walks together. But Anna remarked to her mother, "Mr. Comstock is noted for being a young man who is a sort of general friend to young women of his acquaintance but never wastes any sentiment upon them" (28). Both of them had had romances which fell by the wayside, hers because "it was too emotional to meet the realities of life" (29); his because of the death of his fiancee through tuberculosis.

Their association grew and on October 7, 1878, Anna Botsford and John Henry Comstock were married at her home. There was no time for a honeymoon because Henry had to return to his teaching. Mrs. Comstock reports that immediately upon establishing their home they began entertaining Professor Comstock's students, a custom they continued for 40 years (30).

With the degree awarded and with an appointment as assistant professor, Comstock immediately established contact with the agricultural leaders of the state. The Western New York Horticultural Society engaged him for their program in 1876 and named him entomologist for their organization. He was later cited as the first of Cornell's resident professors to venture into the untried field of extension teaching (90). His influence was extended by an arrangement with Dr. E. L. Sturtevant, head of the State Experiment Station at Geneva, whereby he worked for the station ($100 per year plus travel expenses).

In 1878, C. V. Riley, Entomologist, Department of Agriculture, invited Comstock to accept a special assignment to investigate the cotton worm, which was then threatening the cotton crop in the southern states. This experience brought Comstock into contact with many entomologists and provided him with new insights in economic entomology. His report on this work (44) appeared in 1880 and was well received by farmers and colleagues. Among those offering accolades on the publication were his Harvard mentor, H. A. Hagen, and Charles Darwin.

U.S. ENTOMOLOGIST, DEPARTMENT OF AGRICULTURE, 1879–1881

L. O. Howard, a former student, urged Comstock to apply for the position of U.S. Entomologist when it became evident that C. V. Riley would resign. This Comstock did, taking leave of absence from Cornell. The directness of Administrative protocol is indicated by the longhand letter of appointment (63) from Commissioner W. G. LeDuc, which is quoted in its entirety: "You are hereby appointed Entomologist of this Department, said appointment to date May 1. You will at your earliest convenience take the necessary oath of office and report for duty."

Thus, at age 30 and largely self-taught in entomology, Comstock assumed a key position of leadership. The staff consisted of Comstock, L. O. Howard, and Theodore Pergande. With his usual industry and supported by his wife, Comstock entered upon his new duties. He turned to the leading taxonomists for assistance, traveled to the sites of insect outbreaks, made contacts with the organized groups and leaders of entomological effort in the United States and Canada, arranged contributions to the leading agricultural journals, and concentrated on comprehensive reports that would have enduring value. He seems to have had no difficulty in keeping before him the interests of both his scientific peers and his farmer constituency.

His studies of scale insects, occasioned by their threat to the citrus industry, resulted in three papers (45–47) dealing with the systematics of Coccidae that appeared between 1880 and 1883. These papers, well-illustrated by his wife and complemented by Howard's contributions on the parasites of scale insects, represented major additions to the literature.

In 1881, because of a change in the political control of the government, Comstock was replaced by C. V. Riley. He claimed to feel no great personal disappointment but spoke out against "a system, the existence of which should make the heart of every lover of our glorious country ache with shame." (31)

Short though his tenure had been, it had given him many contacts with entomologists throughout the country, and through his publications he gained recognition as a rising entomologist of exceptional ability.

He immediately turned his attention to opportunities at Cornell. From Washington he wrote to his wife (32):

> And how much we have grown in the past two years! We will take up the work at Ithaca with much more confidence. We will have a happy home. We will give my students the best facilities for obtaining an entomological training that can be found in the world. And we will do some original scientific work.

BACK AT CORNELL

The Cornell scene must have been inviting despite the hard work facing the Comstocks in terms of decorating and landscaping the new home and writing reports. Certainly there must have been a sense of relief in moving from the political

tug-of-war on the Washington scene, for which Comstock's temperament seemed ill suited.

Back at Cornell (August 1881), things got off to a good start. The University raised the annual salary of assistant professors from $1000 to $1200. Comstock was given a new laboratory and a telephone—"a great luxury." He plunged into three consuming tasks: (*a*) developing a base of support for the emerging department, (*b*) perfecting the teaching and (*c*) providing written materials to support the teaching. The support base he envisioned required facilities for studying living material, an insect collection, and photographic equipment, all of these new. He had earlier obtained the first microscope at the university. He convinced President White that it was important to add to the insect collection. He later persuaded I. T. Roberts, Director of the Experiment Station, to allocate funds provided by the Hatch Act (1888) to build an insectary, the first in the world.

Mrs. Comstock, with her husband's encouragement, completed her degree in 1885, getting "more training in the sciences allied to entomology." In addition, she was perfecting her skills as an illustrator and laying the foundation for her work in nature study.

Professor Comstock's goal in teaching was to provide a sound course in general entomology from which later specialization could be developed. The Wilder influence was evident in Comstock's insistence on live material in its natural setting. To take advantage of favorable collecting in the summer, he arranged a novel summer school program. The announcement states (33): "It is planned to have the work of each student, as far as possible, an original investigation." The success of the first full-time summer school session drew editorial comment in the Cornell *Daily Sun* (Sept. 25, 1885). The editorial states that the summer heat and rigor of the course insured that only those with unusual interest pursued the subject. Twelve students were enrolled and each spent time on a taxonomic group of special interest. The plan involved full-time effort divided between field collecting and work with material brought to the laboratory for further study. Comstock's investment in the effort is indicated by the annual report of the president, in which Comstock's teaching load is listed as 3 hours of lecture and 42 hours in laboratory (9). With obvious pride, Comstock cited in his annual report that original work was required of his students and that the work of one of them was included with the student as sole author (62).

We tend to think of the progress of leaders as having been made in great strides. Comstock found satisfaction in modest steps. He reported with enthusiasm to his wife (34), "One of the good things so far is the discovery of the eggs of the peach-tree borer."

The student training method developed by Comstock included active involvement with insects and independent investigation as the companion to classroom lectures. In the process of conducting research, training was provided for students as an integral part of the whole process. The intimate interaction between teaching, research, and extension has been a hallmark of the philosophy and methodology at Cornell, in part because of the influence of Comstock and others of his era, who reacted against the earlier classical methodology in which action and student partici-

pation were secondary. Added to this training program was the gracious hospitality of the Comstock home. Cornell University from the start encouraged foreign students, and they had a special appeal to Mrs. Comstock. Thus the Comstock influence on students included both the social and the academic spheres, and it extended beyond national boundaries.

In addition to teaching at Cornell, Comstock accepted the invitation of his old associate, David Starr Jordan, then president of Stanford University, to offer lectures there in the winter (1892, 1894). This effort led to the founding of a Department of Entomology at Stanford, with Comstock's student Vernon L. Kellogg as its head (1894–1920) (35).

As Comstock's duties increased, he found it difficult to do justice to faculty responsibilities, administration, and his own program of teaching, research, extension, and writing. To lighten his load he added a full-time assistant, Mark Vernon Slingerland in 1890 (36). Slingerland's interests were on the applied side, and he acquired great skill as a photographer and investigator in economic entomology.

In 1896, Alexander D. MacGillivray joined the staff and assumed responsibility for the laboratory phase of the introductory entomology course. He followed the pattern that Comstock had so carefully developed. He had a special interest in taxonomy and greatly expanded the insect collection by drawing on material collected by the students. MacGillivray was described by Comstock as "an excellent drillmaster" (81). With able individuals now providing support in taxonomy, applied entomology, and teaching, Comstock, while keeping a weather eye on the entire effort, became more withdrawn in his research and writing.

The Comstocks' Publications

Mrs. Comstock said of their writing (37): "Our writing was the thread on which our days were strung, despite a thousand interfering activities." Indeed it was. Each of them laid out ambitious plans for publishing and proceeded with remarkable discipline and energy to fulfill them. Over the next 40 years he published eight books and she six (see Table 1). In 1893 the Comstock Publishing Company was formed. Despite dismal predictions, it was tremendously successful and was bequeathed to the University in 1931, becoming part of Cornell University Press.

When the increasing student load interfered with writing, Professor Comstock changed his schedule to devote from 4 AM to 8 AM each day to writing. This meant retiring early, and Mrs. Comstock often entertained the guests or represented the family at social functions to enable him to adhere to this schedule.

Mrs. Comstock writes of his study of wing venation (38):

> I remember how faithfully he worked week after week and month after month before he began to see light. I was never so impressed by my husband's patience and dogged perseverence in search of truth, as when he was feeling his way in the dark trying to find a logical, clear classification of the moths and butterflies by the record of their wing veins. . . . Finally he found the thread to the labyrinth in the division of the Lepidoptera. . . .

The writing and publishing project was very much a partnership. It is not entirely clear from the authorships who had primary responsibility for certain of the vol-

Table 1 Books published by the Comstocks

Year	John Henry Comstock	Anna Botsford Comstock
1888	*An Introduction to Entomology* (48)	
1889	*The Elements of Insect Anatomy*, with V. L. Kellogg (61)	
1895	*A Manual for the Study of Insects*, with A. B. Comstock (56)	
1897	*Insect Life* (51)	
1903		*Ways of the Six-footed* (13)
1904	*How to Know the Butterflies* (59)	
1905		*How to Keep Bees* (14)
1906		*Confessions to a Heathen Idol* (15)
1911		*Handbook of Nature-Study* (17)
1912	*The Spider Book* (52)	
1914		*The Pet Book* (19)
1916		*Trees at Leisure* (20)
1918	*The Wings of Insects* (53)	
1924	*An Introduction to Entomology* (55)	

umes. Comstock is cited as the author of *Insect Life,* with illustrations by Mrs. Comstock. The literary style of the volume, as well as that of *How to Know the Butterflies,* seems clearly that of Mrs. Comstock. In addition, both volumes are laced with poetic quotations that seem more a medium of her expression than of his. One cannot imagine him commenting (60) as follows on the honor paid to S. H. Scudder in having a butterfly named for him:

> Surely it must be one of Mr. Scudder's compensations for a lifetime of infinitely patient and loving research in the habits of butterflies that this beautiful little creature bears his name. Far better to have a name preserved on glinting wings than on tablets of stone, for stone crumbles in the course of time; but every summer when the wild roses bloom through all the future centuries this butterfly will come and tell to a glad world that the life of a great and noble man was lived in close touch with Nature.

Reaction to the naming of a mealy bug (*Pseudococcus comstocki*) for Comstock is not reported—it is a species that comes each year to plague growers.

A notable feature of Comstock's books was his special effort to make each publication as helpful as possible to "teachers and learners." This guiding principle is well expressed in his preface to *A Manual for the Study of Insects* (57). Once a book was published, Comstock continued to study its usefulness in the hands of students. His personal copy of *An Introduction to Entomology* contains the marginal note at one point in a key, "the students have trouble here." At other points he notes how format could be improved.

Two of Professor Comstock's publications well illustrate both the synthesis of new thought and the breadth and orderliness of his grasp of the discipline of entomology. The first was his contribution (49) to the volume honoring 25 years of service by his friend and mentor, Dr. Wilder, and was entitled, "Evolution and