



L. O. Howard, 1925



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LELAND OSSIAN HOWARD: A HISTORICAL REVIEW

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Leland Ossian Howard had a long, outstanding career in entomology. He was a leader, a pioneer on the entomological frontier in the years before the relationship and importance of insects to agriculture and health were known or suspected.

Dr. Howard was an entomologist of the US Department of Agriculture from 1878 to 1931 and was in charge of the entomological work of the Department from 1894 to 1927. During those years he was in the forefront of insect studies that propelled entomology from a nebulous state to full recognition as a legitimate branch of biological science. His thoughts and actions touched the lives of millions of people, and he was highly esteemed, even revered, by many persons. Today, Dr. Howard is a legendary figure to most entomologists, but a look into his life and achievements can acquaint us with a great American entomologist, indeed a great American.

The story of Dr. Howard's life and activities is disclosed in his autobiography, *Fighting the Insects* (28), and additional information can be deduced from *A History of Applied Entomology* (26). Further, his achievements are well documented by several authors (1, 2, 31, 32, 33, 37, 39, 40, 41). And lastly, the memories and thoughts of living persons who worked with or knew Dr. Howard reflect our current views of this multitalented man.

YOUTH AND EDUCATION

Howard was fortunate in being born into a cultured family and in growing up in an environment that fostered wholesome development of mind, body, and spirit. His father was a lawyer, his paternal grandfather was a physician and amateur astronomer, and other forebears were clergymen, farmers, and scientists. On the maternal side, he was related to Professor E. C. Pickering, Harvard astronomer, and to Dr. Charles Pickering of the Philadelphia Academy of Sciences. Other relatives, prominent authors, soldiers, and statesmen, included General O. O. Howard, Senator J. M. Howard, President William Howard Taft, and Secretary of State, Henry L. Stimson.

Leland was born June 11, 1857, in Rockford, Ill., the eldest of three sons of Ossian Gregory Howard and Lucy Denham Thurber Howard. While Leland was an infant, the family moved from Rockford to Ithaca, N.Y., where the father joined a law firm. In the beautiful hills, valleys, and gorges around Ithaca and Cayuga Lake, Leland led the life of a typical outdoor-loving youngster. He rowed and sailed on the lake, camped in the woods, fished in the streams, played games, practiced on the piano, sometimes against his will, went to the Presbyterian Church and Sunday School, and attended Ithaca Academy and a Latin school.

Leland's interest in natural history was aroused when, as a boy of 7 or 8, young friends told him that beautiful moths would emerge in the spring from cocoons collected in the fall. When this actually happened, Leland was fascinated with the cecropia and promethia moths and began to collect moths and butterflies. He also observed the transformation of wrigglers to adult mosquitoes and noted that the insects died when kerosene was poured on the surface of the water. His parents encouraged Leland's interest in insects and gave him books on them—first, *The Butterfly Hunters* by Mary Treat, and when he was 10, *Insects Injurious to Vegetation* by T. W. Harris. When he was 13 or 14, Leland, through his own collecting and that of a friend, established the arrival time of the European cabbage butterfly (*Pieris rapae*) in the Catskill Region of New York.

Leland and his friends were avid collectors, vying for the most spectacular and unusual insects. Their interest was so great that they formed the Ithaca Natural History Society, held weekly meetings, read papers, and discussed insect habits. Leland met Professor John Henry Comstock when they were independently collecting in a field of blossoming buckwheat. Comstock introduced himself as a teacher of entomology at Cornell University and invited the lad to visit him. This was an auspicious meeting, leading to a lifelong, treasured friendship between the two and eventually to a career in entomology for the boy.

The elder Howard died unexpectedly when Leland was 15 years old. Mr. Howard had wanted his son to become a lawyer by studying in a lawyer's office, as he had done, but the mother thought the boy should go to college. Leland passed the entrance examination for Cornell University on his 16th birthday and registered as a freshman in September, 1873. Although he contended that his early interest in nature study and insects was cursory, that he merely collected insects instead of postage stamps, coins, or other objects, he seemed naturally disposed toward biology and wished to study natural history. Against his own inclinations, but following the advice of his mother's friends, many of whom were faculty members at Cornell, Leland enrolled in civil engineering, a field that promised gainful employment instead of a poorly paid professorship in natural science. Leland did not excel in engineering, however, and soon failed differential calculus. Without telling his mother, he dropped engineering and enrolled in natural history courses and others that appealed to him. The latter included French, German, and Italian. His knowledge of these languages, especially French, which he spoke fluently, was a great asset later when he became an international ambassador for entomology.

Leland was Professor Comstock's first laboratory student. In this status he was introduced to the classics of entomological writing—works by Curtis, Fitch, Reau-

mur, Walsh, Westwood, and others—and he heard such celebrated visiting lecturers as Louis Agassiz and C. V. Riley. He graduated in June 1877. His graduate thesis was on the respiratory system of the larva of *Corydalis cornuta*.

As an undergraduate, Leland participated in many extracurricular events. He played baseball and football on class teams, rowed on the crew of the Tom Hughes Boat Club, played whist with his Delta Upsilon fraternity brothers, and edited a magazine. Leland was musical, as were his parents, and he sometimes sang in the church choir where his mother was soprano soloist. He also sang in the University Glee Club and played the bass viol in the Curtis Society Orchestra.

After graduation from Cornell, Leland wanted to become a natural history teacher. But his mother's friends again advised that profitable employment was not available in this field, and he was persuaded to enroll in medical studies. That year, one of the most enjoyable of his life, he worked enthusiastically with Simon Henry Gage in the laboratory of Professor Burt G. Wilder, studying natural history, comparative anatomy, histology, and related fields of biological science. Years later Leland was awarded a Master of Science degree by Cornell for his graduate work there and the fulfillment of other requirements. His Master's thesis was on the morphology of the Chalcididae. The graduate year at Cornell ended Howard's formal education, except for some time in the 1880s when he entered Columbian College (now George Washington University) as a night student in medicine. Although circumstances prevented him from completing the course, George Washington later awarded him an honorary degree.

EMPLOYMENT

In July, 1878, C. V. Riley, Entomologist in the US Department of Agriculture, Washington, DC, upon the recommendation of Professor Comstock, invited Howard to become his assistant at a salary of \$100 a month. Howard wanted to accept, but University professors and other friends advised against it, saying that the position probably would never be sufficiently remunerative to permit him to marry and live comfortably. His grandmother remarked that she wished Leland was not in "such a trifling business" (28). However, Professor Wilder told him, "... naturalists as a rule did not care at all about money, and not especially about comfort; that naturalists were born and not made, and that he thought on the whole that I was a born naturalist" (28). Howard concurred with Wilder's opinion, accepted the offer, and went to work in Washington in November, 1878. Although it was not evident for some years, his decision was a wise one, leading to opportunities to serve mankind and to gain international recognition.

At first Howard was greatly disappointed in his position because his work was more that of a clerk than a scientist. After a few weeks, however, Riley asked his assistant to prepare a manual on silk culture. This was done satisfactorily and was soon published under Riley's authorship. Regarding this plagiarism, Howard (28) wrote, "In those days it was the custom of scientific men to take all credit for work done by assistants. This was considered quite ethical, in fact, the proper thing to do. The assistants accepted the situation, not because it was right, but because

there was nothing they could do about it . . . it resulted that my chief signed everything I wrote, and often without changing a word." Six or eight months after Howard started work, Dr. Riley resigned and was replaced by Professor Comstock. Plagiarism continued, and Howard did not object, but when he reached an authoritative position, he rejected this practice and gave full credit to his fellow workers.

After 2 years with the federal government, Professor Comstock returned to Cornell and Professor Riley was reappointed US Entomologist, a position which he held from 1881 to 1894. During this period Howard was Riley's first assistant, was given more and more responsibility, and was appointed Chief of the Service in June, 1894, shortly after Riley resigned. He held that title, or Chief of the Bureau of Entomology, as the organization was designated in 1904, until October 1, 1927, when he reached age 70. He remained with the Bureau as a consultant, mainly in biological control, for nearly 4 years more and retired permanently on June 30, 1931.

During Dr. Howard's years in the Department of Agriculture, entomology became an established scientific discipline, and while he was Chief of the Bureau of Entomology, service to the public grew tremendously. Studies of economic species increased in agricultural colleges and experiment stations, more people were trained in colleges and universities, Bureau of Entomology personnel increased from five or six people to hundreds, field stations were set up in the United States for the investigation of specific problems, and laboratories were established in foreign lands for the study and possible importation of parasites and predators. Advances were made in chemical control of insects. Laws were enacted for the purpose of preventing the introduction and spread of injurious insects. Specialists in other disciplines—pathologists, physiologists, agronomists, chemists—were enlisted to assist in the fight against insect and mite pests. Annual federal appropriations for entomology increased from \$30,000 in 1894 to about \$3,000,000 in 1927. Dr. Howard fathered the work done under the auspices of the Department of Agriculture and strongly influenced that done by other organizations.

RESEARCH

The nature of Howard's earliest research as a federal entomologist is uncertain because it was not published under his name, but it is likely that it involved rearing, life history studies, and control. Regarding his work under Comstock as chief, Howard (28) stated, "We worked very ardently, and I wrote many papers, some of them based on careful, original investigation. Much to my discomfort, Comstock cheerfully assumed the authorship of these papers, and I entered no protest. I had worked up two of them as a basis for a thesis for a Master's degree at Cornell, but when Professor Comstock asked me to let him publish them in his Annual Report, I consented, and thus their titles do not appear in my personal bibliography. But I enjoyed the work, and we published in Comstock's Annual Report some excellent articles about the life histories of several important crop pests."

In fairness to Professor Comstock it should be noted that in his Annual Report for 1881 (3) three new species of parasitic Hymenoptera were described by Howard

(7). Also in Comstock's account of the sugar cane beetle, he (3) wrote, "The principal source of our present information respecting this insect, in addition to what has been learned through correspondence with planters, is the result of an investigation made during the month of March, 1881, by my assistant, L. O. Howard, who was sent to Louisiana by the department for the purpose of studying this and certain other important insects."

Dr. Howard's best known and most extensive research was in systematics, biological control, and medical entomology.

Systematics

Dr. Howard's earliest taxonomic articles dealt with parasitic Hymenoptera. The first (5) was a description of *Euplectrus comstocki*, a parasite of the cotton worm, an insect of much concern in the South. This was followed by descriptions (6) of *Eupelmus reduvii*, reared from eggs of *Reduvius novenarius*, and *Eupelmus floridanus*, bred from an unknown tineid larva. Three new species, *Entedon diastatae*, *Encyrtus artaceae*, and *Pteromalus calandrae*, were described in the next article (7). His first major contribution (8) was "Report on the Parasites of the Coccidae in the Collection of this Department." This study resulted from interest aroused while Howard was rearing and studying parasites of scale insects collected by Professor Comstock in Florida and California.

In addition to taxonomic aspects of the Report (8), Howard called attention to the possible value of parasites in the control of injurious insects, the lack of specialists working on parasitic Hymenoptera, and the need for study of American species. He stated further that the little published work on the Chalcididae and Proctotrupidae had been done unsatisfactorily by nonspecialists in connection with their studies of injurious species.

His 1881 Report treated 2 families, 7 subfamilies, 14 genera (1 new), and 30 species (26 new). Keys were provided to families, subfamilies, and genera, but not to species. Six subfamilies and all genera were described. Adults of the species were described, and one or two examples of 13 genera were illustrated. The sex and number of specimens examined, complete collection data, and available information on biology were given for each species.

Other exemplary articles on the classification of Hymenoptera were published intermittently through 1910. Howard (9) discussed the morphology of chalcids and (14) revised the Aphelininae of North America. In another article he (10) instituted a tabular form of recording parasites, their hosts, and distribution, which could be used easily and quickly. In the left column, cosmopolitan, European, and American hosts were listed. European parasites were listed in the middle column, and American ones were placed in the right column. The hosts, or victims, which Dr. Howard stated was a more appropriate name, were listed under the orders to which they belonged—Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera. In a longer article he (15) treated parasites of the whitemarked tussock moth, describing several new species.

Howard published about 54 genus-group and approximately 290 species-group names in the Hymenoptera. About 240 species were named from North America,

and 50 were described from foreign countries. Most of his studies dealt with Chalcidoidea and Proctotrupoidea, but he (18) inadvertently named a few species in the Ichneumonoidea, Scoliidea, Vespoidea, and Sphecoidea in *The Insect Book*.

Dr. Howard made an outstanding contribution to the classification of mosquitoes. He initiated the study that resulted in a four-volume publication, *The Mosquitoes of North and Central America and the West Indies*, authored by Howard, Dyar & Knab (29). This classic was the first comprehensive study of mosquitoes of the Western Hemisphere. In this work, volume 1 is entitled "A General Consideration of Mosquitoes, their Habits and their Relationship to Humans," and it contains abundant, interesting, technical information. Volume 2 consists of 150 plates depicting insects that are treated in volumes 3 and 4. The latter volumes are entitled "Systematic Description," and herein all categories of the Culicidae are treated in detail. The family and lower categories are characterized and keyed. The treatment of species includes relevant citations, the original description of previously described species, and a new description of all available stages—females, males, larvae, and pupae. Location of types, number of specimens examined, collectors, hosts, localities where examined specimens were collected, and known distribution of species are given. Habits and biology are given if known.

Professor Riley, as senior author, and Dr. Howard published two taxonomic articles on the scale insect genus *Icerya*. The first (34) was the description of one new species. The second (35) described and illustrated immature and male stages as well as adult females of all species. Keys were provided to first instar larvae and adult females of all known species of *Icerya*. Original citations, hosts, and distribution were given for each species of the genus. Inadvertently these authors (36) named, but did not describe, two other species of scale insects, *Ceroplastes utilis* and *Tachardia gemmifera*.

Quite by accident, Howard (16) named a tingid, applying to it the Riley manuscript name *Corythuca irrorata*. He (20) later discovered that *irrorata* was synonymous with an older name.

Through investigations of biology, hosts, and distribution, Dr. Howard contributed to the classification of several orders of insects in studies intended primarily for field workers. His article (13), "Some Scale Insects of the Orchard," illustrates this fact. In it he gives the native home and known distribution, food plants, life history, and habits of each species. There is a key to species. Original illustrations of all available stages of each species are shown, and diaspine scale covers and host plant infestations frequently are depicted. Articles of this nature remain a source of valuable information for taxonomists.

BIOLOGICAL CONTROL

Dr. Howard began to think about the use of parasites and predators in controlling injurious insects early in his career. He (8) mentioned the few studies that had been carried out in the control of injurious insects by beneficial ones and stated, "It is certainly strange that this line of investigation, which is so fascinating in its outlook,

and which promises such important results, has not been followed up to some more definite conclusions for or against its practicability. As it is, the arguments are all in its favor, and the only difficulty is that we have no precedent."

Thereafter, he frequently wrote on biological control and (10) summarized the findings in "A Commencement of the Study of the Parasites of Cosmopolitan Insects." Much later he (26) again reviewed the use of predatory and parasitic insects on a world basis.

In spite of his optimism concerning the use of parasites, he (28) originally misjudged the possible effectiveness of the predator, the "Australian Ladybird" beetle, in America. In discussing the proposed introduction of the ladybird for controlling the cottony cushion scale on citrus in California, Howard (28) stated that he thought it would not be successful because Australia and California were in different life zones and in different hemispheres. The introduction of the lady beetle was an outstanding success, and this good fortune, as much as anything, encouraged experimental work on biological control of pests. Dr. Howard (28) pointed out, however, that the success of the lady beetle was not entirely beneficial because it gave workers a false sense of security and in some instances led to the abandonment of research along other lines of insect control.

The gypsy moth became established in Massachusetts in 1869 and came into prominence in 1889, and the brown tail moth appeared in the early 1890s. Because of the cataloguing of hymenopterous parasites, which he had carried on since 1880, Dr. Howard knew the parasites that had been recorded from these pests in Europe. The state of Massachusetts asked Howard to help fight the pests, sending him to Europe in 1905 to establish relations with, and to seek advice from, Europeans on the collection, rearing, and importation of parasites of the moths. The Europeans were cordial and helpful, and the venture was successful. Subsequently, the Bureau of Entomology took over the parasite work, establishing laboratories in the United States and in Europe. The foreign offices were staffed by one or two Americans and by native assistants. Over the years millions of parasites were brought to America and released. Concerning the introductions Howard (28) wrote, "While nothing spectacular has been accomplished by this introduction of the parasites of the Gipsy Moth and the Brown-tail Moth, there is absolutely no doubt that the introduced parasites have aided very greatly indeed in our fight against these pests."

This statement probably is an accurate assessment of the success of the introductions. At least they helped to contain the spread of the moths for many years and furnished expertise in the handling of insects that could be applied in later introductions.

The importance of Dr. Howard's contribution to biological control was expressed by H. S. Smith (38), who stated, "Dr. L. O. Howard is in reality the founder of the biological method of pest suppression in the United States. While he was not responsible for the first introductions of beneficial species into this country, it was his interest in the biology and taxonomy of parasitic insects and his enthusiasm for their use in practical pest-control problems that gave the method its impetus here."

Medical Entomology

An interest in medical entomology may have been stirred by Dr. Howard's graduate studies in medicine at Cornell and George Washington Universities. It is likely, however, that his interest developed largely as a result of inquiries concerning mosquitoes and flies that were received by the Department. By 1894, when he was made Chief of the Service, he decided it would be desirable to prepare, with the help of associates C. L. Marlatt and F. H. Chittenden, a comprehensive bulletin on household insects. Howard (30) did the portion on mosquitoes, houseflies, fleas, and other annoying species. In the process, he studied the biology of certain flies and mosquitoes and became intensely interested in their habits, development, relationship, and classification. After the publication of the bulletin, he continued working with mosquitoes and flies. Then, after Sir Ronald Ross discovered in 1898 that malaria was carried by anopheline mosquitoes, Dr. Howard launched further into the role of flies and mosquitoes as disease vectors. He (17) published on the insects found in human excrement with especial reference to the spread of typhoid fever. This was pertinent to him because his daughter Lucy contracted typhoid, presumably from eating ice cream that a fly had crawled over.

Howard became such an authority on mosquitoes that Dr. Walter Reed consulted him before undertaking an investigation of the mosquitoes of Cuba. Reed's mission was to eradicate the carrier of yellow fever which was suspected to be *Aedes aegypti*. Dr. Howard (28) stated that his book *Mosquitoes, How They Live; How They Carry Disease; How They Are Classified; How They May Be Destroyed* (19), published soon after Ross' discovery on malaria and Reed's report on yellow fever, appeared at the "psychological moment." It was furnished to members of the Army Medical Corps, and its recommendations were followed in the "clean-up of" Havana and in the control of mosquitoes in the Panama Canal Zone. The Bishop of New Orleans stated that the book was a "godsend to the people of that city" during the epidemic of 1905. This work led ultimately to the work by Howard, Dyar & Knab (29) on the classification of mosquitoes. Dr. Howard's (21) comprehensive volume, *The Housefly-Disease Carrier*, became a popular and useful publication in combating this insect around the world. It was translated into Spanish, Russian, and Hungarian and was used in the public schools of Hungary.

Dr. Howard (24, 25) published an interesting account of medical entomology up to 1921 and later (26) reviewed the subject, adding information accumulated after the earlier review.

PUBLICATIONS

A complete bibliography of Howard's writings apparently has not been published. However, Wade et al (40) reported that Howard's titles totaled more than 900, whereas elsewhere (31) they were said to approximate 1050. The articles range in size from less than one half page to volumes of 564 pages. Many technical articles were authored jointly with associates.

Howard's earliest publication (4) of record appeared in 1879, although he (28) stated that he had published a few articles previously in farm papers. Other articles appeared in 1880, and from then until his last book (28) was published in 1933, articles for the general public as well as for scientific specialists flowed regularly from the pen of this gifted man. His writings were invariably clear, descriptive, and readily understandable.

The topics treated by Dr. Howard included virtually every aspect of insect study known at the time—life history, habits, distribution, classification, ecology, edibility of insects, carriers of diseases, polluters of food, economic status of insects as a class; crop damage and economic loss, control of pests by parasites, predators, fungi, cultural practices, and chemicals; scientific results of exploration, introduction of injurious and beneficial insects, and laws on their introduction and exclusion; catalogues, bibliography, and biography.

Many of Dr. Howard's writings were published in Department of Agriculture publications—annual reports of the entomologist, bulletins, circulars, leaflets, *Insect Life*, and the *Yearbook*. Others appeared in *Proceedings of the United States National Museum*, *Reports of the Smithsonian Institution*, and in a Publication of the Carnegie Institution of Washington. Numerous articles were published in American and foreign scientific journals. A few general articles were carried in agricultural papers—Cornell Countryman, Penn State Farmer, Agricultural Student, Country Gentleman, and Illinois Agriculturist. Several (18, 19, 21, 27, 28) were printed by publishing houses.

Dr. Howard (28) defined the entomological terms in the *Century Dictionary* of the 1880s, in a later, revised edition, in the *Standard Dictionary*, and in the *New International Encyclopedia*. He also wrote articles for magazines. These tasks were performed on his own time, and he was paid for them. Since his official salary was modest, as were the salaries of other government scientists, he welcomed the income from non-official activities. Regarding his work on the *Century Dictionary*, he (28) wrote, "The whole work was extremely interesting and had a high educational value. Things that I learned then have been of service to me in many ways. Then, too, the extra money was a great help."

Several factors contributed to Howard's large bibliography. One that resulted in numerous short notes was the publication of replies to questions on specific problems or observations received by the Division of Entomology. The questions and their answers were published in *Insect Life*. While Riley and Howard edited this bulletin from 1889 to 1894 and while Howard alone was its editor, 1894 to 1895, replies of five or six lines to a full page appeared in nearly every number. Other short notes published in *Insect Life* under General Notes (11) refer to such diverse topics as Boiling Water for Peach Borer, The Family Phylloxeridae, The Newly Imported Rose Saw-fly, A Paradox.

Another factor was the frequent duplication of articles published on different dates in different publications, or slightly revised articles published on different dates. For example, "The House-fly, Carrier of Disease" (22) was published in Wyoming in 1913-14 without illustrations and was republished (23) in Ohio in 1918

with the addition of one illustration. "A Fifty Year Sketch History of Medical Entomology" (24), first published in 1921, was again printed in 1922 (25) in a different publication with only a few minor changes.

Many of Dr. Howard's writings were responses to specific needs. He was in a position to prepare articles on diverse insects of foreign origin that were, or might be, discovered in the United States. His article (12) on the maple *Pseudococcus* is an example. It gives information on the appearance, hosts, distribution, biology, natural enemies, and methods of controlling the insect. His numerous articles on mosquitoes as carriers of disease and flies as contaminators of food effectively presented the importance of these insects.

THE PERSON

Dr. Howard was a fine person in appearance and character. He was short in stature, erect, and, in his younger years, of strong, athletic physique. His face reflected intelligence and alertness. His congeniality, friendliness, and engaging smile attracted people to him; his unaffected, comfortable manner put strangers and neophyte entomologists at ease. A jovial person who thoroughly enjoyed people, he was an exceptional conversationist and raconteur, excellent in pithy repartee, witty, humorous, overflowing with graphic stories appropriate to every occasion. Because of his broad general interests, his expert knowledge of entomology and related fields, and a charming mode of presentation, he was a favored lecturer before scientific, educational, and cultural organizations. Dr. Howard relished invitations to speak because they gave him opportunities to promote interest in entomology and to crusade against injurious insects.

Dr. Howard was a keen observer, a searcher for fundamental principles, exemplary in the research he cherished and that he managed to continue, with the help of associates, until his retirement. He was an able, effective administrator, purposeful, tactful, creative, and fair, characteristics that earned the gratitude, respect, and affection of fellow workers and inspired them to put forth their best efforts.

Dr. Howard found time for relaxation in spite of the official duties that became heavier as time passed. In Washington, he continued some of the extracurricular activities he had pursued in college. He (28) joined a choral society, where he met Miss Marie T. Clifton, his future wife, "a girl with a glorious soprano voice." He played whist with college friends who also had moved to Washington. One friend, Rutherford B. Hayes, Jr., son of President Hayes, invited the whist players to the White House where they were treated as members of the family by Mrs. Hayes. He belonged to the Capitol Bicycle Club and had great sport racing and going on bicycle trips with other young men. During the 2 years that the Comstocks lived in Washington they and Howard attended the theater regularly. Since their combined salaries were about \$4400 a year and the Comstocks were paying for a small house in Ithaca, cash for tickets was not always available. Dr. Howard made a practice of pawning his watch to pay for the tickets, redeeming it when money became available, and pawning it again when another play came to town. In his later years he is reported (2, 37) to have been an expert with the billiard cue.

Dr. Howard joined the Cosmos Club in 1886, was a member for 64 years, and at the time of his death was its oldest member both in length of membership and in age (40). The Club became his second home, a place where he spent many happy, worthwhile hours. It afforded him opportunities to converse with the greatest scientists, scholars, and statesmen of the day, and he was a lively contributor to their stimulating discussions. Distinguished foreigners who stayed at the Club while in Washington often sought out Dr. Howard with whom some, especially the French, could converse in their own language.

Dr. Howard's marriage to Miss Clifton, also in 1886, sealed a happy union that endured until her death in 1926. They had three charming daughters, two are living, and Miss Lucy Howard still resides in Washington, DC. Dr. Howard adored his family, and they supported him in his activities to the fullest extent. The family home was in Washington, and in 1892 a small house also was built in a community later known as the Onteora Club at Tannersville in the Catskill Mountains of New York state. Mrs. Howard and the girls spent the summers in this congenial community of scientists, writers, artists, and others, and Dr. Howard visited when his travels and administrative responsibilities permitted. His family life was a full, happy one.

During the last 18 years of his life Dr. Howard was out of the main stream of entomological actions in which he had participated for more than half a century. He maintained an interest in entomology, however, read in the Bureau's Entomology Library, which he had wisely established, attended meetings of the Entomological Society of Washington whenever possible, and had contacts with members of his former staff and other friends. Regrettably, in the mid 1920s he suffered a back injury that hampered physical activity and caused some discomfort for the rest of his life. An operation for cataracts in 1932 or 1933 enabled him to continue rather extensive reading, and he continued to enjoy listening to classical music. He lived in Washington for some years and later spent the summers at the Onteora Club and the winters in Bronxville, N.Y., where he died May 1, 1950, at slightly less than 93 years of age.

TRAVEL

Dr. Howard traveled widely in the United States and Europe. In America early journeys took him to Virginia, Illinois, Indiana, Wisconsin, and Alabama to inspect armyworm damage, to Louisiana to investigate borer injury to sugar cane, and to islands off the Georgia coast to study insect damage to rice. He also went to New Orleans to set up an exhibit on applied entomology at the Cotton Exhibition. These and other early travels introduced him to ways of life he had not experienced previously, and contacts with schooled and unschooled people gave him insight into effective dealings with them. Later journeys took him to Canada, Mexico, Cuba, and Hawaii. His journeys were concerned with insect outbreaks, real or threatened, with surveys, reviews of laboratory investigations, conferences, and lectures. His detailed knowledge of the investigations conducted in the Bureau of Entomology laboratories was indispensable when he presented his requests for funds to the House

Agriculture Committee of the United States Congress. During his trips he became acquainted with teachers and students of entomology throughout the land and with persons of many other disciplines.

Dr. Howard's first trip to Europe occurred in 1902 at the insistence of Mr. James Wilson, Secretary of Agriculture. Mr. Wilson wanted to establish the silk worm industry in the United States and sent Howard to learn the practices carried out in Europe. The project was not economically successful here, but the trip was a broadening experience that gave the young man a taste of life in France and Italy that he would savor for the rest of his life.

Dr. Howard visited Europe again in 1905 and 1906 and almost yearly thereafter until the first World War, in connection with studies of malaria and parasites and predators of injurious insects. Over the years he traveled in nearly every country of Europe—Austria, Belgium, Czechoslovakia, England, France, Germany, Holland, Hungary, Italy, Poland, Portugal, Russia, Scotland, Spain, Switzerland, Turkey, Yugoslavia.

After relinquishing official duties, Dr. Howard took his last trip abroad. He traveled from New York down the East Coast, through the Panama Canal to Hawaii, thence to Japan, China, the Philippines, and Ceylon, greeting entomologists in every country. Eventually he reached Paris where he lived with his youngest daughter until the fall of 1932 when he returned to America.

Dr. Howard's acquaintance and friendship with entomologists in the various countries doubtless resulted in greater and more willing cooperation between the United States and foreign scientists than would otherwise have been possible. In regard to foreign travel Dr. Howard (28) wrote, "... gatherings of people interested in some special line of endeavor bring about personal friendships among people of different countries, expose a community of ideas that are extremely enlightening, and promote an international understanding the extent of which can hardly be realized."

HONORS AND AWARDS

Dr. Howard (28) was the recipient of so many honorary degrees that J. Jablonowski, a Hungarian friend, addressed him as "My dear friend, Doctor of everything except Music and Divinity." His first honorary degree was an M.D. *Honoris Causa* granted in 1911 by George Washington University in part for the medical studies he had undertaken there in the 1880s, but principally for his later work with insect vectors of human diseases and his contributions to public health. His grandfather, Dr. Calvin Howard of Delhi, N.Y., had received the same degree 70 years earlier. Other honorary degrees bestowed by Universities included a PhD from Georgetown, a LL.D. from Pittsburgh and from California, and a DSc from Rutgers and from Toronto.

Dr. Howard was given the First Medal Award of the New York Farmers and the Gold Medal of the Holland Society of New York. He received the prestigious Capper Award in 1931. It consisted of a gold medal, \$5000 dollars, and read, "For distinguished services to Agriculture." One of Dr. Howard's most prized honors was his election to a 5-year (1900–1905) term as Alumni Trustee of Cornell University.

Dr. Howard was honored by many foreign countries and organizations. He received the Buffon Medal, Museum d'Histoire Naturelle, Paris, and the Gold Medal of the Italian Ministry of Agriculture. He was decorated as Chevalier 1925, and Officier 1929, de la Legion d'Honneur, France, and as Officier 1925, de l'Orde du Mérite Agricola, France. He was elected an Honorary Member of one or more scientific societies of Canada, Mexico, Trinidad, Chile, Czechoslovakia, England, France, Germany, Portugal, Russia, Sweden, South Africa, and India.

Dr. Howard held important positions in international meetings. He was President of the Fourth International Congress of Entomology held at Cornell University, Ithaca, in 1928. He was appointed Executive Secretary of the World Exposition held in St. Louis in 1904, was active in the Seventh International Congress of Zoology held in Boston in 1907, and was made Permanent President of the First Pan-Pacific Food Conservation Conference held in Honolulu in 1924. He was Honorary President, International Conference of Phytopathologists and Economic Entomologists, held in Holland in 1923, President of the Section of Economic Zoology, International Congress of Zoology, held in Budapest in 1927, and Vice President of the International Congress of Agriculture held in Paris in 1923. He was a delegate to other international events in Cambridge, Oxford, Madrid, Paris, Vienna, Warsaw, and Zurich.

Dr. Howard's other honors included Honorary Curator, Division of Insects, US National Museum, beginning in 1895; Consulting Entomologist, US Public Health Service from 1904; Senior Entomologist with grade of Senior Surgeon, Reserve of US Public Health Service from 1919; Member of the Committee on Agriculture, National Council of Defense 1917; and Chairman, Subcommittee on Medical Entomology, National Research Council 1917.

Dr. Howard was a member in, and officer of, several national societies, some of which he helped establish. The societies included the American Philosophical Society, American Academy of Arts and Sciences, National Academy of Sciences, American Association for the Advancement of Science (Permanent Secretary 1898–1920 and President 1920–21), Washington Academy of Sciences (President 1916), and the Biological Society of Washington (President 1897–98). He helped found the American Association of Entomologists and was its President in 1894, and the Entomological Society of America of which he became President in 1920. He was one of the founders of the Entomological Society of Washington and was its President for 3 years and its Honorary President from 1929 to 1950. He served in every office of the Cosmos Club except as Treasurer and was its Secretary for many years and its President in 1909.

TRIBUTES

Of the many tributes paid to Dr. Howard, two speak succinctly and accurately of the man and his work. Dr. Torre-Bueno (39) wrote, "Foremost among American entomologists of my passing generation stands Dr. Leland Ossian Howard, who has honored me with his friendship these forty years and more. There were other entomologists of great attainments during his active service, but none had so powerful an impact on world-wide study of harmful insects, not alone in this country but

likewise in Europe, perhaps to a greater degree than here." The June 1947 number of the *Proceedings of the Entomological Society of Washington* was "respectfully and affectionately dedicated" to Dr. Howard in honor of his 90th birthday. On that occasion Dr. Rohwer (37) greeted Dr. Howard as a Founder, Historian, President, and Honorary President of the Society, and as Conciliator, Humanitarian, Crusader, Diplomat, Historian, and Good Fellow to all people.

Dr. Howard was the complete entomologist. His work endures.

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