

# BENJAMIN DANN WALSH: Pioneer Entomologist and Proponent of Darwinian Theory

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■ **Abstract** Many entomologists are generally unacquainted with the life and scientific contributions of Benjamin Dann Walsh, the first State Entomologist of Illinois and an early proponent of Darwinian theory. This historical oversight is unfortunate because Walsh was both a pioneer in entomology and the only entomologist of his and Darwin's generation to support and contribute to Darwin's revolutionary theory of species origin. In this review, I attempt to return Walsh to his rightful place among the more fascinating and progressive scientists of the nineteenth century. The review comprises three sections: the first provides a biographical sketch of Walsh's rich and varied life in England and the United States; the second considers his entomological endeavors and legacy; and the third argues for Walsh's prescient advocacy of, and contributions to, evolutionary theory. Also included are passages from some of Walsh's publications and excerpts from his correspondence with Darwin and notable entomologists.

## BIOGRAPHICAL SKETCH

Benjamin Dann Walsh was born in Hackney,<sup>1</sup> a then-small village outside London, England, on September 21, 1808 (22, 25, 26, 34, 45, 46, 78), the fifth of 13 children of Benjamin Walsh and Mary Bidwell Clarke (G. Harris, personal communication). Upon graduation from St. Paul's School in 1827, Walsh matriculated in Trinity College, Cambridge University, receiving a B.A. degree in 1831 and an M.A. degree three years later. A scholar of ancient Greek language and literature, Walsh (54) authored *The Comedies of Aristophanes, Translated into Corresponding English Metres* (the first of an intended three volumes), which ran more than 400 pages. In 1833 he became a fellow of Trinity, where he resided for 12 years, apparently intending to enter the ministry. At that time, Cambridge was an enclave of the Anglican Church, but Walsh developed a great antipathy toward his fellow theologians and eventually resigned his fellowship, as discussed below.

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<sup>1</sup>Hackney is correct, according to G. Harris, Walsh's distant relative. (Other published accounts are in error.)

Religion, wealth, and social rank strongly influenced academic advancement at Cambridge (24, 47, 79). Daily attendance at chapel was expected of all fellows and tutors, and undergraduates had to declare membership in the Church of England to receive a degree. Nevertheless, high-born students could receive a bachelor's degree without examination. In Walsh's case, scholastic records indicate consistently high achievement, but certain family matters may have demeaned him in the eyes of socially conscious Cambridge. When Walsh was a boy, his father besmirched the family name by embezzling funds and attempting to flee to America, abandoning his wife and children. He was expelled from both the stock exchange and the House of Commons, jailed at Newgate, and nearly hanged (47). Presumably, finances were wanting when Walsh entered Trinity because he did so as a sizar, i.e., one who performed menial labor in exchange for reduced tuition. Because of their poverty, sizars such as Walsh occupied the low end of the social hierarchy, dined off the remains of the high-table dinner, and were customarily derided (79).

Just prior to his departure from Trinity, Walsh was passed over for an assistant tutorship, tantamount to denial of academic promotion. His vocational commitment apparently waned, as he was absent from compulsory chapel attendance for five weeks (47). He also sharply criticized some of the university's practices and policies in his 1837 treatise, *A Historical Account of the University of Cambridge and its Colleges* (53), and proffered then-radical suggestions for improvement. In light of this work, historian Peter Searby (47) dubbed Walsh "the Cambridge don who must be judged the most advanced of the internal reformers," noting that all of Walsh's proposals were eventually implemented. With a view toward Walsh's scientific legacy, we note that this early work bears the hallmark of his entomological writings: progressive ideas couched within a framework of details; and bold, impassioned rhetoric.

Walsh's Cambridge experience left him with adamant antireligious sentiments that proved conducive to his acceptance of Darwinian theory, as discussed in *Rationale for Walsh's Support of Darwinian Theory*, below. C.V. Riley, whom many regard as Walsh's protégé, wrote of Walsh (46):

He was not theologically disposed, and naturally had such a strong hatred of hypocrisy and of everything that had the semblance of wrong, that—judging from what he told us—the inconsistent conduct of some of his colleagues who were studying for the ministry, in all probability prejudiced him against the church. At all events his tastes and inclinations were of an entirely different character from those which are necessary to make a minister of the gospel.

This assessment is borne out by a letter Walsh wrote to John LeConte (2):

The shabbiest tricks I ever had played on me in my life were uniformly at the hands of parsons. They are like monks—isolated from the rest of the community & not bound by the laws of honor. As a class, I hate, despise and eschew them. Nine-tenths of them are rascals—believing no more of what

they preach than you & I do; & a large portion of the remaining fraction are fools. I have lived 12 years in the English factory (Cambridge) where they manufacture this kind of ecclesiastical beast; & having mixed familiarly with them on terms of social equality, I know all about them.

Walsh left Cambridge in 1838 and married Rebecca Finn; the couple set sail for the United States, initially settling in the remote area of Henry County, Illinois. Walsh spent his remaining three decades in Illinois, witnessing an era of unprecedented change. In the 1830s the population of the state tripled under an enormous wave of immigration (effected by the completion of the Erie Canal); the federal government dispossessed the Sauk and Fox tribes of their remnant lands; the town of Chicago (population 350) was incorporated; and John Deere developed the self-scouring steel plow, enabling efficient cultivation of the rich midwestern soil. Nevertheless, as one historian noted, “life in Illinois was still crude and rough; money was hard to come by; transportation was unbelievably bad; disease was rampant; and the quality of public education was rudimentary at best” (77). As we shall see, certain of these factors had a direct impact on Walsh’s life. Walsh also lived through the Civil War and its aftermath, espousing the belief that the “pro-slavery men were the real fanatics, if fanaticism meant flying in the face of the moral sense of the whole civilized world” [quoted from a letter in (10)].

At age 30, Walsh’s first occupation in the United States was that of a self-sufficient farmer, the very antithesis to his years as one of the Cambridge intelligentsia. As he later explained in a letter to Charles Darwin, he had resolved to live the life of a philosopher (17):

I was possessed with an absurd notion that I would live a perfectly natural life, independent of the whole world—in *me ipso totus teres atque rotundus*. So I bought several hundred acres of wild land in the wilderness, twenty miles from any settlement that you would call even a village, and with only a single neighbor. There I gradually opened a farm, working myself like a horse . . . .

When the area became malarious, Walsh, seriously ill, moved to Rock Island, Illinois. After 12 years of grueling farm labor, he found himself \$1000 poorer than when he began (17). Next, he opened a lumber business, the profits from which he built 10 two-story rental units. During this time he served briefly as alderman, in which capacity he investigated allegations of corruption against the municipal government of Rock Island, an endeavor that brought several threats upon his life (32). Shortly thereafter, he retired from his lumber business and, aside from management of his rental properties, devoted himself to the study of entomology until his death. Walsh’s willingness to relinquish a more comfortable lifestyle for the pursuit of science is evidenced by a letter he wrote to the hemipterist Philip Uhler (38):

Times are too hard for me to pay a cabinet-maker, so I handle the plane and the saw myself. [Thomas] Say lived on a dime a day, for the sake of devoting his time to Entomology. I am not quite so badly off as that, but I am forced

to do one of two things—either go into business again or dress meanly, and I prefer the latter alternative.

## WALSH AS ENTOMOLOGIST

Walsh's entomological interests began in England, where he collected insects for "6 or 8 years" (38) and admired Darwin's "noble collection of British Coleoptera" (17) when the two were undergraduates at Cambridge. Walsh also observed insects and their habits as he toiled on his Illinois farm, as he would later recall in some of his publications. However, by his own account, he did not resume his insect studies until 1857 (38), although from that time forward he became increasingly involved in various entomological endeavors. Each of these, considered briefly below, catalyzed his scientific career and enhanced his public recognition.

### Affiliation with Scientific Societies; Illinois State Entomologist

From the inception of his career, Walsh was an active member of several scientific societies. In 1858 he became a founding member of the Illinois Natural History Society, representing entomology along with William LeBaron and Cyrus Thomas, who would become the second and third State Entomologist of Illinois, respectively.<sup>2</sup> When the Society's annual meeting for 1860 was held concomitantly with the first commencement exercises for Illinois State Normal University in Bloomington,<sup>3</sup> Walsh delivered a "spirited address" that was reported in Chicago's two leading newspapers, the *Times* and the *Press and Tribune* (3).

Walsh's affiliation with the Illinois State Agricultural Society garnered him early professional recognition. When he spoke at its meeting in January 1860, a reporter for the *Prairie Farmer* wrote, "Mr. Walsh spoke extempore two hours. . . . Those present were eager listeners; Mr. Walsh has a rare faculty of communicating his ideas, and the result of his studies in the insect world, to the popular ear. . . . we became so intensely interested that our hand refused to move the pencil" (44). In 1861 a committee selected Walsh's lengthy article, "Insects Injurious to Vegetation in Illinois," as a "best essay" and thus it was published in the Society's *Transactions* (55). Leaders of professional societies in the eastern United States also recognized Walsh's scientific contributions. In 1861 he was elected a corresponding member of the Entomological Society of Philadelphia, and in 1863 the Boston Society of Natural History granted him the same distinction. Yet undoubtedly the greatest impetus to Walsh's career came from the Illinois State Horticultural Society: It was through their lobbying efforts that the office of State Entomologist was instituted and Walsh appointed to the post. The political turmoil that ensued in the creation of this position is recounted in the Society's *Transactions* and is briefly reviewed here.

<sup>2</sup>Other disciplines were represented in the Society by various well-known individuals, including John Wesley Powell, the celebrated explorer and Civil War veteran.

<sup>3</sup>The University of Illinois and University of Chicago were not yet founded.

In 1865, at the society's annual meeting, the president expatiated on the need for a State Entomologist, and two years later, the executive committee passed a resolution requesting the governor to appoint Walsh.<sup>4</sup> In 1867 a bill was passed establishing the position of State Entomologist, but Walsh's appointment had to await senate confirmation, which was delayed until the winter session of 1868–1869. Meanwhile, the Horticultural Society, acting on the assumption that Walsh's appointment was imminent, tendered him \$500 in May 1867 to begin his official duties. In recognition of the Society's generosity, Walsh focused his efforts on insects "peculiarly injurious to fruit," as perusal of his annual report reveals (71). Finally, in March 1869, legislation was passed appointing Walsh as State Entomologist and granting him back pay for his efforts as "acting" State Entomologist. With typical wry humor, Walsh wrote that he would be receiving compensation "for what I did in the last two years as Acting or Embryo State Entomologist. I am now in the perfect or Imago State."

### Illinois State Fair; Walsh's Insect Collection

Walsh earned early recognition and kudos at the Illinois state fair as a competitor or judge of insect collections and also reaped monetary rewards, as he explained in an 1861 letter to LeConte (2): "I started on Sept. 9th . . . for Chicago, with my entire collection, to attend the State Fair. This year there is a premium of \$75 for the best (named) collection of Insects, which—these hard times—makes it well worth one's while to go." That year Walsh's collection, "Illustrating the Entomology of Illinois, not less than 1,000 species named," so impressed the award committee that it unanimously voted that the collection receive first prize. His insect collections also received the highest honor in subsequent years, and when Walsh died, the state of Illinois paid \$2500 for his entire collection, estimated to contain 30,000 specimens and 10,000 species (31). It was deposited in the "fire-proof building" of the Chicago Academy of Sciences, but as fate would have it, the entire collection, except for a few drawers of Coleoptera and Lepidoptera, went up in smoke in the great Chicago fire of 1871 (32).

### Professional Correspondence

Of critical importance to Walsh's career was the active correspondence he maintained with several entomologists, notably the dipterist Baron R. von Osten Sacken (from 1860 to 1869), the coleopterist John L. LeConte (1861–1869), the neuropterist Hermann A. Hagen (1860–1869), the orthopterist Samuel H. Scudder (1862–1869), the hemipterist Philip R. Uhler (1861–1868), and the celebrated naturalist, Charles Darwin (1864–1869).<sup>5</sup> Because he labored without access to a public library or academic institution throughout his career, Walsh's professional

<sup>4</sup>Interestingly, a year elapsed before the Society passed a resolution to appoint a "practical horticulturist."

<sup>5</sup>These are extant correspondences; Walsh also exchanged letters with other naturalists.

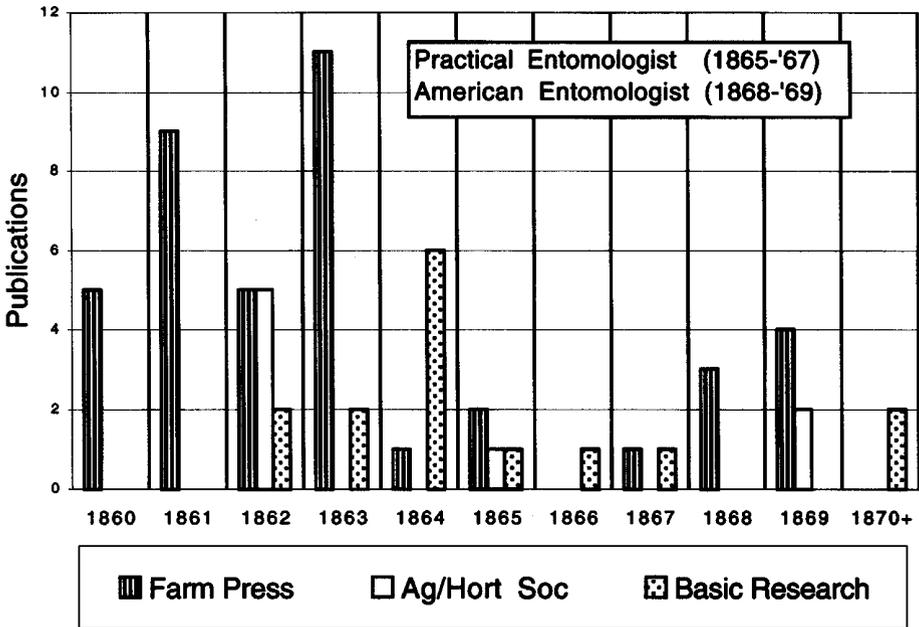
correspondence represented a vital means for exchange of information and ideas. Not infrequently in letters to colleagues, he bemoaned his meager resources and worried that he would err in his own research because he lacked access to published reports. When his work necessitated information not in his possession, he would sheepishly request it from a correspondent, whose response might entail transcription of lengthy passages. Upon receipt of the information, Walsh would express heartfelt gratitude, as in this representative excerpt from a letter to Hagen: "I scarcely know how to thank you enough for your kindness in writing me so long and instructive a letter; the books alone would have been a treasure to me, but the letter & books too were more than I should have dared even dream of" (38).

## Publications

Although Walsh worked in relative isolation with limited resources, his publications were a wellspring of professional renown. Initially, his efforts were restricted to agricultural pests and were published in farm-related periodicals of an "applied" bent, notably the *Prairie Farmer* and *Transactions of the Illinois State Agricultural Society* (Figure 1). However, in 1862, scholarly treatises by Walsh began to appear in the proceedings of various scientific organizations (e.g., Academy of Natural Sciences of Philadelphia, Entomological Society of Philadelphia, Boston Society of Natural History). These works embodied pure or basic scientific research, that is, they provided detailed observations of insect metamorphosis and natural history, comparisons of morphological characters for a given taxon, and/or scientific descriptions of new species. Typically of monographic length, they also served as a vehicle for discourse on what were considered philosophical topics, such as phylogenetic relationships among Cecidomyiidae (64, 73), dimorphism in Cynipidae (62), and homologous stages of insects and crustaceans (60).

## Editorship

The frequency of Walsh's publications in various proceedings peaked in 1864 and then precipitously declined (Figure 1), doubtlessly owing to the editorial duties he assumed in connection with two new journals. From October 1865 to October 1866, he was associate editor (43) of the *Practical Entomologist* and served as its sole editor through September 1867, all without pay (70). Distinguished as the first U.S. journal devoted to economic entomology, the *Practical Entomologist* sought to address the needs of farmers, who were beset with the ravages of insects and a raft of bogus insecticides hawked by disreputable peddlers (48). For two years, Walsh met monthly deadlines for all the published "Answers to Correspondents," which frequently amounted to more than 20 responses per issue, each requiring a paragraph or more, often a feature article (usually on a major insect pest), and numerous shorter pieces. His writings for the *Practical Entomologist* totaled about 55 published pages as associate editor and nearly double that as editor. Yet remarkably, during 1866–1867, he also authored several scholarly works: a substantial rejoinder to J.D. Dana's publication on insect classification (69); a lengthy study of



**Figure 1** Walsh's publications. Farm Press: *Prairie Farmer* and similar journals; Ag/Hort Soc.: *Transactions of the Illinois State Agricultural Society* and similar agricultural series; Basic Research: *Transactions and Proceedings of non-Ag/Hort Societies*, i.e., *Transactions of the Academy of Science of St. Louis*, *Proceedings of the Academy of Natural Sciences of Philadelphia*, *Proceedings of the Boston Society of Natural History*, and *Proceedings of the Entomological Society of Philadelphia*. Owing to the great variation in length and substance of Walsh's articles in the *Practical Entomologist* and the *American Entomologist*, bars are not included for those publications (see text for details).

coleopteran, hymenopteran, and dipteran insects of willow galls (73); an impressive 140-page annual report as State Entomologist of Illinois (71); and an important paper describing the apple maggot, *Rhagoletis pomonella* (74). In this latter publication, Walsh proposed that the apple maggot in the northeastern United States had undergone a recent host plant shift, from native hawthorn to cultivated apple, and would gradually spread westward as a pest of apple. History has borne out his hypothesis, and *R. pomonella* is currently believed to have undergone sympatric speciation (7, 8) (see Speciation via Phytophagic Isolation, below).

In September 1868, one year after the demise of the *Practical Entomologist*, Walsh became senior editor of the *American Entomologist*, with C.V. Riley as junior editor. Aimed at a readership of farmers and fruit growers, this monthly journal featured woodblock prints with accompanying descriptions to distinguish insect friend from foe, with sound approaches toward controlling the latter. Two highly significant findings by Walsh and Riley appeared in this journal: the

discovery of the 13-year form of the periodical cicada (75a), and the first reference to mimicry of the North American monarch butterfly by the viceroy (6, 76). They also cogently presented the concept of intraguild predation, outlining all the possible complex trophic linkages in biocontrol communities (75): “We are apt to forget that the system of Nature is a very complicated one—parasite preying upon parasite, cannibal upon cannibal, parasite upon cannibal, and cannibal upon parasite—till there are often so many links in the chain that an occasional irregularity becomes almost inevitable.” As with the *Practical Entomologist*, Walsh’s editorial duties for the *American Entomologist* were formidable: From the journal’s inception until his death in November 1869, he coauthored 12–27 printed pages per month and also contributed some single-authored articles. Ever diligent and prolific, Walsh also contributed articles to *Prairie Farmer*, *Canadian Entomologist*, *Transactions of the Northern Illinois Horticultural Society*, and *Journal of the Illinois State Agricultural Society* (27). Two lengthy research articles by Walsh were published posthumously, one on chalcids, the other on tenthrinids and ichneumonids (27).

Clearly, Walsh authored a prodigious number of noteworthy publications in agricultural periodicals and various scientific journals, but he labored during the nascency of American entomology and his career spanned only a decade. Therefore, it is wise to exercise prudence when assessing his impact on the discipline of entomology and on biological science in the main. As we examine Walsh within these two contexts, we find him emerging as a prominent transition figure in both. First, he represents a pioneer among “applied” entomologists—those who promoted the application of scientific knowledge to practical ends and received remuneration from public funds for their efforts. Second, among entomologists born prior to 1815, Walsh stood alone—with the majority of his younger colleagues—in strong support of Darwinian theory. The first point is developed below; the second is developed in Walsh as Darwinian Evolutionist.

## North American Entomology, 1870

Perusal of entomology at the time of Walsh’s death reveals a discipline fostered almost exclusively through the zealous yet voluntary efforts of self-taught individuals. Indeed, of U.S. entomologists publishing in 1870, fully 45% who had been to college were trained in medicine, another 20% were trained in either theology or languages, and none had received a degree in the discipline (50). This reflects the fact that the first U.S. professorship of entomology was not established until 1870, with H.A. Hagen’s appointment at Harvard. When Walsh died in 1869, there were two entomological societies in North America,<sup>6</sup> and the only serial publications were the *Transactions of the American Entomological Society* and the *Canadian*

<sup>6</sup>These were the American Entomological Society, organized in 1859 as the Entomological Society of Philadelphia, and the Entomological Society of Canada, organized in 1863, later renamed the Entomological Society of Ontario. The Entomological Society of Pennsylvania existed from 1842 to 1844.

*Entomologist*; the only notable public collections were those of the Academy of Natural Sciences in Philadelphia and the Museum of Comparative Zoology at Harvard; the duties of the lone U.S. government entomologist also included studies of birds, grains, fibers, and domestic animals; and only New York, Illinois, and Missouri could lay claim to a state entomologist (29, 39, 50). In contrast, as Howard (29) observed, Europe had “literally hundreds of books and dozens of entomological societies and probably thousands of collectors.”

## Walsh's Impact on U.S. Entomology

Walsh lamented the status of American entomology in an 1860 address (3):

In Russia and other continental states, Entomology in its rudiments is made a portion of common school education. In the Agricultural Schools a regular Professor of Entomology has a place, and this branch is made his own, with no other *'ologies* added. When one considers that the insect world numbers over 400,000 species, it would seem to be a sufficient theme and branch for one man.

To Walsh, the untold dollars lost on insect-damaged crops reflected an inadequate knowledge of insect natural history, owing to scant government funds for such research. He argued cogently that careful studies, followed by implementation of tested control measures, would alleviate any insect pest problem. This became his *cause célèbre* (3):

Were a foreign army to invade our shores, our law givers would vie with one another in large expenditure and preparation to oppose those invaders. No one would think of objecting. And yet the ravages of such an army would be insignificant in comparison with an army of insects . . . [W]here are the “army appropriations,” in amount, to meet and fight this army of insect invaders? What has been done by our legislators in the matter . . . taking all these sums [rendered] by the [federal] and State Governments since the Revolution, they would not, all told, exceed . . . an average of \$250 per year. And this against an annual destruction of crops by insects of \$1,000,000 to the entire United States. Was ever such folly and blindness? . . . [T]here is no noxious insect that may not be opposed and counter-worked, and for this task, study and long series of experiments are needed.

Walsh strove mightily so that farmers might benefit from applied scientific knowledge, decidedly a laudable goal, but many frontier settlers were illiterate and/or anti-intellectual and suspicious of education and learned individuals (52). Bardolph (4), an agricultural historian, noted that “Illinois farmers in the years before 1870 shared the almost pathological aversion to ‘book farming’ that characterized the rural class throughout the nation,” adding that the circulation of agricultural papers in Illinois during Walsh's era never exceeded 1 farmer in 10.

Still, evidence suggests that Walsh's writings did not go unnoticed. Numerous articles of his were published in the *Prairie Farmer*, which was founded in 1841

and which in 1860 boasted the largest circulation of “any paper of its class in the West and North-West” [quoted in (19)]. The periodical stated in its obituary of Walsh that “his writings in the *Prairie Farmer* did much to awaken an interest in the subject [entomology] throughout the West” (45). Bardolph (4) also concluded that Walsh “reached a considerable audience” through his contributions to newspapers, the farm press, and entomological journals, and by his addresses at agricultural fairs and horticultural meetings.

Farmers notwithstanding, Walsh’s popularity among horticulturists is patent, in that their political clout effected his appointment as State Entomologist. The Illinois State Horticultural Society was spearheaded by progressive men who also championed Walsh’s editorial endeavors, recommending both the *Practical Entomologist* and the *American Entomologist* to Society members.

*Entomologist’s Monthly Magazine*, published in England, stated in its obituary (22) of Walsh that he “probably did more than any other entomologist, either in Europe or America, to demonstrate the necessity for scientific advisers, when absurd prejudices and superstitions regarding the causes, effects, and treatment of depredations caused by insect-pests, surmount all other considerations in the minds of the sufferers.”

Indeed, Walsh’s contemporaries and twentieth-century historians concur that he fought tirelessly to educate the public of the need to formulate control measures on the basis of scientific investigations (18, 29, 39, 78), and his witty style became trenchant where fraud and impropriety were concerned. He did not suffer fools gladly, and he roundly vilified self-serving politicians and dealers of quack remedies. Consider the following passage, in which he argues for parasite importation to control the wheat midge and Hessian fly, both introduced pests (66):

Let a man profess to have discovered some new Patent Powder Pimperlimpimp, a single pinch of which being thrown into each corner of a field will kill every bug throughout its whole extent, and people will listen to him with attention and respect. But tell them of any simple common-sense plan, based upon correct scientific principals, to check and keep within a reasonable bounds the insect foes of the farmer, and they will laugh you to scorn. Probably about nine-tenths of the Members of Congress and of our different State Legislatures are lawyers . . . . What do they know about Farmers, except that they have got votes? Or about Farmers’ pockets, except that most of the taxes come out of them?

DeBach & Rosen (18) noted the vigor with which Walsh advocated classical biological control, adding that this charge may have been taken up by Riley. Indeed Riley, reputedly the most important entomologist of the nineteenth century (50), is believed to have been strongly influenced by Walsh. When the two coedited the *American Entomologist*, Walsh was 60 and Riley 25, and Riley had received no university education. According to Howard (29), who worked under Riley, “All through [Walsh’s] longer articles one finds indicated the methods of study adopted by Riley, and there can be no doubt whatever the latter looked upon

Walsh as his mentor and model and that very much of the sound character of his Missouri Reports is due to his association with Walsh.” In the opinion of this author, Riley possessed a natural genius for scientific study, manifested repeatedly throughout his career. Nevertheless, Walsh’s approach and style may have endured and continued to be influential through the work of his distinguished associate.

## WALSH AS DARWINIAN EVOLUTIONIST

Ernst Mayr (37) has written, “The Darwinian revolution . . . demanded a complete rethinking of man’s concept of the world and himself; more specifically, it demanded the rejection of some of the most widely held and most cherished beliefs of western man.” As discussed below, Walsh was unique among entomologists of his and Darwin’s generation in his strong support of the Darwinian theory of species origin. Space does not permit a robust substantiation of this assertion; however, I examined the work and obituaries of entomologists in Walsh’s and Darwin’s age group (29, 34, 35, 39, 78) and found none who rival this claim. In addition, historian Edward Pfeifer (42) noted that, aside from Walsh, “through 1865, the only other American scientist who wrote consistently on Darwin’s behalf was Asa Gray.” Frank Sulloway [(51); personal communication] also has acknowledged Walsh’s singular support of Darwinian theory.

### Opposition to Darwinian Theory

Darwin observed that, soon after the 1859 publication of the *Origin of Species*, when his concept of descent with modification by means of natural selection gained prominence, entomologists [notably members of the London Entomological Society (14a, 16)] repudiated his theory. Darwin, himself an avid entomologist, wrote the following to Henry Bates: “As you say, I have been thoroughly well attacked and reviled (especially by entomologists—Westwood, Wollaston, and A. Murray have all reviewed and sneered at me to their hearts content).” (17). Similarly, in a letter to Charles Lyell, Darwin wrote, “The entomologists are enough to keep the subject [of the change of species] back for half a century!” (14a).

Entomologists opposed Darwinian theory for reasons shared by other anti-Darwinists, which typically involved three major points of contention (37): (a) Darwin’s mechanism of natural selection, a nonteleological, nonsupernatural force, was offensive because it usurped natural theology and its “argument from design.” The latter attributed the innumerable, seemingly perfect adaptations of living organisms to God’s direct handiwork. (b) Darwin’s emphasis on intraspecific variation was dismissed because species were seen as immutable “types” with an underlying “essence.” (Those who subscribed to this view are termed essentialists.) (c) Darwin’s approach, now termed the hypothetico-deductive scientific method, drew criticism for being speculative, premature, and not experimental. In addition, older naturalists—those of Darwin’s generation—typically rejected his theory, as Darwin himself noted (14a) and modern day historians concur.

## Rationale for Walsh's Support of Darwinian Theory

Walsh first read the *Origin* in 1861 and had approached the book with serious reservations, as he wrote in his first letter to Darwin, dated April 29, 1864 (17):

More than thirty years ago I was introduced to you at your rooms in Christ's College . . . . Allow me to take this opportunity of thanking you for the publication of your *Origin of Species*, which I read three years ago. . . though I had a strong prejudice against what I supposed then to be your views. The first perusal staggered me, the second convinced me, and the oftener I read it the more convinced I am of the general soundness of your theory.

Let us consider why Walsh would be a ready convert to Darwin's theory and become one of its most enthusiastic exponents. First, many denounced natural selection on the grounds that it "dethroned God." However, as stated earlier, Walsh was not a religious man by the time he came to entomology and, according to Riley (46), he was not a member of any church and professed no religious faith. The following passage from a letter of Walsh to Darwin bears this out (23):

Because animals have every mental faculty that Man has, only developed to a less degree, I draw the conclusion that neither men nor animals have any souls, and he [Louis Agassiz, in *Methods of Study*] draws the conclusion that both men and animals have got souls, which can and will exist in a future elysium.

Second, Walsh possessed keen powers of observation and studied insects in nature, frequently emphasizing the prevalence of intraspecific variation. He spoke often of things apparent to "every intelligent and observing field-entomologist" (63) and expounded on the importance of describing new species from many specimens, "carefully noting all the variation" (59). As he stated, "It has always seemed to me that describing from a single specimen is describing, not the species, but the individual" (38).

Third, many rejected Darwin's theory owing to his innovative use of the hypothetico-deductive method (37), yet Walsh employed the same approach. In numerous discourses, he cogitated on the relevance of shared characters among closely related insects, and he argued that only Darwinian theory provided a satisfactory explanation for his observations (58, 61, 64, 65, 73).

Fourth, although Walsh was decidedly an "older" entomologist (he was age 51 when the *Origin* was published), he characteristically advocated progressive scientific approaches and urged others to expunge ill-founded traditions (66, 72). Moreover, he formed close associations with entomologists of the "younger" generation. His most valued correspondents—LeConte, Hagen, Osten Sacken, Scudder, and Uhler—were, respectively, 17, 9, 20, 29, and 27 years his junior. Walsh was 57 years old when he became associate editor of the *Practical Entomologist*, edited by the hymenopterist E.T. Cresson, age 27, and the lepidopterist A.R. Grote, age 25. At age 60, Walsh and the much younger C.V. Riley became coeditors of the *American Entomologist*.

Finally, Walsh reveled in controversy and stalwartly defended his convictions, as his recurrent disputes with entomologists and prominent naturalists attest [References 40, 49 (and references therein), 57, 60, 67–69, 73]. He argued fiercely for Darwinian theory because it rationally accounted for his entomological observations, and, as he often declared, “We are all in search of truth, & for the discovery of truth there is nothing like free discussion” (38).

## Walsh’s Contributions to Darwinian Theory

Walsh’s earliest published reference to Darwinian theory appeared in the farm press and was dated July, 1861<sup>7</sup> (56). The focus of Walsh’s article was the army-worm, which in 1861 had reached devastating population densities in the eastern half of Canada and the United States, including Illinois (49). Walsh quoted exclusively from Chapter III of the *Origin* (12, 15), in which Darwin discusses natural checks on the potential for geometrical increases in populations. From this, Walsh drew the analogy to internecine checks on armyworm populations, giving general descriptions of tachinids, ichneumonids, and chalcids known to attack the pest.

By 1863, evolutionary theory had assumed a central role in Walsh’s thinking. In a single paper (59), he formulated prescient hypotheses on three topics of fundamental importance, each of which warrants consideration below. (We recall that nearly four decades would elapse before the rediscovery of Mendel’s work; thus, the genetics of inheritance and sources of variation were unknown in Walsh’s time.)

**THE NATURE OF VARIATION** On the basis of his stated observations of variation in color markings, wing venation, and genitalia of several insect groups, Walsh proposed the Law of Equable Variability (59):

If any given character is very variable in one species of a group, it will tend to be variable in allied species; and if any given character is perfectly constant in one species of a group, it will tend to be constant in allied species.

He cited this as “confirmatory proof of the Derivative Origin of species” and reasoned that “if species were separately created . . . why should variability have been largely conferred upon some entire groups and almost entirely denied to other entire groups?”

**PREMATING REPRODUCTIVE ISOLATION MECHANISM** In the same paper, Walsh (59) hypothesized a mechanism akin to mechanical premating reproductive isolation:

These facts lead me to suspect generally in the Class Insecta, when a variation useful to a male in his sexual operations does take place in male reproductive organs, it is often seized hold of by Natural Selection to originate a new species, the less favored males being beaten in the struggle for females.

<sup>7</sup>Given that the first edition of the *Origin* was published in London in November 1859 (20), it appears that if Walsh did demur from Darwin’s revolutionary ideas, he did so briefly.

However, he found it “unconceivable” that the minute variations one might observe in the colorational patterns of male insects “could be appreciated by females” and be a product of sexual selection (59). Here, Walsh was referring to a brief discussion on sexual selection in Chapter IV of the *Origin* (12, 15). Walsh then turned to the third major topic, hybrids and the formation of new species.

**SPECIES CONCEPT** Walsh (59) stated that if speciation did occur as he had hypothesized (above), then “we can gain some glimpses of light upon the extraordinary and anomalous phenomena of hybridism” because it would explain why “species of distinct families never cross . . . [and] why . . . varieties generally but not always cross with facility.” He deftly articulated his definition of a species (59):

Two supposed species are distinct [if] . . . they do not now in general mix sexually together, or if geographically separated [they] would not do so supposing them to be placed in juxtaposition. . . . They may even now mix sexually together in some few rare instances. . . . [Y]et if they do not commonly and habitually mix together the species will remain distinct. Hence all experiments on artificial hybridization seem to me to prove nothing as to the distinctness of species, unless they are conducted . . . on the same gigantic scale as that upon which Nature works.

This definition bears striking resemblance to the biological species concept advanced by Mayr in 1942 [quoted in (37)] and, as discussed in this paper, was cited by Darwin in the fourth and subsequent editions of the *Origin*.

**ASSOCIATION OF INSECT AND PLANT GENERA** In another prescient paper, Walsh (62) recognized that insect-plant associations that reflected phylogenetic relationships supported Darwinian theory:

Few things are more striking in the history of the different families of gall-producing insects, than the manner in which certain genera are almost exclusively confined to certain genera of plants . . . . The same propensity . . . has been observed in many other genera of Insects that do not produce galls . . . . These facts have a clear significance on the theory of the Derivative Origin of Species; on the Creative Theory they are inexplicable.

Walsh explored this theme further in a subsequent paper (73).

**SPECIATION VIA PHYTOPHAGIC ISOLATION** Like many of Darwin’s supporters (37), Walsh was unwilling to accept natural selection as the sole mechanism for species origin because he thought it might not be applicable in exceptional cases (61). In an 1864 paper, Walsh (63) proposed a mechanism for speciation without geographic isolation—that is, by means of phytophagic isolation in plant-feeding insects. He posited this model: Assume that phytophagic varieties feed on several host plants and can freely interbreed. If, after countless generations, both sexes of a given phytophagic variety preferentially consume only one particular species

of host plant, such that the females tend to oviposit only on that species, then the preference for that plant species might be transmitted to the descendants. Further, if “an indefinitely long series of generations—say fifty, or a hundred, or a thousand, or ten thousand—” passed without females breeding with males of a different phytophagic variety or laying eggs on an alternate host, then the phytophagic variety might become a phytophagic race. This he likened to a geographical race, which might “finally perhaps acquire . . . a physical inability, to intercross with the other members of the species,” whereupon it would be deemed a phytophagic species. At this point it would “cease to be possible for the insect . . . to feed upon any other plant than that to which it has become habituated by the Laws of Inheritance” (63).

In what was at the time a remarkably forward-thinking effort, Walsh attempted to test the validity of his phytophagic speciation model. He set up experimental rearing cages involving two types of arctiid larvae<sup>8</sup> that differed morphologically only in the color of their hair pencils, but which, he claimed, exhibited very different phenologies and host plant preferences; he knew the adults of the two types to be morphologically indistinguishable. Walsh shifted the larvae to alternate host plants at different times, recording their growth and survivorship. His findings suggested to him that the two types of larvae represented phytophagic species, not merely phytophagic varieties of the same species (63). Today, Walsh’s concept of phytophagic varieties would come under the rubric biotypes (21).

Interestingly, Walsh’s phytophagic species model has been cited as the progenitor of both the Hopkins Host Selection Principle (10a, 11) and sympatric speciation (30). According to the former (proposed in 1917, during the infancy of modern genetics), the adult female can be conditioned (induced) to oviposit on the same host plant species as that which she fed upon in the immature stage. In contrast, sympatric speciation requires the evolution of premating reproductive isolation and a genetically based host shift, culminating in the origin of a new species distinct from the parental species (8). Given that the field of genetics lay shrouded in ignorance in 1864, it is not surprising that Walsh’s model has been interpreted to suggest two very different mechanisms.

**SIBLING SPECIES** In the 1864 paper summarized above, Walsh (63) provided a decidedly modern perspective of what we would now term sibling (cryptic) species:

According to my views, Phytophagic Species are as truly distinct species as those which differ by much stronger characters . . . “The only valid criterion,” as I have already said [here Walsh cited (59)], “of specific distinctness is the general non-existence, either actively ascertained or analogically inferred, of intermediate grades in the distinctive characters, whence we may reasonably conclude that the two supposed species are distinct” [here Walsh reiterated his species definition, quoted above]. But as many naturalists are of [the] opinion,

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<sup>8</sup>Walsh (63) reportedly was working with *Halesidota (Lophocampa) Antiphola* and *Halysidota tessellaris*. As the former is now considered a synonym of the latter, it appears that Walsh’s experiment involved one species, not two.

that to constitute a distinct species it is necessary that the distinctive characters should be tolerably strong, it will be better to distinguish Phytophagic Species by this particular denomination.

Diehl & Bush (21) noted that Walsh was “probably the first to seriously consider the status of insects that morphologically resemble one another so closely that they can only be distinguished on the basis of subtle biological traits.” Mayr (37) stated that, although Walsh recognized sibling species in insects, “the majority of entomologists, firmly wedded to a morphological species concept, generally referred to them as ‘biological races’.”

## Walsh the Staunch Darwinist

Darwin characteristically allowed others to fight his scientific battles over evolution (14a, 20), whereas Walsh thrived on debate and contention. Indeed, LeBaron (32) wrote of Walsh:

He evidently enjoyed a sharp controversy . . . [and] he was not content with a bare victory. He liked not only to conquer, but to utterly demolish his adversary. . . . And yet there is no reason to suppose that in all his pungent writings he harbored a particle of personal animosity. He loved science, and he loved truth.

When Walsh became convinced of the validity of Darwin’s theory, he championed the cause defiantly and steadfastly, both in publications and private correspondence. Let us consider some of Walsh’s most noteworthy and incisive moments in this arena.

**WALSH VERSUS AGASSIZ** During Walsh’s lifetime, the pre-eminent naturalist and most popular lecturer in the United States was Louis Agassiz of Harvard University (33, 36). A founding member of the National Academy of Sciences, Agassiz also was an avowed creationist and a resolute essentialist who held tenaciously to the concept of species as immutable “types,” a view rooted in Plato. Agassiz vociferously opposed Darwinian theory from the outset (20, 33), and in an 1864 publication, Walsh (60) roundly discredited and denounced Agassiz’s antievolutionary arguments. This paper represents Walsh’s single greatest effort in championing Darwinian theory.

In his *Methods of Study*, Agassiz (1) asserted that North American temperate zone insects, compared with European species, “differ specifically throughout.” The fatuity of Agassiz’s claim astonished Walsh, who had observed insects in England and become a serious student of U.S. entomology. As counter-evidence, Walsh (60) tabulated 304 insect species that had been described as common to both North America and Europe, which represented the work of 36 scientists. Walsh (60) reasoned, “Whether we decide by the number of the names, or by the great scientific weight of very many of them, the balance of authority is certainly against Prof. Agassiz.” Walsh (60) also pointed out that, if one accepted Agassiz’s views and LeConte’s zoogeographical distribution of North American Coleoptera, then

projection of the latter findings onto a global scenario would mean that “there must have been many hundred or even thousand distinct creations within the present geological era.” However, Walsh (60) wrote, “[i]f, rejecting the Creative theory, we assume the Derivative Origin of Species, how simple and intelligible become the great facts of the geographical distribution of species!”

Walsh demonstrated unequivocally that Agassiz had “totally misapprehended and misstated the Darwinian Theory,” and he also noted Agassiz’s omissions (60):

[N]ot one solitary word is said about Natural Selection, the Struggle for Existence, or any of the other great leading features of the “Origin of Species,” in any shape, manner, or form . . . and . . . an old, exploded doctrine which Darwin expressly disavows on eight separate occasions, is set up as a target for the dialectic arrows of Prof. Agassiz.

As a well-versed field entomologist, Walsh challenged Agassiz’s (1) claim that feral species are largely invariable, arguing that “the simple fact that naturalists are puzzled every day to decide in the case of wild species, whether differing forms are varieties or species, proves that in a state of nature extensive variations do occur” (60). Agassiz also declared that species immutability could be proven by comparison of living animals with those carved on the walls of ancient Egyptian monuments. This assertion, in addition to Agassiz’s other views, prompted Walsh to conclude with a pointed prognosis: Agassiz had failed to recognize the meaning of obvious facts that would help uncover hidden scientific truths, suggesting that there was a “radical defect in the constitution of his mind” (60).

Walsh sent a copy of his paper (60) to Darwin, who replied with an enthusiastic response (23): “I am delighted at the manner in which you have bearded this lion [Agassiz] in his den. I agree most entirely with all you have written . . . I confess, however, I did not fully perceive how he had misstated my views.”

**WALSH VERSUS SCUDDER** In 1866 Walsh received a letter from Darwin thanking him for his criticism of the entomologist Scudder [then Agassiz’s assistant, now known primarily for his work on Orthoptera, Lepidoptera, and insect paleontology (34)] (23):

I see that you have been attacking Mr. Scudder; and you will do the subject of the changes of species wonderfully good service; for everyone in the U. States must now be aware that if he argues foolishly or misquotes, you will be down on him like a clap of thunder. I have followed Sir C. Lyell’s advice (who is a very wise man) and always avoided controversy; Mr. Lyell’s arguments . . . do not apply to any third party, who has energy and courage and wit enough to enter the arena.

Here, Darwin was referring to a paper (65) in which Walsh, having exposed Scudder’s misstatements of Darwin’s theory, concluded, “A theory must be strong indeed, when, as would seem from the practice of certain Naturalists, it can only be refuted by misstating it.”

**WALSH DEFENDS DARWIN: PRIVATE CORRESPONDENCE** Walsh also championed Darwinian theory in his correspondence with various entomologists. He assailed Scudder's views (which reflected Agassiz's) often and with gusto, but clearly did so in the spirit of science. Here, Walsh (5) refers to Agassiz's claim (1), noted earlier:

I am utterly lost in astonishment at your saying that "granting the whole list of identical species to be correct, the statement would still be in a general way a fair one, that the insects of the two Continents differ specifically throughout." To my mind, if there is one single identical species, which is indigenous on both sides of the Atlantic, the statement is untrue, & if it is untrue it is not a fair statement. If your wife protested that she had been faithful to you "throughout," would you understand her to mean "faithful, barring a few occasional peccadillos?" Your sense of scientific truth has become debauched by allowing your imaginative faculties to get the better of your reasoning powers.

In the same letter to Scudder, Walsh attacked what he termed the New England school of naturalists: (5)

I do not agree with you in thinking that there is nothing in common between Agassiz & Dana but their living in N.E. & disbelieving in Darwin . . . I trace in both of them the same peculiar modes of thinking—the same giving the reins to the imagination—the same utter contempt of close & accurate reasoning or what you call "logic"—the same love of symmetry & habit of sacrificing facts to symmetry . . .—the same arithmetical monomania & torturing of Nature to fit the Procrustean bed which they have pre-determined in their minds she shall lie upon, whether or nay—and finally, they are both of them in love with the same wonderfully mystical number—3, III,  $\Delta$  . . . It is a second edition of St. Patrick converting the wild Irish of bygone times to Trinitarianism by showing them the Shamrock. Not only do I trace these peculiarities in the minds of these two men, but I trace the same, more or less, in all you N.E. naturalists. Excuse me for saying so, but you are none of you sufficiently painstaking & accurate to suit my beau-ideal of a perfect naturalist. You are, truly & correctly speaking, a School, & I take it Agassiz is the founder of the School.

Walsh had high regard for LeConte, yet needled him often about Darwinian theory, as in this passage from an 1865 letter (2):

Darwin writes me word that seven of the most distinguished German Naturalists, whom he names . . . besides others, have recently come round or are coming round to the Derivative Heresy. By and by we shall be the true, orthodox church, & then we shall serve you heretics as the Athanasians served the Arians when they got the upper hand in the primitive Christian times—i.e., roast you.

Again, to LeConte (2): "About specific differences, again, I am, as I think you know, decidedly heretical, & a worshipper of false Darwinian gods . . . If any

character is perfectly constant, no matter how slight it may be, I consider that a valid specific character.”

Referring to his recent visit with Hagen, Walsh informed LeConte: “N.B. He is becoming thoroughly Darwinized, & he does not believe in the real existence of genera one whit more than your humble servant does.” (2).

Let us now briefly examine the mutually beneficial relationship between Walsh and Darwin.

## Walsh and Darwin

Walsh opened a correspondence with Charles Darwin about three years after he first read the *Origin* (12, 15). With his first letter, Walsh included a few publications in which he had defended Darwinian theory, and Darwin’s reply must surely have gratified Walsh (23):

I have been very much pleased to see how boldly and clearly you speak out on the modification of species. I thank you for giving me the pages of reference; but they were superfluous, for I have found so many original and profound remarks, that I have clearly looked through all the papers.

The five-year correspondence between Walsh and Darwin encompassed over 30 letters (most of which have survived) and embodied a fruitful exchange of scientific ideas and knowledge. Darwin sent Walsh information that would otherwise have been unavailable and cited Walsh’s observations and publications in the fourth, fifth, and sixth editions of the *Origin* (12, 15); *Variation of Animals and Plants under Domestication* (14), first edition published in 1868; and the *Descent of Man* (13), published in 1871. From Walsh, Darwin typically requested insect-related information, as in this passage from a letter dated February 14, 1868 (23):

I want you to ransack your memory or notebook for some scraps of information and I know you will excuse me troubling you. I am booking on Sexual Selection and all sorts of facts would be most useful to me . . . [Y]ou who so thoroughly understand my views will easily understand the class of facts I want.

In this instance, Walsh obliged with multiple pages of data and drawings, to which Darwin responded (23): “It was extremely kind of you . . . to take so much trouble in looking through your collection and writing me such copious and minute notes. I value your information much as I well know that you are so trustworthy.” Through Darwin, Walsh received a copy of Bates’s paper on mimicry, which demonstrably influenced his scientific thinking (76), and copies of Darwin’s recent books (12, 14, 15). All evidence indicates that Walsh cherished his relationship with Darwin and held him in the highest esteem. When he learned from Darwin that he was to be cited in the fourth edition of the *Origin*, Walsh felt “sure of immortality” because, as he put it, “I don’t think that book will ever perish” (2). Nevertheless, when a copy of the book reached Walsh, he took umbrage at the passage referring to his species definition, which read (15): “Mr. Walsh . . . is forced to assume that those forms, which it may be supposed would freely intercross, should be designated

as varieties, whilst those which have probably lost this capacity for intercrossing should be called species.”

Soon thereafter, in his annual report, Walsh (71) reproved the renowned naturalist for his choice of words: “This, I think, can scarcely be called an *assumption*. It is a *definition*. Naturalists have been puzzled for ages to designate satisfactorily what they mean by the term ‘species,’ and all kinds of loose and shadowy and intangible explanations of the term have been given.”

Walsh then reiterated his definition of a species (59) and concluded (71):

It is in this sense, and in this sense only, that I have ever used the term “species”; and to call such a definition an “assumption” seems to me much the same thing as saying that Euclid *assumes* a fact, when he *defines* a circle as a plane figure having all external points equidistant from a given point.

Walsh sent Darwin a copy of this paper (71), admitting in the accompanying letter that he had been “presumptuous enough” to criticize Darwin (9). The response from Darwin (23) was both gracious and favorable: “Many thanks for your Report. I agree with your criticism on my expression; as far as I remember I used it merely because others might make a similar objection.”

Stronger language was employed by Darwin in the fifth and sixth editions of the *Origin*: “Mr. Walsh ranks the forms which it may be supposed would freely intercross . . .” (15). However, it is questionable whether Walsh saw the changed version because the fifth edition was published in August 1869, and Walsh died three months later, the result of a railway accident.

## Walsh the Wag

One may justifiably marvel at the scientific acumen evidenced by many of Walsh’s publications, but his letters to colleagues are often delightfully entertaining. They reveal a positively mischievous side that remains uneclipsed by his frequent reproving of colleagues and dogged demand for accuracy. I have found Walsh’s correspondence to be both captivating and insightful, and I close with a few passages from the pen of this remarkable pioneer entomologist and early proponent of Darwinian theory.

To Hagen, dated August 31, 1868, regarding 13- and 17-year periodical cicadas (38):

Two days ago I got together all the male specimens that I could, either of *septemdecim* or of *tredecim*, & . . . examined the genital hooklets . . . The hooklets of all of them seemed as if Dame Nature had cast them in two distinct moulds . . . Judging from the complicated & elaborate structure of their genitals, Insects most certainly ought to take precedence of all Mammals! The human penis, like the Protozoa, is nothing but a sack filled with blood, & a hole at one end of it. Now look at the wonderful penis of Odonata, as illustrated by yourself, with all its auxiliary machinery, & then blush for the degraded race to which you yourself have the misfortune to belong!

To LeConte, dated August 28, 1868 (2):

Not seeing you, as I had hoped & expected, at the Chicago meeting. . . I had begun to be afraid that you were grievously sick, or had eloped with some good-looking young lady for parts unknown . . . No doubt it is a very serious affliction to you to waste your time on the Narragansett sands, watching the young nymphs of America as they emerge like so many *Aphrodites rising* [original in Greek] from the ocean foam . . . [Y]ou can only console yourself with the reflection, that you have become very learned in the anatomical peculiarities of *Homo sapiens* female, var. *americanus*.

To Osten Sacken, dated July 10, 1866 (38):

The thing that really does excite my bile, is to see fellows like Fitch and Packard, that do not even know their Greek letters, parading Greek derivatives . . . & making as many ludicrous philological blunders as I should do if I were ass enough to quote German or Russian.

To Scudder, dated November 14, 1863 (5):

I suppose . . . by “tucked on” you mean “hurried forwards,” or perhaps for “tucked” we should read “tacked.” Excuse the hypercriticism. I spent the 20 best years of my life in studying the philological niceties of the Greek & Latin languages, & I have an inveterate habit of analyzing people’s expression. By the way, while on this subject, I don’t clearly understand what you mean by saying . . . “the longitudinal diameter [of the eyes] lying in the plane of the head.” Surely the head is not a plane surface.

To Scudder, dated December 4, 1863 (5):

You & Agassiz seem to have some new lights in Geological matters. I always supposed that the Eocene, Miocene & Pliocene Periods each contained a certain percentage of recent Shells, but you & he hold that “the origin of no living species dates back into Geological time.” Surely these periods are not to be considered as recent, considering how many extinct mammals & etc. are peculiar to them. I was quite thunderstruck at finding Agassiz broach the same doctrine as you do in his “Methods of Study.” Please explain, or don’t you ever mean to write to me again?

To Osten Sacken dated May 20, 1864 (38):

Pray don’t hesitate to correct this or any other of my blunders in your forthcoming Cynipidous Paper. I am always obliged to anybody that will correct my errors; for I write for truth & not for victory.

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## CONTENTS

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FRONTISPIECE, <i>Benjamin Dann Walsh</i>	xiv
BENJAMIN DANN WALSH: PIONEER ENTOMOLOGIST AND PROPONENT OF DARWINIAN THEORY, <i>Carol A. Sheppard</i>	1
FUNCTIONAL ECOLOGY OF IMMATURE PARASITOIDS, <i>Jacques Brodeur and Guy Boivin</i>	27
INSECT WALKING AND ROBOTICS, <i>Fred Delcomyn</i>	51
THE GUT BACTERIA OF INSECTS: NONPATHOGENIC INTERACTIONS, <i>R.J. Dillon and V.M. Dillon</i>	71
REGULATION OF INTERMEDIARY METABOLISM AND WATER BALANCE OF INSECTS BY NEUROPEPTIDES, <i>Gerd Gäde</i>	93
LONG-TERM, LARGE-SCALE BIOMONITORING OF THE UNKNOWN: ASSESSING THE EFFECTS OF INSECTICIDES TO CONTROL RIVER BLINDNESS (ONCHOCERCIASIS) IN WEST AFRICA, <i>Vincent H. Resh, Christian Lévêque, and Bernhard Statzner</i>	115
VENEZUELAN EQUINE ENCEPHALITIS, <i>Scott C. Weaver, Cristina Ferro, Roberto Barrera, Jorge Boshell, and Juan-Carlos Navarro</i>	141
GALLING APHIDS: SPECIALIZATION, BIOLOGICAL COMPLEXITY, AND VARIATION, <i>David Wool</i>	175
POPULATION GENETICS OF AUTOCIDAL CONTROL AND STRAIN REPLACEMENT, <i>Fred Gould and Paul Schliekelman</i>	193
BIOLOGICAL CONTROL OF CEREAL APHIDS IN NORTH AMERICA AND MEDIATING EFFECTS OF HOST PLANT AND HABITAT MANIPULATIONS, <i>M.J. Brewer and N.C. Elliott</i>	219
THE BIOLOGY OF XYLEM FLUID–FEEDING INSECT VECTORS OF <i>XYLELLA FASTIDIOSA</i> AND THEIR RELATION TO DISEASE EPIDEMIOLOGY, <i>Richard A. Redak, Alexander H. Purcell, João R.S. Lopes, Matthew J. Blua, Russell F. Mizell III, and Peter C. Andersen</i>	243
DEFENSIVE BEHAVIOR OF HONEY BEES: ORGANIZATION, GENETICS, AND COMPARISONS WITH OTHER BEES, <i>Michael D. Breed, Ernesto Guzmán-Novoa, and Greg J. Hunt</i>	271

WASP PARASITOID DISRUPTION OF HOST DEVELOPMENT: IMPLICATIONS FOR NEW BIOLOGICALLY BASED STRATEGIES FOR INSECT CONTROL, <i>Nancy E. Beckage and Dale B. Gelman</i>	299
ERADICATION OF THE MELON FLY, <i>BACTROCERA CUCURBITAE</i> , IN JAPAN: IMPORTANCE OF BEHAVIOR, ECOLOGY, GENETICS, AND EVOLUTION, <i>Juro Koyama, Hiroyuki Kakinohana, and Takahisa Miyatake</i>	331
THE AFRICAN HONEY BEE: FACTORS CONTRIBUTING TO A SUCCESSFUL BIOLOGICAL INVASION, <i>Stanley Scott Schneider, Gloria DeGrandi-Hoffman, and Deborah Roan Smith</i>	351
PHYLOGENY AND BIOLOGY OF NEOTROPICAL ORCHID BEES (EUGLOSSINI), <i>Sydney A. Cameron</i>	377
PLANT-INSECT INTERACTIONS IN FRAGMENTED LANDSCAPES, <i>Teja Tscharntke and Roland Brandl</i>	405
POLYDNAVIRUS GENES AND GENOMES: EMERGING GENE FAMILIES AND NEW INSIGHTS INTO POLYDNAVIRUS REPLICATION, <i>Jeremy A. Kroemer and Bruce A. Webb</i>	431
HUMAN LICE AND THEIR CONTROL, <i>Ian F. Burgess</i>	457
INDEXES	
Subject Index	483
Cumulative Index of Contributing Authors, Volumes 40–49	505
Cumulative Index of Chapter Titles, Volumes 40–49	510
ERRATA	
An online log of corrections to <i>Annual Review of Entomology</i> chapters may be found at <a href="http://ento.annualreviews.org/errata.shtml">http://ento.annualreviews.org/errata.shtml</a>	