Wider aspects of a career in entomology. 10. Undergraduate activities

Hugh V. Danks

This series of articles outlines some ancillary aspects of my entomological career, for the potential amusement of readers. It reports the sometimes unexpected challenges of working in new places and in the real world, an approach that serves also to expose some conclusions about research activities and some information about insects and their environments. This article treats my time as an undergraduate student.

My undergraduate education began towards the end of 1962 in the Department of Zoology and Applied Entomology at Imperial College (University of London). The zoology curriculum included entomology, but more specialized courses were held back until the final year, so I continued to study insects on my own.

Interesting species came to my light trap (noted in ESC Bulletin **52**: 19). Some handsome moths had appealing common names, like the angle shades (Figure 1). Several taxa of small moths were impressively diverse and challenging to identify, including pugs (Figure 2) and tortricids (Figure 3). There were plume moths (Figure 4) with strikingly dissected wings, large orange parasitoids (Figure 5) that search for host caterpillars at night, and green lacewings with shining golden eyes reflecting the light. Some kinds of flies and other insects—even a few individuals of normally diurnal species such as yellowjackets—also assembled at the light.

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Figure 1. The angle shades moth (the noctuid *Phlogophora meticulosa*). Wingspan about 5 cm.

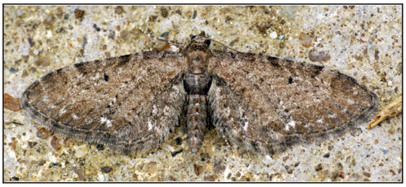

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Figure 2. The common pug moth (the geometrid *Eupithecia vulgata*), one of the 45 species of the genus that are now recognized in the United Kingdom. Wingspan 1.5–1.8 cm.

Hugh Danks (hughdanks@yahoo.ca) retired in 2007 after many years as head of the Biological Survey of Canada. In that role, he helped to coordinate work on the composition and characteristics of the arthropod fauna of the country, and to summarize the results. In addition, his research studied cold-hardiness, diapause, and other adaptations to seasonality in northern regions.

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Figure 3. The barred fruit-tree tortrix moth (the tortricid *Pandemis cerasana*), one of the nearly four hundred species of the family known from the U.K. Wingspan 1.6–2.5 cm.

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Figure 4. The common plume moth (the pterophorid *Emmelina monodactyla*), at rest (top) and with the wing plumes visible (bottom). Wingspan 1.8–2.7 cm.

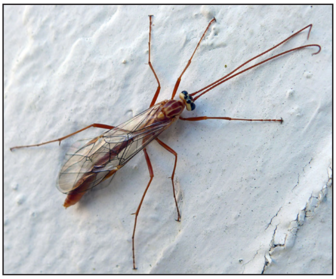

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Figure 5. One of the species of large orange parasitoids that are attracted to light (the ichneumonid *Ophion* sp., perhaps *obscuratus*). Length 1.5–2.0 cm.

Butterflies, moths, bees, and wasps were collected more widely too. My travels even took me to France a couple of times to explore other communities, revealing distinct faunal differences in the resident insects—and distinct cultural differences in the resident humans...

Those interests led to further involvement in the Amateur Entomologists' Society (AES), and before long I became Editor of the Society's Bulletin (Figure 6). The work was time-consuming because there were six issues per year. Resources for this volunteer role were limited, and much of my correspondence (in the days before email) was sent out in used envelopes sealed with unsightly tape.

Editing the Bulletin for the next 5 years taught me many things. First, the job called for communication with authors of widely different personalities, backgrounds, and skills.

Second, preparing manuscripts showed me how to edit for clarity and correct syntax—and naturally I tried to make suggestions to authors as tactfully as possible! The few American contributors posed particular challenges because they used words like "thusly".[1] In addition, the details of each manuscript (including abbreviations, capitalizations, numbers, and many other minutiae) were standardized to make the publication tidy and

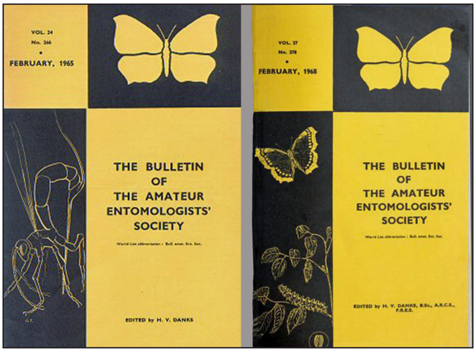

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Figure 6. Covers of two issues of the Bulletin of the Amateur Entomologists' Society from the 1960s.

[1]"Thusly" was regarded in England as a pointless synonym of "thus", used occasionally only for humorous effect.

assist readers. Such tasks are now much easier, compared to work on hard copies only, because modern word-processors have a search function.

Third, the Editor was responsible for liaisons with the printer, requiring mark-up of manuscripts to instruct the typesetter, detailed reading and annotation of the several proof stages, and layout of each issue into pages. This work required knowledge of conventions for copy editing and for correcting proofs. I also developed various schemes for checking the proofs, because simply reading through like many authors do tends to miss most errors[2].

The Bulletin was produced with linotype (metal printing blocks cast in lines of type)[3], and pages were laid out by cutting and pasting the galley proofs and specifying interline separations to optimize general appearance and the location of breaks between articles. Much effort was needed too to learn how to compile an efficient index for the diverse contents of each annual volume, especially because computers were not yet available. All those experiences helped me later to prepare and publish briefs and books (e.g., *Insect dormancy*, *Insects of the Yukon*) on behalf of the Biological Survey of Canada.

It soon became evident that any potentially ambiguous instruction to a printer will be misinterpreted, one of the many elements of Murphy's Law of Printing. A phrase had to be added to the cover of my first issue in the final proof stage. I wrote the addition with a red pen to make sure that the printer saw it, and approved the proof with the message: "O.K. with addition shown in red." Only black ink was ever used on the cover (as elsewhere), but when that issue was printed and distributed, the added phrase shone forth from the front in bright red ink!

A more general lesson came from dealing with the printer. Final production of one of my first issues of the Bulletin was substantially delayed; an enquiry elicited the response that it was almost done. After another long delay, the same assertion was made. Finally, in the continuing absence of action, I concluded that "The squeaky wheel gets the grease" and began daily nagging that led almost immediately to completion of the job. This strategy might be effective when the "wheel" has some power, such as payment to a tradesman, or the likelihood of future business. When there is little power (as for a junior employee), "The quacking duck gets shot" might apply instead! However, composure, logic, and measured persuasion are normally more relevant than either of these aphorisms.

A few professional entomologists were involved with the AES[4]. They included well known taxonomists who worked at the British Museum (Natural History), some of whom were reputed to be somewhat eccentric. One was a volunteer proof-reader for the Bulletin. My visit to his office revealed shelves bearing an impressive assortment of museum drawers housing specimens under study, as well as a number of labelled jars. One of the labels read: "Pieces of string too short to be useful"! It was tempting to speculate about other useless hoards, as exemplified by the labels created in Figure 7.

Even after a year or two, few readers of the Bulletin (apart from people on the AES council) had met me, but they had seen my editorials and articles about insect conservation and other topics. Some of those contributions were rather pompous, which might explain what happened at the Imperial College Biology Club when I was introduced to a new first-year entomology student.

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[2] Moreover, at that time proofs tended to contain many more errors, because text was retyped by the typesetter rather than just reformatted from a digital submission.

[3] Linotype was cumbersome compared with the digital systems now used for printing, but such hot-metal casting systems were much less troublesome than the manual letter-by-letter typesetting (letterpress) that preceded them. Linotype was replaced mainly by phototypesetting, now also obsolete, and then by a series of increasingly sophisticated computer-based methods.

[4] Professional entomologists have long been involved in helping the AES, and the society is now affiliated with the Royal Entomological Society of London.

There was a pause. “Not the Mr Danks who edits the AES Bulletin?,” she asked. When that suspicion was confirmed, a look of incredulity spread across her face. “Oh,” she said, “I thought Mr Danks was an *o-o-old* man.”

Each annual cohort of undergraduates in “special” degree programmes like mine comprised only a dozen students. Courses in zoology and other sciences were prescribed during the first 2 years, but then students specialized for the last year in either parasitology or entomology. The members of my cohort were strikingly diverse despite their limited numbers.

One parasitology student had a photographic memory and could remember every word of a text and even where it was located on the page. Another was very effective although he was dyslexic. A third concentrated on examination technique, spotting questions and seeking extra marks; some Schadenfreude was elicited when the top students learned that he had received a final degree one grade lower than them. A high grade was especially important because only the most successful students would have an opportunity to undertake graduate work.

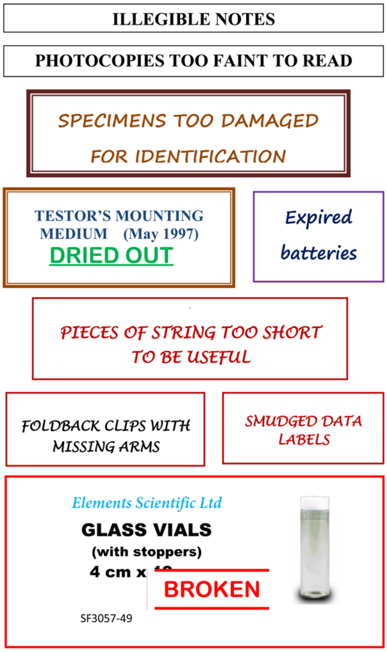

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Figure 7. Potentially useless hoards, as suggested by an actual label referred to in the text.

One entomology student worked long hours, but made sure that everyone knew about his dedication. Another always corrected the pronunciation of scientific names as if he knew how they were pronounced, but later would correct the same names in the other direction. There was even a student from Canada, Barry Wright, who became the long-term curator of entomology at the Nova Scotia Museum of Natural History in Halifax.

A student who lived near the college liked to collect moths in the evening. One night, he climbed to the top of a fine Victorian lamp-post (Figure 8) to obtain a choice specimen attracted to the light. A sonorous voice accosted him from below, as a London policeman enquired what on earth he thought he was doing. The collector reporting this story was highly indignant, because his treasured specimen almost escaped when the policeman insisted on verifying the explanation. In a city with many public houses, most people climbing a lamp-post late at night would not be under the influence of entomology.

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Figure 8. Victorian lamp-post in London.

My daily commute to London was by train and tube (subway) at first, but later used a secondhand motorcycle[5]. This machine was heavy and had limited power (Figure 9), but despite

[5] One summer, I took the motorcycle engine completely apart to learn in more detail how it worked. No parts were left over after the motor had been cleaned and reassembled, and it still operated—but that tedious exercise was most valuable in justifying my decision to become an entomologist rather than an engineer or a mechanic.

Figure 9. Motorcycle of the type ridden by the author during the 1960s (Francis Barnett Falcon 200 cc 2-stroke).

the modest speed, and leather gauntlets, the 20-km journey frequently left my hands so cold on winter mornings that I held my arms up over my head for many minutes after arrival, to slow the influx of blood into my fingers and reduce the unbearable pain as they warmed up. At the time, the winter temperatures that I experienced in Canada some years later would have been inconceivable. Warmer clothing would be readily available there—but no one with any common sense rode a motorcycle in the winter...

The overall reputation of the college was sterling, but some of the classes were not. For example, the organic chemist talked rapidly into the blackboard, which was obscured by his shock of hair as he wrote across the full width of the board whilst erasing with his trailing hand. The insect physiologist imparted little scientific information, but instead told stories about the lives of individual physiologists.

Key courses on vertebrates focussed on the skulls of mammals and on the fossil bones of dinosaurs, with almost no information about living organisms. Information from one of those instructors was unreliable; in an illustration copied from the textbook, she even marked a pair of lines from a label (indicating the key structure) as the structure itself. Such errors created a need during examinations for sophisticated answers that would encompass both the correct information and that provided by the instructor!

These and other imprecisions suggested that my undergraduate work could have been done in a few months if I had known in advance what knowledge was needed—but of course I did not. Indeed, the time could have been even shorter: for instance, learning the complete classification of the Crustacea never proved useful, although the task served as an exercise in organization, memorization, and comprehension of hierarchies. In fact, most activities are relatively inefficient because of the need for incremental learning as they proceed. Nevertheless, no learning is ever really wasted. Exposure at school to Latin and Greek gave context to scientific names. Lessons in French and German stimulated my existing interest in language, an interest that led to further studies of French and, eventually, of Japanese. Moreover, I tried to synthesize scientific literature from across the world, unlike some other authors who limit themselves to work published in their own languages, or even mainly in their own countries.

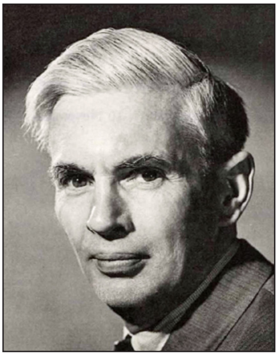

Figure 10. The entomologist O.W. Richards. Image from Biographical Memoirs of Fellows of the Royal Society **33**: 538 (1987).

At the college, course lectures by O.W. Richards (Figure 10) and R.G. Davies, both of whom had been responsible for the textbook of entomology I consulted as a schoolboy, were particularly informative. Those by the former were somewhat dry, but occasionally an unexpected sentence would get the students' attention. To emphasize male-female disparity (as in Strepsiptera), he once declared in a deadpan voice: "The male emerges in the morning, copulates, and is always dead by lunchtime."

He worked on many groups during his career, and had studied sphaerocerid flies collected by a British Museum expedition to the Rwenzori (formerly Ruwenzori) mountains of equatorial Africa. On these high massifs separated by deep gorges, wing reduction has evolved multiple times, as in insects from other isolated and adverse habitats. During his lecture on sphaerocerids, Professor Richards suddenly proclaimed: “You know they call me the King of the Wingless Flies of Ruwenzori.”

Some of our instruction in the final year took place on the Imperial College Field Station at Silwood Park, about 45 km west of the London campus in South Kensington. Interesting entomology classes were held outdoors and followed up in the laboratory. They were led by faculty whose active research programs gave them detailed field knowledge of bugs, beetles, wasps, ants, and other taxa, making the classes more valuable than if they had simply relied on a textbook.

A few presentations featured other organisms. The field component of an introduction to birds started at 5 a.m. so that the songs of the dawn chorus could be heard. The senior zoologist in charge gave a long lecture the previous evening. He was prone to pausing for effect as he drew on a pipe. A recently appointed junior member of the entomology faculty decided to attend the lecture, but eventually nodded off while the professor was waiting for the class to respond to a question. Half an hour later, the faculty member awoke with a start to see the professor, puffing on the pipe, looking in his direction—so he blurted out an answer to the earlier question. This performance was much appreciated by the students, especially those who had not remained fully engaged in a lecture that was approaching the end of its unremitting second hour.

Some students also had difficulty staying alert during later lectures on insecticide spraying, which addressed every conceivable variety of spray nozzle in excruciating detail. The instructor was a former member of the British army, who had classified each nozzle into a hierarchical numbered sequence (1.1.2.4…, etc.), according to such features as size, shape, spray-pattern, pressure, and application.

Despite the lower appeal of a few of these sessions, my interest in biology was sustained not only by entomology courses but also by books on ecology that were published during this period (e.g., Figure 11). They reinforced my ecological interests and consolidated earlier conclusions about conservation and other issues, confirming the complexity with which organisms interact with their environments, as well as the challenges of synthesizing the information.

The final year of undergraduate work included individual research projects. My laboratory project examined oviposition behaviour in a tiny polyphagous parasitoid (Figure 12), and taught me that researchers must be adaptable. For example, I built an experimental arena completely

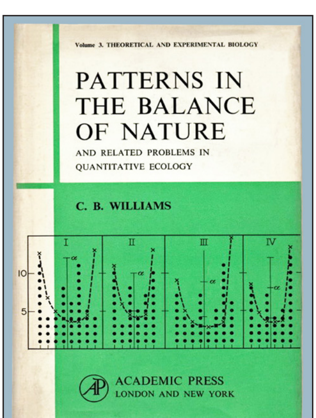

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Figure 11. Patterns in the balance of nature…, by C.B. Williams, published in 1964.

Univ. Oslo, Nat. Hist. Mus. (CC BY-NC-SAP)

Figure 12. Pteromalid chalcidoid of the *Dibrachys cavus* complex. Length usually about 2.0–2.5 mm.

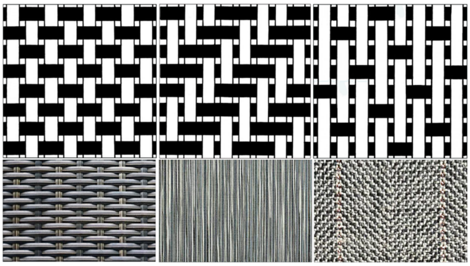

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Figure 13. Features of different fabrics, as might be used to construct artificial cocoons to test parasitoid responses. Top, the three basic weaves: L to R plain (firm), twill (softer), satin (smooth). Bottom, a few variants: L to R basket (doubled in one direction), rib (different thickness in each direction), herringbone (broken twill).

Figure 14. The halictid bee *Lasioglossum calceatum* (synonyms include *Halictus cylindricus* and *H. calceatus*). Length about 0.8 cm.

surrounded by panes of ground glass to minimize the directional effects of ambient light in the laboratory. A detailed study of fabrics allowed me to sew miniature envelopes, containing wax moth larvae, from materials with different weaves, textures, thicknesses, and spaces between fibres (cf. Figure 13), giving a range of "host cocoons" that varied in surface roughness and ease of penetration. (Other conditions were tested too, such as scent from host frass.)

My field project studied bees and wasps nesting in sand at Silwood Park. That project underlined the difficulty of assessing the structure of nests in the soil, but in particular confirmed that observing insects properly requires much detailed attention. Some species active at the sandbank proved difficult to follow until I could develop and refine a "search image" for each one. Moreover, such mental pictures of what to look for were most effective when they were based not only on appearance but also on characteristic behaviour and preferred subhabitat.

Early in the project, I identified a species of bee (Figure 14). In response to my request for confirmation, Professor Richards merely glanced over at the specimen and identified it.[6] He knew hundreds of species of British insects on sight, and remarkably was able to recognize most of them in the field. When asked how, he would quote obscure key characters such as "hairs shorter on sternite 5," features that could not possibly be seen in the circumstances.

This ability showed that there is no substitute for familiarity with the fauna, allowing experienced biologists to arrive at an identification by integrating clues from habitat, structure, posture, and behaviour ("because it looks like it"). In the same way, entomologists who have collected extensively in the field know which pond or other habitat is most likely to contain their quarry.

O.W. Richards knew many efficient means of field identification. He saw a solitary wasp, belonging to a group of species normally discriminated by minor morphological details, and told us that it was either a particular species that could sting humans or its almost identical congener that could not. He picked the specimen up to check. It was the former, but he seemed unfazed as it stung him while he explained the taxonomic characters used to distinguish museum specimens of the two species!

In due course, O.W. would supervise my doctoral studies. His personality and abilities would then become even more apparent.

[6] He gave it a different name, but fortunately my resulting dismay was short-lived because the difference stemmed from a synonym rather than a misidentification.