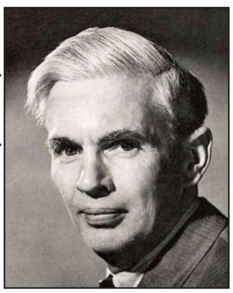
Wider aspects of a career in entomology. 12. Graduate studies in England

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 considers my time as a graduate student in entomology.

My graduate studies in the Department of Zoology and Applied Entomology of Imperial College (University of London) were based at Silwood Park, the field station of the college. This site is close to Ascot, Berkshire, home of the racecourse for thoroughbred horses that is renowned for the ridiculous hats sported by some of the ladies who attend the races during "Royal Week".

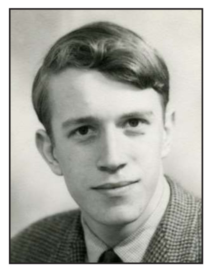


Walter Bird/The Royal Society

Figure 1. Professor O.W. Richards (1901–1984; photographed in 1959), who supervised the author's graduate studies. Image from Biographical Memoirs of Fellows of the Royal Society **33**: 538 (1987).

O.W. Richards (Figure 1) was my supervisor, and before deciding what to study I asked him whether the choice of topic was critical. He replied that what matters is the quality of the work, not the subject. Mundane work, even on a species of great economic importance, would be much less useful—to entomology as well as to a future career—than an investigation that addressed themes of genuine scientific value.

As a doctoral student (Figure 2), I chose to examine the natural history of aculeate Hymenoptera that nest in the pithy stems of bramble (blackberry). Study of this specialized habitat might reveal not only how the species of the community survive and interact, but also how populations of insects thought to occur in extremely low abundance can be measured.



Kensington Cameras

Figure 2. Author Hugh Danks as a graduate student in 1966.

At the end of my undergraduate studies in the spring of 1965, I installed numerous trap-nest bundles on the field station, each one made up of six 30-cm lengths of bramble stem with the ends cut to expose the pith. Most of them were staked out at ground level (Figure 3). Wasps and bees would nest in the pith, and their nests could be examined a few months later, when my research began. Bundles were placed mainly in open areas (e.g., Figure 4), which are favoured by most species.

O.W. Richards invited me to use the back of his laboratory at the field station to prepare the bundles. One day, O.W. was seated at the front bench. He was conducting a major study of beetles and other insects on scotch broom, and was dissecting individual females to assess fecundity. He would put a specimen under the microscope, quickly dissect it, record the fecundity, discard the specimen, and repeat these actions with great regularity.

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. Trap-nest bundle of cut bramble stems, as used in the field research noted here.

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Figure 4. Crop area in Silwood Park (before planting); trap nests were deployed along the left-hand edge.

Alongside him was his cooperator on the faculty, Nadia Waloff. Suddenly, she stopped her corresponding activity and declared: “Oh, do you know, Professor...!” She always spoke enthusiastically, and her voice rose and fell with excitement for many minutes as she explained a theory about the material they were working on. At last, she made a final point, and concluded “So what do you think of that, Professor?!”

O.W. had continued his methodical work of dissection throughout her animated exposition. There was just a second of silence before he lifted his head from the microscope to reply: “Oh, no,” he said, “that can’t be true, because there is only one generation a year.” He looked back down and resumed his work, while Nadia Waloff stared off in stunned silence. At the back of the room, I was perilously close to spontaneous laughter inappropriate for a beginning student.

Many stories about O.W. circulated in the department. One claimed that years ago he had suddenly announced, to general surprise, that he was getting married (to a fellow entomologist), and would soon leave to spend the honeymoon in South America. In the faculty common room upon his return, someone asked him with a knowing look how the honeymoon had gone. South America was an area of particular interest to a student of wasps, as the questioner learned when the innuendo he had intended disappeared without a trace at the response: “Oh, I got four new species, and my wife got three.”

O.W. seemed to be shy: for example, he might look down if someone approached along a corridor, but give a cheery “Oh, hello!” if they appeared suddenly from around a corner. Especially when uncomfortable, he had the habit of brushing back his hair, but he pulled it towards the same side as his hand, unlike the majority of people who push the hair across their forehead. Although O.W. was well respected, some students pointed out that this pattern resembled the action of an insect, which combs its antenna with a leg of the same side…

The field station had two main buildings at that time: the main house, a large country mansion (Figure 5),

Figure 5. Silwood Park house, viewed from the southeast. Bramble in the foreground is on the edge of the crop area that is shown unplanted, and many years earlier, in Figure 4.

Figure 6. Silwood Park house showing the front and the west faces. The room occupied by author Hugh Danks during his PhD is marked by the rearmost dormer on the right-hand side. Part of the conservatory can be seen below it. © Mick Crawley, geograph.org.uk/p/2246549.

and a lodge (Ashurst) some distance away[1]. Smaller structures included a separate building where meals were provided for residents of the field station, a feature that contributed greatly to the efficiency of the studies there. The 100 hectares of land had various types of more or less natural terrain as well as a few crops.

I returned to Silwood in late summer, and a tiny room on the top floor of the main house (identified in the caption of Figure 6) served as my accommodation for the next 3 years[2]. There was space for little more than a bed and a desk—but it was my own domain! My large laboratory on the ground floor was shared with two other students.

Residents at the field station were part of an active community. Communication and morale were enhanced by conversations that took place over the meals served on site, and during afternoon tea held in the conservatory (the glass-roofed structure visible in Figures 5 and 6). Students also socialized at the nearby pub, although our perspectives differed from some of the local gentry, who might talk about Ascot hats or "Mummy's pony," for example. One of them accidentally jostled the student next to me, and then proclaimed in a haughty manner "I'm terribly sorry, old chap." The student responded deliberately with "'s aw'right, mate," a vernacular response that by no means resembled his normal accent. As he had anticipated, it prompted a mighty recoil!

There were organized activities too, such as a well attended Christmas party. One year I compiled a lengthy mix of music to play in the background throughout the event. However, my small tape recorder could not deliver the required volume for long enough without overheating[3], and one of the researchers agreed to lend me his more powerful laboratory machine. On the day of the party he told me that it would not be available because he had decided to run an experiment instead. His last-minute withdrawal despite an earlier promise was a reminder that some people do not take their commitments seriously, and it is wise to be self reliant, or at least to have a back-up plan.

Student activities included a rugby team that travelled to weekend games during the colder months, and a cricket match against the staff each summer. These and other joint ventures helped students to feel part of the department and connect with one another, and my later travels on behalf of the Biological Survey of Canada confirmed that graduate students everywhere do better in more cohesive settings.

O.W. Richards had an extraordinarily wide knowledge of entomology, but in addition he taught people, not just the subject, and was an excellent judge of what each individual might need. He

[1]From about 1988, offices and laboratories were in new buildings constructed near the old mansion, which was then used intermittently for other purposes until safety concerns dictated its closure in 2010. The building has heritage designation, but millions of pounds would be required to make it habitable, and it has been listed for sale, together with nearby land, to allow private development. Ashurst Lodge was sold in 1987.

[2]Many doctorates in England could be completed in 3 years, because students with high undergraduate grades deemed capable of independent research entered PhD programs directly, whereas in Canada and the United States, for example, few students proceeded to a doctorate without first completing an MSc. Also, undergraduate courses in England were closely prescribed, so that specialized subject knowledge for many beginning graduate students was significantly greater than in North America, and typically no additional courses were required.

[3]The reel-to-reel tape recorders then in use required more power than most modern systems.

knew my work as an undergraduate, and apparently had concluded that I was likely (and would prefer) to complete a project without constant prodding. At the beginning of my graduate work he told me: “Well, Danks, you seem to know what you are doing. Come and see me if you need anything.” He delivered fully on the three occasions I did so, but being allowed to work chiefly on my own was of great benefit later in various jobs where I would be the only local scientist in my subject area. It reinforced my existing inclinations to plan for the long term, organize in detail, and use the scientific literature to maximum benefit.

However, another of the doctoral students he supervised had difficulties with taxonomy, and O.W. spent many Friday afternoons in the laboratory providing one-on-one training. Those intensive sessions were effective, and the student’s project was successful.

Occasionally, O.W. would send an essential message with a different approach. A botany student arrived at the field station from the University of Oxford, and was convinced that his attendance at that venerable institution made him far superior to everyone else (although most of the other students regarded him as merely obnoxious). One day, Professor Richards was talking with a group of entomologists, including me, when that student interrupted forcefully to assert his opinion, which of course he deemed much better than any alternative. O.W. turned to look at him. “Oh,” he said “I don’t know you, do I?” ... although as head of the field station he must have known who the student was ... “You’re a botanist, aren’t you?” “Yes, sir,” replied the student bumptiously. “Oh well, then,” O.W. responded, as he turned away to continue his conversation with the entomologists, “I don’t need to know you!”

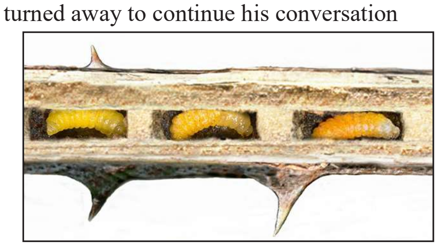
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Figure 7. Section through part of the nest of a solitary wasp in the pith of a bramble stem, showing a series of cells containing *Pemphredon* larvae, separated by partitions made of pith fragments. Larval length about 0.7 cm.

My research at first harvested and examined the trap-nest bundles put out earlier in the year. Figure 7 illustrates a few cells in a typical nest. A record sheet documented the architecture of each nest and the dimensions and contents of its cells, and in due course identifications, emergence dates of living occupants (kept out of doors in individual vials), and other data, were added to the sheets.

Subsequent seasons allowed more intensive trap-nest studies as well as general collecting of nests. Hundreds of stems were sliced open with a large scalpel to log the nest details or to reveal blind alleys—but only once was my finger sliced open instead. The doctor at the emergency clinic in Ascot showed little interest in the deep wound, and applied only a butterfly bandage (although stitches might have been no more effective). The scar persists as a memento of my work.

The study provided invaluable entomological training because so many kinds of arthropods had to be mounted and identified, including immature stages. The bramble-stem community comprised numerous species of wasps, bees, and their ichneumonid, chrysidid, chalcidoid, and tachinid enemies. Moreover, if a wasp larva failed to develop, the many prey items in its cell remained uneaten and could be identified, reflecting the activities of the adult that had collected them. Viviparous aphids were common prey, and so were spiders (mainly immature) of various families. Additional wasp species stocked flies (chiefly Nematocera), larval thrips, psyllids, psocids, or caterpillars. Pollen from plants visited by the bees also had to be determined.


Ian Tew/BWARS

Figure 8. The species most studied, the crabronid *Pemphredon* (then known as *Cemonus) lethifer*. Length usually about 0.65 cm. Image from Bees, Wasps & Ants Recording Society 2019. bwars.com/wasp/crabronidae/inae/pemphredon-lethifer

The most frequent species was an aphid-hunting wasp (Figure 8). Its nests, as well as those of other species, were

Spencer Walker (CC BY-NC-SA 3.0)

Figure 9. The ichneumonid *Perithous divinator*, which attacks stem-nesting aculeates. Length variable, typically about 0.8 cm. © Centre for Biodiversity Genomics (Photography Group).

Kulac (CC BY-SA 3.0)

Figure 10. The chrysidid *Pseudomalus* (then known as *Omalus*) *auratus*, which attacks stem-nesting aculeates. Length variable, typically about 0.5 cm.

often attacked by an ichneumonid (Figure 9) that oviposits through the stem wall, and by a chrysidid (Figure 10) that gains access while the nest is being built. Many of the parasitoids were relatively uncommon. The rarest species have been recorded only from stem-nesting aculeates, but always in very low numbers. Their populations must be unusually sparse.

Logging the cell contents produced a sort of retrospective life table, showing that aculeate mortality from egg to adult in typical species was only 40–60%, unusually low for insects. To obtain complementary data on developmental rate, fecundity, and longevity, at least one species had to be reared.

No account of how to culture successive generations of such species had been published, but various tests revealed the necessary conditions[4]. Then I went to see O.W. Richards, who quickly authorized my request for a costly rearing facility. Female wasps are active in warm sunshine, so a 100-watt tungsten-filament light bulb in a reflector provided the necessary light and radiant warmth to each cage; nesting sites, prey, and sugar solution were also made available (Figure 11). Mating would only take place if wasps emerged into these conditions from undamaged nests (like those in stems on the cage floor in Figure 11). Banks of cages (Figure 12) were housed in a room held at constant temperature, where powerful thermostatically controlled fans extracted surplus heat generated by the bulbs.

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Figure 11. Rearing cage for solitary wasps, showing entrances to nest-galleries excavated in bramble stems (back R), young bean plants (in pots) bearing aphid prey, and (at top L) a tube with 5% sucrose solution, and a means for watering plants without opening the cage.

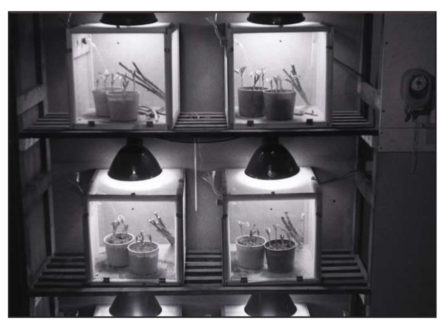

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Figure 12. Part of the rearing facility, showing a set of brightly illuminated cages.

[4]Several species built nests in these conditions, but only those that stock aphids could be supplied with enough prey.

The wasps were successful in this setting, but normal nesting activity could be seen only by patient observers, who kept still for long periods. Females are easily disturbed, readily interrupt their sequences of instinctive behaviour, and may not resume them unaltered.

Female wasps consumed sugar, and also aphids in addition to those stocked in the cells. They could live for many weeks and construct more than 40 cells each. The species shown in Figure 8 developed through successive generations without delay in the laboratory, and had a partial second generation in the field.

These findings demonstrated that the reproductive potential of the wasps is high enough that their populations must be constrained by factors other than the limited mortality in the nests. Such factors were considered in another part of my study.

In addition to research, my editorship of the *Bulletin of the Amateur Entomologists' Society* continued (cf. ESC *Bulletin* **52**: 92). Correspondence was prepared with an ancient but sturdy manual typewriter (as in Figure 13), which occupied a significant area of the desk in my room. Learning to type on this machine without instruction left me with a forceful "visual hunt and peck" technique, albeit a relatively rapid one in the end[5].

Figure 13. Vintage typewriter.

In my experience, entomologists (including hardworking graduate students) are happier when they have a few outside interests. One of my diversions was to learn folk songs, with fingerpicking accompaniment on my acoustic guitar. A link with Canada was established (although it did not seem significant at the time) because some of the songs were from the debut albums—all released during my PhD—of three outstanding Canadian singer-songwriters: Gordon Lightfoot, Leonard Cohen, and Joni Mitchell.

I also decided to teach myself to speak French, given hopeless inadequacies during travels in France as an undergraduate (ESC *Bulletin* **52**: 156). The structure of the language had been emphasized at school, but my vocabulary was limited and my conversational ability was abysmal. Indeed, my comprehension of spoken French was so poor that during a first visit I failed to understand when someone spoke to me in a shop. Asked to repeat what was said, he looked at me sternly: "J'ai dit bonjour!"

Three avenues helped me to improve. First, I compiled hundreds of common words in a notebook and learned them. My school textbooks had contained phrases that were less useful, such as "The postillion has been struck by lightning."

A second avenue was to translate information by French authors about stem-nesting wasps and bees. One series of particularly lengthy papers was written in an old-fashioned style, and for page after page even minor findings were elaborated with both common and obscure words. It took several months to hammer out the translations laboriously on my old typewriter.

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[5]Making changes was much more troublesome than today, when computers allow documents to be modified on-screen, reprinted, and transmitted electronically. The typed sheet of paper was corrected by overtyping after applying correction fluid ("Wite-out") or correction strips, although a page with multiple errors was usually retyped. Before photocopiers became prevalent, copies were generated with carbon paper, which transferred the imprint of each letter to a second sheet—a system echoed by "cc" (carbon copy) in current email systems. A mistake could be erased on the copy, although differential movement of the sheets had to be avoided when the typewriter carriage was rotated to access it. Correcting the top sheet then rectified the copy too. When errors were discovered later, the top and carbon copies might be corrected separately.

Third, I listened whenever possible to French-language broadcasts of the British Broadcasting Corporation, especially the news. The introduction lingers in my memory because it was repeated for every broadcast: “Ici Londres. Vous écoutez en ce moment le …ième bulletin d’information en langue française de la service européenne de la BBC...”.

Eventually, my progress was marked by the fact that I understood a joke. The achievement gave me confidence, so when a student who briefly visited the field station from Belgium had trouble in English, I spoke to him in French—but was disappointed when he just stared at me. Only later was it clear that he came from the Flemish community of that country, members of which maintain some friction with their French-speaking counterparts!

My efforts to learn French would prove useful in due course not for anticipated travel in Europe, but for living in Canada. However, the accents and joual there posed major challenges to someone familiar only with the standardized language and measured tones of newscasters from the European Service of the BBC![6] Going to Canada, though, would depend on completing my doctorate, including estimates of aculeate populations, as outlined in the next article in this series.

[6]Those challenges continue!