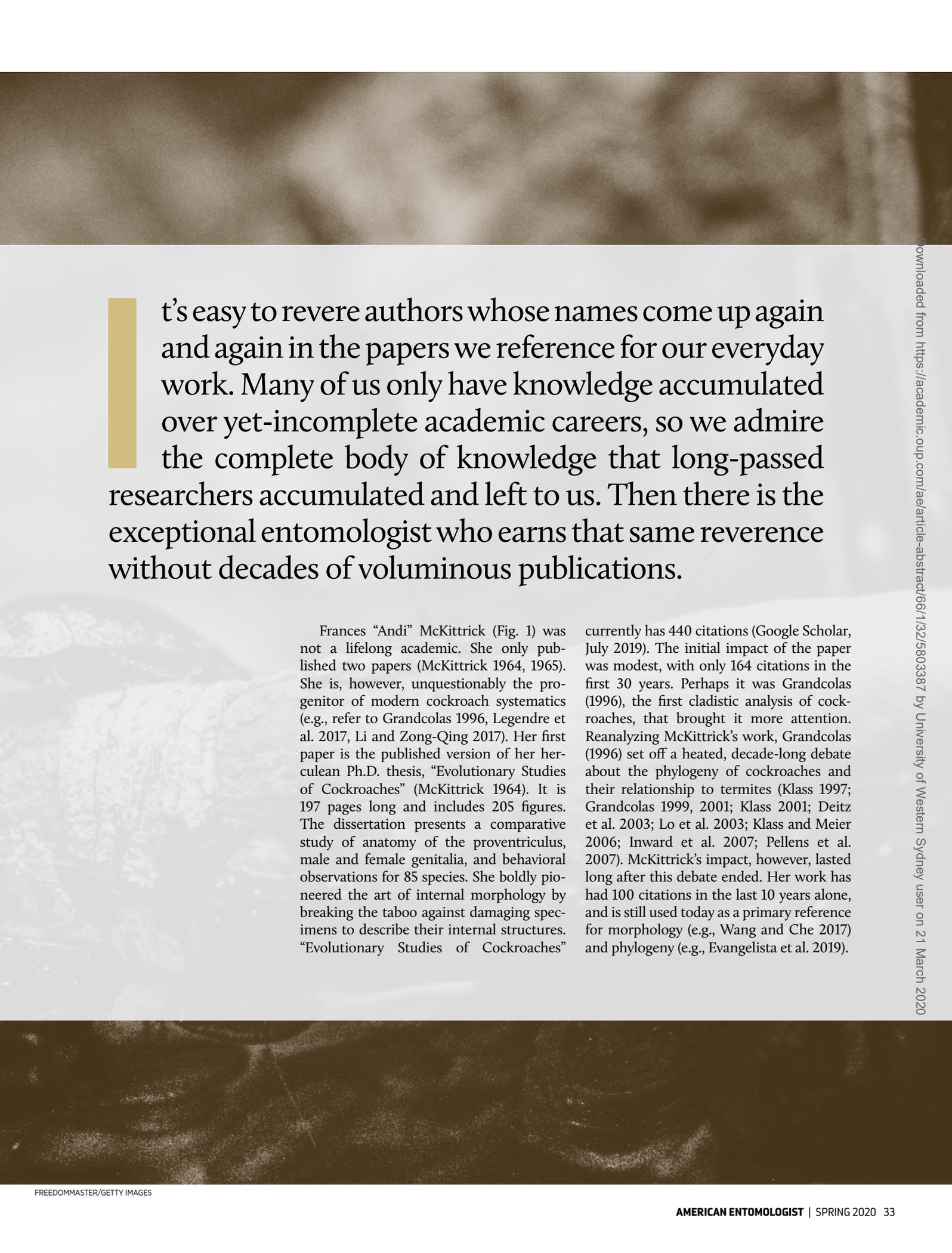


# Frances Ann McKittrick:

## Revolutionary Studies of Cockroaches

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It's easy to revere authors whose names come up again and again in the papers we reference for our everyday work. Many of us only have knowledge accumulated over yet-incomplete academic careers, so we admire the complete body of knowledge that long-passed researchers accumulated and left to us. Then there is the exceptional entomologist who earns that same reverence without decades of voluminous publications.

Frances “Andi” McKittrick (Fig. 1) was not a lifelong academic. She only published two papers (McKittrick 1964, 1965). She is, however, unquestionably the progenitor of modern cockroach systematics (e.g., refer to Grandcolas 1996, Legendre et al. 2017, Li and Zong-Qing 2017). Her first paper is the published version of her herculean Ph.D. thesis, “Evolutionary Studies of Cockroaches” (McKittrick 1964). It is 197 pages long and includes 205 figures. The dissertation presents a comparative study of anatomy of the proventriculus, male and female genitalia, and behavioral observations for 85 species. She boldly pioneered the art of internal morphology by breaking the taboo against damaging specimens to describe their internal structures. “Evolutionary Studies of Cockroaches”

currently has 440 citations (Google Scholar, July 2019). The initial impact of the paper was modest, with only 164 citations in the first 30 years. Perhaps it was Grandcolas (1996), the first cladistic analysis of cockroaches, that brought it more attention. Reanalyzing McKittrick's work, Grandcolas (1996) set off a heated, decade-long debate about the phylogeny of cockroaches and their relationship to termites (Klass 1997; Grandcolas 1999, 2001; Klass 2001; Deitz et al. 2003; Lo et al. 2003; Klass and Meier 2006; Inward et al. 2007; Pellens et al. 2007). McKittrick's impact, however, lasted long after this debate ended. Her work has had 100 citations in the last 10 years alone, and is still used today as a primary reference for morphology (e.g., Wang and Che 2017) and phylogeny (e.g., Evangelista et al. 2019).



Fig. 1. Frances Ann McKittrick c. 1965. Photograph by Bill Watkins.

Recently, Evangelista et al. (2019) found that McKittrick was right about one key evolutionary hypothesis (McKittrick 1964, 1965): lamproblattid cockroaches are the closest relatives to wood-feeding cockroaches (*Cryptocercus* spp.) and termites. This implies an elegant evolutionary scenario in which residing in wood evolved, in part, as relief to the vulnerability of egg cases during oviposition (McKittrick 1964).

Given the impact of McKittrick's work, she unfortunately seems to be underappreciated. Only two species of cockroaches are named after her (Beccaloni 2018), and the biographical sketch of her in Roth (2003) seems lackluster. In an effort to correct this, we named a clade in her honor (Evangelista et al. 2019). The group, *Kittrickea*, contains Lamproblattidae, Cryptocercidae,

and Isoptera—more than 2,500 described species.

Although Frances' academic work had a lasting effect, it accounts for only a few short years of her rich life. Frances was born in East Grinstead, England, in 1935, but her family moved to the United States when she was four years old. Known to her friends and family as "Andi," she was the youngest of four sisters. Her father was an amateur naturalist who recorded fastidious ecological observations. Andi clearly inherited his passion for nature and respect for details. The family moved among various cities in the northeastern U.S. and briefly lived in New York City; Andi, though, had a clear preference for greener landscapes. She got her wish when they moved to rural parts of New York and New Jersey, where

she had a diverse array of farm animals that she considered her pets. Adolescent Andi would have been happy to know she would eventually live out her years raising goats and rabbits at her Florida farmstead.

Frances entered university at Cornell around 1953, majoring in biology, and progressed to entomology for her master's degree in 1958. Though she always had a love for animals, she became specifically interested in insects after learning about the elaborate egg-laying behaviors of cockroaches. Her advisor, Thomas Eisner, convinced her to take a qualifying exam and get her Ph.D. because her master's project was so ambitious. Of cockroaches, she would say to her family, "Nice little bugs, but not in the house!" She was, after all, human. She got her Ph.D. in 1962 and continued to conduct research until 1965. She was supported by an NIH grant.

Her research project offered her the opportunity to travel the world to (what else?) collect cockroaches. She went to Panama in 1960 and again in 1962. Her nephew, Thomas Handel, recounts her return from the first trip:

She had brought back quite a collection of exotic, live cockroaches, neatly housed by species in squat, cylindrical, white paperboard boxes including natural bedding from the places they had been found. At this point in my life, my exposure to "cockroaches" was limited to the "Palmetto bugs" that were numerous in south Florida outdoors at night and only slightly less frequently seen as interlopers in the house. Andi's collection from Panama of many shapes and sizes of roach was, hence, quite a revelation to me. Going through her diverse collection, she gingerly opened each box so we could peek inside and told me a little bit about each one. It was a little like Christmas morning. I particularly remember one very large, and frankly beautiful, pair that were a lovely light brown color, very delicate, and maybe four or five inches long by an inch wide. Suddenly "Palmetto bugs" weren't all that big after all! I also remember she had a lot of fascinating tales of cockroach hunting at night in Panama, including other assorted exotic wildlife she encountered by accident in the process. Alas, the details

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of those stories are beyond retrieval from my memory banks.

After becoming Dr. McKittrick, the first female Ph.D. in her family, she moved to Florida, where the climate was more agreeable to her health. She was briefly a professor of biology at Florida Atlantic University (FAU).

At FAU, Frances solidified the career that would last her lifetime: scientific illustration. She always did artistic renderings of natural things, a skill inherited from her grandfather. As a freelance illustrator during her university years, she illustrated textbooks and was an art teacher. Incidentally, "Evolutionary Studies of Cockroaches" has the most detailed and realistic depictions of cockroach morphology of any publication (Fig. 2). Among her friends and family, she was perhaps most well known for being a prolific illustrator of vertebrate sea life (McClane 1973, 1998; Fig. 3).

At FAU, Andi connected with a fellow academic visual artist, Bill Watkins, a photographer. They married in 1966. Frances "Andi" Watkins died in 2001. As of December 2018, Bill was 87 years old.

By all accounts, Frances was a woman in love with the world and at peace with life. She had no children, although she was a mother figure to many.

Thomas Handel speaks about his aunt as a highly intelligent and compassionate woman with immense artistic talent. He says she had a penchant for solving problems through solutions no one else had considered. Thomas tells that as a compassionate lover of animals, Andi made sure to keep a hatchet in her car for fear that she would mortally wound an animal and have no means of ending its suffering. While she perhaps never used that hatchet, Thomas has "no doubt whatsoever she had the strength of character and sense of duty to do so, no doubt with regret, but without hesitation."

Kate Sanson was equally moved by Andi's love for animals, artistic talent, and wisdom. As Kate's mentor, Andi taught the value of abandoning preconceptions, conditioned beliefs, fear, and emotional baggage. Truly this is a scientist's lesson of self-betterment. Applying these tenets to her own life allowed Andi to achieve an exceptional presence of mind and awareness of the world. Her vehicle for achieving enlightenment through relinquishing

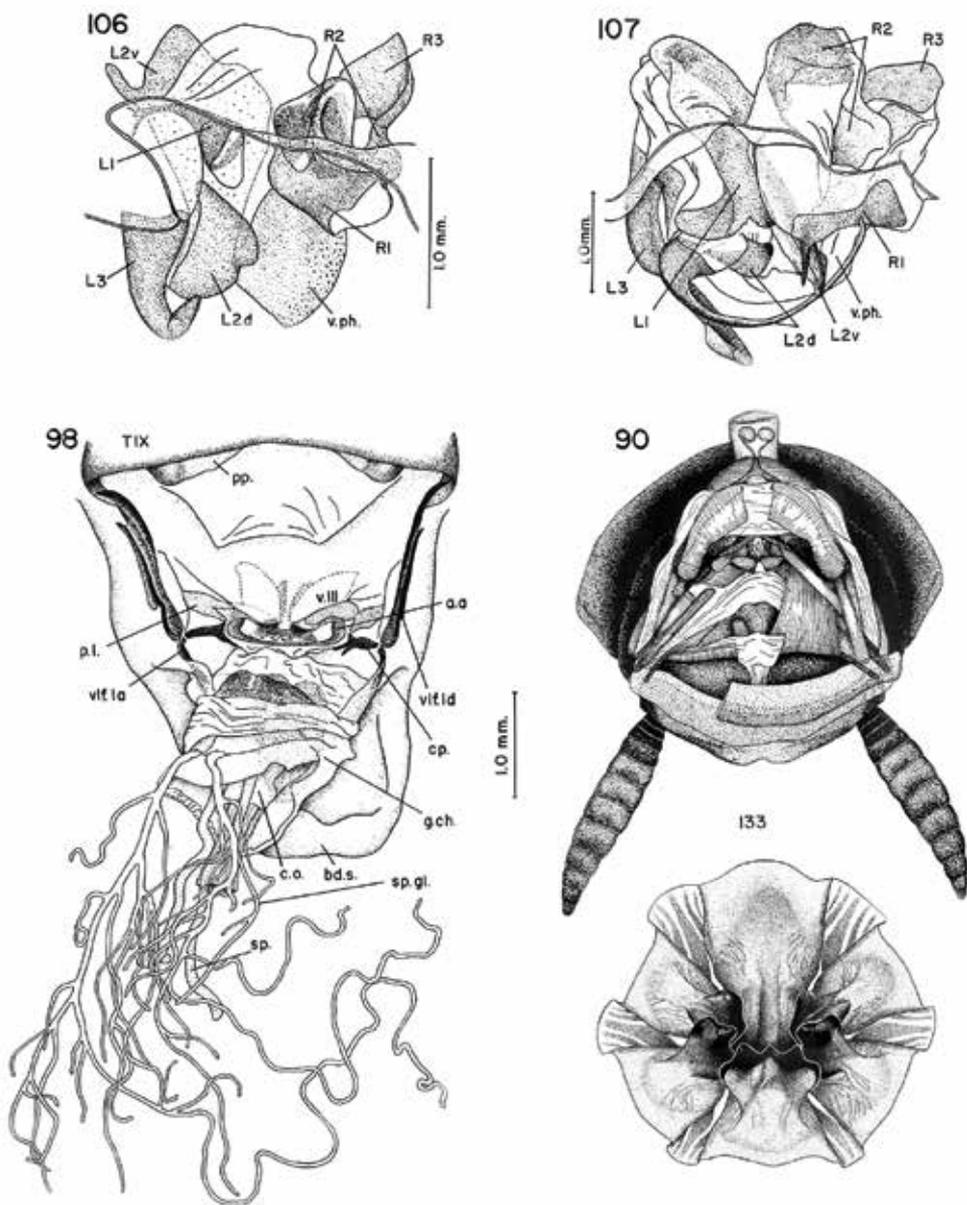


Fig. 2. Selected illustrations from F.A. McKittrick's Ph.D. thesis. From top left to bottom right: (106) *Cryptocercus punctulatus* Scudder, male genitalia; (107) *Lamproblatta albipalpus*, male genitalia; (98) *Rhyparobia maderae*, female genitalia; (90) *Epilampra azteca*, female genital musculature; (133) *Melanozosteria soror*, semi-diagrammatic anterior view of armarium. Labelling as in McKittrick (1964).

baggage was meditation. I can only guess that Frances' love for artistry and her companionship with animals were other methods of turning her mind off and absorbing the world.

It's ironic that Frances Ann McKittrick so valued shutting off the mind when attention to intimate details so permeated her work. Yet, these details never seemed to distract her from the big picture. This

was true of her science, where those details form the basis for a grand thesis on cockroach evolution. It was also true of her art; she sacrificed no small detail, yet she maintained vivid and moving portrayals. That's what makes her stand out.

**Acknowledgments**

Most of the personal and biographical information in this article comes from



Fig. 3. Some artwork by Frances “Andi” McKittrick. Left: Dolphins, done in mixed media. Based on a photograph by Bill Watkins. Right: Atlantic spadefish, done in pointillist style with pen on paper.

Kate Sanson, Thomas Handel, and *The History of Alfred & Sarah Andrews Whitman: Their Ancestors & Descendants*, a family history by Herbert S. Whitman. Thanks to all of them, and to all who assisted in tracking down Kate and Thomas, as well as Frances’ husband, Bill Watkins.

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