



# T. B. Mitchell: The Man Behind *The Bees of the Eastern United States*

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*"Each species must be known by one name only, throughout the entire extent of its range. This systematic study is the foundation upon which all the other work of seemingly more practical importance is based."*

T. B. Mitchell (1946)

In the mothball-scented North Carolina State University Insect Museum, thousands of bees bear the name T. B. Mitchell. The tiny, terse specimen labels, now caramel-colored and flaking, convey a skeleton history of a long and active career. "Highlands, NC, 1920, T. B. Mitchell" reads one nondescript little black sweat bee. An exotic, peanut-sized leafcutting bee, delightfully fluffy and pale as thistledown, came from "La Serena, Chile, 1962, Mitchell and Wagenknecht." Altogether, Mitchell's specimens account for more than 34,000<sup>1</sup> of the approximately 47,000 bees in the collection, which we, the authors, have used regularly to confirm (or correct) our own determinations. Naturally, we began to wonder about this Theodore Bertis Mitchell whose bees we have examined with such attention. So we read his thesis, delved into his archives at NC State's D. H. Hill Library, chatted with those who knew him, and inquired among other bee biologists.

What emerged was a picture of a pleasant, soft-spoken, and

unflappable gentleman, remembered for his high energy and short, wiry stature. With his "butch haircut, he looked like a megachilid bee," recalled Maurice Farrier, a retired entomologist whose time at NC State overlapped with Mitchell's. The

resemblance was apt: Mitchell's most noteworthy contribution to entomology came in the form of thorough, meticulous revisions of the megachilid genera *Megachile* (leafcutting bees) and *Coelioxys* (a group of cuckoo bees) in the Western Hemisphere. Much of Mitchell's taxonomic work is still valid, and his two-volume opus, *The Bees of the Eastern United States*, published in 1960 and 1962, remains an important reference for bee biologists. "I use them still, if I get a bunch of unidentified *Andrena* or some other genus," said renowned melittologist Charles Michener of the University of Kansas.<sup>2</sup>

## Early Life: From Butterflies to Army Bands

Long before he distinguished himself with his bee work, Mitchell demonstrated an early fascination with insects. Mitchell was born in Cambridge,

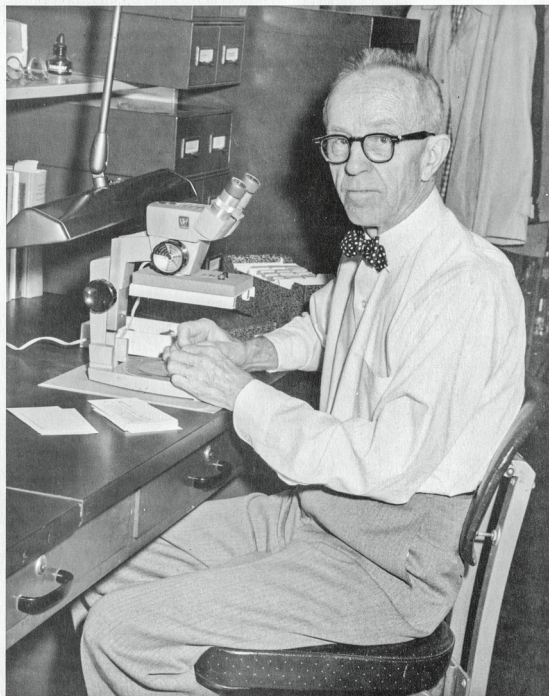


Fig. 1. Mitchell at his scope, circa 1950-1959. Image courtesy of Special Collections Research Center, North Carolina State University Libraries; photographer unknown.

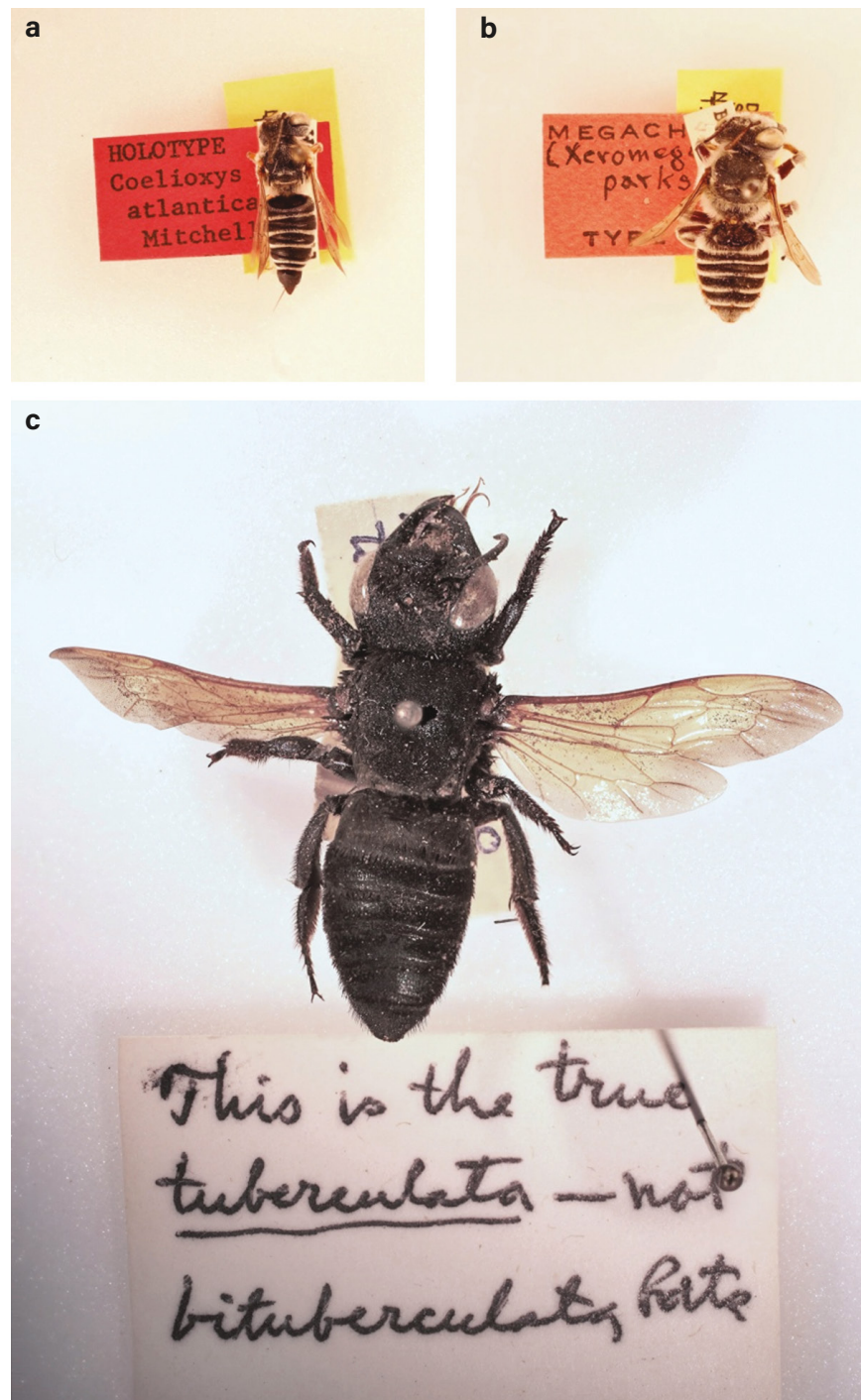
Massachusetts, on 26 October 1890, and grew up with four older siblings. The family lived in an apartment on Boston's Blue-hill Avenue<sup>3</sup> and then in the suburban town of Needham. There, Mitchell started to collect, pin, and spread butterflies, and learned to identify them using Holland's *Butterfly Book*.<sup>3</sup> "I learned that a shop over in Wellesley carried this book. The price was four dollars and I managed to scrape it up and go over there on the streetcar," Mitchell recalled in a 1979 interview.<sup>3</sup> Apparently, he also reared his moths and

butterflies indoors. One of Mitchell's former NC State colleagues, Carol Parron, remembered a story Mitchell told about his childhood. When one of his sisters had a baby, Mitchell had to give up his room. "In the middle of the night, his sister felt that there was something crawling on the baby," Parron said. The light of a candle revealed caterpillars. It turned out that they were Mitchell's, but he had forgotten to move them to his new room and they escaped in the night.<sup>4</sup> His early interests also extended to beetles, when he noticed

cerambycids emerging from the woodpile stacked in the family's basement and flying to the windows.<sup>5</sup>

It would be decades, with multiple interruptions in his formal education, before Mitchell's interest in insects would become his career. In gym class in early high school, Mitchell tripped while jumping over a gymnasium horse and struck the floor headfirst. The accident caused vision problems that took him out of school for several years before an osteopath finally identified and corrected dislocated vertebrae in his neck.<sup>6,7,8</sup> During his gap years, Mitchell worked office jobs, practiced the trumpet, and planned a career in music.<sup>3,6</sup> But the drudgery of the office and the work-all-night, sleep-all-day life of a professional musician convinced Mitchell to resume his academic education.<sup>3,6</sup> He enrolled in the Huntington School, a college preparatory academy run by the Boston YMCA,<sup>3,6,8</sup> and within two years was accepted to the Massachusetts Agricultural College in Amherst (now the University of Massachusetts).<sup>7</sup> He majored in entomology and spent his summers working as the deputy State Nursery Inspector.<sup>6</sup> He also helped survey for pests such as the gypsy moth, European corn borer, and white pine blister rust in Massachusetts—experiences that foreshadowed his later career in North Carolina. In his spare time, Mitchell continued to play the trumpet in a dance band.<sup>6</sup> Although he was initially worried about the "irregularity" of his preparatory education (he was four years older than his college classmates) Mitchell found that his age and motivation were advantages and he "breezed through three years of college."<sup>7</sup>

With U.S. involvement in World War I, Mitchell put his schooling on hold a second time. This disruption led to some of the most memorable events of his life. During his year of Army training in Camp Devens, Massachusetts, Mitchell joined the 302nd Infantry Band in the 76th Division. "It was a smart move on my part because it was an excellent band," he later said.<sup>3</sup> The group was composed of many professional musicians and played the



**Fig. 2.** The NC State Insect Museum holds more than 34,000 of Mitchell's bees—including many holotypes, such as these specimens of *Coelioxys atlantica* (a) and *Megachile parks* (b). Other specimens still bear his hand-written notes, as does this *Megachile tuberculata* (c). Images by Heather Moylett.



works of "high class" composers, especially Mitchell's favorite, Tchaikovsky.<sup>7</sup>

The 76th Division went overseas in June 1918, landed in Liverpool, and crossed the dangerous English Channel to France. There, Mitchell wrote, "the eastern sky was almost continuously aflame."<sup>7</sup> His role as a band member, however, kept him relatively safe during combat. The band spent nearly a year in the vicinity of Bordeaux, where they entertained troops and performed classical concerts every Sunday afternoon on the balcony of the Hôtel de Ville. "That was my best, most interesting musical experience," Mitchell said of his time in the 302nd Infantry Band.<sup>3</sup>

Mitchell's division was finally on its way to the front when the armistice was signed. "The enemy heard we were coming and quit," Mitchell joked.<sup>3</sup> After that, the Army broke up that band and sent Mitchell to serve in an inferior ensemble in the 82nd Division. ("Oh, that band was terrible!" he exclaimed in an interview 60 years later.<sup>3</sup>) But it was in this band that Mitchell experienced "the most outstanding event in [his] life."<sup>3</sup> Called to attend a ceremony, and with a prime vantage point in the band, Mitchell "saw [Sergeant] Alvin York march across the field and halt face to face with General Pershing. I was near enough to hear every word the General said. I remember particularly the phrase, 'above and beyond the call of duty.'"<sup>3</sup> Mitchell watched as Pershing pinned on York's tunic the Medal of Honor, an award he received for leading a handful of heavily outnumbered men on a daring and successful attack of a German machine gun nest in northern France.<sup>9</sup>

## A Yankee Entomologist Moves South

In 1919, Mitchell's entomology career gained momentum. He completed his bachelor's degree in Massachusetts just as the North Carolina Department of Agriculture was hiring a Nursery Inspector.<sup>3,6</sup> With his inspection experience, Mitchell got the job offer and moved to North Carolina in 1920. Each summer, he visited nurseries all over the state. At first he traveled by train and rental horse, then became one of the first inspectors to drive a car into the misty hills and muddy roads of western North Carolina.<sup>6</sup> Many of his stories from this time convey oddities in housing, usually imposed by impassable roads and nightfall: there was the nurseryman whose sofa was so infested with

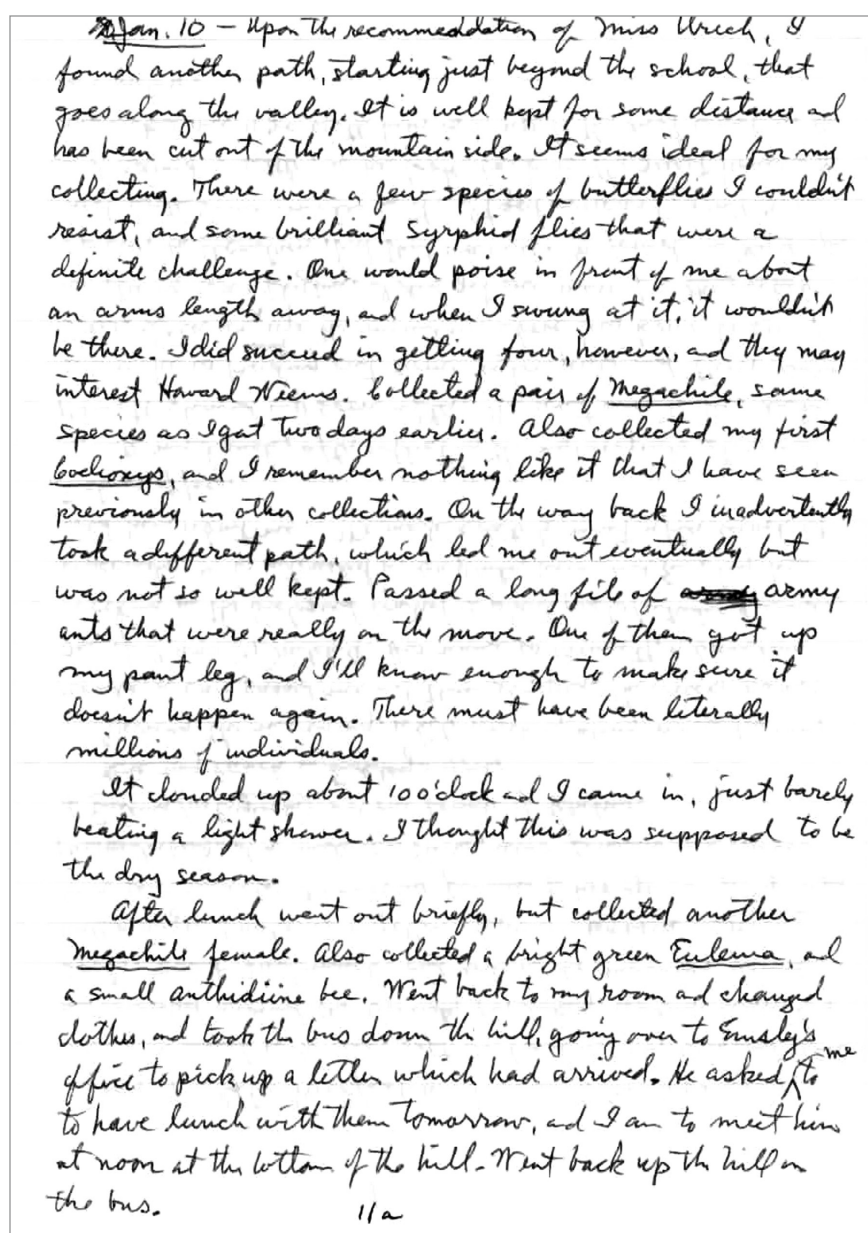


Fig. 3. A page from Mitchell's field notes recorded during a trip to Trinidad in 1963. Image courtesy of Special Collections Research Center, North Carolina State University Libraries.

bed bugs that Mitchell slept on a pair of hard wooden chairs instead.<sup>10</sup> There was the time he was traveling with a mail carrier—a stranger—when their cart got stuck in the mud and they had to spend the night in a local's small shack, sharing a bed. And there was the farm that served fried eggs, grits with red-eye gravy, country ham, fried chicken, hot biscuits, and apple pie—for breakfast.<sup>11</sup> "Southern hospitality is no myth," Mitchell wrote.<sup>11</sup> He seemed to relish being a Yankee in the South, and wrote about one of his early inspection trips in which he met "a couple of attractive young ladies" from Alabama; the three of them "had a wonderful time

poking fun at each other's pronunciation of various words, and comparing our back-home lifestyles."<sup>11</sup>

During his summer nursery inspections, Mitchell was also tasked with compiling a list of insects known to occur in North Carolina. This project, initiated by Franklin Sherman and led by C. S. Brimley of the North Carolina Department of Agriculture (Mitchell 1962), was apparently the origin of Mitchell's interest in bees. This fascination would underlie his thesis, his dissertation, and the rest of his career (although it would still be many years before bees would pay his bills).

When nursery inspections concluded

**Fig. 4.** A figure Mitchell drew for his 1924 master's thesis, illustrating a wing and glossa typical of the genus *Andrena*.

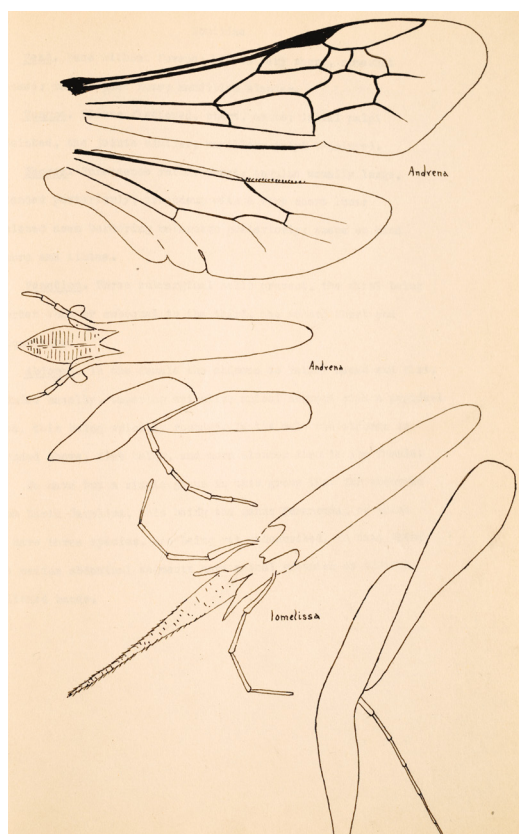
in the fall, it was Mitchell's job to monitor invasive species in North Carolina, particularly the boll weevil and Mexican bean beetle. For the boll weevil work, he traveled county by county, following the weevils' yearly movements by checking cotton fields for punctured squares.<sup>3</sup> From 1920 to 1925, Mitchell said, he "chased the boll weevil all the way from the South Carolina line to the Virginia line."<sup>3</sup> He also started inspecting honey bee hives for foulbrood, an inspection that was required for beekeepers who shipped bees or honey to states where the disease was less prevalent.<sup>3</sup> But honey bees did not captivate Mitchell's interest the way wild bees did. He would often comment that his "relation to the honey bee is the same as that of a bird watcher to the poultry industry."<sup>3</sup>

In the winters, when Mitchell's inspection and survey work was slow, he spent the time identifying specimens he had collected in the summer and taking classes at NC State (then State College) in Raleigh, culminating in a master's degree in 1924. This was also the year in which he married a "Raleigh girl," Olivia Gowan, with whom he would later raise their son, Richard.<sup>3</sup>

### NC State: "I Have Never Regretted Coming Here"

Mitchell's thesis advisor was Zeno Metcalf, who was then head of NC State's department of Entomology and Zoology and an expert in Auchenorrhyncha. In 1925, Metcalf offered Mitchell a position on the teaching faculty as Assistant Professor of Zoology (Brett 1975),<sup>3</sup> thus launching Mitchell's three-decade teaching career at NC State. Metcalf also recommended that Mitchell pursue a doctorate at Harvard's School of Applied Biology,<sup>3,12</sup> which he did in the summers of 1926 and '27 while continuing to teach in the spring and fall.

When he joined the department, Mitchell was one of just three entomology teaching faculty. In his first year, he taught six courses—half of the total entomology course offerings: Farm Insects, Fruit and



Vegetable Insects, Economic Entomology, Field Crop Entomology, Horticultural Entomology, and (for graduates only) Applied Entomology (Brett 1975). Mitchell later estimated that he had taught 100 new students each year throughout his career, for a total of some 3,000.<sup>3</sup> He had excellent relationships with his students, and enjoyed seeing former pupils working as county agents across North Carolina.<sup>10</sup> They, in turn, appreciated his devotion to teaching, and in 1963, the NC State College Graduate Entomology Club dedicated its annual newsletter to "Dr. Mitchell the man and the scientist." The newsletter included a three-page biographical sketch and Mitchell's own synopsis of his "current research on *Megachile* and *Coelioxys*." As a mentor, Mitchell advised several graduate students, mostly budding taxonomists and morphologists, who acknowledged his contributions to manuscript preparation, field collections, and photography of specimens.

Mitchell's teaching schedule allowed him to dedicate his summers to his bee research, with the exception of an interlude of public health work during World War II. He "wanted to do something for the war effort," but by then he was nearly 50 and "too old for the Army."<sup>3</sup> So he offered to help a former student who was

in charge of malaria control in North Carolina's military camps. During the war, he spent his summers at Fort Bragg Army base working on mosquito control, particularly with DDT sprays.<sup>3</sup>

Mitchell quickly became concerned by the widespread use of DDT, and supervised a master's student, John Geary, who found that mosquito populations on military bases often increased beyond pre-treatment levels in the year following a spray (Geary 1950). Mitchell also wrote an article, intended primarily for farmers, warning of the effect of DDT on bees and other beneficial insects (Mitchell 1946). His concerns sound familiar today amid ongoing pollinator health research; he reported that bee populations were already declining due to habitat loss and pesticide use. "Above all," he wrote, "something more than the nearly total lack of information concerning the effect of DDT on...native bees should be available before the widespread and unregulated use of this poison is allowed."

### Like a Drug Addiction

Mitchell's interest in bees grew out of a need he identified while working as a nursery inspector and collector for the North Carolina state insect inventory. Although his official collecting duties involved no particular focus on bees, they were the group that captured his attention and became the subject of his research. "My work with bees began as a hobby," he told the *Raleigh Times* newspaper in 1974 (Maynard 1974). "But it's like a drug addiction...once you start, you can't quit."

When he started his survey work in 1920, only 64 bee species were recorded for the state and all records were sourced from the literature, rather than specimens collected by department personnel (Mitchell 1960). There had been very little bee collecting done in the southeastern United States, making it nearly "virgin territory" for a taxonomist (Mitchell 1924). Mitchell quickly collected many species that were new to science or previously unreported in North Carolina. He also found that existing identification keys were inadequate or difficult to find (Mitchell 1960). "Such a challenge proved to be irresistible, and the pattern of my future studies and field work was set," Mitchell told entomologist Bruce Heming in a 1963 profile article.<sup>6</sup>

In his thesis, "The Bees of North Carolina," he described the economic



importance of bees, their habitats, their relationship to flowers, and their phenology. He also recorded a new species list for the state that included 266 described species and 68 undetermined species. Mitchell considered his thesis incomplete, a “statement of progress rather than a final and complete report” (Mitchell 1924). (Nearly 40 years later, in the foreword to *The Bees of the Eastern United States*, Mitchell still didn’t feel his work was done, writing that completion of such a comprehensive project was a “will-o’-the-wisp” [Mitchell 1960].)

Throughout Mitchell’s career, the net was his most important collecting tool. Although fluorescent pan traps are a popular method among melittologists today, the technique was not typically used for bees until the 1990s (Aizen and Feinsinger 1994, Leong and Thorpe 1999), and we have no indication that Mitchell used them. He did try suspending a malaise trap from trees, recalls his friend Jim Baker, now a retired entomologist, who helped him build the trap. But “he really didn’t catch many bees with it,” Baker said. Instead, in *The Bees of the Eastern United States*, Mitchell recommended only two essential collecting tools: the net (short-handled and with a small ring to facilitate rapid movement) and plentiful killing bottles.

Although Mitchell was enthusiastic about all non-*Apis* bees, he chose leaf-cutting bees, *Megachile*, as his taxonomic specialty. He intended to complete a revision of Nearctic *Megachile* for his doctoral degree at Harvard, but after his first summer in the program, he realized that it was too lengthy a project. He opted instead to describe intersexes, an anomaly he had observed during his study. “I had found some very interesting specimens that started out as females,” he later explained, “but before they had completed all the structures, the character of the tissues changed to the other sex.”<sup>3</sup> Mitchell used the terms “intersex” and “gynandromorph” to refer to different anomalies, and this distinction is still in place today. The difference is now defined genetically, such that intersexes are genetically uniform but express some physical characteristics of the other sex, while gynandromorphs have genetically distinct male and female tissues (Mitchell 1928, Narita et al. 2010). Mitchell described and interpreted these specimens for his dissertation and in a 1928 paper, “Sex Anomalies in

the Genus *Megachile*.” In this and a 1941 publication, “Some Additional Intersexes in *Megachile*,” Mitchell reviewed the literature on the different types of sex abnormalities in insects, and described intersexes for 12 species of *Megachile* (Mitchell 1929; 1932; 1941). He thought the most likely explanation for the large number of *Megachile* intersexes was that parasite attacks “interfered” with the bees’ developmental pathways and resulted in the intersex phenotype. Although this possibility has never been confirmed, it remains a plausible hypothesis. Along with other genetic and environmental factors, parasitism is one of the known causes of intersexual phenotypes in other arthropods (Narita et al. 2010).

At Harvard, Mitchell worked with taxonomist Charles T. Brues and polymath William M. Wheeler, and he credited them, along with taxonomist James C. Crawford, with influencing his view of taxonomic research (Mitchell 1960).<sup>6</sup> Although Mitchell and his mentors had already embraced evolutionary thinking, and understood morphology to reflect the process of natural selection, Mitchell’s own focus remained more taxonomic than evolutionary. This point of view is sometimes seen as a weakness in Mitchell’s work, despite its undisputed meticulousness. “It was something of a challenge that he did not approach systematics from a strongly evolutionary standpoint,” noted Michener.<sup>2</sup>

After finishing his doctoral degree, Mitchell did complete the revision of Nearctic *Megachile* and published it in eight parts, from 1934 to 1937. For several years, he continued to spend his summers preparing taxonomic notes on megachilids, expanding the scope of his work to the Neotropics,<sup>13</sup> but after World War II, Mitchell was ready for a change in routine. Thirty years of teaching had taken a toll on his lecturing voice, and in the early 1950s, he approached Roy Lovvorn, then director of the NC Agricultural Experiment Station, with a big idea: if Mitchell could get a grant from the National Science Foundation to pay half of his salary, would the experiment station pay the other half and “free” him of his teaching duties?<sup>3</sup> Lovvorn said yes, and Mitchell got the grant. From 1955 to 1962, he devoted himself to producing his best-known work, the two-volume *Bees of the Eastern United States*. This was, Mitchell said, “the biggest thing I ever did.”<sup>3</sup>

Mitchell retired in June 1961 (Brett

1975), but still came to work every single day.<sup>4</sup> “He had a good and long life after his retirement to work on bees,” Farrier said.<sup>10</sup> Mitchell spent the entire year of 1965 in Brazil on a Fulbright-Hayes research grant working with Padre Jesus Santiago Moure at Universidade Federal do Paraná, and he also collected in Mexico, Argentina, Chile, Peru, Puerto Rico, Trinidad, and several U.S. states, including Texas, Arizona, Utah, California, Oregon, and Kansas (Brett 1975).

Mitchell’s colleagues remember him as a congenial personality who appreciated a good joke (“I can hear him chuckle to this day,” Farrier said<sup>10</sup>), and he responded warmly and promptly to many requests for specimen identifications,<sup>14</sup> but he was often fiercely solitary in his own research. As was the custom at that time, Mitchell’s advisees did not work on bees,<sup>10</sup> and research on non-*Apis* bees was difficult to fund because their value as pollinators was not yet widely recognized.<sup>2</sup> Mitchell’s single-author approach also came from his own attachment to his work. Even if collaboration was offered, Mitchell didn’t seem to want it. “This is my baby,” Mitchell would say of his bee projects, remembers Baker.<sup>5</sup> Mitchell’s daughter-in-law, Janet Mitchell, suggested that Mitchell’s ability to travel and collaborate was also reduced when his wife was affected by a difficult, long-term illness.<sup>15</sup> Although it was not unusual for researchers to work alone at the time, Michener said, he and many others did collaborate, “and the results were often better than if we had worked alone.”

As a result, Mitchell’s legacy has not grown exponentially through the work of students and collaborators—but his contributions have endured. Two hundred forty-six of the species he described are still valid (136 *Megachile* [72 described from South America and 64 described from North America] and 110 non-*Megachile* species described from North America). Under his attention, the number of bee species records in North Carolina grew from 64 to 524 species reported in the *Bees of the Eastern United States*, approaching the 528 known here today (although the species composition of this list has changed somewhat, due to reidentification and synonymy).<sup>16</sup> “Mitchell not only described numerous species, but also proposed several groups as an attempt to establish a solid classification,” wrote Victor Gonzalez, a bee systematist at the University of Kansas.<sup>17</sup> “His descriptions

are detailed and often illustrated, facilitating species identification.”

Non-systematists also continue to rely on his work. “For those of us who are ecologists and not taxonomists, his two-volume set [*The Bees of the Eastern United States*] has been immensely critical,” noted ecologist Rebecca Irwin. Mitchell was careful not only to describe species’ morphology, but also to document their geographic ranges and floral hosts by compiling his own observations and those of other collectors. Through the efforts led by Sam Droege of the U.S. Geological Survey and John Pickering of the University of Georgia, these species descriptions are now integrated with the online keys at [discoverlife.org](http://discoverlife.org), and the full text of *The Bees of the Eastern United States* can be downloaded in PDF format from the NC State Insect Museum.

And, of course, his specimens—the bees that first piqued our interest in Mitchell’s life—remain an important resource. Many of his holotypes are housed at the Smithsonian and elsewhere, and 34 (representing 10 genera and four families) are housed at Mitchell’s home institution, in the NC State Insect Museum. The data associated with these and Mitchell’s other specimens provide a valuable historical record of species distributions and populations for use in current research and conservation efforts. In addition to the many identified bees Mitchell contributed to U.S. collections, the NC State Insect Museum also holds more than 8,000 unidentified specimens, of which nearly half are megachilids. Much of this material was collected by Mitchell and Brimley from North Carolina, as well as Mexico, Chile, and the Caribbean. As with any museum collection, there may be undescribed species waiting for an interested systematist.

Mitchell died on 10 February 1983 at the age of 92. Near the end of his retirement years, he had planned to write an autobiography. Although he never got around to it, “he quoted his first line of the first chapter several times,” Baker said.<sup>5</sup> It was “something along the lines of ‘It was a warm spring day in 1929 when I walked... to the Natural History Museum.’” It’s fair to say that bee biologists today are fortunate that he did.

## Acknowledgments

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## Endnotes

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- <sup>2</sup> Charles Michener, telephone interview, 6 Feb 2015.
- <sup>3</sup> T. B. Mitchell, transcript of interview by D. W. Colvard, 1 Feb 1979, Theodore B. Mitchell Papers, MC 00183, Special Collections Research Center, NC State University Libraries, Raleigh, NC.
- <sup>4</sup> Carol Parron, phone interview, 28 Jan 2015.
- <sup>5</sup> Jim Baker, interview, 26 Jan 2015.
- <sup>6</sup> Bruce Heming, “Dr. T. B. Mitchell: A Biographical Sketch,” NC Entomology Club Newsletter, 1963.
- <sup>7</sup> T. B. Mitchell, handwritten manuscript. Theodore B. Mitchell Papers, MC 00183, Special Collections Research Center, NC State University Libraries, Raleigh, NC.
- <sup>8</sup> Celebrating 150 years: the YMCA of Greater Boston, 1851–2001 <https://archive.org/details/celebrating150ye01hesk> accessed 9 Jul 2015.
- <sup>9</sup> Medal of Honor Recipients, World War I, US Army Center of Military History, <http://www.history.army.mil/html/moh/worldwari.html#YORK> accessed 9 Jul 2015.
- <sup>10</sup> Maurice Farrier, telephone interview, 12 Feb 2015.
- <sup>11</sup> T. B. Mitchell, “Highlands, 1920” (unpublished manuscript), Theodore B. Mitchell Papers, MC 00183, Special Collections Research Center, NC State University Libraries, Raleigh, NC.
- <sup>12</sup> Bussey Institution collection, 1872–2007: Guide, The Arnold Arboretum of Harvard University, [http://arboretum.harvard.edu/wp-content/uploads/VI\\_BI\\_2012.pdf](http://arboretum.harvard.edu/wp-content/uploads/VI_BI_2012.pdf) accessed 16 Jul 2015.
- <sup>13</sup> Based on T. B. Mitchell’s publication list.
- <sup>14</sup> Multiple documents, Theodore B. Mitchell Papers, MC 00183, Special Collections Research Center, NC State University Libraries, Raleigh, NC.
- <sup>15</sup> Janet Mitchell, personal communication, August 2015.
- <sup>16</sup> John S. Ascher, unpublished list.
- <sup>17</sup> E-mail correspondence with ML-U, 9 February 2015.

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