



# A SEASON OF MIDGES

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(AS NOTED), GETTY IMAGES, AND COURTESY OF CARLOS DE LA ROSA

An enthusiastic naturalist, William Coffman spent his career in biology in quest of midges, gnat-like insects that live in vastly diverse settings worldwide. In fact, midges serve as telltale markers of global ecosystem health. But no one foresaw the ultimate destiny of the Pitt professor's rare collection of specimens and data. Not even the former student so familiar with its allure.

For most of his adult life, biologist William Coffman couldn't get through a day without a midge fix.

Midges were his addiction for more than half a century—the same midges people confuse with other gnat-like insects or create vague names for, like sand flies, muckleheads, blind mosquitoes, or chizzywinks. Midges, which range from less than 1/16" to about 1/2" long, are related to flies and mosquitoes. They typically live close to water and marshes, their breeding grounds. The incredible diversity of the various species fascinated Coffman. He sometimes lay awake in bed thinking of a unique midge from India, or a newfound species from Costa Rica, or a subfamily from Linesville Creek near Pitt's ecological station, the Pymatuning Laboratory of Ecology, not far from Linesville, Pa. They're the "bacteria of the insect world," he liked to say, found on all seven continents.

More importantly, midges can be used to gauge the health of ecosystems worldwide. Coffman's vast collection of mounted specimens, representing thousands of species, contains five decades of accumulated knowledge about midges' diversity and their relationship to ecosystem and climate change around the world. Combined with his detailed journals of the various freshwater ecosystems and terrestrial locales where he had found the midges, the collection has the potential to teach and inspire future generations of biologists and ecologists. But only if it survives and Coffman's legacy endures.

Carlos de la Rosa was interested in studying insects even when he was enrolled in the mechanical engineering program at the Universidad Simón Bolívar in his hometown of Caracas, Venezuela. Before long, he would fall under the spell of midges, too.

When a newly created biology department opened at his university, de la Rosa began taking courses. It was the late 1970s, and midges were a mystery to him. For a month, he tried to discern

the difference in subfamilies within *Chironomidae*, the scientific name of the vast family that encompasses midges. Was he looking at *Chironominae* or *Diamesinae* midges, or a completely different subfamily? Then one day a visiting guest speaker was introduced—Professor Bill Coffman from the University of Pittsburgh, who had been a doctoral advisor to de la Rosa's biology professor a decade earlier. The students were invited to hear the Pitt biologist describe his encounters with midge species in the *Chironomidae* family.

Afterward, Coffman visited the students' biology lab, where he found de la Rosa perplexed by the midges in his sample. Coffman peered through the microscope and immediately identified several separate types, rattling off their characteristics. Even better, he found a few that he suspected were new species, possibly even a new subfamily.

That was a turning point for the undergraduate student. From then on, midges were a passion of de la Rosa's. He became a biology major, accelerated his learning of English, and finished his undergraduate study at the University of Pittsburgh, where he stayed to earn a PhD in biology with Coffman as his advisor.

De la Rosa spent several years immersed in research at Pitt's Pymatuning Laboratory of Ecology, and he accompanied Coffman on midge collection trips around the globe. He began to understand the value of midges as ecological health indicators for freshwater ecosystems, and he became increasingly fascinated by the insects' diversity and worldwide distribution.

It turns out that midges are so ecologically diverse, the absence or presence of certain species in an ecosystem signals what's happening in the environment. Some midges live only in pristine water, while others can thrive in foul water, laced with contaminants or sewage. Some midges like heat, others cold. Coffman's collection technique enables biologists to collect extensive samples of midges, even over time at the same locale, to gauge what's happening: Which type of midge exists in a particular ecosystem? Have



A male midge in the wild

clean-water midges been replaced by foul-water midges? Have cold-loving midges disappeared, while other species that prefer a warmer climate now thrive? All of this can be documented through the study of midge pupal skins—and Coffman's collection is without equal, detailing midge species from more than 70 locales around the globe.

During his years with Coffman, de la Rosa learned his mentor's idiosyncratic way of cataloging the specimens. Coffman helped to pioneer the technique of sampling midges by collecting the pupal skins or *exuviae* that are left behind when midge larvae mature to adulthood and emerge from the pupa. These thin skins serve as protective shells for the developing adult within the larvae and show impressions of anatomic surface details that are unique to each species. The waxy shells naturally float on the water when the insects emerge and fly away. The empty shells then accumulate in eddies or along the shores of streams, rivers, and lakes. The collection technique requires only a net and a sieve, followed later by a microscope and curiosity.

Coffman was the first midge naturalist to use pupal-skin collections to study entire stream midge communities, particularly focusing on emergence diversity and time patterns of midges in a stream—Linesville Creek—over the course of a full year. His innovative work enhanced the accuracy of such studies by enabling the efficient collection, processing, and species identification of huge numbers of specimens.

Late last summer, faculty and staff in Pitt's Department of Biological Sciences began preparing for an upcoming move to new space. Coffman, at age 70, wasn't sure where to begin sorting through a lifetime of research and teaching. He also was distracted by unusual and excruciating back pain. He would have to pack up his



Chironomid exuviae specimens (magnified) from the collection

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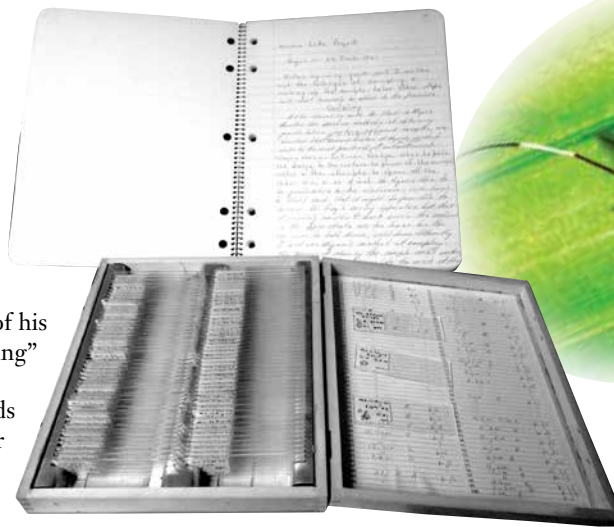


office and lab belongings of nearly 40 years, including his unparalleled collection of more than 100,000 specimens of midges, along with his intricate field notes and detailed observations about locales, water characteristics, times of year, and so on. What would become of his life's work?, he wondered. Very few people had the specific knowledge of his collection to preserve its value as "living" ecological history.

At about the same time, thousands of miles southeast of Pittsburgh—near Puerto Viejo, Costa Rica—de la Rosa was sharing a rare, aged rum with a visiting Pitt biology professor, Walter Carson, at the end of a steamy August day. In addition to talking science, the two colleagues were reminiscing about Pitt and Coffman.

De la Rosa (A&S '80, '85G) had collaborated with his faculty mentor on many scientific

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Above: A snippet of Coffman's mounted specimens and notes  
Right: A Chironomid photo from La Selva



research projects involving several hundred researchers and many students. Carson specializes in tropical forest ecology and is Pitt's official representative to OTS and La Selva.

After his August visit, when Carson left La Selva to return to Pittsburgh, he carried a letter from de la Rosa. The letter, addressed to Coffman, asked whether it might be possible for the La Selva station to acquire, curate, and build upon the Costa Rican portion of Coffman's collection.

In the few days before Carson had a chance to deliver the letter, Coffman discovered that the excruciating back pain he'd been experiencing was not temporary. He was diagnosed with terminal pancreatic cancer.

"This galvanized my interest in bringing the complete, worldwide collection to La Selva," says de la Rosa. "There are very few people that know his collection well enough to use it. I couldn't bear the thought of his life's work being lost to science."

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papers during the 1980s and '90s. Eventually, he left Pittsburgh for other positions in the United States and Caribbean that had less to do with midges and more to do with ecological research and conservation. Still, he and Coffman stayed in touch. They took research field trips together and mutually enjoyed hobbies like stamp collecting and photography. Then, in March 2012, de la Rosa became head of one of the world's premier tropical research field stations. He was named director of the Organization for Tropical Studies' renowned La Selva Biological Station in Costa Rica.

**T**he University of Pittsburgh has been a member of the Organization for Tropical Studies (OTS) for 16 years and is one of 63 members worldwide. Through its members, OTS produces between 140 to 200 scientific publications annually in peer-reviewed journals and currently has more than 100 ac-



Coffman, far left, and de la Rosa, far right, with colleague Marvin Jimenez and his two sons in the 1990s



Coffman sampling midges in the Murg River, Northern Black Forest, Germany

So, a plan developed to transfer the entire collection to La Selva, where de la Rosa had the lab, students, visiting researchers, and resources to use the collection for training and ongoing research on midges for all those interested in conservation, biological assessment, and ecosystem health. Although the collection technically belonged to Pitt, some internal legal assistance and a whirlwind of meetings enabled it to be packed and shipped—in nearly one hundred boxes—to Costa Rica, along with a new name: the William P. Coffman Laboratory of Aquatic Entomology.

“Keeping these pieces together is critical for continuing the life of this collection,” says de la Rosa, “and there will be many people interested in it.” The collection contains “snapshots” of ecosystems from areas in North America, Africa, India, Venezuela, Central America, New Zealand, and Europe, as well as a robust collection from Costa Rica. These ecological snapshots are derived from the locales where Coffman, his students, and collaborators collected and documented various midge types and species, creating a record that not only offers historical snapshots of individual ecosystems, but also provides data that can be compared across times and locations.

De la Rosa plans to use the collection for several purposes, including foundational knowledge about the diversity and species characteristics of midges from Costa Rica and worldwide. All of the vast information contained in the collection will be placed in a database and will be accessible digitally, including on the Web. Apart from this collection, for instance, very little is known about Costa Rican species. “Getting that information

“Midges have never left my heart,” said Coffman. “I lie awake at night thinking about them. It’s an addiction; it gets in your blood—always challenging, always finding new things and revealing new relationships, whether it’s geographical in number of species, or temporal in a particular place, or ecological in terms of what these species are doing.”

into the hands of a large number of people, and in a format that is readily usable, will be the very first step for us,” says de la Rosa. The collection will be accessible to the critical mass of researchers and students who study aquatic invertebrates in Central America and beyond. Then, says de la Rosa, “we need to take it to the next level. If we train students in this process, they can become the users of this methodology, add new technologies like DNA bar coding and pattern-recognition software, and start building regional collections that will increase knowledge about aquatic insects and their environments.”

Already, workshops are planned that will be taught initially by de la Rosa and another Pitt graduate, biologist Rick Jacobsen (A&S ’98G), who was mentored by Coffman and who trav-

eled to Pitt from his work with midges in the Florida Everglades to help pack the collection for its new life in Costa Rica. De la Rosa recently received a grant from the Norwegian government to conduct the first workshop for Central American freshwater biologists.

Coffman estimated there are about 20,000 species of midges in the world; the number identified so far is half that, which means there’s opportunity for new discoveries and original research. Beyond that, according to Coffman, extinction in midges is very rare. They have survived for eons, throughout all kinds of climates and across diverse terrain. In fact, midges found embedded in Cretaceous Age amber in Lebanon share the same morphology as a contemporary midge found at Linesville Creek.

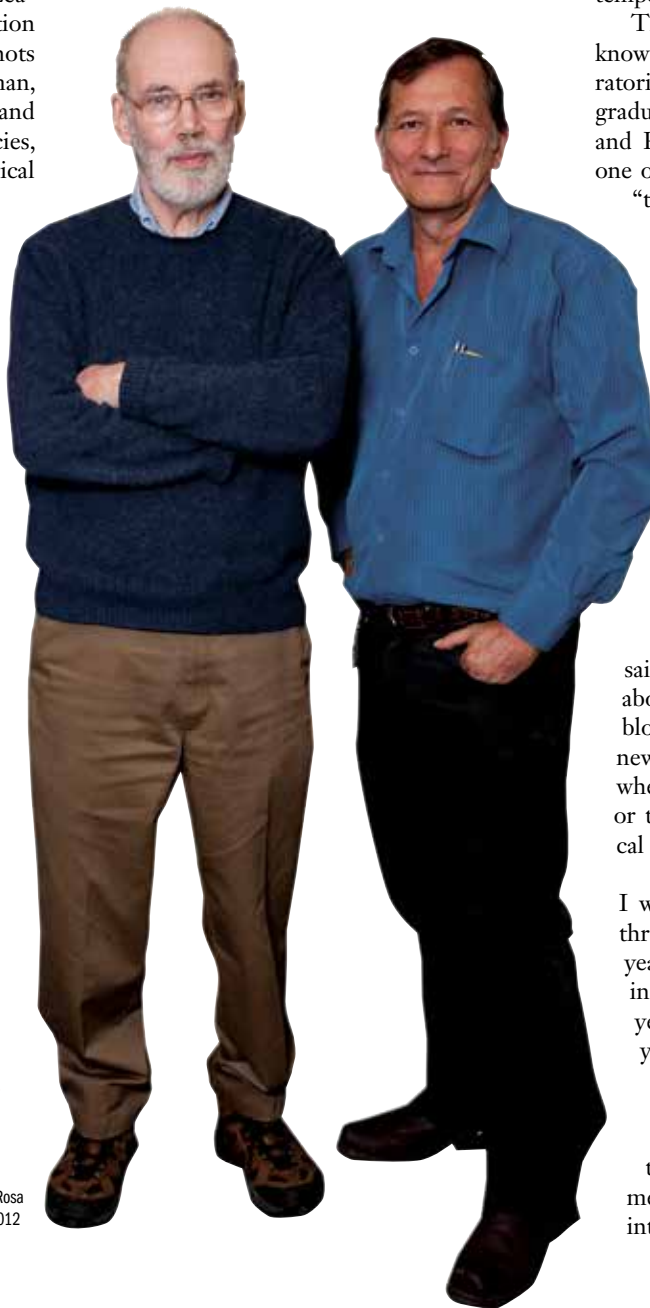
Through the years, Coffman shared his knowledge and expertise in classrooms and laboratories with thousands of undergraduate and graduate students, including Carlos de la Rosa and Rick Jacobsen. During his career, he was one of the few midge specialists who looked at “the big picture”—large-scale biogeographical patterns in midges—and because of his skills as a communicator, his scientific presentations were well attended and often the highlight of international meetings.

Coffman had planned to teach an undergraduate biology class during the 2012 fall semester, but his medical diagnosis prevented that. He also had plans to visit La Selva and hoped to go before the new year began. But that didn’t happen, either. He did, though, find time to talk about his passion for midges as 2012 waned.

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Then, he added: “There was many a year I was working at home on midges, looking through a microscope as I passed from one year to the next. I would make sure I was doing that at midnight on the last day of the year—as a way to transcend into the next year.”

William Coffman died on Jan. 25, 2013. His lifelong passion for midges and their ecological role will live on at La Selva in the expert hands of a student he trained and mentored at Pitt. His legacy will transcend into another year, and another, and another. ■



Coffman, left, and de la Rosa on campus in October 2012. Photo by Tom Altany