THEY SAY I'M A MONSTER

A Gila monster extends its forked tongue near Florence. Like many reptiles, Gila monsters use their tongues to pick up scent particles in the air, helping them find their next meal.
EIRINI PAJAK

There are two species of venomous lizards in the world, and one is found almost exclusively in Arizona. Although Gila monsters have been described as "sending forth a greenish, frothy slime" from their mouths, the elusive creatures with the gloriously banded tails are more beloved than feared.

BY MATT JAFFE

THE GILA MONSTER was in no hurry. Untroubled by a car's approach, and with forked tongue flicking and sampling the spring day, the lizard crossed the road in Tucson's Catalina Foothills with the plodding, side-to-side gait common to its kind. Soon he (or, for that matter, she — it was rather impossible to tell) reached a thicket of prickly pears, then disappeared.

That was it. My one and only sighting of a Gila monster had ended.

"Well, that's one more than most people ever see," says Dale DeNardo, an associate professor and environmental physiologist at Arizona State University, when I tell him about my brief encounter with this Southwestern reptile — one of only two species of venomous lizards in the world, and the bearer of just about the coolest name in the animal kingdom. Give or take the Komodo dragon, a distant relative with a common lineage from 70 million years ago.

I have come to DeNardo's office to discuss Gila monsters, which have intrigued me ever since I spotted one in a battered 1950s copy of the Golden Nature Guide to reptiles and amphibians in my family's Chicago basement. No offense to skinks and geckos, but at 7, you'll go with a monster every time.

DeNardo's office is at the end of a short side hallway posted with mock street signs marking "Gila Monster Drive" and "Venomous Alley." One imposing door bears an official, no-nonsense sign that reads, "Restricted Entry: Dangerous Reptiles." That's where I want to go.

DeNardo grew up back East before his family moved to the West Coast, where he traded the amphibians of Vermont's forests for the reptiles of Southern California's deserts.

"It all started for me when I began to walk and, like most kids, caught lizards and frogs and stuff," he says. "Most kids grow out of it. I just got more curious."

On a professional level, his curiosity turned to how organisms interact with their environments, especially in deserts, where limited water and food, in

combination with extreme temperatures, pose unique challenges.

"Gila monsters, for multiple reasons, had not had a lot of work done on them," says DeNardo in his rapid-fire delivery. "There were a handful of papers on their ecology, but nothing really on how they're able to survive the desert. It was to the point that they were actually considered maladapted to live in the desert. That statement always bugged me. Gila monsters have been in the Sonoran Desert as long as the Sonoran Desert has existed."

GILA MONSTERS certainly present logistical challenges for researchers. For one thing, they're difficult to find: In the fall and winter, the animals spend as much as 98 percent of their lives underground. But it seems surprising that these lizards have received so little study. Because although the Arizona ridge-nosed rattlesnake was designated the official state reptile, a snub that still bugs DeNardo, the Gila monster is a genuine icon.

While they range, in limited numbers, all the way to Southern Utah, Gila monsters are very much Arizona creatures, with a preference for upland saguaro and paloverde habitats. Their overall territory extends into Mexico before they give way to the Mexican beaded lizard, a far larger relative and fellow venomous lizard in the genus *Heloderma*.

Heloderma roughly translates as "nail-studded skin," and with their gloriously banded tails and ornately beaded scales in a mottled pattern of reddish-orange and black, Gila monsters resemble living and breathing Southwestern art — as if they were crafted by a Hohokam potter. They are depicted in petroglyphs and Native American baskets, and the animals appear frequently as a motif in Mimbres pottery from Southwestern New Mexico.

Different Native American cultures attribute medicinal qualities to Gila monsters. As recounted by Gerald Hausman in *The Gift of the Gila Monster: Navajo Ceremonial Tales*, the Navajos consider the Gila monster a deity and the original medicine man. During a ceremony known as hand-trembling, Gila monsters are believed to possess healers, whose arms start shaking involuntarily as the source of a victim's disease is located.

American pioneers had a more troubled relationship with Gila monsters, with misconceptions enduring well into the 20th century. As one 1891 account described a Gila monster: "To the new arrival … who discovers it upon a rock with its mouth sending forth a greenish, frothy slime and puffing like a small steam engine, it presents a very formidable aspect."

The very breath of "Healy monsters" was presumed to be fatal, in part because it was thought that the animals had no opening for excretion, resulting in a buildup of toxins. In actuality, DeNardo says, Gila monsters do stockpile some wastes, but for a very different reason. During drier periods, the lizards store urine in their bladders and can reabsorb pure water back into their systems. That allows them to go 80 days or longer without drinking. "Gila-monster bladders are like enormous canteens," he says.

THOUGH NOT EXACTLY cuddly and certainly best not cuddled (in 2007, a man in Saguaro National Park was bitten by a Gila monster that he had placed on his shoulders, later explaining that the lizard "wanted to be friends"), Gila monsters eventually became more beloved than feared, and a symbol of Arizona.

Created by Pulitzer Prize-winning *Arizona Republic* editorial cartoonist Reg Manning, Gila Hank has served as the rootin', tootin', two-gun-toting symbol for the Eastern Arizona College Gila Monsters for nearly 70 years. At football games, a mascot dances and performs backflips, although the purple-and-gold costume makes Hank look more like some mutant spawn of Barney than a Gila monster.

Around the time of Gila Hank's debut, Gila monsters also made forays into the broader culture. During a famous scene in the Academy Award-winning film *The Treasure of the Sierra Madre*, Tim Holt dares Humphrey Bogart to reach inside a rock crevice where a Gila monster may or may not be waiting. Holt delivers a speech filled with long-held myths about Gila monsters: "They never let go … once they grab onto you. Cut 'em in two and the head'll still hang on until sundown, I hear. By that time the victim doesn't usually care because he's dead anyway."

Gila monsters do have relatively strong jaws, and they repeatedly clamp down when they bite to channel venom in their saliva through grooved teeth and into victims. But the venom isn't fatal to humans, nor is it used to subdue prey. While most lizards need food every day, Gila monsters, like snakes, eat only sporadically, maybe six times a year. They raid nests where their common prey — baby rabbits, quail eggs and dove eggs — is defenseless. Instead, DeNardo says, the venom serves as a protective mechanism. By temporarily distracting attacking predators, the slow-footed Gila monster buys time to escape.

Not that a bite is exactly pleasant. "A baby Gila monster once bit me, and at first I didn't see any blood, so I figured I was OK," DeNardo says. "Then, all of a sudden, it felt like someone was smashing my finger with a hammer as hard as they possibly could. My finger swelled like a pickle, and after 45 minutes, the pain peaked. But it took days to calm down."

From that cameo with Bogart, Gila monsters had their Godzilla moment in one of the most memorably bad B-movies in cinema history: the 1959 drive-in classic *The Giant Gila Monster*. The movie featured vintage electro-theremin music by Jack Marshall, the arranger for Peggy Lee's *Fever* and composer of the theme to *The Munsters*, and improbably co-starred Lisa Simone, Miss France of 1957, as one of the teens menaced by the title creature.

Played by a beaded lizard in what is presumed to be his only starring role, the Gila monster has relatively few scenes and looks rather bewildered as he ravages a train before terrorizing a sock hop by banging his head into a building. Spoiler alert: The hero, a singing mechanic named Chase, saves the day by rigging a hot rod carrying nitroglycerin to blow up the beast. Of course.

BECAUSE OF THEIR APPEARANCE, Gila monsters are often described as "living dinosaurs." But DeNardo says most lizards are physiologically closer to dinosaurs than Gila monsters are. "Gila monsters are more snakes with legs than they are lizards in the way they deal with things," he says. "And a little bit of tortoise thrown in there, too. They're very evolved."

DeNardo returns to the misconception that Gila monsters are somehow ill adapted to the Sonoran Desert. Their ideal body temperature of about 86 degrees may be low for desert animals. But during their comparatively active times — from March through May, and from mid-July through August — Gila monsters manage their temperature by emerging in the morning on cooler spring days to warm up, then at night in summer to avoid the hottest times.

It's also said that Gila monsters have what biologists call "leaky skin," meaning that they lose moisture through their body surface more easily than other reptiles. But that ability to draw water from their bladders helps Gila monsters perfectly bridge the dry period between the end of spring rains and the start of monsoon storms.

"That's why they're not in the Mohave [Desert]," DeNardo says. "The Mohave doesn't get any monsoons."

The past 12 years have been a golden era for Gila-monster research, he says, as scientists have learned more about these animals than they ever knew before. In addition to discoveries such as a protein in Gila-monster saliva — now synthesized as the drug Byetta to stimulate insulin production in patients with Type 2 diabetes — Gila monsters are yielding other secrets, too.

Part of the value in studying Gila monsters, DeNardo says, comes from better understanding their adaptations, especially with the prospect of climate change. He says the anticipated reduction in spring precipitation and a delay in the arrival of the monsoon storms could test Gila monsters' capacity to withstand dry periods, and ultimately restrict their range.

A Gila monster prowls the Sonoran Desert south of Globe. The species is well adapted to the desert's scorching climate and can go 80 days or longer without water.
JOHN SHERMAN

"We need to figure out these kinds of relationships between an organism and its environment if we're going to understand how climate change might affect animals," he says. "Then we can understand whether it will have impacts on certain species and not others."

After a grad student drops off cookies for DeNardo, the time finally comes to see Gila monsters. DeNardo unlocks that imposing door, which opens into a windowless storage room, a kind of Gila hostel where the lizards live in individual bins lining several rows of shelves. He quickly grasps one Gila monster behind the head and holds it up, pointing out the venom glands on the lower jaw as I run a finger along the pebble-grain-like surface of the lizard's back. DeNardo suggests I touch the bottom of the lizard's foot, which feels surprisingly soft, almost like velour.

I'm so caught up in the moment that it takes me a few minutes to notice a loud, rhythmic sound that goes on ceaselessly as we talk. Not only does the room have Gila monsters, it's filled with rattlesnakes, too.

DeNardo understands my excitement. "I've seen Gila monsters probably way over 1,000 times," he says. "But I still get a grin on my face whenever I see another one. I'm like a kid again." AH

FOR HEAVEN'S SAKE

That there's an observatory on Mount Graham isn't unusual. That it's run by the Vatican is hard to figure. But, there it is. And its mission, according to the newly canonized Pope John XXIII, is twofold: to explain the church to the scientists, and to explain science to the church.

BY MATT JAFFE

PHOTOGRAPHS BY BILL HATCHER

Shortly after dawn, the sky swirled with the pink remnants of Hurricane Odile as Father Paul Gabor, S.J., and I headed east from Tucson along Interstate 10. Our journey, first to Safford and then up to the Mount Graham International Observatory, was a modest drive but also a road trip into the universe.

An astrophysicist and Jesuit priest, Gabor serves as vice director for the Vatican Observatory Research Group, which operates the Vatican Advanced Technology Telescope (VATT) on Mount Graham. This immediately brings up two questions: Why does the Vatican have an observatory? And what is that observatory doing in Arizona?

Gabor, I quickly discovered, is a fine traveling companion, his reserve balanced by a dry, mischievous wit. That said, I admit to being overmatched: Raised in the former Czechoslovakia, Gabor holds multiple advanced degrees, from astrophysics to divinity. He speaks eight languages, six fluently. As for me, I'm neither especially religious nor adept at the physical sciences, having pulled a C in college astronomy — a fact I confessed to Gabor early on.

If the idea of a Vatican observatory suggests *The Da Vinci Code*-style intrigue, with researchers probing the origins of the Star of Bethlehem, Gabor quickly dispelled such notions. "We are really a very standard scientific institution," he said.

The observatory traces its roots to Pope

Father Paul Gabor, S.J., the vice director of the Vatican Observatory Research Group, looks to the heavens outside the Vatican Advanced Technology Telescope (VATT) building. Gabor calls the observatory atop Mount Graham "a very standard scientific institution."

Gregory XIII's 16th century effort to study the annual cycle and reform the Julian calendar. Simply put, the Julian calendar was slightly inaccurate and didn't accurately reflect the precise time the Earth takes to orbit the sun. Over the centuries, those errors add up. There's now a 13-day discrepancy between the Julian and Gregorian calendars.

Gabor said it's a misconception that today's observatory has "some sort of particular project set out for us by the pope or someone at the Vatican."

He added: "I really love the quote from the newly canonized John XXIII, who supposedly said: 'The observatory has a two-fold mission. One, to explain the church to the scientists. Two, to explain science to the church. So it appears we are doing much better at the former.' There's some truth to that. Within the church itself, many Catholics have no idea that there is a Vatican observatory. And that includes the bishops."

Its 10,695-foot summit cloaked in clouds, Mount Graham, a sacred Apache peak, loomed to the north as we turned toward Safford. For permitting reasons only slightly more fathomable to me than the operations of Switzerland's Large Hadron Collider (on which Gabor once worked), we were unable to drive up to the observatory together. So Gabor dropped me off at Eastern Arizona College's Discovery Park Campus, which conducts public observatory tours, and I joined a group of the school's engineering students. Waiting for the van, they resembled a casting call for a prequel to *The Big Bang Theory*.

The roughly 30-mile, nearly 8,000-foot climb from Safford to Mount Graham's three observatories is an endless series of stomach-churning switchbacks. I heeded Gabor's advice to take Dramamine, then wrangled a spot in the van's first row. There was plenty of chatter at first, before the hairpin turns exacted their most cruel toll and the passengers fell silent.

We reached the observatories in about 90 minutes, then received strict instructions not to cross yellow ropes marking the boundaries of the Mount Graham Red Squirrel Refugium, a protected area for this federally endangered species. Up the road among the spruce and firs, the Large Binocular Telescope loomed. Operated by an international consortium that includes the University of Arizona and Arizona State University, it is very large indeed — one of the world's most powerful telescopes.

Gabor waited at the VATT, the smallest of Mount Graham's three facilities. Boxy, not baroque, and with gray steel walls, the VATT building hardly looks the role of a Vatican observatory, except for the telescope's silver retractable dome. It certainly doesn't resemble the lair of mad monks scanning the darkness for the coming of an alien Antichrist from outer space, among the many existing conspiracy theories. ("I can assure you that's not true," Gabor said.)

Even so, the VATT creates endless speculation. Although the observatory had no role in the project, when Germany's Max Planck Institute for Extraterrestrial Physics installed an infrared camera and spectroscope at the Large Binocular Telescope, the move inspired all sorts of breathless headlines about the Vatican's nefarious intentions. Mainly because of the device's allegedly demonic acronym: LUCIFER. Now shortened to LUCI, the new name, by contrast, hasn't engendered conjecture about a secret papal search for Lucille Ball.

More oil well than H.G. Wells in aesthetics, with bundles of cables, ladders and iron girders, the Vatican telescope's industrial look belies its awe-inspiring capacity to observe stars and galaxies 12 million light-years or farther from Earth.

Gabor told our group that the telescope had marked its 21st birthday two days earlier. "It's of age; it could have a drink," he said. "Or, rather, just a change of oil."

He explained the VATT's history and how it came to Mount Graham: For centuries following the calendar reform, the church operated several observatories before Pope Leo XIII formally refounded the Specola Vaticana (Latin for "Vatican Observatory") near St. Peter's Basilica in 1891.

He declared, "The church and her pastors are not opposed to true and solid science, whether human or divine, but they embrace it, encourage it and promote it with the fullest possible dedication."

Light pollution forced the observatory to relocate, and in the 1930s, it moved to Castel Gandolfo, the papal summer residence, which sits above a lake within a volcanic crater 25 miles outside Rome. That site, too, was eventually compromised, so the Vatican sought a new telescope location, with Sardinia as one possibility.

The esteemed astronomer and priest George Coyne, S.J., provided the Arizona connection. At the time, Coyne was the Vatican Observatory's director and also served as acting director at the University of Arizona's Steward Observatory. "They put two and two together, and the observatory came to Arizona," Gabor said.

That was the simplest equation I would hear all day.

The Vatican telescope's eye is its primary 1.83-meter mirror. There are far bigger mirrors, including the two 8.4-meter giants in the Large Binocular Telescope. But the VATT mirror holds a unique place in the history of astronomy.

As the Vatican looked for a telescope site, Dr. Roger Angel, director of the Steward Observatory's Mirror Laboratory, revolutionized the fabrication of mirrors. He pioneered a technique known as spin-casting, and the VATT mirror was the first of this kind to be deployed.

"It was a tremendously thrilling time," said Father Christopher Corbally, S.J., Gabor's predecessor as vice director, who has worked at the observatory since 1983. "There was such an element of excitement at developing a new technology that is now the current generation of telescopes."

Guided by Corbally, I toured the lab, located in an unlikely spot beneath the east stands and end zone at Arizona Stadium in Tucson. It's an enormous, hangar-like space. We watched as a worker polished an 8.4-meter mirror, which, along with six others of equal size, will comprise what amounts to a single piece of 80-foot-diameter glass for the Giant Magellan Telescope in the Chilean Andes.

Larger, yet lighter, than earlier designs, Angel's mirrors feature a honeycomb structure. Air can also be circulated within the mirror, thus bringing glass and outside temperatures quickly into equilibrium to reduce distortion.

Pieces of high-grade glass (the 8.4-meter mirrors require 20 tons) are placed atop an array of hexagonal columns half an inch apart, then spun within a rotating oven and melted at 2,156 degrees Fahrenheit. The molten glass fills spaces between the columns and flows over the top to form a continuous, curving glass surface, with the honeycomb structure below. The mirror cools for three months before grinding and polishing can begin, a process that originally took seven years and even now requires two and a half years. It's accurate to a millionth of an inch.

Hard to imagine it all started with some Pyrex custard cups. But Angel first tested the concept by fusing a pair of cups in a kiln. And before the mirror lab's 1985 move to the stadium, Angel worked in a onetime synagogue building on campus.

Or, as Corbally put it, "an Angel created a mirror for the Vatican in a temple."

After the drive down the mountain, during which red-squirrel stew and football seemed to be equally popular topics, I met Gabor in Safford. He was scheduled to speak at the Discovery Park Campus, so we stopped for dinner at El Charro Restaurant. As the steam from the fajitas cleared, Gabor gamely tried to explain notions of refraction to me, tracing diagrams on the table amid the chips and salsa.

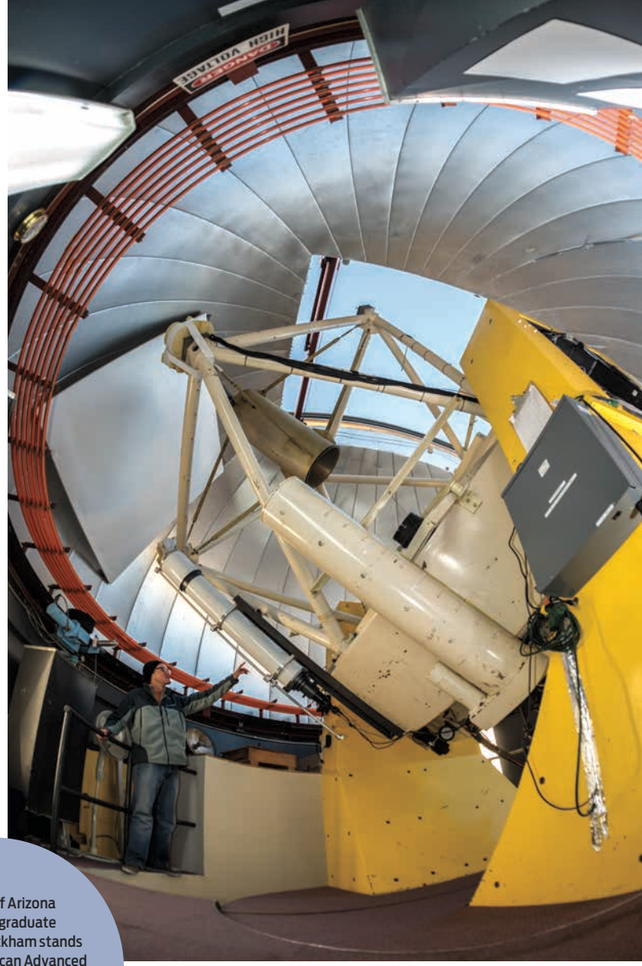
The theme of Gabor's speech was "Martyrs of Science," and he addressed allegations of the church's historic persecution of scientists: "The story of supposed conflict between science and religion is not what it has appeared to be." It was a far-reaching presentation, perhaps too far-reaching for kids in the audience, who, safe to say, heard about cosmic pluralism and 15th century German theologian and astronomer Nicholas of Cusa, if not Galileo, for the first time.

Eager to hit the road (I had agreed to drive back), I could tell Gabor was running long — by the Julian and Gregorian calendars alike. Then, with 50 slides remaining, Gabor quickly wrapped up and gamely donned a knitted cap given to him as a gift. Soon we were outside, gazing up at stars through broken clouds. "They'll be able to observe tonight," he said.

We spoke about many things as I drove. He described the intellectual climate while growing up in communist Czechoslovakia, where he wanted to join the priesthood only to realize that the only two legal seminaries were controlled by the secret police. He longed to "pursue a life of intellectual inquiry without ideological biases," and he found a refuge of sorts by studying particle physics. But years later, Gabor said he knew he needed to enter the priesthood.

"As soon as I entered the building of the novitiate, all of the nagging ceased," he said. "It allowed me to feel this is really the place where I should have been all along."

Reconciling his religious and his scientific sides proved less challenging than one might expect, Gabor said.



University of Arizona astronomy graduate student Ben Rackham stands beneath the Vatican Advanced Technology Telescope. The instrument's 1.83-meter mirror is supported by a 20-ton platform.

"How shall I put this? I think that most astronomers actually have a very similar need to share the amazement and, generally speaking, the joy of understanding the universe," he said. "We're fortunate to have the privilege of being witnesses. In spite of the fact that many astronomers wouldn't label it in religious terms, I'm perfectly convinced that this is a profoundly religious attitude."

In Tucson, we passed the football stadium where, somewhere above the mirror lab, the Arizona Wildcats were mounting their miracle fourth-quarter comeback against California. I handed Gabor the keys, and we said our goodbyes, both too tired to linger. He drove off, and I briefly searched for stars, bright even through city lights.

I imagined how different Corbally's and Gabor's perspectives might be upon looking at the same view. But, as Corbally had said, "So often in our work, there are such incredibly large numbers, powers of 10, and amazing figures of time and distance. But every now and then, there's also a chance to think, 'Gosh, this is all really wonderful, isn't it?'" AH

To learn more about the Vatican Observatory, visit www.vaticanobservatory.org.

A lesser long-nosed bat searches for nectar near Turkey Creek in Southeastern Arizona. The bats transport pollen from flower to flower as they eat.

Things That Go Bump in the Night

Vampire bats get most of the attention this time of year. Admittedly, they're pretty cool, but we don't have any in Arizona. We do, however, have 28 other bat species, including lesser long-nosed bats, which are one of only two species in Arizona that rely primarily on nectar and pollen. They won't suck your blood on Halloween, but they might drain your hummingbird feeder.

BY MATT JAFFE ◆ PHOTOGRAPHS BY BRUCE D. TAUBERT

WHEN A NECTAR-EATING BAT PEES ON YOUR head, it's not nearly as unpleasant as you might think.

That's a sentence I never expected to write, probably because it was a sensation I never expected to experience. But as waves of lesser long-nosed bats wing through the darkness and feed at nectar dispensers within inches of where you're sitting, the chances of rain, if you will, are pretty high. And in fairness, Ted Fleming, a world-renowned bat expert, did warn me of this professional peril seconds ahead of time.

"Don't worry; it will actually be kind of sweet," Fleming said. He was right, too.

Fleming was staked out in the backyard of a house in the Tucson Country Club area along with Meghan Murphy, a graduate student at the University of Western Ontario. She had set up video cameras and a microphone array to record the bats in three dimensions as they came in to eat at hummingbird feeders. It was part of a study on echolocation, the ability to identify and find objects by using reflected sound. Echolocation is not part of my skill set, so I stumbled through the blackness in search of a place to sit, unable to see Fleming's face even though he was just a few feet away.

It didn't take long to realize that the three of us were hardly alone. Before getting drizzled, I felt rushes of air as squadrons of three or four bats flew to the feeders, lighting on them for just an instant. Then there was the soft swish of beating wings, kind of a *fwww fwww fwww* sound, as the bats quickly disappeared back into the night.

Bats don't usually approach humans so closely, but "leptos" (derived from their scientific name, *Leptonycteris yerbabuenae*) are not your average bat. Of Arizona's 28 bat species, the lesser long-nosed bat is one of only two (the other is the Mexican long-tongued bat) that rely primarily on nectar and pollen.

Two lesser long-nosed bats approach a hummingbird feeder. The bats have become more common at Tucson feeders in the past decade.

After migrating north from southwestern Mexico along what are called nectar corridors, timing their journeys with the peak blooming season of columnar cactuses, these bats arrive in Arizona by spring to feed from saguaro and organ pipe cactus flowers and, as the summer progresses, agaves at higher elevations. During May, they give birth in maternity caves in Southwestern Arizona and typically remain in Southern Arizona through mid-October before returning to Mexico.

Leptos transport pollen from flower to flower as they eat, so in the world of Arizona pollinators, avian mixed metaphors notwithstanding, the nectar-eating bats are the ugly duckling to the hummingbirds' swan. Not that everyone agrees with that assessment.

"I actually think they're quite beautiful," Fleming says. "Their coats are a nice tawny brown, sometimes almost a honey color. They're also quite gentle to work with. I'm able to handle them without gloves."

THERE ARE BAT PEOPLE AND NON-BAT PEOPLE, with the second group by far the larger of the two cohorts. By any measure, Fleming is a bat man. A native of Michigan, he was a self-described "snake chaser" with an interest in reptiles and amphibians. "As a kid, I liked nature right from the start," he explains.

While in graduate school at the University of Michigan, Fleming traveled to Panama to research rodent populations and also began working with bats. Intrigued by his findings, the National Science Foundation offered to support his bat studies, and soon Fleming shifted his emphasis to these flying mammals. "I wasn't born to work with bats, necessarily, but bats became very interesting to me," he says. "Just the diversity and abundance. Man, in some places I could stand under a fruiting fig tree and watch all of these bats swarming. It was amazing to see them in action."

At the time, not many biologists focused on tropical bats, and because the animals' lives were so dependent on specific plant species, Fleming had to become an expert in both. "The hours were tough," he says. "I routinely did 18-hour days. I worked on plants during the day and the bats at night."

Every summer for 16 years while he was at the University of Missouri and the University of Miami (where he now is an emeritus professor of biology), Fleming traveled to Costa Rica to study fruit-eating bats. He also spent time in Australia, where he and his wife, Marcia, adopted a trio of orphaned black flying foxes — that continent's largest bat, with wingspans of more than 4 feet.

Then, in 1988, Merlin Tuttle, the founder of Bat Conservation International, asked Fleming if he wanted to trade the rainforest for the Sonoran Desert and study leptos, which had been newly listed as an endangered species, as pollinators of columnar cactuses. "I thought about all of the cool things that might be going on in the desert, based in part on my memories of Disney's *The Living Desert*," Fleming says. "I saw it as a kid, and those nature films were really influential. So I said, 'Yeah, it sounds cool. I'll give it a try.' Boy, I never looked back."

◆

FOR MOST OF MY LIFE, I HAVE BEEN bat agnostic — that is, until hummingbirds proved to be my gateway pollinator to leptos. A few years ago, while in Southeastern Arizona, I heard several hummingbird experts describe how bats drained their feeders during the night. That didn't square with my understanding of what bats ate. Bugs, certainly; fruit, too, and, notoriously, blood for the world's three kinds of vampire bats (none of which live in Arizona). But along with the birds and the bees, there were also, apparently, bats.

At first it was difficult to picture bats, those denizens of the dark, flitting among the flowers. After all, plenty of the world's more than 1,300 kinds of bats (about a quarter of all mammal species) resemble gargoyles come to life, as if they flew straight out of a closet of nightmares. Some — like ghost-faced bats, whose range includes Arizona — are just plain weird.

The Arizona-Sonora Desert Museum's website gamely tries to capture the appearance of ghost-faced bats: "They probably get their name from their unusual-looking face. Their large ears are rounded and join at their forehead. This makes their small eyes look like they are actually in their ears. They also have leaf-like skin flaps protruding from their chin."

Leptos are Smurfs with wings. Unlike ghost bats, leptos have defined features: bright, alert eyes; mouths that curve up into what we perceive as smiles; and long snouts tipped with upturned nose leaves that give them an impish, Pixar-ready quality.

By comparison, leptos are Smurfs with wings. Unlike ghost bats, leptos have defined features: bright, alert eyes; mouths that curve up into what we perceive as smiles; and long snouts tipped with upturned nose leaves that give them an impish, Pixar-ready quality. They are great athletes, too, muscular little creatures that fly 25 miles from their day roosts to stop at feeding areas.

Although they boast 14-inch wingspans, leptos weigh only about 0.8 ounces. While similarly sized mammals, such as rodents, have short life spans, leptos routinely live six or seven years. They don't reach sexual maturity for two or three years, and then they give birth to only one pup annually, a reproductive strategy more typical of much larger mammals.

With enormously long tongues featuring brushy tips and small teeth, leptos are well adapted to their nectar-and-pollen diet, which is supplemented by cactus fruit and insects. Considering the high sugar content of what they eat, leptos are remarkably resistant to diabetes and tooth decay, Fleming says. They're the main pollinators of cardon cactuses, a prominent columnar species in Mexico with nectar three times more sugary than Coca-Cola. Fleming says that even though blood-sugar readings do spike while leptos eat, they quickly drop back to normal levels. But, like any bat, leptos are not without mystery. "There's still a lot we don't know about the basic biology of lesser long-nosed bats. Which makes them fascinating," Fleming says.

◆

SINCE 2007, A NETWORK of "citizen scientists" in the Tucson area has helped add to the data that experts like Fleming draw upon in trying to understand leptos' behavior. Bats foraging at hummingbird feeders in Southeastern Arizona, including eastern sections of Tucson, was nothing new. But after a poor season for agave flowers in 2006, leptos started to visit feeders throughout the Tucson area.

Under the auspices of the Arizona Game and Fish Department, the U.S. Fish and Wildlife Service and the town of Marana, locals were enlisted to keep track of bat behavior and feeding patterns in their backyards. Now, this network of citizen scientists has grown to around 100, says Janine Spencer, environmental-projects manager in Marana.

"Our volunteers love watching the bats and want to be the first ones to report them at the feeders at the start of the season," she says. "It's so much fun to go out on the back porch and see them zooming all around. With all of the bats in the air, it's like swimming in the ocean among fish."

Spencer says the bats at her house go through about a quart of nectar per night. One participant, however, quit the program when the bats' appetites became too much. "He was putting out a gallon of sugar water every night," she says. "He just kept trying to keep the feeders filled until one day he finally said, 'I give up.'"

In 2013, program participants first reported bats feeding west of Interstate 10, and radio-telemetry tracking has revealed a new day roost in the Santa Catalina Mountains. But some basic questions remain unanswered, Fleming says. For one thing, virtually all the leptos that visit feeders are juvenile or yearling females.

"When we started looking at the feeders, I would have expected that adults would be as common as juveniles," Fleming says. "But apparently the youngsters are finding these feeders in the absence of teaching by adults. And it's not like the juveniles are roosting around the corner and these feeders are their closest food sources. They're foraging over huge areas."

Another question that arises: Why are leptos expanding their activities in urban areas? Fleming says it's unclear whether the rate of agave blooms has been fluctuating. "There's something driving the bats into the city more and more because there's something changing outside the city," he says. "But who knows what it is."

After a couple of hours, the leptos appeared to be done for the night, and I said my goodbyes to Fleming and Murphy before making my way through the darkness. I drove back to my sister's house in the Catalina Foothills. It was two nights before the new moon. Bolts of lightning split the September sky, and thunder rumbled in the distance. *Perfect bat weather*, I figured, before settling in on the deck next to the hummingbird feeders, hoping that some unannounced guests would pop by, hungry for a midnight snack. AH