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Little Horrors

By Jenny Blair

Wednesday, March 31, 2010 12:00am

How Yale made friends with tiny flesh-eaters



Rae Wynn-Grant thought it would be an ordinary job interview at the Peabody. The Yale forestry student does research on wild lions, and she thought the museum might be the perfect spot for a job in between trips to Africa.

Like any natural history museum, the Peabody collects animal bones for research and teaching purposes, and she wanted to work with those bones. "I figured that's the closest I can get to the species I study," she says.

So she started to ask around. Soon a museum worker told her there might be a job opening in the mammal collection. She remembers being told, "It's kind of a dirtier job. You would have to come in and see what it's like."

The trusting Wynn-Grant was led into the Peabody basement to a lab where skeletons are prepared for research or display. Surrounded by the huge skeletons of rhinoceros and lion, she was thrilled, and thought she was in her element. At first.

"Then," she says, "he opened up the bug room."

Winning the popularity contest

The dermestid beetle, sometimes called the carpet beetle or the leather-eating beetle, is dark brown and about the size of a pumpkin seed. It eats dead flesh and picks the bones clean. That's why the Peabody keeps colonies of them. It was the door to that colony that swung open during Wynn-Grant's job interview.

Skeletons are key for studying evolution and other aspects of biology, like zoology and anatomy. But it's not as easy as you might think to skeletonize a dead animal. Scraping away at the flesh by hand is inefficient and ineffective. Boiling might not do the job completely, or it might overdo things and cause a skeleton to fall apart.

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No, what's needed are hundreds of tiny, hungry mouths, each taking a bite out of the task, until only clean bones remain. [See sidebar for other ways in which munching insects can help humans.]

They're perfect for the job. In the wild, these six-legged eating machines are attracted to carcasses, which they smell and soon swarm over a few days after death. Forensic entomologists even use them to help determine a corpse's time of death. They're so popular with taxidermists and high-school biology labs that you can order them delivered to your door (Ward Scientific, \$18.25 for a box of 50).

"You get basically a little Dixie cup. It's supposed to have multiple life stages," says Gregory Watkins-Colwell, one of two full-time vertebrate collection workers at the museum. Trade in dermestids is brisk. Museums send each other refresher batches, or offer a starter colony to high school teachers. Done right, the colony can sustain itself; females lay eggs and the eggs go through larval and pupal stages before becoming adults again.

That's a lot of chowing down.

Up close, dermestids are covered with hairs, and their mouth parts are adapted for chewing (as opposed to the piercing-sucking mouth of, say, a mosquito, which drinks blood instead of taking a bite). The larvae have spines lining their backs. Dermestids aren't actually bugs — the scientific word "bug" actually refers to a different type of insect — but everyone at the Peabody uses that fond nickname.

Part of daily life

The bug room is located deep within the Osteology Lab, a lab devoted to cleaning and preparing vertebrate bones. It lies behind two doors with special seals, marked by a simple sign that reads "Prep Room." When you open the inner door, the seal is broken. A small roll out. Warm, meaty and nauseating, it is the stench of rotting flesh. It is 80 degrees and humid. Hidden fans roar in the ceiling. And giant glass tanks line the walls. Inside those tanks lie shapes, half-shrouded under damp white gauze. Shapes that command an onlooker to look closer, then make him want to look away: A bird's empty eye sockets and half-open beak. A huge fish's arched back. And larger, vaguer bones in grubby piles. Flesh still clings to these bones. And all across them, a writhing, scuttling activity: black beetles and pale larvae, in numberless hordes, devour what is left.

It was there that Wynn-Grant learned that her job would include the care and feeding of these strange insects.

She's made of tough stuff. She studies cattle-eating lions in Tanzania. Excited about getting to work with the mammals' bones, she said yes. Soon she found herself reaching into the tanks and serving the beetles their carcass meals. She mists them with water and makes sure the room's temperature is just the way they like it. "Now it's just a part of my daily life," she says. "I'll be telling my roommates, 'Oh, I've got to water my bugs.'

"The bug room came with the job," she says. "And I learned to embrace it."

A fantastic job

The Peabody's bug room isn't unusual. Museums have used them for decades, because biologists often look at bones to learn about their owners and compare species. That's because bones themselves — their shapes, thicknesses, ridges and bumps — can say a lot about how the animal lived. Google "gorilla skull" and look at the pictures. That crest of bone across the top is where its giant jaw muscles anchor down. If you didn't know already, you might guess that a gorilla does a lot of chewing, and in fact gorillas do subsist largely on leaves. Humans eat softer food, so we have smaller jaw muscles — and that shows on our skulls, which lack that crest. Comparisons like these between living and extinct species of animals are a backbone of many kinds of biology, as well as of paleontology, the study of fossils.

Christopher Gilbert is a Yale primatologist who studies blue monkeys and owl-faced monkeys from the Congo. ("I've cleaned quite a few monkey heads for him," reports Wynn-Grant.) When his colleagues in Africa send him specimens (all legal and carefully regulated), they've been skinned and gutted. But they're not ready to be studied. "There's

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Are public employees the reason for our budget woes?

- Yes. Taxpayers shouldn't be stuck paying huge costs for retired public workers.
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generally always some tissue left," says Gilbert — muscle, fat and ligaments clinging to the bones, none of it with the kind of smell you want to get onto your hands. He delivers them over to Wynn-Grant's team and its tender mercies, and when they come back a few weeks later, they're just bone. "You get these skulls that are just in beautiful condition," says Gilbert. Clean, white and odorless, they look like things you see in, well, a museum.

Then Gilbert marks various spots on the skull as landmarks and creates a digital 3-D image. He can then compare different populations of monkeys to each other to learn more about the species that live in that part of Congo. He couldn't do it without the dermestids.

"The bugs and Rae do a fantastic job," he says.

An acquired taste

The bug room is an everyday necessity for scientists like Gilbert. But the insects help with the museum's backlog of specimens, too. There are hundreds to be skeletonized.

Not far from the bug room is a fluorescent-lit hallway. It is lined with gray-green cabinets labeled "Dirty Bones." Behind the cabinet doors, wrapped in burlap and labeled with metal tags, are the prizes of collecting expeditions over the decades — some from our grandparents' era, and some still waiting to be catalogued. They look like bones at the end of a meal of someone who wasn't too hungry. Scraps of muscle and ligament still cling to them, and there is a fusty smell. Gregory Watkins-Colwell and his boss Tim White are inspecting the contents of the cabinets.

After the animals were found, explains Watkins-Colwell, they were field-dressed and dried, then sent to the museum.

"This is a bison, from the Yale scientific expedition in 1870," he says of a one leathery specimen. "It's been like that since 1870. It's probably not bug food anymore. This is a lion. 1931, from Kenya. That's the tag that was on the specimen from the taxidermy team in the field. These are beaver. These are, I think, hippo."

"That's no beaver — come on," White says.

"It's someone's tail," Watkins-Colwell retorts.

"This one," he says of another pile of bones in burlap, "is northeastern Bangkok. Female golden gibbon, age 2-and-a-half years old." That label was written in 1957.

"Backlogs are inevitable," White says. "People love to collect; they love to acquire and be out in the field."

The two of them go into the Osteology Lab, which smells like a weaker version of the bug room. "This does have a bit of a rank odor to it," says White. "It's an acquired taste."

Spoiled rotten

How do you keep flesh-eating bugs fat and happy?

Once you have your live bugs, you put them in a tank lined with moist cardboard so they can burrow, hide and lay their eggs. Though they like it warm and humid, they take their meat on the dry side. That's no problem when the bugs are chewing meat off old specimens. (Occasionally they refuse the toughest flesh, so the specimen is placed in a huge pot of water and heated on a range until it is, as Watkins-Colwell puts it, "not jerky any more.") But fresh specimens are skinned, gutted and left out under fans overnight before they go into the tanks. On big animals, he cuts away muscles to reduce the workload. After all, there are entire cabinetfuls of specimens to chew on. "If you're looking at rapid turnover, the less they gotta eat, the better."

How rapid is rapid? "When the colony is really, really going, you know, a specimen the size of a squirrel? Maybe three days. A specimen the size of a spring peeper is hours. I'll put it in in the morning and take it out before lunch." Bigger animals, like emu, walrus and sturgeon, take weeks.

And in a museum the size of the Peabody, you must label your dead. Heaven forbid you mix up, say, your zebra carcasses. "We have a Burchell's zebra and a Grévy's zebra, and I can't tell the difference by its carpal," says Watkins-Colwell. A note on one burlap-wrapped

should cut elsewhere.

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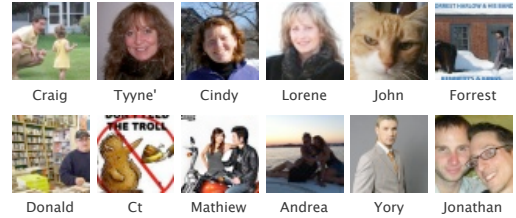
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carcass reads "Do not open until other zebra is done." And label them properly — no paper, no cardboard, as the bugs might eat those if any fat soaks into them. Plastic embossed labels work, the kind you squeeze letters into with a Dymo.

Sometimes the bugs seem to neglect a spot. Then some slight "detailing" will need to be done, says Watkins-Colwell. "If there's a little bit of soft tissue left on a bone, you can spray that bone with water and they'll go to that spot."

Despite climate control, the bugs' appetite dwindles in winter. And sometimes a fit of pique shuts their jaws: Once a group of beetles has tasted the best, they turn up their mouthparts at lesser fare. "Once they do mammals," says Watkins-Colwell, "they don't want to do anything else. Mammals are very greasy. They like that. If you have a colony that's doing well with reptiles and someone puts a fatty mammal in there, they leave the reptiles alone. You've spoiled them."

But there are ways to whet the appetite. Rae Wynn-Grant says she sometimes buys a rotisserie chicken, eats it, then brings in the bony carcass for the colony. That can get them eating again.

"The bugs can be a little bit moody," she muses. With student workers coming and going throughout the school year, "they go through periods where they get a lot of attention and periods where they are neglected. [Sometimes they] get upset and stop doing their job, which is really cute. I can tell when they're mad, because they won't touch the bones. They'll kind of congregate in one section of their cage."

Making a museum-keeper's heart sink

The security surrounding the bug room is elaborate. The beetles themselves are confined to tanks. (An older bug room at the museum did not do this — they crawled freely all over the room — and Watkins-Colwell remembers bugs flying into his hair.) The room lacks drywall and has no drop ceiling, since those are edible. Instead, the walls are vinyl and the joints have aluminum seals. Fans pull air into the room beneath the door, so would-be escapees face a windstorm. A trough with a sticky substance lies in the doorway across their path.

Why all the precautions? The bugs are harmless to living flesh. But if they began wandering around inside a museum drawer, the result would be chaos. Dermestids don't care if they're enjoying their assigned emu carcass or a preserved passenger pigeon.

"They do exactly what they do in the bug room," Watkins-Colwell says. "They will eat skin. They will eat labels. Insects. Leather."

A clue that dermestids have been in a collection — besides the specimens looking distinctly chewed — is that they leave their poop lying around. It's called frass and it looks like brown specks, and the sight of it makes a museum-keeper's heart sink.

So everybody's careful. Before bones come out of the bug room, says Watkins-Colwell, "you pick off all the bugs that are still on your specimen. Then I have that canned air stuff. I use that to blow them out of the nasal passages and the vertebrae." The bones are taken straight to a minus-40-degree freezer for a week, which is supposed to kill any remaining hitchhikers or their eggs. An alcohol bath is the last step before the bones are presented, clean as a desert, to eager researchers, or filed away in the museum's permanent collection — which is refrigerated, in case any dermestids do wander in.

Except with cold, dermestids are hard to kill. The Peabody kindly provided this reporter with an adult and a larva, which she took home in a vial of alcohol. After an hour or two, presumed dead, they were fished out and left out to dry overnight. The next afternoon, as they were photographed, both of them began to twitch, then stagger across the table.

Museum entomology curator Leonard Munstermann says he isn't surprised. He explains that the dermestids have evolved to be resistant to drying. They can actually close the air-holes, called spiracles, that run along the sides of their body. "When the dermestid senses an adverse environment, they lock up the spiracles and wait for better times — in this case, a session with three nutty photographers."

Unnerved, the photographers swiftly reintroduced them to their alcohol sarcophagus.

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An unusual calling

All things considered, Wynn-Grant is glad she took the job supervising a subterranean flesh-eating beetle cafe. The unusual calling has not hampered her social life. "Pretty much everyone I talk to thinks it's amazing," she says. "Most people envision them to be almost like piranhas to the point where they'll devour something in 10 minutes."

It takes a little longer than that, but Watkins-Colwell hopes the bugs will finish eating the old specimens by the end of the year. And the dermestids won't be out of a job afterward. There are a half-dozen freezers full of fresh meat: birds that collided with windows, dead zoo animals and scientists' creatures like Gilbert's. "If I get to the bottom of one freezer a year," he says, "I'm happy."

Mankind's little helpers

When we think of critters with an appetite, pests like mosquitoes, termites and cockroaches come to mind. But for centuries, doctors put hungry invertebrates to work. It's called biotherapy.

Maggots, or fly larvae, love to eat decaying flesh. Civil War doctors were horrified at first to find soldiers whose wounds squirmed with maggots. But the soldiers often healed nicely. The maggots were doing them a favor, as they painlessly nibble dead tissue while leaving healthy flesh untouched. And they can do a more precise job of it than any scalpel. Maggot therapy was popular in the 1930s, and is enjoying a comeback since a California doctor started a sterile-maggot company in 1989. The treatment works so well — particularly on diabetic wounds — that sterile blowfly maggots are now FDA-approved medical devices. Doctors can write prescriptions for them.

Bees, it turns out, are packed with antibiotics. Their venom, honey and other bodily substances seem to kill germs amazingly well — some kinds of honey may even kill the superbug MRSA. Venom might also cut some kinds of inflammation. These bee bodily substances (in purified form) are being studied for infections and immune diseases like rheumatoid arthritis in labs from Turkey to Korea to Brazil.

Leeches have been used in bloodletting for so many centuries that people used to call doctors themselves "leeches." But they aren't the stuff of quackery anymore. These wormlike creatures with three jaws secrete a blood thinner that can keep wounds from becoming swollen with blood. That has proven useful after surgeries to reattach severed ears or other body parts. And leeches, like maggots, are FDA-approved and available for purchase online. One company, whose Web site warns clinicians never to reuse a leech, even offers an emergency delivery service "when you need leeches after our regular working hours." If you're curious about biotherapy, check out the International Biotherapy Society's page, biotherapy.md.huji.ac.il.

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