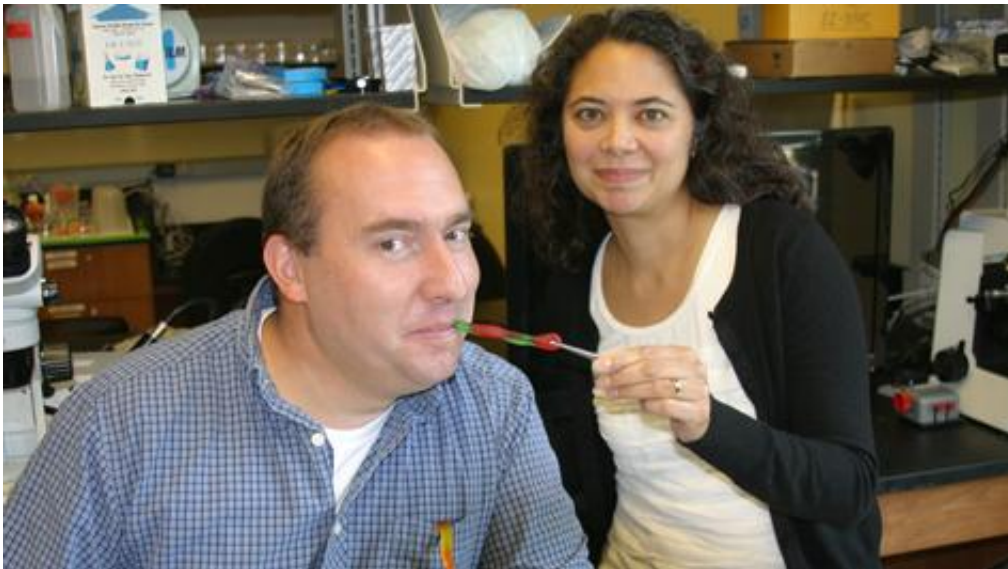


Scientist researches parasite that he removed from his own body

October 2 2013, by Joseph McClain



Aurora Esquela-Kerscher pulls a Gummi Worm from the mouth of her collaborator Jon Allen. Allen found a real (and much smaller) parasitic worm living in his mouth lining. (No nematodes were harmed in this re-enactment of parasite extraction.) Credit: Joseph McClain

Early one morning in December, Jon Allen had decided that enough was enough. He was up anyway, having taken his young son back to bed after a trip to the bathroom. Allen returned to the bathroom with a pair of #5 super-fine-tip forceps, drew a deep breath, and carefully fished a three-quarter-inch long parasitic worm out of his own mouth.

Allen, an assistant professor in William & Mary's Department of Biology, had been experiencing "intermittent rough areas" that he could feel with his tongue. The rough areas seemed to migrate around his mouth and Allen, whose specialty is invertebrate biology, suspected that he might have been harboring an unwanted invertebrate guest.

Once he got the worm out of his mouth, Allen did what any good scientist would do: He inserted the worm, alive, intact and still wriggling, into a jar of his own saliva and headed for the lab.

Allen arrived at William & Mary's Integrated Science Center when it was still dark and he was still in his pajamas. He put the worm under his microscope. The specimen turned out to be a nematode known as *Gongylonema pulchrum*, a member of a genus of parasites that are more often found in livestock than people.

In fact, Allen is only the 13th known human in the U.S. to be infected with *Gongylonema pulchrum*, a distinction noted in "Gongylonema pulchrum Infection in a Resident of Williamsburg, Virginia, Verified by Genetic Analysis," a paper co-authored by Allen and Aurora Esquela-Kerscher of the Department of Microbiology and Molecular Cell Biology in the Leroy T. Canoles Jr. Cancer Research Center at Eastern Virginia Medical School. Their paper was published in the *American Journal of Tropical Medicine and Hygiene*.

The journal article omits a minor point: The worm's name is Buddy. It was Esquela-Kerscher's idea. "He's your buddy, Jon!," she said. "So his name is Buddy."

The collaborators suspect that *Gongylonema pulchrum* infection in humans might be substantially more common than the medical literature reflects. Allen and Esquela-Kerscher are extending their work, funded by one of the 10 grants awarded by William & Mary and EVMS to

foster collaboration among the faculties of the two institutions. They want to sequence the entire *Gongylonema pulchrum* genome, something that hasn't been done anywhere. The collaborators also want to "go on a worm hunt," to seek out other human infections by Buddy's relatives.

When Allen sat down at his microscope in his pajamas, he was able to identify Buddy morphologically. Morphological identification is done by examination of characteristics unique to the species, much as one would use field marks and song to distinguish a cardinal from other birds. Esquela-Kerscher verified Allen's identification through DNA analysis, comparing a section of Buddy's DNA to a database. It's work that marks the first confirmation of *Gongylonema* infection in a human by molecular methods.

Esquela-Kerscher is Allen's neighbor. Her husband, Oliver Kerscher, is also a biologist at William & Mary. Allen wanted to get genetic verification of his identification and Esquela-Kerscher came to mind, because she is experienced in conducting genetic analyses using tiny bits of an organism. There's not much to an individual *Gongylonema* worm. Buddy looks like a bit of curled sewing thread at the bottom of a jar filled with ethanol. Allen wanted to be sure that the DNA analysis use as small a sample as possible from the tiny nematode.

"There are a lot of people who could do PCR [polymerase chain reaction] work," Allen said. "But it's important that we preserve as much of this worm as possible and few people are as skilled as Aurora."

Esquela-Kerscher is experienced in working with small worms. In her EVMS lab, she often does genetic examination of *C. elegans*, a soil-dwelling organism that is a common animal used in cancer research. She was able to get enough material to perform her work using just a small piece of Buddy.

"I didn't want to take the head or the tail, because we need those for morphological identification," she said. "I just took a little bit out of the middle."

Reports of *Gongylonema pulchrum* infection in humans are rare, but Allen and Esquela-Kerscher are wondering if the worms may be a lot more common—just hard to detect. Allen said his first sensations of having the worm weren't particularly alarming.

"You know when you bite down on a potato chip? And sometimes you catch that sharp edge of the chip on the roof of your mouth? That's what it felt like," he said.

Other than causing rough spots in your [mouth](#), *Gongylonema pulchrum* infections are largely asymptomatic. "There are reports in the literature of some associated symptoms, mild nausea and things like that," Allen says. "But nothing consistent. I had no other symptoms."

Allen explained that genetic analysis is important in the investigation of the parasites for a couple of reasons. In the first place, most parasitic worms aren't extracted intact, and the bits that get mangled or left behind tend to be the parts that are most helpful to morphological identification.

Secondly, the collaborators have a hunch that human cases of gongylonemiasis—the medical term for infection by one of these nematodes—may be more common than anyone realizes and that it is often misdiagnosed. They write in their paper, "Previous case studies have reported the misdiagnosis of gongylonemiasis as oral candidiasis [often called 'thrush'] and even psychosis."

Allen went to the doctor when he first suspected the nematode had taken up residence in his cheek. His general practitioner referred him to an oral surgeon. Allen got off easy; he avoided diagnoses of psychosis or

delusional parasitosis. The oral surgeon did, however, disagree with Allen's self-diagnosis, saying the area where Allen felt the worm looked like "normal discoloration of the affected area."

Allen did his nocturnal surgery the day after his visit to the oral surgeon. He woke up his wife, Margaret Pizer, a communications specialist for Virginia Sea Grant. He needed her to hold a flashlight in the medicine cabinet mirror while he operated on himself.

Both Allen and Esquela-Kerscher say it's hard to fault the medical community. Gongylnemiasis in humans is rare not just in the U.S., but also throughout the world. Allen and Esquela-Kerscher's worm represents only the 57th of its species known to infect a human. The few gongylnemiasis cases in the medical literature include histories of people who have complained of symptoms for months; Allen said one man had symptoms over the course of a decade. He said the mild symptoms of gongylnemiasis make a chain of many weak links that lead from infection to diagnosis.

"There are all these steps," Allen said, counting off on his fingers. "You have to have the infection. The organism has to migrate into a place where you notice it. You have to recognize that there's something that's not right. Then you have to go to the doctor and convince the doctor that it's not normal."

Allen isn't sure where he picked Buddy up. He has three hypotheses, though; each scenario involves an insect as an intermediate host of the worm.

"These nematodes reproduce inside a cow," Allen explains, "the cow excretes and the eggs are in the fecal matter of the cow. Those eggs are then ingested by an insect."

He said that *Gongylonema pulchrum* can develop inside an insect, but the nematode can't fully mature until it gets inside a cow or other mammalian host.

"So somehow, I got insect parts inside of me," he said.

His first hypothesis and the one Allen says is most likely, is that the *Gongylonema* eggs got into something he ate. Allen admits that he likes his burgers medium rare, but he doesn't think Buddy arrived via meat. Allen notes that the U.S. Food and Drug Administration has a long slate of regulations governing the maximum allowable insect content of various foods. One of the papers he and Esquela-Kerscher have studied dealt with the insect content of boxed foods such as cereal and, in particular, raisins.

"We have little kids, and we eat a lot of raisins for snacks," he shrugs. "So it could be raisins."

The second hypothesis is well water. In 2012, Allen and his family summered in a Maine farmhouse that was served by a well. They returned this summer and Allen examined the water, finding enough mandible bits and other pieces of bugs to make the well a potential source of *Gongylonema pulchrum* eggs.

The third hypothesis is accidental ingestion: "You know how you'll be walking along, talking, and all of a sudden you've realized you've just swallowed a bug?" he said. "That's happened to everyone and you don't think anything of it."

One problem in tracing Buddy's roots is that he can't say when he might have picked the worm up, because there isn't any good information about the rate at which *Gongylonema* matures inside humans.

"So it could have been only a few weeks between the time I ingested it and the time I noticed it," Allen said. "It could have been months. It could have been longer than that."

Allen believes that it's possible that his days of hosting *Gongylonema pulchrum* may not be over. Buddy's children may well be growing in Allen's body. Esquela-Kerscher says if Allen does indeed have such guests, they probably are living near the bottom of the biologist's esophagus. "That's where they're usually found in livestock," she said.

Allen says he believes the nematodes only start to migrate from their comfortable esophageal home when they are fully mature and looking to mate. "For all we know, I could have some more in me right now," Allen said.

"Which would be awesome, because we need some more material," Esquela-Kerscher added.

There are anti-nematode drugs that could purge Allen of any *Gongylonema* still hanging around, but he hasn't taken them. When Allen is asked to explain why, the collaborators exchange sheepish laughter.

"That would ruin our experiment," he said.

Provided by The College of William & Mary

Citation: Scientist researches parasite that he removed from his own body (2013, October 2) retrieved 7 August 2024 from

<https://medicalxpress.com/news/2013-10-scientist-parasite-body.html>

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