SCI-TECH

"The blood is rare and sweet as cherry wine"
CHERRY WINE HOZIER

Undergraduate discovers, publishes description of new sawfly species

BY KARISSA CHENG
CONTRIBUTING REPORTER



KIMBERLY ANGELES / PHOTOGRAPHY EDITOR

Leah Mock '28 recently published a description of a new sawfly species, Anoplonyx rasnitsyni, in collaboration with a French research institute. She encountered the specimen in Yale's Peabody Museum, where she was researching invertebrate fossils.

It's often details in the wings that give flight to new insect discoveries.

This fall, Leah Mock '28 published a description of a new sawfly species, Anoplonyx rasnitsyni, in collaboration with the Institute of Systematics, Evolution, Biodiversity, or ISYEB, in Paris. One of the qualities that differentiates the species from others is a unique cross-vein in its wings.

"There's a level of subjectivity, so you're really making an argument that this should be a new species," Mock said in an interview, "based on the combination of characteristics, the fact that there's a difference in time between this and everything else there ever was."

Mock, who studies earth and planetary sciences at Yale, said she encountered the specimen through her work in the Peabody Museum's Division of Invertebrate Paleontology, where she marked fossils that needed further identification. She reached out to André Nel, an ISYEB professor specializing in the study of fossil insects, with photos of the specimens for identification. When Nel wrote back that the sawfly specimen was different from other sawflies in the fossil record, the two began the process of describing the new species along with Nel's doctoral student at the time, Mathieu Boderau.

According to Boderau, describing a new species involves comparing the specimen of interest to previously documented species.

In this case, Mock took photos of the fossil specimen using a digital microscope. Then, the team searched current literature to find the taxonomic ranks it fit into through examining its features relative to existing descriptions of similar species.

"The work is more complex than it may appear," Boderau wrote in an email to the News. "It relies on access to fossil data and to extant specimens for morphological comparison, on familiarity with a specialized literature, and on close supervision."

The sawfly fossil specimen was collected from the Green River Formation, a 50-million-year-old geologic formation known for its abundance of exceptionally preserved fossil insect fauna. The fossil Mock worked with was of a nearly complete adult, which allowed for detailed comparison of the sawfly's wing venation to other species.

The discovery of this sawfly fossil improves our understanding of insect diversity and environmental conditions, Mock said.

The publication of the Anoplonyx rasnitsyni description is not the end of the road for Mock's collaboration with the ISYEB. In her original message to Nel, two other specimens were found to be unidentified, so the three have written papers on them as well. One of them, a description of an ichneumon wasp, has been accepted for publication. The other remains in review.

Outside of her work with the ISYEB, Mock has also published a paper with Vladimir Makarkin, a paleoentomologist at the Far Eastern Branch of the Russian Academy of Sciences, and has another one coming out soon.

Lidya Tarhan, an earth and planetary sciences professor and an associate curator of Invertebrate Paleontology at the Peabody, wrote in an email to the News that Mock is "clearly an exceptionally talented researcher." Mock currently works in Tarhan's lab, studying the impacts of interactions between organisms and sediments.

"That her careful scrutiny of the Peabody Museum's Invertebrate Paleontology (and Entomology) collections are yielding exciting new insights into a variety of arthropod groups (including but not limited to sawflies) speaks to her keen eye and diligence," Tarhan wrote.

Mock said the sawfly project taught her both about taxonomic work and the publishing process for papers and expressed gratitude for Nel and Boderau. In the future, she wants to study the "coevolution of life and Earth," meaning the ways that Earth's development has influenced diversity of life and vice versa, she said.

"Understanding how conditions on Earth have contributed to such an explosive group of animals is a good question to be interested in," she said. "But to understand that question, you have to do this kind of work, where you're doing taxonomy, you're understanding what has been on Earth."

The name of the species, Anoplonyx rasnitsyni, honors the renowned entomologist Alexandr P. Rasnitsyn.

Contact
KARISSA CHENG *at*
karissa.cheng@yale.edu.

Yale takes on novel method aiming to rapidly identify drugs in the body

BY LILIANA DUMAS
CONTRIBUTING REPORTER

Yale's Clinical Chemistry Laboratory became the first group to utilize a new method that helps physicians identify novel drugs in-house in a clinical setting.

The lab's director, Joe El-Khoury, said it currently takes six months to a year to develop an immunoassay, which is a test that uses antibodies to determine if there are drugs in urine. He said that the new method, known as direct analysis in real time tandem mass spectrometry, or DART-MS/MS, could speed up the screening development process.

"This would be a nice cutting-edge feature that would help us give results faster, especially for these high-need areas like we're describing with the opioid crisis," El-Khoury said. "It is important for me to say this is still very much in the evaluation phase."

According to El-Khoury, patients often enter the emergency room with unknown compounds in their system. He said that if the new technique works, it could reduce the processing time for urine samples to expedite drug screening for both known and novel compounds.

In recent years, he said, the novel drugs that the Clinical Chemistry Laboratory has most frequently encountered are the animal tranquilizers xylazine and medetomidine, which DART-MS/MS has shown promise in detecting.

El-Khoury noted that the method will not work to identify all drugs. He said some require separation through a different technique, but that some researchers in his lab have found that DART-MS/MS provides a promising avenue for opioids, novel psychoactive substance benzodiazepines and animal tranquilizers xylazine and medetomidine.

Ibrahim Choucair, the director of special chemistry and toxicology and assistant professor of clinical pathology at the University of Kentucky College of Medicine, worked with El-Khoury on optimizing DART-MS/MS as a clinical chemistry fellow.

Choucair said one limitation of mass spectrometry is that it is difficult "to differentiate two molecules having the same weight."

Immunoassays, which are the most common way to test for drugs using antibodies, are prone to false positives because an antibody can react with other molecules, so all positive tests are tested using liquid chromatography–tandem mass spectrometry for confirmation, El-Khoury said.

"It's an involved process, usually that confirmation may take a day or two," El-Khoury said of the current process. "That's why they don't use this rapidly for the ER, but it's a follow-up or for pain management."

The new method, DART-MS/MS, can detect cocaine on a dollar bill. The person setting up the machine ran a "classical experiment," El-Khoury said. The team put a dollar bill in between the DART source and the mass spectrometer and got a clear peak for cocaine.

In the past, Yale New Haven Hospital has faced difficulty getting timely in-house screening assays for new drugs. According to El-Khoury, in 2016, 12 people ended up in the emergency room due to a crisis on the New Haven Green.

Those people had all consumed fentanyl, but at the time fentanyl testing was not readily available, so the hospital had to find a vendor that produced an immunoassay they could use. In 2018, 52 people arrived at the emergency department, but only a third were positive for fentanyl. The hospital had to outsource testing to NMS Labs, a specialized toxicology lab.

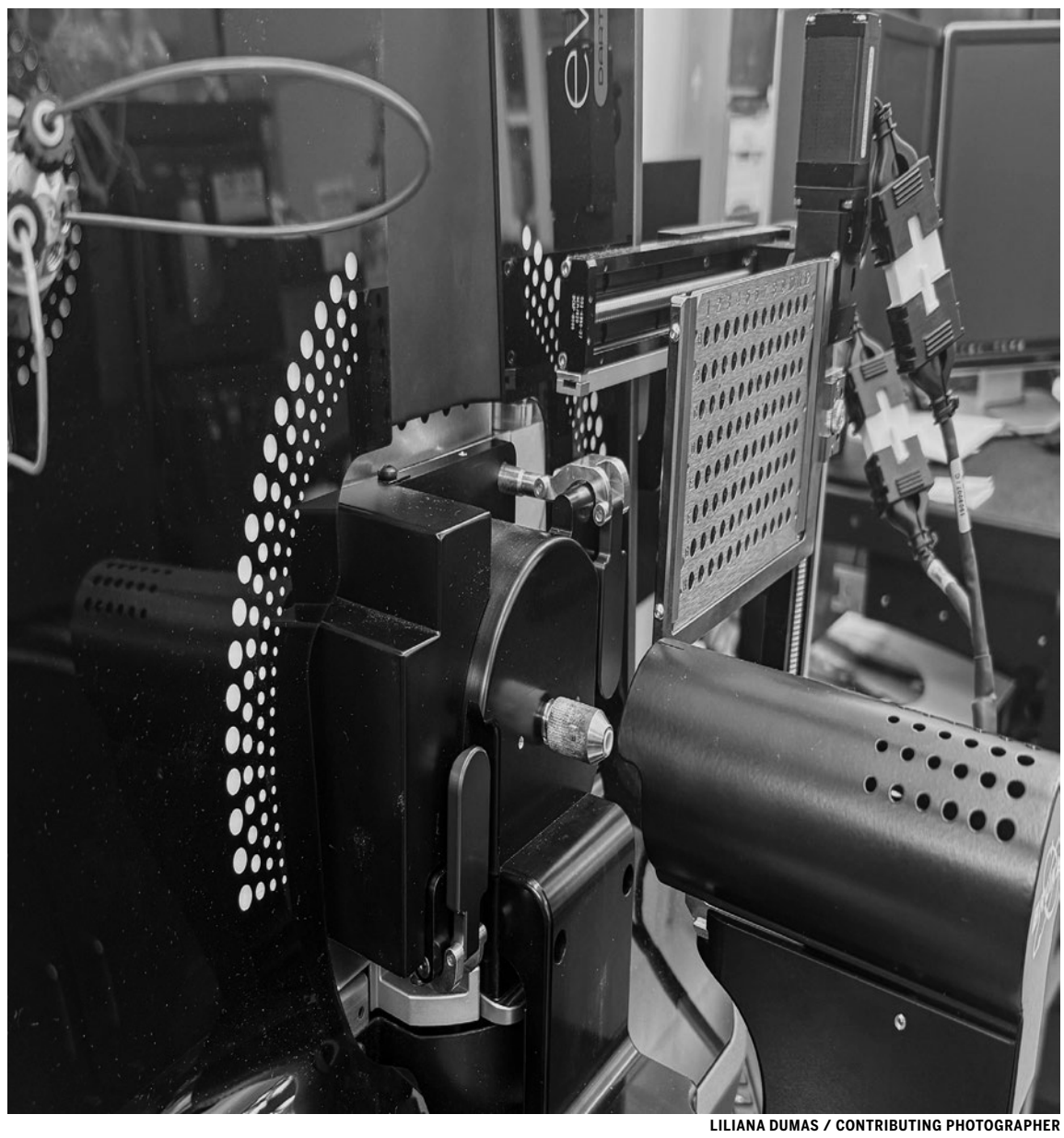
"I've heard horror stories about young people going to hospitals, practically begging for help, only to be discharged without any real support while toxicology results were still pending. In some of these accounts, those individuals lost their lives within 24 hours of being discharged," Eric Rubenstein, a board member of For Cameron, a local nonprofit that aims to end stigma around substance abuse, wrote in an email. "It's heartbreaking."

Choucair said the use of DART-MS/MS in a clinical setting might be limited by space, finances and the high level of expertise required to run the method and other mass spectrometry-based techniques.

El-Khoury said his team is continuing to develop these techniques on new compounds.

The Yale Clinical Chemistry Laboratory is located at 55 Park St.

Contact
LILIANA DUMAS *at*
liliana.dumas@yale.edu.



LILIANA DUMAS / CONTRIBUTING PHOTOGRAPHER

The new office and storage space has already been filled with medical supplies and is set to allow the program, which provides free blood pressure screenings and glucose tests for New Haven residents, to collaborate with more local organizations.