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Buzzworthy breakthrough: BYU students utilize AI to decipher the ‘language of the bees’

Google Translate for insects? How BYU students are helping humans understand animal communication

By Tyler Stahle,

July 19, 2023

For years, scientists have buzzed about the bee waggle – the groovy dance honeybees do by shaking their abdomen upon returning to the hive. This waggle tells other bees where to fly to find delicious nectar. Now, a team of BYU computer science students is abuzz to decode the secret language of the hive. Armed with a hum-dinger of a research project and cutting-edge technology, these students are translating the bee waggle in real-time.

“Bees will do this dance on a vertical surface and they’ll kind of waggle or shake in a line, and the angle of that line has to do with the angle of the sun that the bees need to fly from the hive to go to the food source,” said BYU computer science professor and project advisor Sean Warnick. “There’s a surprising amount of sophistication going on between these creatures that we just think of as insects.”

The project team, comprised of students across disciplines such as computer science and business, is creating a computer program that tracks bee waggles and interprets them in real-time on a computer screen. To capture the waggle dances, students constructed an observation hive with plexiglass siding in the BYU greenhouse. A camera records the waggle dances, and algorithms created by the students measure, annotate, and interpret the movements.

While the project may sound un-bee-lievable, the students themselves say that they're learning more about bees than they ever anticipated. Nonetheless, they find inspiration in seeing the practical application of their classroom knowledge in real-world situations.

“As a computer scientist I definitely spend a lot of time staring at screens and data, but it’s been really cool to go out and actually work with the bees,” says Caelen Miller, a BYU computer science student working on the project. “I want to have it as a hobby for the rest of my life and honestly I’d love to keep studying them because they’re fascinating creatures.”

Because of BYU’s unique emphasis on undergraduate research, Warnick says he’s excited about the future application of this research and he’s impressed by the level of care BYU students bring to the project.

“Students here at BYU tend to be very focused on doing good in the world and building something amazing. They care very much about the way they’re going to use their education,” he said.

The lasting impact of the project could be far-reaching, especially for the agriculture industry, which relies on efficient pollination. With the ability to better understand and interpret bee waggle communications, farmers may optimize pollination strategies and plan more systematically, ultimately enhancing agricultural productivity and ecosystem health.

https://news.byu.edu/intellect/buzzworthy-breakthrough-byu-students-utilize-ai-to-decipher-the-language-of-the-bees

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WASHINGTON STATE UNIVERSITY

Bees evolved from ancient supercontinent, diversified faster than suspected

By Seth Truscott, College of Agricultural, Human, and Natural Resource Sciences
July 31, 2023

PULLMAN, Wash. –The first bees evolved on an ancient supercontinent more than 120 million years ago, diversifying faster and spreading wider than previously suspected, a new study shows.

Led by Washington State University researchers, the study provides a new best estimate for when and where bees first evolved. Newly published in the journal Current Biology, the project reconstructed the evolutionary history of bees, estimated their antiquity, and identified their likely geographical expansion around the world.

The results indicate their point of origin was in western Gondwana, an ancient supercontinent that at that time included today's continents of Africa and South America.

"There's been a longstanding puzzle about the spatial origin of bees," said Silas Bossert, assistant professor with WSU's Department of Entomology, who co-led the project with Eduardo Almeida, associate professor at the University of São Paulo, Brazil.

Working with a global team, Bossert and Almeida's team sequenced and compared genes from more than 200 bee species. They compared them with traits from 185 different bee fossils, as well as extinct species, developing an evolutionary history and genealogical models for historical bee distribution. In what may be the broadest genomic study of bees to date, they analyzed hundreds to thousands of genes at a time to make sure that the relationships they inferred were correct.

"This is the first time we have broad genome-scale data for all seven bee families," said co-author Elizabeth Murray, a WSU assistant professor of entomology.

Previous research established that the first bees likely evolved from wasps, transitioning from predators to collectors of nectar and pollen. This study shows they arose in arid regions of western Gondwana during the early Cretaceous period.

"For the first time, we have statistical evidence that bees originated on Gondwana," Bossert said. "We now know that bees are originally southern hemisphere insects."

The researchers found evidence that as the new continents formed, bees moved north, diversifying and spreading in a parallel partnership with angiosperms, the flowering plants. Later, they colonized India and Australia. All major families of bees appeared to split off prior to the dawn of the Tertiary period, 65 million years ago—the era when dinosaurs became extinct.

The tropical regions of the western hemisphere have an exceptionally rich flora, and that diversity may be due to their longtime association with bees, authors noted. One quarter of all flowering

plants belong to the large and diverse rose family, which make up a significant share of the tropical and temperate host plants for bees.

Bossert's team plans to continue their efforts, sequencing and studying the genetics and history of more species of bees. Their findings are a useful first step in revealing how bees and flowering plants evolved together. Understanding how bees spread and filled their modern ecological niches could also help keep pollinator populations healthy.

"People are paying more attention to the conservation of bees and are trying to keep these species alive where they are," Murray said. "This work opens the way for more studies on the historical and ecological stage."

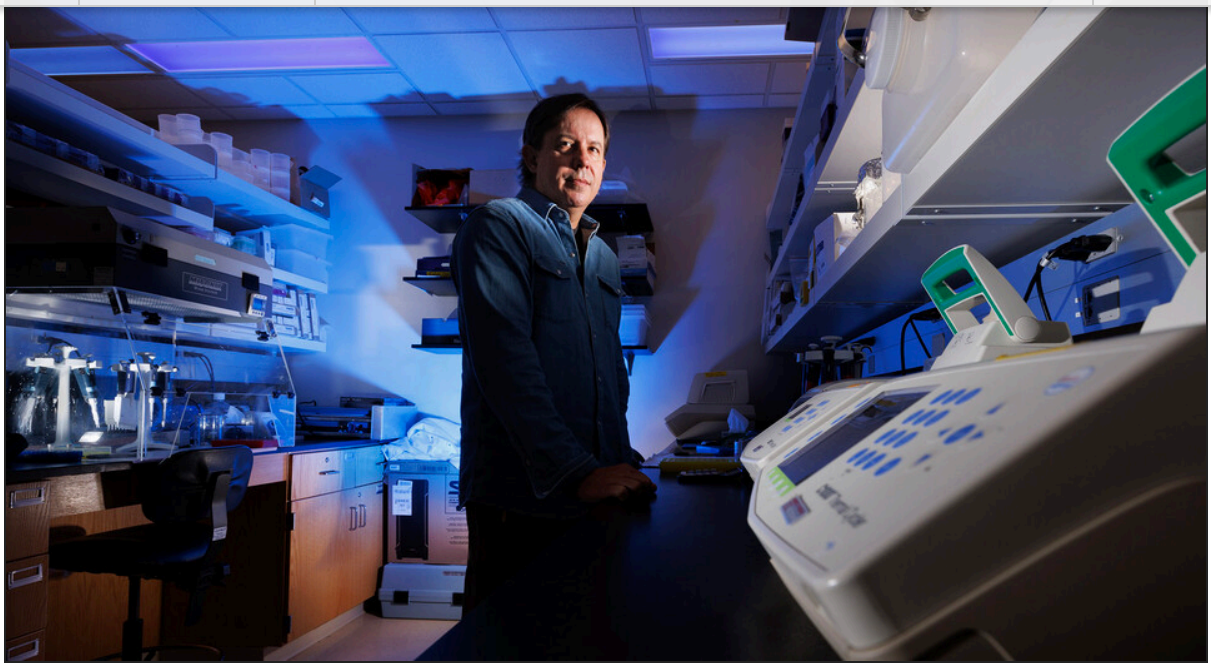
Additional contributors included Felipe Freitas, Washington State University; Bryan Danforth, Cornell University; Charles Davis, Harvard University; Bonnie Blaimer, Tamara Spasojevic, and Seán Brady, Smithsonian Institution; Patrícia Ströher and Marcio Pie, Federal University of Paraná, Brazil; Michael Orr, State Museum of Natural History, Stuttgart; Laurence Packer, York University; Michael Kuhlmann, University of Kiel; and Michael G. Branstetter, U.S. Department of Agriculture.

https://news.wsu.edu/press-release/2023/07/31/bees-likely-evolved-from-ancient-supercontinent-earlier-than-suspected/

UNIVERSITY OF Nebraska® Lincoln

Research boosts honey bee protection against deadly viruses

by Geitner Simmons | IANR Media



America's honey bee population faces enormous stress. During 2022, nearly half the nation's managed colonies were lost. A central threat is the Varroa mite, a parasite whose spread of viruses regularly triggers catastrophic colony loss.

However, new research findings by a group of scientists, including Husker entomologist Troy Anderson, could provide a breakthrough in combating the threat.

Through field study and cutting-edge biochemical analysis, the researchers have identified a specific drug treatment that stimulates honey bees' immune systems and dramatically strengthens protection against mite-facilitated viral assault.

Infected honey bees that received the treatment, Anderson and his colleagues reported, "had similar survival rates as uninfected bees." Once colonies received treatment at the proper level via the drug pinacidil, their viral infection rates were reduced "to levels comparable to non-inoculated colonies."

The team, led by researchers at Louisiana State University, explained its findings in an article recently published in Virology Journal.

"We've provided a critical proof of concept that you can find a therapeutic target to inhibit virus-mediated mortality in bees at the field level," said Anderson, professor of entomology at the University of Nebraska–Lincoln. "That is not only groundbreaking. It's a huge step forward in being able to improve bee colony health with specific chemistries."

With these research findings in hand, Anderson said the task now is to develop "novel therapeutics" — drug treatments — for commercial hives. This initial treatment approach identified by the researchers might be feasible for only some beekeepers, "but what we've shown is that we can regulate the immune system to provide some protection for bees against viruses," he said. "So now we need to work on other drug treatments that may work better or are more cost-effective."

To achieve the breakthrough, the scientists needed to understand the specifics of using pinacidil to administer the proper amount of reactive oxygen species — unstable molecules commonly known as free radicals — that can stimulate a body's immune response. The reactive oxygen species, or ROS, produced the desired immune system activity by entering cells through potassium ion channels — biological entry points whose signaling regulates a wide range of cell activity.

The researchers needed to get the ROS level just right, Anderson said, because a level of free radicals too high can damage tissues, and a level too low fails to stimulate the immune system.

"A moderate increase in these ROS can benefit bees by enhancing their immune function, which is what we've done here with pinacidil treatments," Anderson said.

The scientists delivered the drug through sugar water drizzled on beehive frames. Bees ingested the liquid and passed it on to younger bees.

Previous laboratory research by the scientists had indicated the likely viability of the treatment approach, and this new project confirmed the effectiveness in the field, using hives at Louisiana State University. The hives were sizable, with at least 80,000 honey bees per hive.

Over the past 12 years, the annual loss of colonies nationwide averaged 39.6%. In 2022, the figure stood at 48%, the second-highest mortality rate on record. Bee colony loss undercuts environmental sustainability and the U.S. agriculture sector, given the broad importance of honey bee pollination for many plants and crops.

Honey bee colonies "are complex, dynamic machines," Anderson said, and affected by multiple stressors including parasites, pathogens, pesticides, landscape and climate change. By identifying treatment to address the Varroa mite and its viral-spreading capacity, this research addresses one of the gravest threats to bee colony health.

https://news.unl.edu/newsrooms/today/article/research-boosts-honey-bee-protection-against-deadly-viruses/

Bees have appeared on coins for millennia, hinting at an age-old link between sweetness and value

by Adrian Dyer, The Conversation

July 25, 2023

In 2022, the Royal Australian Mint issued a $2 coin decorated with honeybees. Around 2,400 years earlier, a mint in the kingdom of Macedon had the same idea, creating a silver obol coin with a bee stamped on one side.

Over the centuries between these two events, currency demonstrating a symbolic link between honey and money is surprisingly common.

In a recent study in Australian Coin Review, I trace the bee through numismatic history—and suggest a scientific reason why our brains might naturally draw a connection between the melliferous insects and the abstract idea of value.

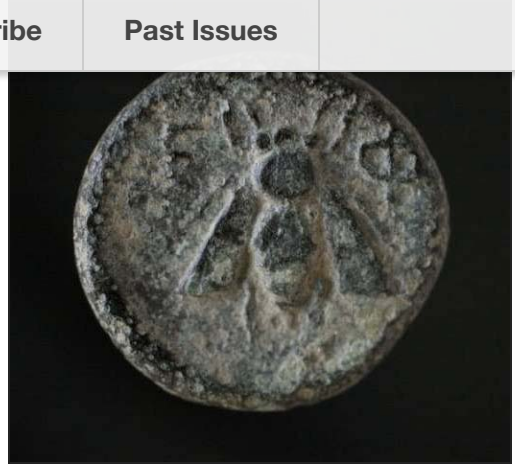
What is currency and why is it important?

Money is a store of value, and can act as a medium of exchange for goods or services. Currency is a physical manifestation of money, so coins are a durable representation of value.

Coins have had central role in many communities to enable efficient trade since ancient times. Their durability makes them important time capsules.

Ancient Malta was famous for its honey. The modern 3 Mils coin (1972–81) celebrates this history with images of a bee and honeycomb. According to the information card issued with the coin set, "A bee and honeycomb are shown on the 3 Mils coin, symbolizing the fact that honey was used as currency in Ancient Malta."

In ancient Greece, bees were used on some of the earliest coins made in Europe. A silver Greek obol coin minted in Macedon between 412 BCE and 350 BCE, now housed in the British Museum, shows a bee on one side of the coin.



Bees also feature on coins minted elsewhere in the ancient Greek world, such as a bronze coin minted in Ephesus dated between 202 BCE and 133 BCE.

The use of bees on ancient coins extended for many centuries including widely circulated bronze coins, and new varieties continue to be discovered.

Why we might like bees on coins

Why have bees appeared so often on coins? One approach to this question comes from the field of neuro-aesthetics, which seeks to understand our tastes by understanding the basic brain processes that underpin aesthetic appreciation.

From this perspective, it seems likely the sweet taste of honey—which indicates the large amount of sugar it delivers—promotes positive neural activity associated with bees and honey.

Indeed, primatologist Jane Goodall once proposed that obtaining high-calorie nutrition from bee honey may have been an important step in the cognitive development of primates.

Our brain may thus be pre-adapted to liking bees due to their association with the sweet taste of honey. Early usage of bees on coins may have been a functional illustration of the link between a known value (honey) and a new form of currency: coins as money.

The bee on modern coins

The use of bees as a design feature has persisted from ancient to modern times. A honeybee visiting a flower is shown on a series of ten-centesimi bronze coins issued in Italy from 1919 to 1937.

(As an aside, the world's last stock of pure Italian honeybees is found in Australia, on Kangaroo Island, which was declared a sanctuary for Ligurian bees by an act of parliament in 1885.)

More recently, a 20-seniti coin from the Pacific nation of Tonga shows 20 honeybees flying out of a hive. This coin was part of a series initiated by the Food and Agriculture Organization of the United Nations to promote sustainable agricultural and cultural development around the world.

Bees are relevant here because their pollinating efforts contribute to about one-third of the food required to feed the world, with a value in excess of US$200 billion per year, and they are threatened by climate change and other environmental factors.

Bees on coins, today and tomorrow

Public awareness of bees and environmental sustainability may well be factors in the current interest in bee coins. The diversity of countries using bees as a design feature over the entire history of coins suggests people have valued the relationship with bees as essential to our own prosperity for a long time.

In Australia, the 2022 honeybee $2 coin is part of a series developed by the Royal Australian Mint. In 2019, the Perth Mint in Western Australia also released coins and stamps celebrating native bees.

Despite the decline of cash, bee coins still appear to be going strong. The buzzing companions of human society are likely to be an important subject for coin design for as long as coins continue to be used.

https://phys.org/news/2023-07-bees-coins-millennia-hinting-age-old.html

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Raw Honey from Argentina, Brazil, India, and Vietnam Injures U.S. Industry, Says USITC

May 11, 2022

News Release 22-058

Inv. No. 731-TA-1560-1562 and 731-TA-1564 (Final)

Contact: Jennifer Andberg, 202-205-1819

Raw Honey from Argentina, Brazil, India, and Vietnam Injures U.S. Industry, Says USITC

The United States International Trade Commission (USITC) today determined that a U.S. industry is materially injured by reason of imports of raw honey from Argentina, Brazil, India, and Vietnam that the U.S. Department of Commerce (Commerce) has determined are sold in the United States at less than fair value.

Chair Jason E. Kearns, Vice Chair Randolph J. Stayin, and Commissioners David S. Johanson, Rhonda K. Schmidtlein, and Amy A. Karpel voted in the affirmative.

As a result of the Commission's affirmative determinations, Commerce will issue antidumping duty orders on imports of this product from Argentina, Brazil, India, and Vietnam.

The Commission made a negative critical circumstances finding with regard to imports of this product from Argentina. The Commission made an affirmative critical circumstances finding with regard to imports of this product from Vietnam.

The Commission's public report *Raw Honey from Argentina, Brazil, India, and Vietnam* (Inv. Nos. 731-TA-1560-1562 and 731-TA-1564 (Final), USITC Publication 5327, May 2022) will contain the views of the Commission and information developed during the investigations.

The report will be available by June 20, 2022; when available, it may be accessed on the USITC website at: *http://pubapps.usitc.gov/applications/publogs/qry_publication_loglist.asp*.

UNITED STATES INTERNATIONAL TRADE COMMISSION
Washington, DC 20436

FACTUAL HIGHLIGHTS
Raw Honey from Argentina, Brazil, India, and Vietnam
Investigation Nos.: 731-TA-1560-1562, 1564 (Final)

Product Description: Honey is a sweet, viscous fluid produced from the nectar of plants and flowers which is collected by honeybees, transformed, and combined with substances of their own, and stored and left in honeycombs to mature and ripen. Raw honey is honey as it exists in the beehive or as obtained by extraction, settling and skimming, or straining.

Status of Proceedings:

1. Type of investigation: Final antidumping duty investigations.
2. Petitioners: American Honey Producers Association ("AHPA"), Bruce, South Dakota; and Sioux Honey Association ("SHA"), Sioux City, Iowa.
3. USITC Institution Date: Wednesday, April 21, 2021.
4. USITC Hearing Date: Tuesday, April 12, 2022.
5. USITC Vote Date: Wednesday, May 11, 2022.
6. USITC Notification to Commerce Date: Tuesday, May 31, 2022.

U.S. Industry in 2020:

1. Number of U.S. producers: approximately 30,000 to 60,000.
2. Location of producers' plants: North Dakota, South Dakota, California, Texas, Montana, Florida, Minnesota, and Michigan
3. Production and related workers: 1,360.
4. U.S. producers' U.S. shipments: $302 million.
5. Apparent U.S. consumption: $690 million.
6. Ratio of subject imports to apparent U.S. consumption: 42.8 percent.

U.S. Imports in 2020:

1. Subject imports: $296 million.
2. Nonsubject imports: $93 million.
3. Leading import sources: Argentina, Brazil, India, Vietnam.

https://www.usitc.gov/press_room/news_release/2022/er0511ll1935.htm

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What does this mean for beekeepers?

The decision will be transmitted to the Commerce Department, which will issue antidumping duty orders shortly. In addition, the Commission reached an affirmative critical circumstances determination against Vietnam. This means that U.S. Customs will collect antidumping duties on entries going back an additional 90 days prior to the preliminary antidumping duty determination —from August 28, 2020, forward. This is an important additional finding, and one that the Commission rarely makes.

These results should continue to ensure that the American honey producer gets the fair prices they deserve.

We truly appreciate all of the donations that we have received to cover legal fees.

The good fight isn't over yet, however, and we still need your support.

To donate to the Antidumping Fund, please contact
Cassie Cox: cassie@ahpanet.com
281-900-9740

Or donate on our secure website: https://www.ahpanet.com/donations-1

American Honey Producers Association

AHPA App

As AHPA continues to work on behalf of all beekeepers, one of our initiatives is advocating with the FDA in Washington D.C. to update honey labeling guidelines. As part of this effort, we need your help to collect pictures of honey labels from around the United States. Our goal is primarily to find honey that is mislabeled according to current FDA guidelines. Secondarily, we need examples of any labels which misrepresent country of origin or are purposefully confusing to consumers so that we can advocate for positive changes and updates.

Search the App Store or Google Play for "AHPA app". We need to collect as many pictures from honey on the store shelf as possible. Please take a few minutes to help collect this data.

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