SPORE PRINTS

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Number 620 March 2026

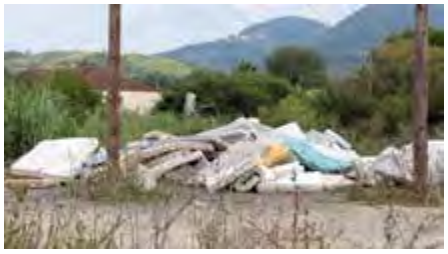
FUNGI HELP TURN OLD MATTRESSES INTO INSULATION

Andrew Paul

https://www.popsci.com/, Feb. 4, 2026

Shopping for a new mattress can be stressful—this is something you plan to sleep on for years to come, after all. But your old one can be its own problem for the environment.

Despite containing upwards of 75 percent recyclable material, an estimated 50,000 mattresses are still discarded every day in the United States. Once in a landfill, the bulky trash can take as long as 120 years to decompose. It's such a huge problem that there's now even a Mattress Recycling Council dedicated to addressing the issue.



Discarded mattresses.

Luckily, its council members may soon have a new cause for celebration. According to a recently published study in the journal *Scientific Reports*, researchers at Australia's Swinburne University of Technology have developed a process that converts retired mattresses into safe, eco-friendly building insulation. Their secret weapon for making it happen? A fungal relative of penicillin.

"Mattresses are durable, bulky, and often end up in landfill," study co-author and chemical engineer The Nguyen said in a statement. "Through natural biological processes, we can give this waste a second life."

In this case, Nguyen's team relied on *Penicillium chrysogenum* to get the job done. *Penicillium chrysogenum* isn't the same species of fungi famously repurposed by Alexander Fleming (that would be *Penicillium rubens*); it is in the same genus as that life-saving antibiotic. After cultivating the conidia, the researchers then combined them with shredded polyurethane foam harvested from old mattresses. As the fungi began binding to the trash, they formed calcium carbonate deposits. These mineral compounds then meshed with the foam to create a lightweight solid that is also incredibly heat resistant. In stress tests, the material easily withstood exposure to temperatures nearing 1,832 degrees Fahrenheit.

"The material performed well as an insulator, with heat-blocking ability very close to commercial insulation products already used in homes and buildings," explained Nguyen.

The team believes that with further development, their new recycling strategy could create a new generation of materials used for fire-resistant insulation, building panels, and possibly even 3D-printed construction components.

"Our work shows how combining biology with waste materials, while leveraging deep manufacturing science, can lead to smart, low-impact solutions that better the environment and the lives of everyone," said Nguyen.

Photographic and microscopic analysis of mattress waste before and after treatment. (a) Shredded mattress waste, (b) Optical image of mycelium-based bio-composites derived from recycled mattress waste, (c) Scanning electron micrograph of the mycelium-based bio-composites.

THE CHANGING CHEMISTRY OF INVASIVE DEATH CAP MUSHROOMS

Lydia Picotte

https://ls.wisc.edu/, Feb. 11, 2026

The California Department of Public Health reported 39 related poisonings in the last three months leading to the death of four people, at least three liver transplants, and many more people sick. The culprit? In each case it is believed Death Cap mushrooms (*Amanita phalloides*) are the source.

Even before the uptick in poisonings, these dangerous mushrooms were the subject of a collaborative study by two departments at the University of Wisconsin-Madison and the USDA-ARS Cereal Disease Lab in St. Paul, Minnesota. The scientists have just published new research about the chemistry of Death Cap mushrooms. Researchers learned that the species is not only spreading rapidly as an invasive fungal species in the United States, but the move across continents has changed the chemistry of the species.

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CALENDAR

Mar. 8	PSMS election deadline
Mar. 10	Membership meeting, 7:30 pm, CUH
Mar. 16	Board meeting, 7:30 pm, CUH board room
Mar. 24	*Spore Prints* deadline

BOARD NEWS — Peg Rutchik

Shannon Adams updated the board on development of a new website. Veith Consulting has set up the framework, but progress to make the site functional has stalled. The board voted to identify a lead person to help drive efforts, set up a small committee to oversee finishing the development, and add the website development to all upcoming board meetings until its completion.

Megan and Cindy Brewster presented the 2025 financials and 2026 financial projection. Although financials will likely be flat again in 2026, there is room to increase spending on mission-driven initiatives. There was a lively discussion on this topic. A small subcommittee will be formed to identify goals related to income, expenditures, and plans for investments. Amy Foster, Marian Maxwell, and Shannon Adams will participate in this group along with one or two other members. In addition, the fiscal management policy will be modified to provide guidance to committee chairs on work plans and budgets.

The UW plans to charge for parking at the Center for Urban Horticulture in the future. Kelsey Hudson will obtain the website url for community input so PSMS members may add their comments. Also noted was that our lease specifies paying for 90 parking spaces during our monthly meetings. More to come on this topic in the future.

MEMBERSHIP MEETING — Joseph Zapotosky

March 10, 2026
7:30–9:30 pm
Center for Urban Horticulture, UW
"Taxonomy and Nomenclature: Lessons from Botany"


Julian Banbury

Julian Banbury

Our speaker this month is Julian Banbury, who will explore the foundations of botanical taxonomy and scientific naming systems, drawing on his experience presenting botanical Latin and plant nomenclature. His talk will highlight key historical developments and practical strategies for decoding Latin names, with insights drawn from prior presentations on orchid classification.

Accurate naming and sound classification are essential to our work—from distinguishing look-alike species to understanding evolutionary relationships. Julian's perspective from botany offers tools that can enrich our engagement with fungal nomenclature and deepen our appreciation for scientific names as meaningful windows into biodiversity.

Julian is an orchid enthusiast who has been cultivating orchids since 2019, with a particular interest in *Bulbophyllum*. A native German speaker who grew up in Seattle, he has long been fascinated by etymology and the Latin roots of scientific language. He is also a freelance photographer with a passion for orchid photography and traditional darkroom work.

The meeting is open to the public and will be offered both in person and via Zoom for those unable to attend physically. Julian Banbury has graciously agreed to allow PSMS to record this presentation for later viewing on the PSMS website (members only).

CAN WE MAKE MUSHROOMING EVEN BETTER? — Wren Hudgins

Most of us are familiar with several benefits of mushrooming. We spend considerable time outdoors in fresh air, we exercise, we engage in new learning (navigation, mushroom identification), and we do all this with fellow hobbyists. But most mushroomers do not get interested in mushrooming for these reasons. Mostly they walk in through the edibility door.

Certainly there are nutritional and taste benefits, but let's have a look at what the research says about these secondary benefits.

1. Research backs benefits of spending time in forest environments. Much of this research focuses on what the Japanese call "forest bathing," mainly because they are doing more research on this than anyone else.

    a. Stress reduction, defined as lowered cortisol levels, reduced sympathetic activity, increased relaxation (Antonelli et al., 2019).

    b. Improved mood and emotional well being, defined as reduced depression, anxiety and anger, increased calm and positive affect (Siah et al., 2023).

    c. Cardiovascular benefits defined as lowered blood pressure, reduced heart rate, autonomic nervous system balance (Oh et al., 2017).

    d. Immune function enhancement, defined as increased natural killer cell activity and immune markers (Liey et al., 2022).

    e. Cognitive restoration and reduced mental fatigue, defined as improved attention, reduced cognitive load, mental refreshment (Antonelli et al., 2022).

2. Time spent in clean, nonpolluted air is associated with measurable reductions in cardiovascular risk and systemic inflammation (Brauer et al., 2021).

3. Exercise supports health by reducing risk of cardiovascular disease, type two diabetes, some cancers, improvements in mental health by reducing depression and anxiety, and improving musculoskeletal health for functional ability and longevity (Warburton et al., 2006).

4. There are immediate and longer-term cognitive benefits to new learning, such as learning mushroom identification or forest navigation. The short-term benefit from learning new and demanding material is that episodic memory and cognitive function are improved. Passive activities such as TV watching did not produce this benefit (Park et al., 2014). Beyond the short term, there is evidence that engaging in intellectually stimulating activities like new learning builds "cognitive reserve" which itself is associated with delayed onset of cognitive decline and dementia symptoms, so is protective across the life span (Stern, 2012).

5. Since mushroom hunting is a social activity (it's not recommended to go alone), there are significant social and health benefits such as reduced mortality. This is a very real effect, equal in size to the benefits from exercise and quitting smoking, and it is true for every age, sex, and health status. Activities like mushrooming naturally combine shared attention, low-pressure conversation, and cooperative learning—forms of social engagement that research suggests are particularly beneficial for psychological and physical health (Holt-Lunstad, et al., 2010).

The above benefits of mushrooming may be unsurprising to many of us, but citing the research behind the benefits adds depth. Although this seems like a perfect storm of health inducing benefits, we can do yet better. Active participation in a mushroom club, like community service of any sort, often involves educating, organizing, supporting others, mentoring, and contributing knowledge. Volunteering one's time in offering these contributions is associated with better mental health (lower depression and greater life satisfaction), and the effects are strongest when the volunteer role offers meaning, role identity, and social integration. (Thoits & Hewitt 2001). Beyond the mental health benefits, when volunteering is "other oriented" rather than self-focused, it is associated with lower mortality (Okun et al., 2013). Certainly active volunteerism benefits the mushroom club, but the volunteer benefits even more. So mushrooming quietly combines six evidence-based benefits into a single enjoyable activity that requires no prescription; just one pair of muddy boots.

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Changing Chemistry of Death Caps, *cont. from page 1*

The final paper, titled "Leaderless RiPPs* Expand the Repertoire of Fungal Secondary Metabolites," is published in the *Proceedings of the National Academy of Sciences* (PNAS). It's co-authored by Anne Pringle, the L&S Mary Herman Rubinstein and Vilas Distinguished Achievement Professor of Botany; Nancy Keller, the Robert L. Metzenberg and Kenneth B. Raper, Professor of Mycology in Medical Microbiology & Immunology and Plant Pathology; and Milton Drott, a research leader at the USDA-ARS Cereal Disease Lab. The lead author of the paper is Sung Chul Park, a natural product chemist in the Keller lab.

"What we hope people take away from this paper," says Keller, "is that scientists are actively studying this serious issue. We're working hard to understand why it's happening."

When Pringle first came to UW-Madison, she was interested in the Death Cap mushroom's migration from its original locations in Europe to California. Since arriving in the United States in the 1930s—likely in the roots of a tree—the mushroom has spread across the West Coast. According to Cecelia Stokes, a Ph.D. student in the Pringle Lab studying the Death Cap, the organisms can now be found as far south as Mexico and north of the Canadian border. They've also been identified in the New England area but seem to be spreading less quickly on the eastern side of the country.

"I have no doubt these invasive mushrooms are impacting native ecosystems, but we are still working towards understanding the actual consequences and bigger picture," Stokes says. "We do know Death Cap mushrooms are popping up in dense patches in forests from year to year. You can find more than 40 mushrooms under one tree, and this is abnormal, especially in comparison to the native mushroom species."

Keller and Pringle began working together to determine if the chemistry of the Death Cap was different between the two continents. They found that the mushrooms in California are producing previously unknown natural products, otherwise referred to as secondary metabolites, which have not been found in Europe. Not only did they confirm that the mushroom chemistry has changed since arriving in North America, but they discovered some metabolites that have never been isolated before in any fungus.

Prior to the publication of this study, the team released another paper which sequenced the Death Cap's genes, called MSDIN genes. That research led to the discovery of uncharacterized MSDIN genes on the mushrooms in California. This newest publication uncovers the new natural products being created by several new MSDIN genes. This was done by isolating the peptides encoded in the accessory MSDIN genes and correlating peptide production with gene expression.

The revelation is especially timely, as the state of California continues to receive reports of Death Cap poisonings and has issued a warning about eating foraged mushrooms.

The next step for researchers will be to continue examining their newly discovered products for bioactivity. Since so many drugs and medicines come from fungi and bacteria, discoveries like these will inform future research at universities and in biotechnology companies.

Getty Images

Death Cap mushrooms Amanita phalloides.

*Ribosomally synthesized and post-translationally modified peptides

SPACE MINING WITHOUT HEAVY MACHINES? MICROBES HARVEST METALS FROM METEORITES ABOARD THE SPACE STATION

David Nut

https://phys.org/, Feb. 11, 2026

If humankind is to explore deep space, some small passengers should not be left behind: microbes. In fact, it would be impossible to leave them behind, since they live on and in our bodies, surfaces, and food. Learning how they react to space conditions is critical, but they could also be invaluable fellows in our endeavor to explore space.

Microorganisms such as bacteria and fungi can harvest crucial minerals from rocks and could provide a sustainable alternative to transporting much-needed resources from Earth.

ESA/NASA

Michael Scott Hopkins performs a microgravity experiment on the International Space Station.

Researchers from Cornell University and the University of Edinburgh collaborated to study how those microbes extract platinum group elements from a meteorite in microgravity, with an experiment conducted aboard the International Space Station. They found that "biomining" fungi are particularly adept at extracting the valuable metal palladium, while removing the fungus resulted in a negative effect on nonbiological leaching in microgravity.

The team's study is published in *npj Microgravity*. The lead author is Rosa Santomartino, assistant professor of biological and environmental engineering in the College of Agriculture and Life Sciences; Alessandro Stirpe, a research associate in microbiology, is a co-author.

Testing Space Rocks with Microbes

The BioAsteroid project, which was led by senior author Charles Cockell, professor of astrobiology at the University of Edinburgh, and included other University of Edinburgh researchers, used the bacterium *Sphingomonas desiccabilis* and the fungus *Penicillium simplicissimum* to see which elements could potentially be extracted from L-chondrite asteroidal material. But understanding how the microbes interact with rocks in microgravity was equally important.

"This is probably the first experiment of its kind on the International Space Station on meteorite," Santomartino said. "We wanted to keep the approach tailored in a way, but also generally to increase its impact. These are two completely different species, and they will extract different things. So we wanted to understand how and what, but keep the results relevant for

a broader perspective, because not much is known about the mechanisms that influence microbial behavior in space."

These microbes are promising tools for resource extraction because they produce carboxylic acids, the carbon molecules which can attach to minerals via complexation and spur their release. But many questions remain about how this mechanism works, according to Santomartino, so the team also conducted a metabolomic analysis, whereby a portion of the liquid culture is collected from the completed experiment samples and the researchers examine the biomolecules contained, specifically the secondary metabolites.

Running Parallel Experiments on Earth

NASA astronaut Michael Scott Hopkins performed the ISS experiment to test microgravity, while the researchers conducted their own control version in the lab to test terrestrial gravity and compare these results with the space results. Santomartino and Stirpe then analyzed the voluminous amount of data that was collected, which comprised 44 different elements, of which 18 were biologically extracted.

"We split the analysis to the single element, and we started to ask, OK, does the extraction behave differently in space compared to Earth? Are these elements more extracted when we have a bacterium or a fungus, or when we have both of them? Is this just noise, or can we see something that maybe makes a bit of sense? We don't see massive differences, but there are some very interesting ones," Stirpe said.

What Changed in Microgravity Conditions

The analysis revealed distinct changes in microbial metabolism in space, particularly for the fungus, which increased its production of many molecules, including carboxylic acids, and enhanced the release of palladium, as well as platinum and other elements.

For many elements, nonbiological leaching—in which a solution without microbes is used to pull out the elements—was less effective in microgravity than on Earth. Meanwhile, the microbes had consistent results in both settings.

"In these cases, the microbe doesn't improve the extraction itself, but it's kind of keeping the extraction at a steady level, regardless of the gravity condition," Santomartino said. "And this is not just true for the palladium, but for different types of metals, although not all of them. Indeed, another complex but very interesting result, I think, is the fact that the extraction rate changes a lot depending on the metal that you are considering, and also depending on the microbe and the gravity condition."

Future Promise and Unanswered Questions

In addition to aiding space exploration, applications could have terrestrial benefits, such as efficient biomining from resource-limited environments or mine waste or creating sustainable biotechnologies for a circular economy. Santomartino cautions that while the biotechnology community is eager to learn the exact impact that space has on microbial species for this purpose, a tidy explanation may not be forthcoming. There are just too many variables.

"Depending on the microbial species, depending on the space conditions, depending on the method that researchers are using, everything changes," Santomartino said. "Bacteria and fungi are all so diverse, one to each other, and the space condition is so complex that, at present, you cannot give a single answer. So maybe we need to dig more. I don't mean to be too poetic, but to me, this is a little bit the beauty of that. It's very complex. And I like it."

CHANEL HAUTE COUTURE MAKES MUSHROOMS MAGIC

Bebe Howorth

https://www.aol.com/, Jan. 27, 2026

Over the past few years, mushrooms have become an increasingly prominent fixture in home decor. They pop up on table linens and tea towels, as playful stools and sterling silver objects, and even hand-painted onto fine china. Today, the lowly fungus reached its peak as it became a prominent fixture in the most opulent of spaces—Paris's Grand Palais. There, towering mushrooms of different varieties soared above the models in Chanel Haute Couture's spring-summer 2026 runway show.

The highly anticipated collection was creative director Matthieu Blazy's couture debut for Chanel. In both the sets and the fashion, he nodded to the natural world. He bordered the Grand Palais with drooping powder pink willow trees and dotted the runway with pastel mushrooms in varying shapes and sizes. Even the invitations included petite mushroom charms.

The show opened with an anonymous haiku: "Bird on a mushroom / I saw the beauty at once / Then gone, flown away." In the couture collection, some pieces continued to champion the champignon with embroidered trim depicting mushrooms and beadwork on dresses. Other models represented birds, in feathers and light, fluttering fabrics, as they passed through Blazy's mushroom maze.

"The women at the center of the collection, begin to transform into birds. A multiplicity of birds is imagined, each singular in shape and form, realized through the rituals of the Haute Couture *flou* and tailleur ateliers, together with the artisans of fabric making, embroidery, and pleating at *le* 19M," read the show notes.

Chanel

Set of the Chanel Haute Couture show.

They continue: "Birds are seen as ultimate symbols of freedom—or simply as themselves."

BOOK REVIEW: *Pedro the Vast* — Ron Post

Pedro the Vast, a short, recent sci-fi novel by Simón Lopez Trujillo, takes us to an exploitative timber plantation in Chile amid the somewhat inscrutable life forms that affect the workers and their families barely making livings in the vast mossy forests owned by uncaring entities. Foremost among these life forms are living webs of edible mycological specimens, as well as the hungriest and most mystical and most dangerous of the fungi.

Falling ill from an actual, real-life fungus, Pedro pushes to keep providing for his family. He himself inhabits some places that are authentic locales while being less than clearly drawn, but the majority of the characters and settings are edgy and invitingly surreal. Pedro's caretakers realize his two-month coma after being infected by the near-fatal *Cryptococcus* is as exotic as it is uncharted. When he finally wakes up, "The doctor diagnosed him with a fleeting psychotic break as a consequence of the coma, but as the days passed some of the nurses detected another complexity—a strange angel had seized control of his face…."

A congregation of church members claim the recovering Pedro is their new prophet. The main character's role here becomes a bit murky. Much of Pedro's rambling is just babble and his elevation to near-sainthood is unsatisfying, giving the religious leader, Balthasar, a rather thin, cardboard personality. When Pedro is screened from the public except on Sundays, the narrative bounces its focus between the congregation and Pedro's children and a mycologist who has no connection with Pedro but is studying the deadly fungus.

A mysterious spore-laden cloud adds to the mishmash. Fungal spores are replaced with eyes. Eco-warnings appear as the author's narrative becomes gilded with footnotes.

One way of hinting at a plot summation is to explain that the familial burden of having your father become a prophet simply gets to be too much. But the arresting finale is too good to pass up and Lopez Trujillo ties it up quick and neatly; that's more than one can say about some of the fungi so well described in this fun little book.

ANCIENT GREEKS USED PROCESSED ERGOT FUNGUS IN THE ELEUSINIAN MYSTERIES, STUDY FINDS — Nisha Zahid

https://greekreporter.com/, Feb. 17, 2026


BBC

A new study is offering a fresh explanation for one of ancient Greece's most enduring Eleusinian mysteries. Researchers say the secret drink used in the Mysteries may have contained a carefully prepared psychedelic derived from ergot fungus—processed in a way that reduced its toxicity while preserving its mind-altering effects.

A Ritual That Crossed Social Boundaries

For more than a thousand years, the Mysteries took place in Eleusis, a small town west of Athens. Each year, initiates from across the Greek world arrived to take part. They included politicians, soldiers, poets, and enslaved people. Inside the sanctuary, social rank carried no weight.

Ancient sources describe a demanding ritual sequence. Participants walked the Sacred Way in silence. They fasted for days. They underwent purification rites. At the heart of the ceremony, inside a vast hall known as the Telesterion, they drank a potion called kykeon. Its ingredients were never revealed. Breaking that secrecy carried a death sentence.

Myth, Agriculture, and the Promise of Renewal

The Mysteries drew their meaning from the Homeric Hymn to Demeter, composed around the seventh century BCE. The poem tells how Demeter searched desperately for her daughter Persephone, who had been taken by Hades.

Demeter's grief halted the growth of crops. Her reunion with Persephone restored life. The story mirrored the agricultural cycle of death and rebirth, a theme initiates symbolically reenacted each autumn.

Ancient writers refused to describe what followed the drinking of kykeon. Instead, they hinted at overwhelming light, powerful visions, and a profound inner transformation. Many said the rite changed how they understood death itself.

A Controversial Theory Revisited

For centuries, scholars debated whether the drink was symbolic or pharmacological. In 1978, researchers proposed that kykeon may have contained ergot, a fungus that infects barley and produces ergot alkaloids—compounds chemically related to LSD.

The idea drew attention, but also sharp criticism. Untreated ergot causes ergotism, a disease that led to mass deaths in medieval Europe. Skeptics questioned how such a substance could have been used safely for centuries.

Testing Ancient Chemistry with Modern Tools

The new study revisits that theory with experimental evidence. Researchers from the National and Kapodistrian University of Athens, working with international collaborators, tested whether ancient techniques could transform toxic ergot into safer psychoactive compounds.

Using a lye solution made from wood ash and water—materials available in antiquity—the team heated powdered ergot under controlled conditions. The process broke down the most dangerous compounds and produced lysergic acid amide, or LSA, along with iso-LSA. Both substances are psychoactive but far less potent than LSD.

Chemical analysis confirmed the transformation. Under optimal conditions, one gram of treated ergot produced about 0.5 milligrams of LSA, a dose known to affect perception.

Addressing Safety and Scale

Researchers say only a few kilograms of ergot would have been needed to supply large ceremonies. The alkaline mixture could also have been neutralized before consumption through air exposure or by mixing with barley and mint.

Geography strengthens the case. Ergot growth in Mediterranean climates tends to be localized. The fertile Thriasian plain could have supplied infected barley in controlled amounts. Archaeological evidence from Mas Castellar de Pontós, a sanctuary linked to Demeter, has already revealed ergot fragments in a ritual context.

More Than Chemistry Alone

The authors stress that the Mysteries were not drug rituals. Fasting, expectation, myth, and collective ceremony shaped the experience. LSA's effects on serotonin receptors, combined with that setting, could have produced intense emotional and perceptual changes.

What Remains Unknown

The study does not claim proof that ergot was used at Eleusis. No residue from the Telesterion has been chemically analyzed. What the research provides instead is feasibility. It shows that ancient practitioners could have neutralized ergot's toxicity using simple methods.

The Eleusinian Mysteries ended in the fourth century CE, when the sanctuary was destroyed during the Christianization of the Roman Empire. Their central secret endured because no initiate spoke of it.

Now, modern chemistry is reopening the question. What once sounded like a myth no longer appears impossible. The most guarded secret of ancient Greece may not have been mystical alone. It may have been chemical, and science may finally be close to understanding it.

UNIQUE CANADIAN FUNGUS "BANK" SAVED BY FAMILY FOUNDATION

Emily Chung

https://www.cbc.ca/, Feb. 11, 2026

A unique collection of microscopic fungi used for Canadian medical and biodiversity research has been saved from being shipped overseas.

The UAMH Centre for Global Microfungal Biodiversity has received a $1 million donation from the Weston Family Foundation, allowing it to remain in Canada for Canadian use.

"This unique biobank has the potential to fuel medical discovery, public health preparedness, and innovation for generations to come," said the Weston Family Foundation in a statement Wednesday. "As a foundation committed to investing in innovation and learning, the Weston Family Foundation felt that it had a responsibility to step in where the stakes are long-term and the benefits are shared by all."

Ayush Kumar, a University of Manitoba researcher who has used specimens in his search for new antibiotics and contributed specimens to the collection over the past 10 years, said he was "super excited" that this "tremendous resource" is staying in Canada.

He added that he was pleased to see a Canadian foundation interested in saving it and supporting science. "That's also a very exciting part of it," he said.

James Scott, a University of Toronto professor and director of the fungal biodiversity center, said he was "really stunned" when he was told about the donation.

He estimates it will provide bridge funding for about five years, allowing the center to come up with a sustainable plan to remain here long-term. He said that since getting the news, the University of Toronto has committed to help protect and grow the facility.

Why Canadian Scientists Need the Biobank

The collection—billed as the largest of its kind in the western hemisphere—contains nearly 12,000 specimens from 3,200 species around the world that were available to Canadian researchers and companies.

Craig Chivers/CBC

This fungal sample is among tens of thousands at the UAMH Centre for Global Microfungal Biodiversity at the University of Toronto. It had been at risk of closing, but has been saved by a donation.

They include many fungi that cause diseases in humans and animals that need to be studied in the hunt for new drugs and cures, or to save threatened species. Some are emerging or becoming more prevalent due to climate change.

Kumar said fungi are an important potential source of new antibiotics, as they are "some of the best chemists that are out there."

Mary Berbee is a professor emeritus of botany at the University of British Columbia who has deposited samples in the biobank—one of which turned out to be a new fungal species. She says that making such samples available to other researchers is the only way to ensure scientific results can be reproduced or duplicated.

Berbee says she was "delighted" by the news that the collection had been saved. "It's really difficult to keep culture collections going. There aren't that many in the world," she said. "And I was really worried about this one."

About two-thirds of the strains in the collection are unique in the world. Berbee said if researchers can no longer access them, their research may be delayed or not possible at all.

The collection ran out of funding in 2024, and Scott realized he could not keep it going for much longer with his own personal funds. He started looking for a fungal biobank elsewhere in the world that could absorb the collection so it didn't end up in the trash.

"The challenge," he said, "is that once you send these materials out of the country, it can be hard to get them back."

Many international regulations control the movement of dangerous or rare species across borders, meaning that many Canadian

cont. on page 8

Canadian Fungas Biobank Saved, *cont. from page 7*

researchers would find it difficult or impossible to get access to them from another country.

How a Solution was Found

But after CBC News ran a story about the biobanks' troubles, a couple of foundations contacted Scott to ask for more information.

After learning more, the Weston Family Foundation, which prioritizes projects related to healthy aging and healthy ecosystems, invited the biobank to apply for a grant. It was finalized in January.

Scott said in the process, the biobank has been encouraged to promote itself to a wide group of researchers, institutions, and companies that might find its specimens useful—something it hesitated to do when its future was uncertain.

He noted that biobanks are one of the only ways for researchers to access specimens of microorganisms, which can't just be ordered from an online store like chemicals and other scientific supplies.

The Centre for Global Microfungal Biodiversity plans to work on cataloging its specimens online and making them more accessible, in the hopes that it can earn more from user fees. It's also looking to put together an endowed fund that could cover the rest of its costs.

GIFTS OF THE FUNGI — Susan Goldhor

FUNGI Magazine, Winter, 2025, Volume *18*(5), 11.

In the Winter 2025 volume of FUNGI, Susan Goldhor discussed "three gifts from Kingdom Fungi that you might not know about." Gift 1, chili peppers, was presented last month. This month we present gift 2.

Scent

Perfume and incense are highly regarded across multiple cultures, with their value in the Middle east exemplified by the biblical story of the Wise Men bringing frankincense, myrrh, and gold to the infant Jesus, the implication being that the fragrance of frankincense was as valuable as gold.

Côté Bougie

Oud.

There's another scent with a long history in the Middle East, and this is oud. Oud is derived from agarwood, which is the fungally infected heartwood of *Aquilaria* trees. Saying that oud is valuable seems like an understatement; its heady scent which has been used for centuries in incense and perfume in the Arab world and is now used increasing in modern Western perfumes, is currently worth up to 40 times more than gold, gram for gram. (Take that, frankincense!) And high-quality agarwood, as the source of oud, sells for up to $5,000/lb. and has been called the most valuable wildlife commodity on the planet. Unfortunately, the value of agarwood has set off an illicit trade, with 13 species of *Aquilaria* now considered endangered.

I first read about oud in the magazine *Aramco World* (Biswas, 2025), which stated that a fungus is involved in forming the fragrant resin in the tree's heartwood as a defense against an insect pest, the moth Z*euzera conferta*, which bores tunnels into *Aquilaria*. When I followed up the *Zeuzera* hint, I was led to an entomological article which mentioned in passing that *Fusarium* might be part of the oud picture. This was exciting! How parallel to the story behind the hot chili peppers! Perhaps a boring insect plus *Fusarium* might have been responsible for hundreds of plant exudates or resins long valued by humans for their food, cosmetic, medicinal properties. Well this may in fact be the case, but what further searching really led me to was the uncomfortable knowledge that I knew nothing about *Fusarium*.

It turns out that *Fusarium* is a kind of super genus, with over 330 known species. And, some of these species are actually species complexes, with sub-species displaying the sort of life style and metabolic variety that would make them a genus of their own in any less over-the-top genus. Although I'd pictured *Fusarium* as a sort of plant pathogenic rust with airborne spores (it can live in soil—among other places), over 70 species have been identified as endophytes, living within plant tissues. *Fusarium*'s exuberance in speciation is matched by its extraordinary metabolic abilities: while endophytes have long been famous for their production of unique chemicals, *Fusarium* may be in a class of its own. A review article by Ahmed et al. (2023) entitled "The endophytic *Fusarium* strains: a treasure trove of natural products" is worth looking at, even if you simply flip through the dazzling arrays of chemical structures produced by this group of fungi. I read this as meaning that a *Fusarium* might be lurking in *Aquilaria* heartwood ready to set off resin production if properly activated.

However, when I pulled myself back from the seductions of *Fusarium* species and limited by compulsive googling to oud, my next discovery was that maybe it wasn't *Fusarium* at all. Or at least not only *Fusarium*.

The full story came from an online source: the appropriately titled *Ouddict*, whose January 21, 2018, issue offered an article entitled "Agarwood history and botany" by Sudhir Ahlulwalia, extracted from that author's book *Holy Herbs: Modern Connection to Ancient Plants*. Offering references for each genus, the author writes, "Dark wood without white streaks indicates the presence of resin, which is produced when the heartwood is infected by a fungus. These fungi include *Aspergillus* spp., *Botryodiplodia* spp., *Diplodia* spp, *Fusarium* spp., *Penicillium* spp. and *Pythium* spp." So not necessarily *Fusarium* but still—a fungus. And, in the hopes of countering the illegal trade in agarwood which is endangering some *Aquilaria* spp., the experimental production of oud via wounding young trees and applying a fungus to the wounds wiped out the need for *Zeuzera* or any other boring insect as will. Damn it. Some day I'll learn when to stop googling.

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continued next month