

# SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY  
Number 598 January 2024



## MOREL MUSHROOMS AT CENTER OF DEADLY FOOD POISONING OUTBREAK

Keely Larson

<https://www.cbsnews.com/>, Dec. 13, 2023



A food poisoning outbreak at a Montana restaurant that killed two people and sickened 51 more has highlighted just how little is known about morel mushrooms and the risks in preparing the popular and expensive delicacy for public consumption.

The U.S. Food and Drug Administration (FDA) conducted an investigation into morel mushrooms after the severe illness outbreak linked to Dave’s Sushi in Bozeman in late March and April. The investigation found that undercooked or raw morels were the likely culprit, and it led the agency to issue its first guidelines on preparing morels.

“The toxins in morel mushrooms that may cause illness are not fully understood; however, using proper preparation procedures, such as cooking, can help to reduce toxin levels,” according to the FDA guidance. Even then, a risk remains, according to the FDA: “Properly preparing and cooking morel mushrooms can reduce risk of illness, however there is no guarantee of safety even if cooking steps are taken prior to consumption.”

Jon Ebelt, spokesperson for Montana’s health department, said there is limited public health information or medical literature on morels. And samples of the morels taken from Dave’s Sushi detected no specific toxin, pathogen, pesticide, or volatile or nonvolatile organic compound in the mushrooms.

Aaron Parker, the owner of Dave’s Sushi, said morels are a “boutique item.” In season, generally during the spring and fall, morels can cost him \$40 per pound, while morels purchased out of season are close to \$80 per pound, he said.

Many highly regarded recipe books describe sautéing morels to preserve the sought-after, earthy flavor. At Dave’s, a marinade, sometimes boiling, was poured over the raw mushrooms before they were served, Parker said. After his own investigation, Parker said he found boiling them between 10 and 30 minutes is the safest way to prepare morel mushrooms.

Parker said he reached out to chefs across the country and found that many, like him, were surprised to learn about the toxicity of morels. According to the FDA’s Food Code, the vast majority of the more than 5,000 fleshy mushroom species that grow naturally in North America have not been tested for toxicity. Of those that have, 15 species are deadly, 60 are toxic whether raw or cooked—including “false” morels, which look like spongy edible morels—and at least 40 are poisonous if eaten raw but safer when cooked.

The North American Mycological Association, a national nonprofit whose members are mushroom experts, recorded 1,641 cases of mushroom poisonings and 17 deaths from 1985 to 2006. One hundred and twenty-nine of those poisonings were attributed to morels, but no deaths were reported.

Marian Maxwell, the outreach chairperson for the Puget Sound Mycological Society, based in Seattle, said cooking breaks down the chitin in mushrooms, the same compound found in the exoskeletons of shellfish, and helps destroy toxins. Maxwell said morels may naturally contain a type of hydrazine—a chemical often used in pesticides or rocket fuel that can cause cancer—which can affect people differently. Cooking does boil off the hydrazine, she said, “but some people still have reactions even though it’s cooked and most of that hydrazine is gone.”

Heather Hallen-Adams, chair of the toxicology committee of the North American Mycological Association, said hydrazine has been shown to exist in false morels, but it’s not as “clear-cut” in true morels, which were the mushrooms used at Dave’s Sushi.

Mushroom-caused food poisonings in restaurant settings are rare—the Montana outbreak is believed to be one of the first in the U.S. related to morels—but they have happened infrequently abroad. In 2019, a morel food poisoning outbreak at a Michelin-star-rated restaurant in Spain sickened about 30 customers. One woman who ate the morels died, but her death was determined to be from natural causes. Raw morels were served on a pasta salad in Vancouver, British Columbia, in 2019 and poisoned 77 consumers, though none died.

Before the new guidelines were issued, the FDA’s Food Code guidance to states was only that serving wild mushrooms must be approved by a “regulatory authority,” though cultivated wild mushrooms can be sold if the cultivation operations are overseen by a regulatory agency, as was the case with the morels at Dave’s Sushi.

States’ regulations vary, according to a 2021 study by the Georgia Department of Public Health and included in the Association of Food and Drug Officials’ regulatory guidelines. For example, Montana and a half-dozen other states allow restaurants to sell wild mushrooms if they come from a licensed seller, according to the study. Seventeen other states allow the sale of wild mushrooms that have been identified by a state-credentialed expert.

The study found that the varied resources states use to identify safe wild mushrooms—including mycological associations, academics, and the food service industry—may suggest a need for better communication. The study recognized a “guidance document” as the “single most important step forward” given the variety in regulations and the demand for wild mushrooms.



# Spore Prints

is published monthly, September through June by the  
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## CALENDAR

- Jan. 9 General membership meeting, 7:30 pm, CUH and via Zoom  
Jan. 15 Board meeting, 7:30 pm, CUH boardroom  
Jan. 23 *Spore Prints* deadline

## BOARD NEWS

Carolina Kohler

Greetings, fellow PSMS members,

We hope you have all had an enjoyable holiday season and an excellent start to the year! 2024 is here and we are looking forward to what it will bring.

At our last meeting of 2023, the board kept working on some housekeeping matters. Tidying-up efforts have been ongoing, and negotiations have begun regarding the upcoming lease renewal of our spaces at CUH. The monthly financial reports were approved, and a lengthy discussion was had regarding the code of conduct that the Policies and Procedures task force will be working on.

And the elections are just a few weeks away! Five trustees and two officers (Vice President and Treasurer) will be up for election,

and we were delighted to hear that there is a healthy roster of interested candidates. All positions are for a two-year term, from April 2024 through March 2026. You can encourage friends to run or nominate yourself until the end of our general membership meeting on January 9th. Like to know more? Contact the PSMS Elections Committee at [elections@psms.org](mailto:elections@psms.org).

Does a position on the board sound too daunting? There are countless other opportunities to become active at PSMS, from taking part in projects like the Bridle Trails Study, to becoming a guide for our field trips, to helping us with the technical aspects of our virtual meetings, or sharing your skills in your field of expertise. Remember, PSMS is an organization run **100 percent by volunteers**. Your help is appreciated! You can browse opportunities by logging into the PSMS website and going to the Projects/Committees tile of the Members Page.

Here's to a brand new 2024, and the promise of mushrooms to come!

## MEMBERSHIP MEETING

Scott Maxwell

*Happy New Year!*

Our membership meeting on January 9, 2024, will again be both in-person at the Center for Urban Horticulture at the University of Washington and broadcast via Zoom. In-person attendees will be let into the hall at 7:00 pm and the meeting will begin at 7:30 pm. Zoomers will be let in beginning at about 7:20 pm.



The speaker this month will be Paul Kroeger from Vancouver B.C. He will be presenting a talk entitled "There's Fungus Among Us: Urban 'weed' mushrooms and immigrant fungi." This presentation will highlight mushrooms growing in urban areas in landscaping and under street trees, fungi that often have come from elsewhere. Humans create habitats that are home to many common and some unusual fungi, adding diversity, beauty, and interest to our city surroundings. In addition to his main talk, Paul will also give a short 10 minute summary of interesting BC fungi poisoning cases of 2023. As Paul cannot be with us in person, he has offered to present via Zoom from Vancouver. Though he will be remote, we plan to allow a question and answer session after the Zoom presentation.

Paul has studied mushrooms for over 45 years and is a founding member of the Vancouver Mycological Society. He's considered a leading expert in field identification of mushrooms of western Canada and has made a special study of "little brown mushrooms" including magic mushrooms and their relatives. He has been involved in many projects and studies and has gained knowledge about fungal biology and ecology as well as the biochemistry of toxic, hallucinogenic, medicinal, and edible mushrooms. Years of experience have provided him unique insights and understanding of fungal life-ways and interactions in temperate ecosystems.

Paul has worked at the University of British Columbia researching the biochemistry of medicinal mushrooms. He is a major contributor to the mycological herbarium collections in the Beaty Biodiversity Museum at UBC and has been a research associate of UBC Department of Botany for many years. He's also contributed

significant collections to the DAOM Herbarium in Ottawa and the DAVFP Herbarium in Victoria. He is a regular consultant for the British Columbia Drug and Poison Information Centre, and various other agencies concerned with mushroom poisonings of humans and animals. He is also a coauthor of *The Outer Spores: Mushrooms of Haida Gwaii* published in 2012.

## ALABAMA MAN “HIGH ON MUSHROOMS” ARRESTED WITH PARROT ON SHOULDER AFTER FIGHTING WITH FLORIDA DEPUTIES

FOX 13 News

<https://www.fox13news.com/>, Dec. 18, 2023

ELBA, Fla. - An Alabama man has more of a “Florida man” story to tell after explaining to deputies he was high on mushrooms when they found him in a truck on a panhandle road with a parrot on his shoulder.

According to the Washington County Sheriff’s Office (WCSO), on Friday deputies received a call about a man pounding on the front door of a home and a vehicle sitting stationary nearby. Deputies say the homeowners asked the man to leave, but he would not comply.

As WCSO deputies were headed to the scene, a car matching the description of the one reported was found in the area. Deputies say the driver, later identified as Timothy Brandon Bowers, 38, was sitting inside the vehicle with a blank look on his face and a parrot on his shoulder.

According to WCSO, as the deputy began speaking to Bowers, he saw several weapons near Bowers and asked him to exit the vehicle. The deputy says Bowers was non-compliant and combative.

Deputies say they deployed a department-issued Taser and he was detained a short time afterward.

Bowers told deputies there was nothing wrong with him, he was just high on mushrooms, according to WCSO. While searching Bowers’ vehicle, deputies say they found several illegal items.

According to WCSO, the parrot, who did not appear to be injured, was secured in a pet carrier and taken by Washington County Animal Control.

Bowers was taken to an area hospital for evaluation, and then to jail. He has been charged with two counts of possession of a controlled substance, two counts of battery on a law enforcement officer, resisting an officer with violence, possession of drug paraphernalia, and trespassing.

## GRINCH FUNGUS IS COMING FOR NORTHWEST’S CHRISTMAS TREES

Lauren Paterson

<https://www.kuow.org/>, Dec. 21, 2023

Like a Grinch with a grudge against holiday greenery, a fungus is targeting the Northwest’s Christmas trees. That’s essentially the findings of new research exploring how climate change is affecting the region’s tree farms.

Gary Chastagner, aka “Doctor Christmas Tree,” is a plant pathologist at Washington State University. He’s been working with Christmas trees for nearly 50 years. Over the last couple of years, he says there’s been an uptick in sick trees.

“There’s a variety of diseases that affect the production of Christmas trees, many of them are caused by fungi,” Chastagner said.

Christmas trees are generally a non-irrigated crop, so hotter summers can stress fir trees, leaving them more susceptible to disease. On top of that, more rain in the spring and fall (like the past few years) also causes problems. A changing climate means more rain, which can oversaturate tree roots, causing fungi to grow, Chastagner said. The fungi then affect the roots of the trees, choking them until they die.

“Some trees may be more tolerant to the moisture stress and drought stress,” Chastagner said. “Those are the trees that growers could utilize to avoid the problems that we’re seeing now in the future.”

He notes that scientists are currently experimenting with Eurasian fir trees, to see if they are more tolerant to drought conditions. Chastagner and his team plan to survey multiple growing sites in Washington and Oregon throughout 2024, with the aim of helping to find solutions.

According to the Pacific Northwest Christmas Tree Association, Oregon is the top Christmas-tree producing state and Washington ranks sixth.



Christmas trees at a farm in Western Washington and other growing sites in the Northwest were killed by root diseases. Chastagner and his team plan to survey tree farms in 2024 to find out more about the pathogens affecting ornamental conifers.

### *The Toadstool House*

*I wish I lived in a toadstool house,  
Beneath an old oak tree,  
With a tiny door and a chimney pot,  
and windows—one, two three.*

*I'd play with each wee squirrel,  
Who chanced to come my way,  
I'd get to know the woodland birds,  
And feed them every day.*

*And if you ever wandered by,  
I'd ask you in to tea,  
Inside my little toadstool house,  
Beneath the old oak tree,*



## 407-MILLION-YEARS-OLD MICROFOSSILS REVEAL EARLIEST-KNOWN DISEASE-CAUSING FUNGUS

Enrico de Lazaro

<https://www.sci.news/>, Dec. 12, 2023

*Potteromyces asteroxylicola* existed during the Early Devonian epoch, approximately 407 million years ago.

The new species was discovered in microfossil samples from the Rhynie Chert, a crucial geological site in Scotland. The site is known for a remarkably preserved Early Devonian community of plants and animals, including bacteria and fungi.

“Fungi are integral to well-functioning ecosystems, and their broader impact on Earth systems is widely acknowledged,” said lead author Dr. Christine Strullu-Derrien, a paleontologist at the Natural History Museum London, and her colleagues.

“Fossil evidence from the Rhynie Chert shows that fungi were already diverse in terrestrial ecosystems over 407 million years ago.”

*Potteromyces asteroxylicola*'s reproductive structures, known as conidiophores, had an unusual shape and formation unlike anything seen before. Equally unusual was the fact this mysteri-

ous fungus was found attacking the lycopsid plant *Asteroxylon mackiei*.

The plant had responded by developing dome-shaped growths, showing that it must have been alive while the fungus was making its attack.

“The fungus forms a stroma-like structure with conidiophores arising in tufts outside the cuticle on aerial axes and leaf-like appendages of *Asteroxylon mackiei*,” the paleontologists said. “It causes a reaction in the plant that gives rise to dome-shaped surface projections.”

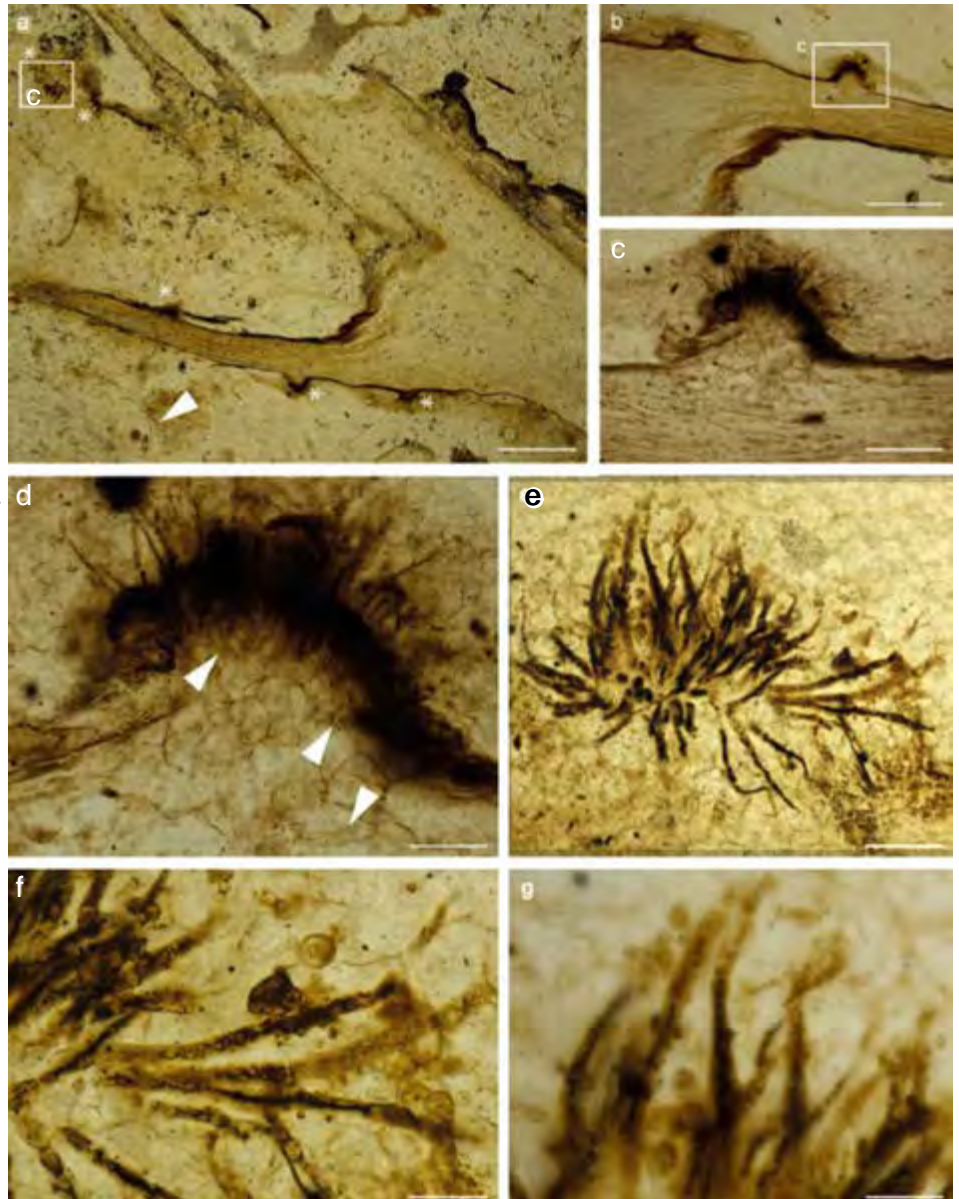
“This suite of features in the fungus together with the plant reaction tissues provides evidence of it being a plant pathogenic fungus.”

According to the team, *Potteromyces asteroxylicola* is likely related to the fungus phylum Ascomycota in the subkingdom Dikarya.

“Although other fungal parasites have been found in Rhynie Chert before, this is the first case of one causing disease in a plant,” Dr. Strullu-Derrien said.

“What’s more, *Potteromyces asteroxylicola* can provide a valuable point from which to date the evolution of different fungus groups, such as Ascomycota, the largest fungal phylum.”

*Potteromyces asteroxylicola*, holotype in white light: (a) location of the fungus (asterisks) along the aerial axis and enations of the plant *Asteroxylon mackiei*; arrowhead showing animal remains; (b) plant reaction induced by the fungal attack; (c, d) higher magnifications of the framed zone from (b) showing the plant cell proliferation in response to the fungal attack; arrowheads showing hyphae; (e) conidiophores in tuft; (f) higher magnification of (e); (g) conidiophores in high magnification, slightly shrunken at their distal end, and conidia. Scale bars – 900  $\mu\text{m}$  in (a); 400  $\mu\text{m}$  in (b); 120  $\mu\text{m}$  in (c), 45  $\mu\text{m}$  in (d), 85  $\mu\text{m}$  in (e), 35  $\mu\text{m}$  in (f, g).



Strullu-Derrien et al.

## SCIENTISTS TEST MUSHROOMS AS CANCER TREATMENT

Jack Armstrong

<https://greatlakesecho.org/>, Dec. 13, 2023

Hundreds of years ago a lord of the Tohoku region in Japan offered villagers a deal—equal weight in silver to any who could find a rare mushroom.

The villagers danced with joy when they found the valuable fungus, inspiring the mushroom's name, "maitake," or "the dancing mushroom."

That's the story told by Shogun Maitake, a Canadian company partnering with University of Windsor researchers to investigate if the black maitake mushroom [*Grifola frondosa*] could help treat cancer or ease negative reactions to chemotherapy.

"It is really promising," said Siyiram Pandey, the team's research lead and a chemistry professor at the University of Windsor. "It is not only killing a specific cancer, it seems to be active on many cancers."

The team is running tests with maitake extract, a dark, odorless liquid provided by Shogun Maitake, which sells maitake mushrooms.

In early trials, the extract killed 70% of cancer cells, Pandey said. That's 10% more effective than taxol and cisplatin, two of the most popular chemotherapy drugs. And it has fewer extreme side effects, he said.

"It is a bit better than chemotherapy in terms of our results," he said. That's because the extract has fewer side effects than other treatments.

The team recently received a two-year, \$60,000 grant from Mitacs, a Canadian nonprofit research organization, to investigate the mushroom's effect on cancer cells and chemotherapy. If the lab's findings are confirmed, cancer patients could one day take an oral maitake supplement to fight the disease.

The results are preliminary, but natural treatments do have a basis in science. There's a long history of drugs coming from nature, said Kathy Borden, a professor at the University of Montreal and a researcher at the Institute for Research in Immunology and Cancer.

"There are examples of very successful natural products or things that started as a natural product and became modified in order to become the drug they are," she said.

For example, rapamycin, a drug used to help lower the chances that a patient will reject a transplanted organ, has natural origins. The antibiotic bacterium was discovered in soil on Easter Island. It's also being used in cancer treatment.

Still, the road to proving if maitake mushroom can fight cancer is long and paved with more research and more funding.

"Maybe they found something very cool and useful and maybe not," Borden said. "It's just going to be the time that tells."

To test the fungus' effectiveness, the research team grows a variety of cancer cells in petri dishes, including lung cancer, colon cancer, and melanoma. They treat these cells with extract from the maitake mushroom and wait to see if the substance triggers a process called apoptosis.

That process refers to the cells killing themselves. This is a fairly common way we fight cancer, Borden said.

Pandey said it's also "a very good way of killing cancer cells without causing any trouble," since it avoids killing healthy cells, unlike chemotherapy. He said the extract is well tolerated by healthy cells and can selectively kill cancer cells.

The researchers also combine the extract with chemo to see if they work well together. So far it seems they do, Pandey said.

Aside from its cancer-fighting abilities, the maitake mushroom could also help patients cope with chemo. Pandey said the maitake interacts positively with chemotherapy and actually accelerates the treatment.

Chemo can also weaken the immune system, making patients vulnerable to attacks and infections. Research from the Sloan-Kettering Cancer Center showed extract from the maitake modified the immune system when given to cancer patients.

However, the research noted the mushroom's effects were complicated, and it may enhance as well as diminish immune function. Pandey said he hopes to test the use of maitake alongside chemo, and one day it may be tested as a sole treatment for cancer patients.

Researchers aim to begin animal trials by next year.

But the mushrooms are already commercialized and marketed as immunity enhancing supplements. Shogun Maitake sells fresh mushrooms in Costco, Farm Boy, and even in five-star hotels. But its presence in the North American market is fairly new—the Shogun Maitake website advertises the fungus as "a tradition crafted in the heart of Japan..."

Supplements are increasing in popularity as more and more people begin to believe in natural treatment methods, said John Jacobs, the marketing director at Shogun Maitake.

"We want to tell to the world, maitakes have very unique properties...people don't know about the importance of the maitake," he said.



Cancer researcher Siyiram Pandey and his students at the University of Windsor with a box of maitake mushroom extract. His lab is studying the anti-cancer effects of the extract with a new \$60,000 grant.

*Ignorance more frequently begets confidence than does knowledge.*

— Charles Darwin, *The Descent of Man*

## OVER 700 PEOPLE USED PSYCHEDELIC MUSHROOMS UNDER OREGON'S PROGRAM IN 2023

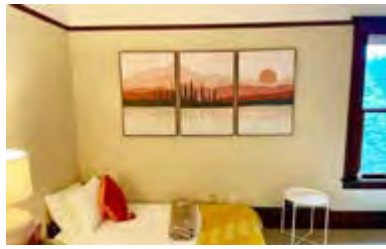
Lizzie Acker

<https://www.oregonlive.com/>, Dec. 19, 2023

In an unassuming house in Northwest Portland, for the past two months, visitors have been among the first people in the country to use “magic” mushrooms under a legal state program.

Chariot looks like any other house in the neighborhood—a hundred years old, a stately Craftsman. But inside, the rooms have almost all been renovated to be quiet, calming spaces to experience the effects of psychedelic mushrooms.

Courtney Campbell who runs Chariot, is a trained psilocybin facilitator, though he hasn't applied for his license yet and hasn't done any facilitation yet, either. He's too busy running the operation. Since they started operating this fall, Chariot has seen about 60 clients.



*A room at Chariot, a psilocybin service center in Portland.*

Lizzie Acker, The Oregonian/OregonLive

Chariot is one of 20 licensed service centers in the state and one of the centers that began seeing clients in Oregon in 2023.

As Oregon closes out the inaugural year of its first-in-the-nation legal psilocybin program, hundreds of Oregonians and visitors are finally accessing services in Portland and throughout the state.

According to informal data gathered by Healing Advocacy Fund, a nonprofit that advocates for legal psilocybin programs in Oregon and Colorado, at least 715 people have accessed services in Oregon since the program officially launched this year.

The Oregon Health Authority, which runs the psilocybin program, does not currently collect data from people participating in the program. That will change in 2025 when the Oregon Psilocybin Services section of the health authority will start to collect some aggregated data from service centers as required by Senate Bill 303, which passed in June.

While Oregonians passed the legal psilocybin framework in 2020, the law allowed the state to spend two years developing the system. Oregon released the first draft rules for the psilocybin program in February of 2022. In late 2022, the state started licensing facilitator training programs, and in January of 2023 began accepting applications for licenses for workers, facilitators, manufacturers, laboratories, and service centers as required by the new law.

By May, the Oregon Psilocybin Services began issuing licenses for psilocybin treatment centers. Later that month, Oregonians and visitors started accessing services.

Advocates of psilocybin say it can help people dealing with a host of issues from trauma to addiction. And many are hoping that Oregon's program allows for more extensive research into the therapeutic properties of the substance, which remains illegal at the federal level.

A video from Healing Advocacy Fund shows the experience of a woman, referred to as “KC,” going through the program.” KC is hoping to address childhood abuse that continues to disrupt her life.

After going through the initial meeting with a facilitator, the psilocybin experience and the post-psilocybin processing, KC was hopeful.

“For the first time,” she said in the video, “I see a spark of brightness and I'm really glad for that.”

For Campbell, it was his own experience with psilocybin that led him to get trained as a facilitator and then open Chariot. He was medicated for years for anxiety and depression, but in 2020 he began the process of getting off of his medication and then going on a psilocybin retreat in Jamaica.

By the end of it, he said, the group of strangers on the retreat with him were close friends. “By the end of it,” he said. “I was like, ‘I am a good person worthy of love.’”

“I don't know what it does,” Campbell said. “But what I know is that it helped me with my depression and anxiety. It's the only substance that makes me not want to do any other substance.”

The experience helped him so much, he said that when he came back he felt almost obligated to give other people the same experience. So he pivoted from film-making and with the help of his wife, also named Courtney Campbell, he launched Chariot.

Now he is doing just that. Campbell said most of the people coming through his doors were first-time psilocybin users and many were somewhat apprehensive.

Who is using the service is still becoming clear. Of the roughly 60 clients that Chariot has hosted, Campbell estimates about half are from out of state.

An early concern among those involved in Oregon's psilocybin program was equity. Who would be able to access the services, which can cost \$600 at the very lowest end and up into several thousand dollars?

The question remains a big one for the psilocybin industry. Senate Bill 303 seeks to at least quantify that issue by requiring psilocybin service centers and psilocybin service facilitators to collect data about who is accessing services and cost, as well as adverse events, to help monitor the safety and equity of the program.

For Angie Allbee, who manages Oregon Psilocybin Services, dealing with inequity in the system is one of her goals for 2024.

“As we continue working toward eliminating health inequities in Oregon,” Allbee said, “we look to the coming year as a time to deepen our commitment to equity and access, to community partnerships, and to safe, effective, and equitable psilocybin services.”

## FUNGUS-INFESTED TOMBS OF SOME OF HISTORY'S MOST SIGNIFICANT FIGURES MAY HAVE CAUSED A MYSTERIOUS STRING OF DEATHS

Rachael Funnell

<https://www.iflscience.com/>, Dec. 22, 2023

When Casimir IV Jagiellon, the King of Poland, died in 1492, nobody could've predicted the death that would follow the reopening of his tomb half a millennium later. [His body] having rotted away into a biological bomb of pathogen potential, [the tomb] became a hazardous place for the living to poke around in. Unfortunately, in 1973, that's exactly what a group of archaeologists did.

According to researchers at Guy's King's and St Thomas' School of Medicine, of the 12 scientists present when the tomb was opened, 10 died within weeks. They also reported that a variety of fungi was cultured from the tomb. *Aspergillus* was among the samples, a fungus that's been pinpointed as a possible explanation for the death of Lord Carnarvon soon after opening Tutankhamun's tomb, spurring rumors of the "mummy's curse."

It wouldn't be the first time harmful pathogens have been found in ancient tombs. In 2018, researchers studying publicly available databases of ancient DNA stumbled across something significant lurking in the Frälsegården passage grave in Sweden that dates back a modest 4,900 years. The strain of the Black Death found there may have been behind the earliest known human pandemic.

## FOR BETTER MUSHROOM TEXTURE, PRESS OUT EXTRA LIQUID AFTER STEAMING

Claire Redden

<https://www.tastingtable.com/>, Dec. 16, 2023

Nobody likes a slimy mushroom, and whether it's your typical Portobello or a delicacy like jian shou qing [*Lanmaoa asiatica*, a bolete], achieving a meaty texture that highlights their savory flavors is everything when you're serving up fungi. Added to everything from pizza to soups and burritos to burgers, mushrooms have the power to make or break your meal. To get a better mushroom texture that will elevate all of your favorite foods—and is never, ever slimy—the best thing you can do is press out any of the extra liquid they're holding onto after you steam them.

Steaming might not seem like the way to go if you're trying to avoid something slimy, but it's actually the first step many chefs take when they're making dishes that feature mushrooms. A quick steam before sautéing mushrooms collapses the fungi and draws out the moisture from within them. Afterward, they'll just need a bit of cooking time for the liquid to evaporate. Then, you can continue to let them brown in the pan or prepare them another way—but, if you want an extra meaty texture, press out the extra liquid from them first.

Whether you're roasting, sautéing, or frying, a quick preliminary steam ensures that your mushrooms won't absorb any of the cooking oil you use. Pressing out the moisture by squeezing them between two paper towels is an extra step you can take to make sure that they come out extra dense and meaty, making them the perfect meat alternative for your vegetarian dishes.

## ARE MAGIC MUSHROOMS THE NEW OXYCODONE? INGREDIENT COULD HELP TREAT CHRONIC PAIN: NEW STUDY

Brooke Steinberg

<https://nypost.com/>, Dec. 19, 2023,

Magic mushrooms could become the new oxycodone.

A new study published in the journal *Current Biology* found that an injection of psilocybin—the active ingredient in magic mushrooms—potentially provides long-lasting relief from chronic pain.

Scientists at the University of Michigan injected the feet of rats with formaldehyde to simulate the effects of chronic inflammation.

The rats were separated into three different groups. The first group was given a low dose of psilocybin, the second was given a high dose, and the third got a saltwater placebo.

Scientists exposed the rats to pricks on their feet and hot plates to gauge their reaction.

The rats that were given psilocybin were found to be less sensitive to pain from foot pricks than the rats that were not treated with the ingredient.

However, there was no improvement when the rats were exposed to the heat from hot plates.

Findings suggest that psilocybin could alter and reshape pathways in the brain, which could potentially treat the cause of chronic pain, not just the pain itself, as it's suspected that chronic pain is more a consequence of the brain and spinal cord rather than the specific body part, the authors wrote.

While more research is needed to fully understand the medical benefits of psilocybin for chronic pain, this is not the only study that has provided hope for therapeutic psychedelics to be used in the future—including ketamine, ayahuasca, LSD, and MDMA.

## PLANTS USE TROJAN HORSE STRATEGY AGAINST MOLD INVASION

University of California - Riverside

<https://www.miragenews.com/>, Dec. 20, 2023

UC Riverside scientists have discovered a stealth molecular weapon that plants use to attack the cells of invading gray mold.

If you've ever seen a fuzzy piece of fruit in your fridge, you've seen gray mold. It is an aggressive fungus that infects more than 1,400 different plant species: almost all fruits, vegetables, and many flowers. It is the second most damaging fungus for food crops in the world, causing billions in annual crop losses.

A new paper in the journal *Cell Host & Microbe* describes how plants send tiny, innocuous-seeming lipid "bubbles" filled with RNA across enemy lines into the cells of the aggressive mold. Once inside, different types of RNA come out to suppress the infectious cells that sucked them in.

"Plants are not just sitting there doing nothing. They are trying to protect themselves from the mold, and now we have a better idea how they're doing that," said Hailing Jin, Microbiology & Plant Pathology Department professor at UCR and lead author of the new paper.

Previously, Jin's team discovered that plants are using the bubbles, technically called extracellular vesicles, to send small RNA molecules able to silence genes that make the mold virulent. Now, the team has learned these bubbles can also contain messenger RNA, or mRNA, molecules that attack important cellular processes, including the functions of organelles in mold cells.

"These mRNAs can encode some proteins that end up in the mitochondria of the mold cells. Those are the powerhouses of any cells because they generate energy," Jin explained. "Once inside, they

*cont. on page 8*

## Trojan Horse Strategy, cont. from page 7

mess up the structure and function of the fungal mitochondria, which inhibits the growth and virulence of the fungus.”

It isn't entirely clear why the fungus accepts the lipid bubbles. Jin theorizes they might just be hungry. “The fungus likely takes up the vesicles because they just want nutrients. They don't know those RNAs are hidden in the vesicles,” she said.

The strategy is an efficient one for the plants, because one mRNA molecule can have an outsized effect on the fungus. “The beauty of delivering mRNA, instead of other forms of molecular weapons, is that one RNA can be translated into many copies of proteins. This amplifies the effect of the mRNA weapon,” Jin said.

Mold also uses these same lipid bubbles to deliver small, damaging RNAs into the plants they are infecting to suppress host immunity, an ability developed as part of a co-evolutionary arms race. Because RNAs are easily degraded, the bubbles provide excellent protection for transporting vulnerable cargo, for both plants and fungi.

“During infections, there are always a lot of communications and molecule exchanges where plants and fungi try to fight against each other,” Jin said. “Previously people looked at proteins being exchanged. Now, modern technology has enabled us to discover another important group of players in this battle.”

Going forward, the scientists are hoping to use this discovery to create innovative, eco-friendly fungicides. “RNA-based fungicides would not leave toxic residue in the environment and would not affect humans or animals. RNA is present in most food, and it is easily digested,” Jin said.

“There is a never-ending battle to control pests and pathogens. If we can deliver mRNA that interferes with mold cellular functions, we may be able to help plants more effectively fight in this battle.”

## SCIENTISTS FIGHT MEDICINE-RESISTANT BACTERIA WITH ANCIENT MOLECULES FROM STONE AGE

Katie Hunt

<https://abc11.com>, Dec. 15, 2023

The quest for new antibiotics is going back to the Stone Age.

The urgency to identify possible candidates has never been greater as the global population faces nearly 5 million deaths every year that are associated with microbial resistance, according to the World Health Organization.

A research team led by bioengineering pioneer César de la Fuente is using artificial intelligence-based computational methods to mine genetic information from extinct human relatives such as Neanderthals and long-gone ice age creatures such as the woolly mammoth and giant sloth.

The scientists say some of these small protein, or peptide, molecules they have identified have bacteria-fighting powers that may inspire new drugs to fight infections in humans. The innovative work also opens up a completely new way to think about drug discovery.

“It has enabled us to uncover new sequences, new types of molecules that we have not previously found in living organisms, expanding the way we think about molecular diversity,” said de la Fuente, Presidential Assistant Professor at the University of Pennsylvania, where he heads the machine biology group. “Bacteria from today have never faced those molecules so they may give us a better opportunity at targeting the pathogens that are problematic today.”

The approach may seem to come out of left field, but experts say that new ways of looking at the problem of antimicrobial resistance to existing medicines, a deadly and pressing problem for global health, are sorely needed.

“The world is facing an antibiotic resistance crisis. My view is that a land, sea, and air approach is needed to solve the problem—and if we need to go to the past to provide potential solutions for the future—I am all for it,” said Michael Mahan, a professor in the department of molecular, cellular and developmental biology at the University of California, Santa Barbara. He wasn't involved in the research.

De la Fuente agreed. “I think what we need is as many new and different approaches as possible, and that will increase our chances of being eventually successful,” he said.

## LOADED MAITAKE MUSHROOM BURGERS

Katherine Pendrill

<https://www.trendhunter.com>, Dec. 24, 2023

Dom Dom Burger, Japan's oldest hamburger restaurant chain, recently unveiled the ultimate burger for mushroom lovers: the Konya wa Maitake Burger.



The new Konya wa Maitake Burger, which loosely translates to “Maitake Burger for Dinner Tonight,” is a fungus-heavy burger loaded with the crown jewel of Japanese mushrooms: maitake. In fact, the new burger features a whopping 200 grams of maitake mushrooms [*Grifola frondosa*], alongside a beef burger patty, some crisp lettuce, and a rich teriyaki glaze.

The Konya wa Maitake Burger officially debuted on December 19 and is currently available for either lunch or dinner. And best of all, it's not as expensive as you might expect for a burger loaded with high-end mushrooms. Each burger will cost you just 890 yen, which is a little over \$6 USD.

## A MUSHROOM SUPPLEMENT FOR DOGS

Jordan Tyler

<https://www.petfoodprocessing.net/>, Dec. 13, 2023

Real Mushrooms, a company specializing in mushroom-based food, health, and supplement products, announced Dec. 11 the launch of Daily Dawg, a new multipurpose supplement for dogs touting a variety of health benefits. According to data from Grand View Research, pet supplement sales in 2022 exceeded \$2 billion.



**Welcome, 2024!**  
Here's to a happy, healthy new year.

