SPORE PRINTS

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RESEARCHERS DUG BENEATH A 2,400-YEAR-OLD TREE AND WERE SHOCKED BY THE NUMBER OF MUSHROOM SPECIES THEY FOUND

Cecily Knobler

https://www.upworthy.com/, Mar. 15, 2026

Close your eyes and let your imagination take you to the seaside coast of the southern Chilean rainforest. Now picture a giant cypress tree called an alerce [*Fitzroya cupressoides*], to be exact—thought to be a relative of the giant sequoia of North America. Beneath it is where the magic happens.

Researchers have unearthed a massive number—more than 300—of fungal species beneath one of these trees. While scientists already knew about the symbiosis between trees and fungi, they were shocked to find so many different kinds of fungi in a single soil sample. What this means for the ecosystem could be groundbreaking and, at the very least, supportive of the Darwinian view that the fittest species survive.

The Alerce Tree

According to writer Helen Pilcher's article in *Discover Wildlife*, these trees are not only enormous, they can grow to be thousands of years old: "These slow-growing trees can grow as tall as the Arc de Triomphe and as wide as a shipping container. Renowned for their longevity, some individuals have lived for over 3,600 years, making Alerce the second-longest-lived tree species on Earth."

The tree that is especially exciting to researchers in this study is called Alerce Abuelo. This individual, whose soil was studied alongside that of 31 other trees by researchers in *Biodiversity and Conservation*, is approximately 2,400 years old.

Evolutionary biologist Toby Kiers takes soil samples at the foot of an Alerce tree. During the study, the team found thousands of underground fungal species, hundreds of which are likely new to science.

How it Works

Pilcher explains the partnership: "These mycorrhizal fungi funnel water and nutrients into the tree roots, and help the plants to fight stressors, such as drought and pathogens. In exchange, the trees feed their fungal partners with sugars, fueling the growth of underground networks that help shunt carbon into the soil."

On the National Park Service's website, they also explain how mutually beneficial these relationships can be: "Mycorrhizal fungi form a mutualistic relationship with the Redwoods and other plants in the forest. A mutualistic relationship is when both organisms benefit. The fungi will combine their mycelium with the tree's roots. As a result, the fungi make it easier for the trees to get more nutrients and moisture from the soil, and the fungi get access to sugars from the trees."

Why it Matters

At a time when many people are concerned about climate change happening at an alarming rate, this doubling of fungal species is promising. Pilcher reiterates how exciting it was that one tree had so many fungal species: "In addition, the fungal richness under Alerce Abuelo was more than two times greater than in any other sample. The study highlights the importance of protecting these older, bigger trees."

Pilcher also cites Adriana Correlaes, field science lead at the Society for the Protection of Underground Networks (SPUN), who exclaimed, "All that diversity means resilience."

The Nature Conservancy further explains how important it is to have thriving, healthy trees for a number of reasons: "Through photosynthesis, trees absorb carbon dioxide from the air and store it in its wood. Trees and plants will store this carbon dioxide throughout their lives, helping slow the gas's buildup in our atmosphere that has been rapidly warming our planet."

CHARCOAL-EATING FUNGI FLOURISH AFTER FIRES. UNCOVERING THEIR GENETIC SECRETS COULD HELP REBUILD BURNED ECOSYSTEMS

Kunjal Bastola

https://www.smithsonianmag.com/, Mar. 13, 2026

When people think of fungi, most tend to picture mushrooms, the spore-bearing bodies of some fungi that are typically found growing in soil or on trees. However, the whole fungal kingdom is so much more than that: Our planet hosts an estimated 2.2

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Spore Prints

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University of Washington, Seattle, Washington 98195
(206) 522-6031 http://www.psms.org

CALENDAR

April 14	Membership meeting, 7:30 pm, CUH, in person & via Zoom
April 20	Board meeting, 7:30 pm, CUH board room, in person & via Zoom
April 26	Outreach Committee, Arboretum Earth Day plant sale
April 29	Outreach Committee, Bellevue College Earth Day
May 8–10	Field trip (see psms.org members page)
May 12	Membership meeting, 7:30 pm, CUH

BOARD NEWS

Peg Rutchik

Karen Dawson, the new Vice President, announced that speakers are being lined up for the coming year. Shannon Adams updated the board on the status of the new website. The modifications are mostly making the website fresher and easier to change but do not involve as many functional changes as was hoped. There is the option for making functional changes down the road.

Peg Rutchik plans to address volunteer recruitment at the April meeting, to give members more information on the club's volunteer needs and whom to contact. PeiPei Sung announced that at this point we do not have applications for the Ben Woo scholarship fund. We are also looking for someone to chair this committee this coming year. Finally, the subcommittee reviewing how to align our mission with decisions regarding the use of our financial resources has met initially. Although consensus was not reached, many ideas were addressed.

MEMBERSHIP MEETING

Karen Dawson

Tuesday, April 14, 2026
Doors Open/Social: 7:00 pm
Program Starts: 7:30 pm
Center for Urban Horticulture, UW

Dr. Tom Bruns.

Our speaker for April is Dr. Tom Bruns and his topic is "A burning interest in fungi—recolonization in the post-fire fungal community."

His talk will address the question, "How do fungi survive or recolonize after wildfire?" This question was the basis for multiple studies in the Bruns lab over three decades. Some of these studies were initiated after wildfires burned through research plots that were originally set up for other questions, while other studies involved controlled experiments. All used DNA-based identification methods that allowed the fungi to be identified in their vegetative and spore stages.

Bruns is an emeritus professor in the Department of Plant and Microbial Biology at the University of California, Berkeley. He is best known for his work in ectomycorrhizal systems where he has contributed to the understanding of community and population structure, spore banks, mycoheterotrophic plants, spore dispersal, and molecular method development. His later work focused on post-fire saprobic fungal communities, and involved experimental fire manipulations, coupled with gene expression and soil metabolomics.

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

FUNGI PROTEINS HELP WATER FREEZE MORE EASILY, STUDY FINDS

https://www.boisestate.edu/, Mar. 13, 2026

An international research team led by Konrad Meister from Boise State University's Department of Chemistry and Biochemistry and the Max Planck Institute for Polymer Research has identified a new class of ice-crystal forming proteins in lower fungi.

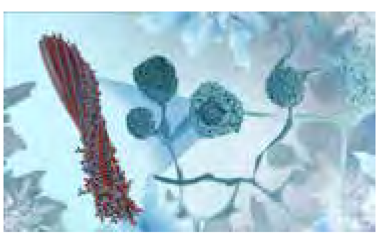
The study shows that fungi of the family *Mortierellaceae* use a genetic blueprint that originates from bacteria. Unlike bacteria, however, the fungi use the gene to form water-soluble proteins. This structural adaptation explains the high stability and efficiency of ice formation by the fungi. According to the researchers, the fungal proteins are promising for applications in the field of freezing technology.

- **Genetic origin:** The study shows that the fungi produce proteins that originally come from bacteria to freeze ice.
- **Ice nucleation:** The ability to nucleate ice could be evolutionarily important for microorganisms, offering them survival advantages in the atmosphere.
- **Practical applications:** The newly identified proteins could be important in the cryopreservation of cells and organs, in food processing, and in snow production.

Water freezes at 0°C—at least according to school textbooks. But under ideal conditions, pure water remains liquid down to a temperature of –40°C. A small shock or a dust particle is then enough to cause the liquid to abruptly and suddenly turn into ice. Some types of bacteria are also good ice formers because they produce special proteins that promote freezing at temperatures around 0°C. For example, proteins from the bacterium *Pseudomonas syringae* cause water to freeze better than any other known material. Such ice nucleation proteins are found not only in bacteria, but also in some fungi. While the structure of bacterial proteins has been well studied, that of fungi has remained unclear until now.

The international team led by Meister describes for the first time a new class of ice nucleation proteins from the *Mortierellaceae* family of fungi. This family belongs to the lower fungi, which also include yeasts. Researchers from the Max Planck Institute for Chemistry and researchers at Boise State, including Biomolecular Sciences Ph.D. students Rosemary Eufemio and Kaden Shaw, collaborated to carry out the work.

To uncover the structure of the fungal proteins, the researchers sequenced the genomes of ice-active fungi isolated from water samples and lichens collected during previous polar expeditions. In doing so, they discovered genes closely related to a gene already known from ice-active bacteria such as *Pseudomonas syringae*: The gene *InaZ* is the template for making ice nucleation proteins.



Katharina Maisenbacher and the Max Planck Institute for Polymer Research

Ice-nucleating proteins in fungi help water freeze more easily.

Gene Transfer Across Species

However, during structural analysis, the researchers discovered significant differences. Unlike the bacterial proteins, which must be embedded in a membrane to function, fungal proteins are water-soluble and unusually stable.

Based on phylogenetic analyses—i.e., analyses of the origin of a gene—the team concluded that the InaZ gene was most likely transferred from bacteria to a fungal ancestor across species in the distant past. Instead of developing ice nucleation independently, the fungi adopted a highly effective trait of the bacteria and adapted it to their own physiological requirements.

"It's a bit the same and yet different," Eufemio said. "Fungi use the same repetitive sequence architecture as bacteria for their ice-forming sites but have made them more soluble and stable, which probably benefits their ecological function."

To prove that the identified fungal genes are indeed the template for ice-nucleating proteins, the research team transferred two of the identified genes into non-ice-active yeast and bacteria. The modified microorganisms then became ice-active, which confirmed the functional connection.

Applications in Cryopreservation Conceivable

In addition to the biological significance of the discovery, Meister also sees concrete practical applications in technologies based on controlled freezing. "Soluble ice-nucleating proteins are easier to isolate, handle, and integrate into formulations and technological processes than membrane-bound ones. This opens up new possibilities for controlled freezing in the cryopreservation of cells and organs, food processing, and snow production."

Ice Nucleation: Properties and Significance

The ability to nucleate ice—i.e., to form ice nuclei in a targeted manner—is of great evolutionary importance for certain microorganisms. It gives them survival advantages, especially in the atmosphere. When ice forms in clouds, the frozen droplets fall to earth as precipitation. "This allows bacteria and fungal spores to be transported over long distances and reach new habitats such as plant surfaces, soils, or other geographical regions," explained biologist and Earth system researcher Janine Fröhlich from the Max Planck Institute for Chemistry.

A well-known example is *Pseudomonas syringae*, which is commonly found on plant leaves. By triggering ice formation on the leaf cells, it causes frost damage. This causes plant sap to leak out, which serves as a nutrient source for the bacteria—in other words, they deliberately damage the plant in order to feed.

In addition, ice-nucleating bacteria have a climatic significance: they are among the most effective natural triggers of ice formation in clouds and can thus influence precipitation, weather events and the global water cycle.

The researchers report their findings in the study "A Previously Unrecognized Class of Fungal Ice-Nucleating Proteins with Bacterial Ancestry" in *Science Advances*.

SEEKING ELSIE BURKMAN ARTWORK

We are working on a book about Zoe Dusanne, an art dealer in Seattle in the 1950s and 60s. Dusanne exhibited artwork by Elsie Burkman (1912–2003), who we understand was very active in the Puget Sound Mycological Society.

Because Burkman had no heirs, we are reaching out to ask if any PSMS members have artwork by her. There will be an exhibition at the Cascadia Art Museum in Edmonds next fall corresponding with our book launch. We would love to include a piece by Burkman, especially one done in her mushroom ink!

We would also be interested in a photo of Burkman that anyone would be willing to share.

Please contact us at richelle@plainsight archive.org. Thank you!

Richelle Munkhoff & Beth Ann Whittaker
Plain Sight Archive
plainsight archive.org

DID LEWIS & CLARK EAT MUSHROOMS ON THEIR FAMOUS JOURNEY? Brian S. Luther

Recently my wife, Pam, and I had the pleasure of visiting Larry Baxter, an old mushroom friend and long-time former PSMS member who moved to Montana several years ago.

As well as being knowledgeable about mushrooms, Larry is an avid student of the Lewis & Clark expedition. He has all of the complete journals, with the maps and drawings, and is always reading and studying them.

Copper engraving 1811 from Patrick Gass journal of The Lewis & Clark Expedition.

Drawing by Sgt. Patrick Gass showing one of the party having jumped off his horse (nearby) to escape up a tree after attempting to shoot a grizzly but missing it. Notice the grizzly is white. It turns out that many of the grizzly bears Lewis & Clark first encountered were a very light color, approaching white. In many of their journals party members often refer to them as "white bears."

Near his place in western Montana, there are several notable campsites and routes used by Lewis & Clark (both to and fro). Many are designated historic sites, some with expedition artifacts on display. On our visit, Larry took us to some of these fascinating locations.

What with Larry's knowledge of Lewis & Clark and our mutual enthusiasm about mushrooms, it seemed almost inevitable that the following question would come up. Did Lewis & Clark eat mushrooms on their expedition, and if so, what kinds? Larry and I set out to find out.

The Lewis & Clark expedition (May 14, 1804–Sept. 23, 1806) started out with about 45 members, but one died early on, and only 33 completed the entire journey. They travelled in very rough conditions and were either hungry or nearly starved during several parts of their arduous trek. They were well prepared with food at first, but didn't realize the challenges they'd encounter getting enough to eat, consistently, along the way.

It's well known that they had to eat some of their horses (or horses traded with natives) and they also bought dogs along the way so they'd have something to eat. The variety of different game they ate was incredible (all documented in their journals), with rare foods including a wolf, whale blubber, and eagles. They also resorted to melting and eating their animal fat, or tallow, candles they'd made when they were especially desperate.

On Sept. 18, 1805 in desperation they had "portable soup*, a little bear oil and about 20 lbs. of candles." This was during one of their most challenging sections of travel, going over the Bitterroot Mts. from what is now Lolo, Montana, heading west. And, this is all they had to eat on June 27, 1806, heading back east: "bears oil … with boiled roots."

Being experienced outdoorsmen, they were familiar with many sources of food, including animals, native plants, and vegetables. But, their Shoshone guide and interpreter, Sacajawea, was especially helpful being able to identify many other plants to eat that were unknown to the explorers. We'll never know if she had any knowledge of edible fungi—she did not keep a journal.

On June 19, 1806, on their trip home, Meriwether Lewis made the following journal entry from Eldorado Creek, near Dollar Creek in Idaho Co., Idaho:

> *Cruzatte* [*party member Pierre Cruzatte*] *brought me several large morells which I roasted and eat without salt pepper or grease in this way I had for the first time the true taist of the morell which truly is an insipid taistless food. our stock of salt is now exhausted except two quarts which I have reserved for my tour up Maria's River and that I left the other day on the mountain.*

We'll never know which species of morel Cruzatte found. We have more than 12 species of morels here in Washington State, all edible after being properly prepared. It's unknown how Cruzatte or Lewis knew that morels were edible to begin with. I think it's logical to assume that Cruzatte had eaten them before and thus found and offered them to Lewis. Based on his comments, this was clearly the first time Lewis had ever eaten a morel.

It's well known that those in the Lewis & Clark expedition were especially fond of meat, so Lewis' remarks about the taste of morels is not surprising. He "roasted" the morels enough so he didn't get sick from them being under-cooked. Fresh morels must be thoroughly cooked—eating raw or undercooked morels can make you very sick, or worse.

There is no specific mention of any other kind of fungus being consumed in their journals, but they may have. Not everyone in the party kept journals, and some may have been lost, denying us knowledge of additional details. Knowing that the expedition was going through conifer forests in what is now Montana, Idaho, and Washington in the fall of 1805 heading west (during the chanterelle season), it's surprising that there is no mention of such obviously noticeable and brightly colored fungi as chanterelles being collected or eaten in their journals.

This is interesting, because chanterelles would have been common and certainly seen, since Lewis & Clark were very aware of most everything in their surroundings. Studies have shown that some West Coast native Americans may have eaten chanterelles. Also, chanterelles were also known to be edible in the European literature at that time, and some of our native species would have looked the same to them. I think they may have been extra cautious, and wisely so, about eating mushrooms they didn't know.

In conclusion, based on the information in their journals, morels were the only fungi that Lewis & Clark consumed. When they

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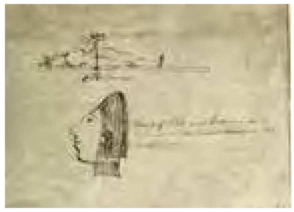
*Portable soup was a mixture of cooked meat products, including bone marrow, etc. which was dehydrated and compressed into firm cakes, concentrating it, saving space, and preventing it from spoiling during the journey. This had to rehydrated in boiling water forming a gooey-soupy consistency and was barely edible. It was clearly a last resort desperation food.

had new, different, or unusual food, it was usually well documented. Thus, unless evidence to the contrary is revealed in the future, it could be that morels were the only fungi eaten during their expedition. We'll never know for sure.



https://clickamericana.com/

Clatsop Indians, by Clark—an old man and a child having its head flattened. Many tribes around the lower Columbia River also flattened their heads, as a status symbol.

CALIFORNIA AMATOXIN POISONING TIED TO WESTERN DESTROYING ANGEL MUSHROOMS

Vada Hepner

https://krcrtv.com/, Mar. 19, 2026

A Humboldt County, California, resident remains seriously ill after eating wild mushrooms that state health officials have now confirmed were Western Destroying Angel mushrooms [*Amanita ocreata*] that were mistaken for puffball mushrooms.

Burke Herbarium, UW

Amanita ocreata.

Officials said the individual ate the mushrooms on Friday, March 13, 2026, and went to a local emergency department Saturday, March 14, 2026, after feeling sick, and has since been transferred to an out-of-area hospital. The individual has been too ill to provide additional information about who they received the mushrooms from.

Details remain limited, but officials said the person who picked the mushrooms appeared to be an experienced forager who shared the mushrooms with the now-sick individual and possibly other friends on Friday, March 13.

THE SCARLET ELF CUP: A FUNGUS THAT BRIGHTENS EARLY-SPRING FORESTS

Bob Confer

https://wellsvillesun.com/, Mar. 16, 2026

I'll never forget the first time I saw a Scarlet Elf Cup.

While hiking one March day some years ago, I noticed some red on the forest floor that caught my eye from some distance away. When walking in the woods during this month, which you could consider our "mud season," one doesn't expect to see a splash of color, especially with the beauty of the understory's ephemeral flowers being weeks away.

So, I had to check it out. As I approached it, I thought it was a piece of plastic, maybe a chunk of a kid's rubber ball. It was certainly bright enough. As I went to pick it up to properly dispose of it, I stopped as I quickly realized it was not of Man's creation, but of Nature's—a brilliantly hued fungus.

The Scarlet Elf Cup is unusual as its fruiting bodies appear in late winter and early spring. Most other mushrooms of brilliant appearance are seen during August and early September. It is believed its color is so intense because that pigment protects the fungus from damaging UV rays, a necessity since it appears long before the protective canopy of the forest grows its leaves.

Not only is it eye catching in color, it has decent size to it, too, being one half to two inches in width. It can be shaped like a flat dish or as a deep cup, hence the "cup" part of the name. As for the "elf" part of the nomenclature of this fungus—that can be found across the entire northern hemisphere—in European folklore it was believed wood elves drank morning dew from the cups.

It's not too common, and you are more likely to see it in forests that have basswood trees, though they will also be found to a lesser degree in woodlands that have beech trees. It grows on rotting wood that has fallen to the ground. Although the visible fruiting bodies will be gone soon, the mycelium of the elf cup—its roots, if you will—are active all year long, consuming that wood. It is vitally important to the ecosystem as it decomposes the fallen limbs and puts the nutrients into the soil, which will be utilized by microorganisms, fungi, and plants.

The flesh of the fungus can be thick and rubbery, even elastic, which would make you believe that it actually is a piece of plastic. Because of that tough skin, and its general chemical make up, depending on what book you read, some say that it's an inedible mushroom, while others say it is edible, but in moderation. When it comes to fungi, I almost always default to inedible — it's safer.

While it may not be edible, that doesn't mean it's lacking in use. The Oneida saw it as a useful medicine. It was primarily used as a means to help newborn babies when it was placed on their navels to help with healing after severing of their umbilical cord. They also used it as a hemostatic agent, placing it under bandages to stop bleeding.

Scarlet Elf Cup (*Sarcoscypha coccinea*).

So, the next time you are in the woods and you see what looks like a piece of litter from afar, get closer and inspect it—it might be a Scarlet Elf Cup, which is definitely not garbage and is an important treasure of the wild kingdom.

SCIENTISTS GREW CHICKPEAS IN FAKE MOON DIRT WITH THE HELP OF FUNGI

Ellsworth Toohey

https://www.msn.com/, Mar. 21, 2026

Coat a chickpea seed in beneficial fungi, plant it in a pot that's three-quarters fake moon dirt, and you can grow a harvestable crop. Texas A&M researchers pulled this off in a climate-controlled growth chamber, showing that the right fungal partner could be what makes lunar agriculture viable, according to a Reuters report. The fungi in question—arbuscular mycorrhizal fungi—latch onto plant roots and help them pull nutrients and water from hostile soil.

The team planted a chickpea variety called Myles in blends of vermicompost and simulated lunar soil built to match Apollo-era samples. Up to 75 percent simulant, the plants produced harvestable chickpeas, though the more fake moon dirt in the mix, the

cont. on page 6

Fire-Loving Fungi, *cont. from page 1*

million to 3.8 million species of fungi, which are essential to life on Earth, acting as primary decomposers and nutrient recyclers.

Yeasts, for instance, act as rising agents for bread, and molds add flavors to certain smelly cheeses. Lichens—unique organisms created from a symbiotic relationship between a fungus and algae and/or cyanobacteria—are important indicators of environmental health. In vast networks beneath forest floors, mycorrhizal fungi interlace throughout the soil, forming symbiotic relationships with plants and even, some research has suggested, helping trees communicate.

And in the charred aftermath of a forest fire, some strange fungi pop up on soil and wood as bright patches of color—like pink or white crusts or little orange cups—for only a few ephemeral weeks.

Sydney Glassman, a microbial ecologist at the University of California, Riverside, who has been studying mycorrhizal fungi for more than a decade, stumbled upon this post-fire occurrence by accident. "Not once, but twice during my PhD, my plots burned down in catastrophic mega fires," she says. "So I ended up having the situation where I had sampling pre- and post- a mega fire. … And what we found was that certain fungi are really increased in abundance after a fire."

Sydney Glassman / UC Riverside

Neurospora discreta, a type of fungus, forms pale patches on the charred bark of dead Joshua trees after the 2020 Dome Fire, in California.

These hardy organisms are known as pyrophilous fungi—also called fire-loving or burn fungi—because of their fascinating ability to thrive in the aftermath of conflagrations. While other fungi, plants and bacteria might die after a blaze, these species flourish. They degrade pyrogenic matter—the carbon-rich residue left behind by a fire, such as charcoal, soot and ash—and help rebuild the forest.

By breaking down the compounds in charcoal, "they play this really important functional role in releasing nutrients that plants can use, improving the structure, or recreating the original soil structure, and allowing water to filter through the soil," says Erin Spear, a mycologist at the Smithsonian Tropical Research Institute.

For this reason, scientists are hoping to leverage certain abilities of pyrophilous fungi to help forest ecosystems recover after a wildfire. But although mycologists have been researching and publishing work on pyrophilous fungi since as early as 1909, exactly how these organisms are able to grow in abundance post-fire remains a mystery. To begin to unlock the answer, Glassman's team looked at their genes.

In a study published in January in the *Proceedings of the National Academy of Sciences*, Glassman and her colleagues sequenced the genomes of 18 species of pyrophilous fungi that they had collected from seven different burn sites across California and cultivated in the lab over five years. The team exposed some of the fungi to charcoal, then monitored their growth rates—and tracked which genes became active as the fungi responded.

"We know a lot about plant adaptations to fire, but all these plants are associated with microbes, and we don't know a whole lot about how the microbes"—such as some fungi—"are adapted to fire. Fire is natural in California and other Mediterranean climates, so it makes sense that there'd be adaptations," says Glassman. The area sees so many fires that "it seemed like a really important thing to study."

Sydney Glassman / UC Riverside

Fire-loving fungi are often colorful.
(*from left, Pyronema, Geopyxis, and Peziza*)

Thriving after Flames

As a fire scorches a forest, pyrophilous fungi can endure the heat and flames. Some produce heat-resistant structures, called sclerotia, and survive inside until ideal, postfire conditions arrive. Others withstand the blaze by living deeper in the soil, then emerge when the forest has been razed, growing into an ecosystem with far fewer competitors.

At the center of burn fungi's ability to remediate devastated forests is their ability to absorb charcoal. "Fungi have to eat like animals. They can't make their own food," says John Taylor, a mycologist at the University of California, Berkeley, who was not involved in the study. So the charcoal is "a resource, and fungi have evolved to take advantage of it."

Glassman and her team examined the fungal genes responsible for encoding enzymes that help break down carbon compounds in charcoal, as well as genes that were crucial to acquiring nitrogen released by the fire. They found that these genes have evolved in three main ways.

The first is gene duplication, which is essentially a "copy-paste mechanism," Glassman says. It allows the fungi to replicate the genes necessary to degrade charcoal, resulting in more total enzymes that can break down the residue. Second, some fungi use sexual reproduction, which can produce new charcoal-metabolizing traits as genes are recombined in the offspring.

But perhaps the most exciting way these fungi were able to obtain the genes, and Glassman's personal favorite, is a mechanism called horizontal gene transfer. Genes are typically transferred through vertical transmission, such as when parents pass genes down to their offspring. Horizontal gene transfer, however, would be "as if you're transferring genes between other people in the room with you," says Glassman.

"Bacteria can do that, and that enables them to be really diverse," she adds. The team's findings indicate that the genes originally came from bacteria and were transferred to the ancestral lineage of certain pyrophilous fungi during their evolutionary history. "So there's this cross-kingdom horizontal gene transfer," Glassman notes, "which is really rare."

Monika Fischer, a mycologist at the University of British Columbia in Canada who was not involved in the study, says the massive amount of data behind this paper is a huge contribution to the scientific community. Taylor adds that this study provides strong evidence that, through natural selection, pyrophilous fungi have adapted to metabolize charcoal. Work like this, he says, "opens the field" to further research into the traits that allow fire-loving fungi to prosper.

Spear, of the Smithsonian Tropical Research Institute, who was not involved in the study, emphasizes that the team's culture-based approach is one of the paper's strengths. Cultivating and maintaining a living fungal collection over time allows researchers to begin to showcase the complexity of these organisms, she adds.

"A single snapshot in time is exactly that, and we can't draw these big conclusions about microbial communities from that one time point," says Spear. One moment alone does not reveal "how dynamic these communities are."

Restoring Burned Forests

As wildfires continue to grow in intensity and size, unlocking the mysteries of fire-loving fungi might accelerate forest recovery. Their ability to break down charcoal and release carbon makes them key to restarting nutrient cycles, and some fire-loving fungi can even digest chemical pollutants.

Charcoal contains ring-shaped compounds called aromatic hydrocarbons, which are naturally occurring in wildfire areas but are carcinogens and pollutants in other contexts. Burn fungi, because they can break these compounds down, "also play this role in protecting human health," Spear says. And future innovations might utilize the fungi more broadly. "Aromatic hydrocarbons are in other things, like oil, for example," Glassman says. "Can [the fungi] be used to clean oil spills?"

Glassman highlights the possibility for industrial applications where these organisms can be used to help restore polluted landscapes and make the environment more hospitable for returning plants.

They do this in a multitude of ways. Some pyrophilous fungi form thick mycelial mats, or networks of fungi that bind the soil together, preventing erosion and allowing water to permeate. They might also grow abundantly then die off, leaving behind a nutrient-rich "necromass" that paves the way for future life in the soil, which Fischer has described in her own work. Glassman also found, in a 2015 study, that some fungi form symbiotic relationships with plant seedlings, enabling plant regrowth.

Within weeks after their emergence, many of these fungi have vanished. Though crucial to forest recovery, fire-loving fungi remain elusive, briefly transforming the landscape before disappearing again. "In one moment, they can be dormant and have low abundance in the soil," Spear says. "Then the next moment, they're the most important players."

"To dream of mushrooms denotes fleeting happiness, to dream you are gathering them, fickleness in a lover or consort."

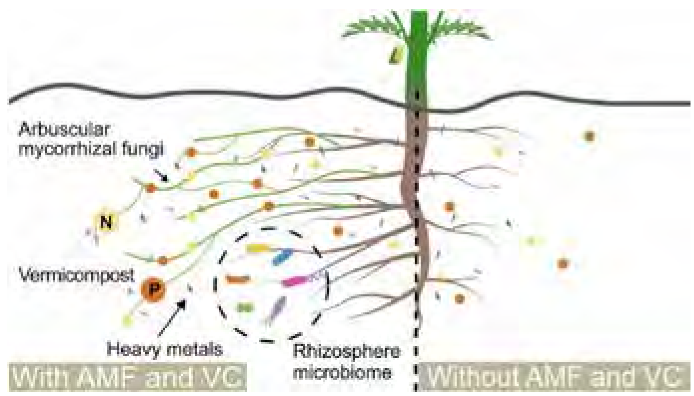
—Richard Folkard in Plant Lore (1884)

Chickpeas in Fake Moon Dirt, *cont. from page 5*

fewer pods they yielded. Size held steady. At 100 percent simulant, the plants never flowered and died early.

The fungi made a measurable difference. Treated seeds outlasted untreated ones by a wide margin and took up fewer toxic metals from the soil—a useful trick, since lunar regolith contains compounds that are bad for both plants and the people eating them.

The study was published in *Scientific Reports*. Growing food on the moon still faces enormous engineering problems—radiation, low gravity, sealed habitats—but at least the dirt part is looking more solvable.



https://doi.org/10.1038/

Chickpea roots with beneficial fungi (left) spread wider, absorb more nutrients and water, and block harmful heavy metals. Without the fungi (right), roots are shorter and less protected. Worm compost feeds the soil with microorganisms and nutrients the plant needs to grow.

COLUMBIA, TENNESSEE, FIRE & RESCUE WON'T RESPOND TO MEDICAL CALLS AT MAGNOLIA HEALTH, CITING "INFECTION CONTROL CONCERNS" **Patsy Montesinos**

https://www.newschannel5.com/, Mar. 23, 2026

COLUMBIA, Tenn. (WTVF) - Columbia Fire & Rescue sent a memo last week announcing it will not respond to medical calls from Magnolia HealthCare and Rehabilitation due to infection -control concerns involving *Candida auris*, a dangerous, drug-resistant fungus.

The March 19 memo, addressed to Maury Regional EMS and the Maury Emergency Communications District, said this temporary change in response protocols is meant to "ensure the safety of personnel and limit potential exposure to a highly transmissible and difficult-to-control organism."

The *Candida auris* precautions at Magnolia mean fire crews will only respond to fire-related emergencies—such as fire alarms, structure fires, and other confirmed hazards—until health officials declare conditions safe.

The memo also stated that Maury Regional EMS will ensure uninterrupted medical coverage for the facility. In Maury County, EMS operates separately from the fire department, and during a phone call with News Channel 5, EMS officials explained they only bring in fire crews for medical situations when needed.

PSILOCYBIN—FROM PSYCHEDELIC MUSHROOMS—MAY HELP PERSISTENT LYME DISEASE SYMPTOMS

Nancy Dougherty

https://www.lymedisease.org/, Mar. 24, 2026

[abridged] People living with Lyme disease-associated chronic illness often face persistent symptoms such as pain, fatigue, cognitive fog, and mood issues, even after repeated antibiotic treatments.

A new Johns Hopkins pilot study tested psilocybin-assisted treatment, using the active compound in psychedelic mushrooms in a controlled setting to address these long-standing challenges.

The study was led by Albert Garcia-Romeu, Ph.D., psychopharmacologist at Johns Hopkins Center for Psychedelic and Consciousness Research, and John Aucott, MD, Director of the Johns Hopkins Lyme Disease Research Center and Clinical Care Program. Twenty adults with confirmed post-treatment Lyme disease (PTLD) received two doses of psilocybin, spaced two weeks apart, supported by trained facilitators. Participants were followed for six months after the final dosing session.

The results, while preliminary, were striking:

- 40 percent average reduction in overall symptom severity at six months
- Broad improvements in fatigue, depression, pain, and sleep quality
- Sustained benefits, without fading, as placebo effects often do
- No serious adverse events
- 100 percent study completion rate

Aucott remarked, "These findings, though preliminary, demonstrate the importance of collaborative innovation in Lyme disease research. We're beginning to see what can happen when neurological, immunological, rheumatologic, and neuropsychological expertise comes together around a shared goal of improving the lives of Lyme disease patients, who've too often been left with inadequate options."

Johns Hopkins researchers are designing follow-up research using multimodal brain imaging such as functional MRI and biomarker analyses to test these possibilities, examining how brain activity, immune response, and inflammation are impacted by psilocybin in the context of Lyme disease.

The durability of the improvements raises a fascinating scientific question: What's happening in the body and brain to create lasting relief?

To the dear lone lands untroubled of men
Where no voice sounds, and amid the shadowy green
The little things of the woodland live unseen
And shall not loveliness be loved forever?
—Bacchae, Euripides, 5th Century BCE

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 2, scent, was presented last month. This month we present the third gift.

Insulin

This is the most surprising fungal gift, and the most recently discovered (Hill et al., 2025).

We've all read about (and we all shelter) the human microbiome, the thousands of species that live in and on us. These are largely bacterial. I'd accepted that the relatively small number of fungal residents we host are likely to be pathogens, like the yeast, *Candida albicans*, *C glabrata*, and *C. auris*, which are kept in check by our friendly bacteria (why we get yeast infections after taking antibiotics). But in a surprising development, it turns out that the development of normal pancreatic β cells capable of producing insulin, is dependent upon the recognition of specific cell wall components of a different year, *Candida dubliniensis*, at a critical window after birth.

This research was carried out on mice since the dissection of fecal samples from infants of different ages is not (yet) acceptable; however, testing human fecal samples for infants of different ages on the appropriate mouse tissues suggested that we, too, have a post-natal period (7 to 12 months) of requiring this fungus in order to prevent early onset (Type A) diabetes.

Perhaps the most exciting and hopeful is the last sentence in the Results section of his summary publication: "We also tested the capacity of *C. dubliniensis* to mitigate diabetes in mouse models and found that not only could it reduce disease prevalence and severity, but it could also promote β cell restoration in adult animals after ablation."

And because I've been dazzled by *Fusarium*, I can't resist mentioning that although some *fusarium* species can cause us serious infections and even death, there's a recently discovered (Zhou et al., 2025) species (*Fusarium foetans*) that's a permanent resident in the gut of essentially every healthy human on earth, and offers us significant protection against fatter liver metabolic disease. It doesn't offer total protection because if you pig out sufficiently on fatty foods, you can overcome it. Still, it's in your gut and, together with the fleeting *C. dubliniensis* hookup protecting you against sweets and alcohol, you'll probably get through the season safety. *Happy Holidays!*

References Cited

Hill, J. H., et al 2025. "Neonatal fungi promote lifelong metabolic health through macrophage-dependent β cell development." *Science 387*: eadn0953; DOI:10.1126/science.adn0953.

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April Showers Bring May Morels!