SPORE PRINTS

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AMANITA MUSCARIA AND THE CONSUMER GUMMY MARKET: What the Chemistry and the FDA Action Actually Tell Us

Belle Gibson

FUNGI Magazine, Summer 2026, Vol. *19*:(2), 22–24

When the fly agaric appeared on pharmacy shelves in 2022, not as a warning illustration but as a product ingredient, it represented something the mycology community had not quite anticipated. A mushroom with 6000 years of documented human use, studied by mycologists, ethnobotanists, and toxicologists for generations, had became a mainstream consumer item. Today muscimol gummies are sold in gas stations and supplement shops across most of the United States. Some carry third party Certificates of Analysis. Many do not. Most consumers cannot explain what muscimol is or how it is made.

This is a situation the mycology community is positioned to address clearly. This article covers the chemistry that makes the modern *Amanita muscaria* product category possible, the regulatory framework that governs (and mostly doesn't govern) it, and what the FDA's December 2024 action actually means, because the coverage of that action has left consumers more confused than informed.

How the Produce Category Emerged

The shift from foraged *A. muscaria* to consumer gummies was not an obvious development. Raw *Amanita muscaria* is dominated by ibotenic acid, a prodrug that is roughly four to ten times more toxic than muscimol and produces the nausea, delirium, and unpredictable reactions historically associated with the mushroom (Michelot and Melandez-Howell, 2003). The traditional Siberian use involving urine recycling was, in part, an early attempt to manage this conversion. Ibotenic acid decarboxylates to muscimol in the body, and urine from someone who had consumed the mushroom contains higher muscimol concentrations (Wasson 1968).

Modern production inverts this process. Ibotenic acid decarboxylates to muscimol through heat and changes in pH (Aranko et al., 1985). Manufacturers apply controlled heat, typically 60–80°C, in an acidic environment to convert the mushroom's ibotenic acid content before extraction. The resulting extract is then incorporated into an edible format. The claim, when it made honestly, is that the product contains extracted muscimol rather than the raw alkaloid profile of the mushroom itself.

What this means in practice depends almost entirely on the quality of the conversion process and third-party testing. Incomplete decarboxylation leaves residual ibotenic acid in the final product. A product labeled "5 mg muscimol" may contain any ratio of muscimol to ibotenic acid depending on manufacturing quality. Since muscimol is the intended active compound and ibotenic acid is the toxicological concern, this distinction matters in a way that does not hold for most food supplements.

The Testing Gap

Certificates of Analysis for muscimol products vary widely. Some test for muscimol content only; others test for both muscimol and ibotenic acid and report a conversion ratio; others test for neither, relying instead on heavy metals, microbial counts, and pesticide panels that tell the consumer nothing about the compound they are actually buying. There is no regulatory standard for what a muscimol product's COA must include.

Two studies are particularly relevant here. Michelot and Melandez-Howell (2023) documented the pharmacological activity of muscimol and ibotenic acid across the human and animal subjects and noted that the differential toxicity between the two compounds creates different consumer risk profiles depending on the processing quality. Aranko et al. (1985) established that ibotenic acid converts to muscimol reliably under acid heat conditions but incompletely without sufficient time and temperature, parameters that vary by manufacturer.

The consumer has no practical way to verify these parameters from a product label. This is a standard problem in the botanical supplement space, but it has particular force here because of the pharmacological gap between a well-converted and poorly converted product is larger than in most categories.

The FDA's December 2024 Action

In December 2024, the Food and Drug Administration issued a formal alert classifying muscimol as an unauthorized food additive, noting that it had not been granted Generally Recognized as Safe (GRAS) status and had not undergone food additive approval. The alert referenced ibotenic acid in the same terms.

What the FDA did not do is equally important. The agency did not issue a recall. It did not classify muscimol as a controlled substance; muscimol is not scheduled by the Drug Enforcement Administration. It did not initiate enforcement actions against specific companies. The December 2024 alert was regulatory positioning: a formal statement that the FDA considers these

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CALENDAR

Sept. 8	Membership meeting, 7:30–9:30 pm, CUH
Sept. 14	Board of trustees meeting (via Zoom)
Sept. 22	*Spore Prints* deadline
Sept. 26	PSMS field trip (see psms.org members page)
Oct, 10	PSMS field trip (see psms.org members page)

BOARD NEWS

Peg Rutchik

Amy Foster updated the board regarding strategic planning. The goal is to establish a vision based on the PSMS mission. From the vision, a framework of objectives and tasks will be established driving the activities of PSMS. These should acknowledge the work being done by the various PSMS committees. A need was identified for better connection between the committees and the board. This will be addressed at a future meeting. Applicants for scholarships to the Ben Woo Foray are being received; names will be pulled out of a hat in September to identify recipients. Derek Hevel shared an image of the new show poster and updated the board on the Wild Mushroom Show.

MEMBERSHIP MEETING

Karen Dawson

Date: Tuesday, Sept. 8, 2026

Time: Doors open/social, 7:00 pm
Meeting starts, 7:30 pm

Where: Center for Urban Horticulture
University of Washington
3501 NE 41st Street, Seattle

Leah Bendlin

To start off the Fall season, our speaker for September will be Leah Bendlin, who will present "Common Fall Mushrooms of the Pacific Northwest and Their Lookalikes."

In her presentation, Leah will show and describe some of the most common and memorable mushrooms found in the fall in the Pacific Northwest. She will focus especially on common edibles and how to tell them apart from poisonous or just otherwise tricky lookalikes, noting particular physical features and habitats that will help you to identify them on your own.

Leah Bendlin is a Portland-based mushroom and community science enthusiast. She caught the mycology bug after her first outing hunting chanterelles with a friend in 2012. She was amazed at the diversity of other mushrooms that day, and set out to learn the science of identification. That curiosity proved insatiable, and now she has become an expert taxonomist, aspiring to learn the name of every mushroom she encounters, and delights in teaching others. Leah's special interests include taxonomy, uncommonly known edibles, mycoheterotrophic plants, slime molds, and ascomycetes (cup fungi). She regularly leads mushroom ID classes and walks through various Pacific Northwest organizations, sequences mushroom DNA at Molecular Solutions, LLC, and volunteers as a teacher, identifier, and board member of the Oregon Mycological Society. She also volunteers as a mushroom identifier for poison control. You can find her Instagram page, focused primarily on teaching mushroom species of the Pacific Northwest, at https://www.instagram.com/leah_mycelia/ .

BEN WOO MEMORIAL FORAY Oct. 16–18, 2026

Marian Maxwell

We are pleased to announce that registration is now open for the annual Ben Woo Memorial Foray. The foray will be held at the Cispus Learning Center located in the heart of the majestic Gifford-Pinchot National Forest between Mt. Adams and Mt. St. Helens. With legendary mushroom habitat in all directions, this is the perfect location for a mycological gathering. Check-in is Friday, October 16, from 3:00 to 6:00 pm. Cost is $230.00 per person. A $25 cancellation fee per person will be charged through Sept. 16 at 10 pm. After Sept. 16 at 10 pm, there are no refunds of registration fees. All attendees must be PSMS members and be over 12 years of age.

This year we have many outstanding evening presenters including Paul Stamets, founder of Fungi Perfecti; mycologist Noah Seigel; Alex Winstead, owner of Cascadia Mushrooms in Bellingham, and Kristen and Trent Blizzard, creators of Modern For-

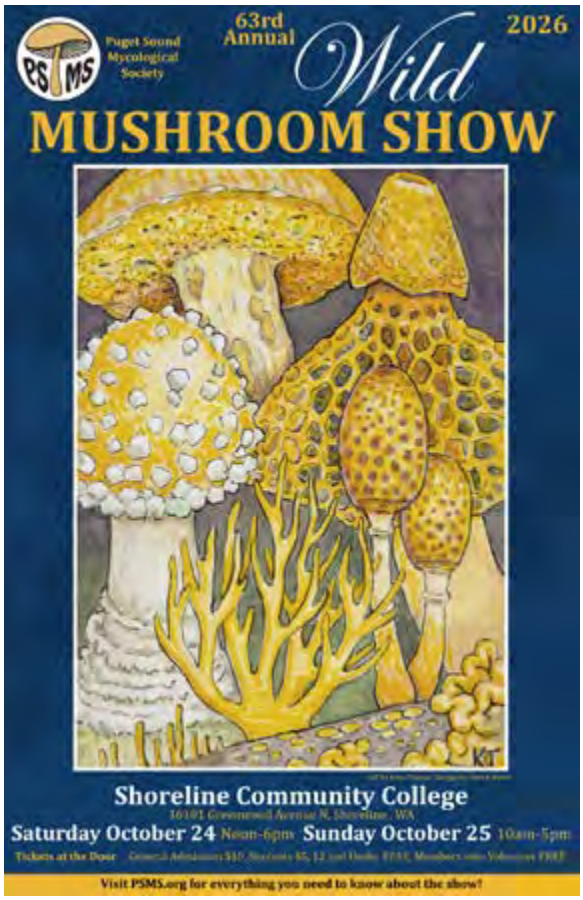
ager and GeoForager. PSMS scientific advisor, mycologist, and author Steve Trudell will provide a Sunday morning overview of the specimen collection.

In addition to our fabulous lineup of presenters, we offer an amazing selection of hands-on workshops designed to educate and engage. Advance registration is required. There is a listed fee for participation, with one afternoon workshop per person. The Microscope and Cooking workshops take place after lunch from 1:00–4:00 pm and the Cultivation workshop is from 4:00–5:00. The Navigation workshop includes an hour before lunch in the lecture hall and then in the field from 1:00–4:00 pm. The Dyeing workshop includes an hour-long morning walk to collect dye mushrooms around the Cispus grounds from 11:00–12:00, and then meets again from 1:00–4:00 pm to dye scarves. The Cultivation workshop can be taken with any of the other workshops.

This year, PSMS is providing 10 scholarships to the Ben Woo foray. This is intended to assist those who may not otherwise be able to attend because of financial difficulty. All members applying for scholarships must be at least 12 years of age and current PSMS members. A drawing for a scholarship will be held on Sept. 9 from all the applications.

To register for the Ben Woo foray or the Ben Woo scholarship, you will need to log into the Member's area at psms.org and select "Events." This is a fun and educational event!

2026 WILD MUSHROOM SHOW — Derek Hevel



The Wild Mushroom Show chairs are happy to announce that the dates of the fall Wild Mushroom Show will be October 24th (12–6 pm) and 25th (10 am–5 pm), and we will return to Shoreline Community College at 16101 Greenwood Avenue North, Shoreline, Washington. This is our biggest event of the year, where we share everything we do as a mycological society with the general public. This year's co-chairs are Derek Hevel, Milton Tam, Marion Richards, and Peg Rutchik.

We always need your help to make the show happen. Year after year, we put on one of the largest and best shows on the West Coast. Please volunteer to help with one or more tasks, including helping at the touch-and-feel table, cultivation, cooking and tasting, book sales, admissions, hospitality, and loading/unloading. Sign up online starting in mid-September at psms.org under "Events." Publicity posters and postcards will be distributed at our September membership meeting. Also, look out for an email with digital images you can use to help publicize the show on social media. As usual, as a volunteer, you get into the show for free, have access to that amazing potluck in the break room, and will be eligible to attend the volunteers-only Memorial Day field trip in 2027.

We will also need YOUR mushroom specimens for our display tables. As always, the won't know how good a mushroom season we will have until October, but we have already seen a few folks finding the earliest chanterelles, lobsters, and porcini. We don't know when the rains will arrive, but we're all crossing our fingers for a well-timed fruiting in order to put on the best show. Come mid-October, we strongly encourage members to forage far and wide to collect specimens wherever they can be found. A month out, experts have suggested collecting display specimens in the foothills of Mount Rainier, the Olympic Peninsula, and the Washington Coast, but it is impossible to predict when and where our mushrooms will flush. Since we will not do organized collecting trips this year, we encourage you to self-organize to find and bring back mushrooms, moss, and duff for the show. We're counting on YOU to make the mushroom display happen!

MUSHROOM CHAMPIGNONS TAKE OVER AUCKLAND COSTUME PARADE — RNZ Online

https://www.google.com/, Aug. 15, 2026

A four-day celebration of all things mushroom included a fungi-inspired costume parade on Karangahape Road, Auckland, on Saturday. Photographers Abigail Dell'Avo and Felix Jackson were on hand to snap the 'shroomy revelers.

Felix Jackson

compounds to be operating outside the food additive framework, not a prohibition of sale.

This distinction is one that much of the popular coverage missed. *Amanita muscaria* mushrooms remain legal to buy, sell, and possess in 49 U.S. states. Louisiana banned *A. muscaria* in 2005, though the law has faced legal challenges (Louisiana Revised Statutes, 2005). The mushroom itself is not a controlled substance. What the FDA action created is documented regulatory risk for manufacturers. It did not change the legal status of the product for consumers.

For manufacturers, the alert means that products making food health claims or sold in ways that bring them under FDA food or supplement jurisdiction face formal regulatory exposure. For consumers, it means the category is operating in acknowledged regulatory gray space, which is relevant to purchasing decisions but is not a prohibition.

What the Market Looks Like Now

The *A. muscaria* gummy market grew quickly between 2022 and 2025. Third-party retail data suggest hundred of brands entered the category, with products ranging from single-milligram "microdose" formats to high-dose products claiming 10 mg muscimol or more per unit. The demographic overlap with the functional mushroom category is high: Lion's Main and Reishi consumers, psilocybin-adjacent wellness buyers. Many approach *A. muscaria* products with a framework developed for adaptogens or dietary supplements, which does not apply.

The pharmacology of muscimol is reasonably well understood. Muscimol is a GABA-A receptor agonist, producing sedative and dissociative effects at sufficient doses (Johnston, 2014). It does not act on serotonin receptors, which distinguishes it pharmacologically from psilocybin and LSD. At the doses appearing in consumer products, typically 3 mg to 10 mg per serving, effects include mild relaxation, altered sensory perception, and sedation. Ibotenic acid is an NMDA receptor agonist and neurotoxic at high doses in animal models, though human clinical data on dose thresholds is limited (Michelot and Melandez-Howell, 2003).

Consumer understanding of this pharmacology is, by most measures, poor. Marketing language in the category tends toward the experiential and the vague. "Legal psychedelic," "entheogenic," and "mind-expanding" appear frequently. The specific receptor mechanisms and the conversion quality question—the factor that most determines whether a product behaves as advertised—are rarely mentioned.

What Mycologists Can Offer

The mycology community has two things this conversation needs: accurate taxonomy and pharmacology and credibility with general audiences increasingly drawn to fungi as medicine, food, and experience.

Amanita muscaria has a long scientific literature. The ethnobotanical record is extensive. The toxicological data, while not as thorough as clinical drug trials, is more rigorous than most of what appears on consumer product pages. There is a real opening for mycologists and mycology-adjacent writers to engage with this market, not as endorsers or critics but as the people who actually know the relevant facts.

Whether consumer interest in *A. muscaria* translates into durable market demand or regulatory intervention is a question for the next few years. What is not in question is that the mycology community will be better positioned to shape that conversation if it starts now, while the category is still forming, rather than after the narrative has settled without input from people who study mushrooms.

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TWO INTERESTING FUNGI FOUND ON THE LAST PSMS 2026 SPRING FIELD TRIP

Brian S. Luther

Western Gall Rust, *Cronartium harknessii*

On our last spring PSMS field trip June 6 near Blewett Pass, WA, a small branch of Lodgepole Pine (*Pinus contorta*) was brought to me for ID. It was infected with Western Gall Rust, *Cronartium harknessii*, formerly in the genera *Peridermium* and *Endocronartium* (Ziller, 1974).

Rusts are parasitic fungi, and this species causes distinctive, swollen, gall-like infections scattered on the branches of the host tree. Rust fungi generally have complex life cycles, often including five different spore stages and alternate plant hosts. Rusts with this complicated life cycle are called heterecious rusts. Normal control of most rust fungi starts by being able to interrupt the life cycle by eradicating alternate hosts, which form different infecting spores.

Cronartium harknessii is unusual in that it has evolved an abbreviated life cycle that does not require an alternate host to infect the tree. Rusts with this type of life cycle are called autoecious rusts; they are also called a microcyclic or endocyclic rust because they have only one spore stage, which alone infects other trees.

Heterecious rusts infect their hosts with aeciospores and basidiospores, but in this case that does not apply, because *C. harknessii* does not produce either of these spore types and there's no alternate host. Instead this fungus uses teliospores to infect its host. Teliospores are binucleate. They go through nuclear fusion, then go through meiosis and form basidiospores, as in all other

rust species. However, the teliospores of this fungus are unique. In *C. harknessii* basidiospores are not produced from the teliospores; instead after meiosis they produce uninucleate infection peg hyphae that infect new host plants.

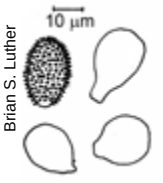
Having a single spore type cause an infection is to the advantage of the fungus, making it easier to reproduce and to complete its entire life cycle on a single host.

The photo below shows the swollen, gall-like area of infection on the branch with the bright yellow teliospore stage of this fungus. The pine branch was broken off just below the infected area. These teliospores are virtually identical to the aeciospores seen in other species of *Cronartium* and are referred to as "aecioid teliospores." The microscopic teliospores are carried by wind and spread to new uninfected hosts.


Brian S. Luther

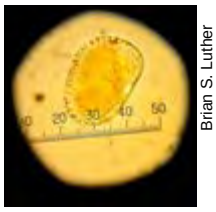
Lodgepole pine infected with Cronartium harknessii.

These spores are bright yellow in mass, are quite variable in size and shape, being 20-45 × 14–24 µm and varying from subglobose to ovoid to tear-drop shaped to ellipsoid, often irregular. They're pale yellowish-brown under the microscope, thick-walled, and covered with a uniformly dense layer of short peg-like ornamentation from 1–2 µm long, with one end of the spore having a distinct thick, nearly hyaline, short blunt apiculus-like spore wall projection which is unornamented. These teliospores also have distinct, round guttule inclusions as seen in ammonia mounts. Refer to the photo, photomicrograph, and line drawings.



Brian S. Luther

Cronartium harknessii teliospores, showing variation in size, shape, and ornamentation.


Brian S. Luther

Cronartium harknessii teliospore at 1,000× mounted in 3% NH4OH.

This fungus also infects other hard pine species: the two- and three-needle pines called Diploxylon pines, including Ponderosa Pine and others.

Only rarely in the past have PSMS members brought in tree rust fungi for identification, but I do remember a sample of White Pine Blister Rust (*Cronartium ribicola*) coming in sometime in the 1980s or 1990s. In a previous article (Luther, 2011) I discussed another rust fungus we have here, which you may be interested in reading about.

Helvella corium

The second unusual species found on this field trip was *Helvella corium*. Only rarely have I seen this all black stipitate ascomycete. It's in a complex of several similar looking fungi with small cups with distinct stems that includes *H. fibrosa*, *H. macropus*, *H. villosa*, and *H. atra*. *Helvella pezizoides* is also a similar all black species, but the cup is saddle-shaped and it has a smooth rather than ribbed stipe. *Helvella corium* is entirely black, remains cup-shaped at maturity, and the stipe is ribbed. The upper, fertile inside of the cup is smooth, but the exterior and stipe are grayish granular hairy (see photo).


Brian S. Luther

Helvella corium.

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CHIMNEY SWEEP OR MUSHROOM COLLECTOR?

Brian S. Luther

PSMS members Ben Moore, Cindy Ide, Wren Hudgins, and I collected morels together in the Lower Sugarloaf Fire in Chelan Co., Washington, in late May earlier this year. Many PSMS members had great success collecting in this burn during some of our spring field trips. But after climbing through heavily burned ground and woods and holding onto blackened/burned tree trunks in very steep terrain, we were literally covered with charcoal from head to foot. Was it worth it? You bet—we found plenty of morels, had a lot of fun and got good exercise! The photos here were all taken by Wren and show what I (we) looked like afterwards.


Wren Hudgins


Wren Hudgins

We currently have an even more extensive forest fire this year in Chelan Co.: the Little Giant Fire. So, I predict it'll be another bumper crop year for burn-site morels in spring 2027.

SCIENTISTS WARN FUNGI FROM MUMMIFIED REMAINS COULD POSE HEALTH RISKS TO HUMANS

https://english.bombaysamachar.com/, Aug. 13, 2026

Handling mummified remains carries a risk of fungus spreading to humans, which could endanger their health. According to a study by scientists at the University of Staffordshire, microbial growth on mummified human and animal remains could transfer to those handling them, including buyers. Many people are purchasing such mummified remains, including hands and feet, sold online. The researchers examined 128 online posts and auction listings and found that very few offered any guidelines on the safe handling of remains.

The listings were also found to be non-compliant with postal regulations, putting everyone involved in the delivery process, including delivery workers and customs officials, at risk. Hands, feet, and heads at varying levels of preservation were up for sale in the listings, with some posts showing people handling mummified human remains without gloves.

cont. on page 6

Fungi on Mummified Remains, *cont. from page 5*

If remains are not packaged and stored appropriately, biodeterioration and fungal growth can accelerate, with fungal spores spreading into the air. Substances used in the embalming process, such as arsenic, mercury, and lead, could also be highly toxic.

Notably, *Aspergillus* spores are believed to have killed 10 out of 12 conservation scientists who opened the tomb of King Casimir IV Jagiellon in Kraków in the 1970s. Similarly, *Aspergillosis* is thought to have been the cause of Lord Carnarvon's death, after he apparently inhaled spores inside Tutankhamun's tomb.

"The rise of the internet, especially social media, has amplified international trafficking and driven demand for unique cultural heritage, including mummified humans and animals," lead author Dr. Kirsty Squires, Professor of Human Bioarchaeology at the University of Staffordshire, said.

Scientists noted that even when fungal growth is not visible and extensive deterioration might not appear on the surface, this does not mean microbes are absent. They warned that microbial colonization may not always be visible to the naked eye. "These preserved remains pose health and biosecurity risks, due to the toxicity of embalming methods and/or suboptimal storage that can promote microbial growth," Squires said.

The research revealed that mummified remains sold online show signs of biodeterioration, but "sellers provide no safety guidance, suggesting limited awareness or deliberate disregard of hazards."

Squires said the remains are being shipped across the world without consideration for health and safety implications, adding that clearer, more prominent guidelines are needed to ensure buyers and sellers cannot misinterpret or exploit loopholes in shipping policies.

DRUG-RESISTANT *CANDIDA AURIS* SPREADS TO 23 STATES. WHAT YOU SHOULD KNOW

Brian Wiechert

https://www.wbaltv.com/, Aug. 5, 2026

According to the latest tracking data from the Centers for Disease Control and Prevention, more than 3,000 cases of drug-resistant *Candida auris* have been reported so far this year. Texas has reported 706 cases, with Michigan reporting 503.

Cases of the drug-resistant fungus *Candida auris* have exploded across the U.S. in the past decade, with federal health officials sounding the alarm.

Cases have been reported in 23 states so far this year, according to CDC data. As of July 18, 3130 total cases have been reported across the nation, including in Arizona, Colorado, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Nevada, New Jersey, North Carolina, North Dakota, Ohio, Pennsylvania, Tennessee, Texas, Utah, Virginia, and Wisconsin. Texas has reported 706 cases, with Michigan reporting 503.

But perhaps the biggest red flag for federal health officials is how sharply cases have climbed over the past decade, increasing from 48 clinical cases in 2016 to more than 6300 in 2024.

Health officials say the fungus primarily threatens people with serious underlying medical conditions and emphasize that early detection, patient screening, and strong infection-control measures are key to preventing outbreaks.

Candida auris is transmitted from contact with someone who has it—even if they have no symptoms. It can also be transmitted through a contaminated surface. In healthcare settings, infections can pass from person to person or through contaminated medical equipment, officials with the Cleveland Clinic state. It can also infect you through a medical device in your body — like a central venous line or breathing tube. Experts do not believe it spreads through the air.

The "superbug" can cause serious infections and death in those who are vulnerable. Most people without underlying health conditions are not at risk.

DEADLY *CANDIDA AURIS* HIDES IN HAIR FOLLICLES BY REWIRING SKIN IMMUNITY

Gaby Clark, ed.

https://medicalxpress.com/, Aug. 5, 2026

Since its discovery in Japan in 2009, a deadly fungus has emerged in hospitals around the world. The pathogen, known as *Candida auris*, lives silently on the skin. But it can be deadly if it reaches the bloodstream, killing about 3,000 patients in hospitals and long-term care facilities a year in the U.S.

To understand what allows *C. auris* to persist on the skin, unlike other fungi, researchers compared it with *Candida albicans*, a common skin fungus that the immune system normally clears quickly. In mice, *C. albicans* disappeared within days, but *C. auris* persisted, taking refuge in hair follicles.

"*Candida auris* colonizes skin way better than most other fungi, setting it up to invade once the immune system is weakened," said Dean Merrill, MD, a dermatologist and professor at UCSF and first author of the study, which appears in *Science* on Aug. 6. "The big clinical problem is that we have no effective way to remove it from the skin."

The researchers discovered that the two fungi produced very different immune responses. *Candida albicans* triggered an immune signal called IL-17, which renewed the skin's surface and boosted antifungal defenses, clearing the infection. But *C. auris* triggered interferon gamma, a signal more commonly linked to viral infections.

It did this by remodeling its exterior cell wall to expose more of a molecule called chitin, which spurred immune cells to release interferon gamma around the hair follicle. The interferon gamma blocked the skin's antifungal defenses, including IL-17. It also slowed the natural replacement of hair follicle cells, leading to a buildup of older, damaged cells—a niche where *C. auris* could flourish.

"Chitin is widespread in nature, so it's not like human skin never encounters it, but we were surprised to see that *C. auris* actively

uses its chitin to turn the skin into a perfect nest," said Suzanne Noble, MD, Ph.D., a professor of microbiology at UCSF and co-senior author of the paper.

The findings reveal potential targets for preventing *C. auris* from persisting on the skin.

One approach could involve drugs that tilt the immune system away from interferon gamma signals and toward IL-17, which drives the skin's normal antifungal clearing process. Or perhaps drugs that block chitin could prevent the fungus from amplifying interferon gamma signals, according to Merrill.

More broadly, the researchers say the work offers a new way to think about how microbes can quietly coexist with us before becoming dangerous.

"For most people, *Candida auris* hangs out on the skin and doesn't cause any problems. It's only when it reaches deeper tissues in medically vulnerable patients that it becomes dangerous," said Ari Molofsky, MD, Ph.D., an immunologist and UCSF professor and co-senior author of the paper. "Understanding how it survives on the skin may help explain how it eventually causes serious infections."

FUNGI ENHANCE HYDROGELS FOR STRONGER, SAFER MATERIALS **Scott Gibson**

https://www.newswise.com/, Aug. 10, 2026

Study Assesses Fungal Chitin as an Alternative to Traditional Crustacean Sources

Researchers at the Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) and the University of Tennessee (UT), Knoxville, have made a scientific advance by using a natural substance from fungi, called chitin, to create hydrogels that are both significantly stronger and tougher. This new material could lead to safer medical devices, longer-lasting coatings, and other innovations that improve everyday technology and health care.

Fungal chitin is a natural, fibrous substance found in the cell walls of fungi. Hydrogels are flexible, water-rich materials used in medical implants and contact lenses, as well as soft robots that can bend, flex, and even self-heal in ways that mimic natural, living systems. The study, published in the *International Journal of Biological Macromolecules*, offers a fresh approach that could transform those types of materials used in medicine and engineering.

Yue Yuan of the Center for Nanophase Materials Sciences (CNMS), a DOE Office of Science user facility at ORNL, said this research project built on previous work when she was an intern at ORNL, including a 2021 paper. As an ORNL Laboratory Directed Research Development (LDRD) Distinguished Staff Fellow, Yuan said LDRD funding, early career development programs, and the laboratory's collegial research environment enabled her to convene experts from multiple fields to assess fungal chitin as a promising alternative to traditional crustacean sources.

The researchers extracted chitin from three types of fungi using a gentle treatment that preserves the tiny particles' structure. Unlike chitin from shrimp or crabs, fungal chitin has a much lower allergenic potential and does not require extensive processing to remove unwanted chemicals and heavy metals. The new method uses a mild alkaline pretreatment and a ball milling process to break down the material into a fine powder. This approach improves the material's performance without the extra energy use or harsh chemicals typical of traditional techniques.

Yuan brought together a multidisciplinary team that included Tomás Rush and Yunqiao Pu from the ORNL Biosciences Division; John Lasseter from CNMS; and Toby Nelson, Kehao Ren, Lu Wang and L. P. Tharika Nirmani from UT.

Reflecting on the team's collaborative approach, Rush, an ORNL fungal biologist, said, "Fungi offer an untapped reservoir of bioproduct potential, a perspective that guided our exploration beyond the usual model species."

Nelson, a key figure in advanced materials design at the UT-Oak Ridge Innovation Institute (UT-ORII), added, "This collaboration integrates biosourced fiber processing with advanced materials design, demonstrating the power of a well-connected research community."

To validate the material's structure, the team used advanced electron microscopy techniques. Lasseter said, "Our ability to image these delicate biopolymers at low voltages without metallic coatings has been crucial in capturing their true shape and structure and confirming the chitin's integrity."

Andrew Sproles/ORNL, U.S. Dept. of Energy

Fungal chitin particles reinforce a flexible, dog-bone-shaped hydrogel much like rebar strengthens concrete. Hydrogel-forming polymer chains and fungi, the source of the chitin, appear in the background

Mechanochemistry Drives Material Innovations

The research also draws attention to the benefits of mechanochemistry in modern materials engineering. Yuan said that using a ball milling process to produce submicron to nanoscale particles demonstrates how desired material properties can be achieved without relying on severe chemical reactions or high temperatures.

"When materials are designed for applications such as contact lenses, water cleanup systems, or wound dressings, every improvement in durability and functionality is crucial," Yuan said. The ability to tailor the molecular architecture of fungal chitin by selecting different species opens the door to a vast range of material properties.

Yuan said the choice to pursue fungal sources over traditional crustacean sources was motivated by several factors. The fungi produce unique chemical profiles that provide a platform for designing materials from the ground up. The availability of a variety of fungi enables researchers to tap into a warehouse of molecules to address different engineering and medical challenges. The consistent fermentation process facilitates fundamental research, including sample characterization using ORNL's unique neutron scattering tools.

cont. on page 8

Fungi Enhance Hydrogels, *cont. from page 7*

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WORLD'S LARGEST POPULATION OF RARE MUSHROOM DISCOVERED IN BELARUS NATIONAL PARK

Hanna Kaltygina

https://en.belsat.eu, Aug. 12, 2026

Belavezhskaya Pushcha National Park

Osteina rhodophila.

The world's largest known population of the rare fungus *Osteina rhodophila* has been discovered in the Belavezhskaya Pushcha National Park in Belarus. Scientists from the national park have identified 14 sites where it is fruiting stably. Meanwhile, the forest remains the only place in Europe where this species has been recorded. The Belavezhskaya Pushcha National Park announced the discovery on August 11.

Osteina rhodophila is a rare wood-decomposing fungus with an unusual ecological specialization: it develops exclusively on the old, dead fruiting bodies of another rare species, the pink polypore (*Fomitopsis rosea*), which is listed in the Red Data Book of Belarus.

The name *rhodophila* translates from Latin as "one who loves pink." Besides being associated with the pink bracket fungus on which it develops, the fungus's own fruiting bodies take on a characteristic delicate pink hue as they grow.

The role of *Osteina rhodophila* in the forest ecosystem is also unusual. First, the pink bracket fungus breaks down dead fir wood. After this process is complete, its own decayed fruiting bodies become a substrate for *Osteina rhodophila*. It continues the decomposition process, helping to return organic matter to the forest nutrient cycle.

According to the national park, *Osteina rhodophila* has not been recorded anywhere else in Europe to date. The nearest known growth sites are located a significant distance away—at two isolated locations in Russia's Forest Volga region.

Scientists attribute the preservation of the fungus's large population to the strict nature reserve status of the Białowieża Forest. Its existence requires the convergence of several conditions: large fallen spruce trees in the late stages of decomposition, the presence of the pink bracket fungus on them, and a stable microclimate.

This ecological chain is particularly sensitive to human interference. Sanitary clearings or the removal of debris from the forest destroy the conditions necessary for the fungus. Therefore, scientists from the national park consider the find to be confirmation of the effectiveness of the protected reserve status and the high degree of preservation of the Belavezha Primeval Forest's old-growth forests.

THIS AMAZONIAN SPIDER DISGUISES ITSELF AS THE EXACT FUNGUS THAT KILLS SPIDERS

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On a rainy night in Ecuador's Amazon rainforest, a conservationist reached out to prod what looked like a clump of parasitic fungus growing on the underside of a leaf. The kind that infects and kills spiders, takes over their bodies, and sprouts from their corpses. He poked it.

It moved.

What he had found was not a fungus. It was a spider. And not just any spider. It was a species nobody had ever documented before, one that had evolved to look exactly like the thing that kills its own kind. The discovery, published in the journal *Zootaxa*, describes the newly named *Taczanowskia waska*, an arachnid that mimics the fruiting body of a *Gibellula* fungus. This fungus belongs to the Cordycipitaceae family, the same group that inspired the zombie infections in "The Last of Us."

www.wildlifediscoveries.com

Taczanowskia waska.

The spider doesn't just look the part. It also acts the part. It stays completely motionless on the undersides of leaves, the exact spot where *Gibellula* fungi are typically found growing on dead spider hosts. Its abdomen carries elongated, pale structures that closely resemble fungal growths. Under field conditions, at night, the resemblance was convincing enough to fool trained researchers on first look.

What makes this case particularly strange is the nature of the disguise itself. In most known examples of animal mimicry, the model is something dangerous to the predator. A harmless fly mimics a wasp. A non-venomous snake copies the markings of a venomous one. The mimic pretends to be something that would hurt whatever might try to eat it.

This spider does the opposite. It copies something that would normally signal its own death. A spider covered in *Gibellula* is a dead spider. Any predator seeing what appears to be a fungus-covered corpse would likely move on. Why eat something that is already infected and decaying? The disguise doesn't say "I'm dangerous." It says "I'm already dead. Nothing to see here."

The research team, which included scientists from the Leibniz Institute for the Analysis of Biodiversity Change, noted that the discovery traces back to an observation posted on the citizen science platform iNaturalist. Users flagged what appeared to be a mushroom as a possible spider, which prompted the research team to collect a specimen from the Llanganates-Sangay Corridor, one of the richest biodiversity hotspots on Earth.

My Opinion

This is evolution at its most creative and most disturbing. A spider that pretends to be a zombie version of itself just to avoid getting eaten. If nature had a horror film division, this would be the pitch that gets greenlit immediately. And the fact that it was first spotted by a regular person on iNaturalist, not a lab team, makes it even better.