

# SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY  
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## RAREST ELEMENT USED IN CANCER CURE EXTRACTED FROM EDIBLE MUSHROOMS

**Nimesh Khakhariya**

<https://timesofindia.indiatimes.com>, Feb. 16, 2023

RAJKOT - Mushrooms growing in Kutch, India's largest district, can potentially provide the key chemical element for an emerging radiation therapy given to cancer patients. Scientists at Gujarat Institute of Desert Ecology (GUIDE) and Kutch University have

successfully extracted astatine, the rarest naturally occurring element on the earth, from edible Pink Oyster Mushrooms (*Pleurotus djamor*). Astatine, which is not just rare but also has an extremely short life, is said to cause minimal side effects that come with chemotherapy. Scientists say availability of astatine on earth is just a few grams as this radioactive element decays within hours.



*Pink Oyster Mushrooms*  
(*Pleurotus djamor*).

V. Vijay Kumar, director, GUIDE, said, "Cobalt radiation is used in chemotherapy for cancer treatment. But cobalt remains inside the body for a longer time and damages healthy cells as well as the cancer ones, which results in side effects. Astatine targets only cancer cells and gets deactivated after a short time, thus causing minimal damage to the body."

The common side effects of chemotherapy are hair loss, weakness, nausea and vomiting, blood clots, memory loss, and others. As cobalt remains in the body for a long time, the gap between two chemotherapy sessions is also more.

K. Karthikeyan, principal scientist at GUIDE working on this project, claimed, "Researchers across the world have found that this radioactive element will improve radioimmunotherapy efficiency for treating tumors and other cancers since it kills the tumor cells that are typically resistant to chemo and radioactive therapy."

"A large number of studies and research is underway in the world on astatine's therapeutic use, but the problem is the supply of this element is limited because only a few places can make it. As a result, a more in-depth research is difficult due to the less availability. However, if it can be extracted from mushrooms, hopes of better cancer treatment are bright," he added.

GUIDE has successfully cultivated edible as well as medical mushrooms in recent times. The scientists gave some edible mushrooms for laboratory evaluation to the chemistry department of Kutch university which has highly sophisticated high-end equipment.

Vijay Ram, assistant professor of the chemistry department claimed, "During testing, we found the rarest of the rare element astatine. We confirmed the presence of this element and informed GUIDE."

G. Jayanthi, another scientist at GUIDE, said, "We are planning to take the research further so that funding is available to support the study for further characterization and purification of the element. This will enable cancer patients to overcome the impacts of chemotherapy."

## WORLD'S DEADLIEST MUSHROOM CHANGED HOW IT REPRODUCES AS IT SPREADS ACROSS THE U.S.

**Carly Cassella**

*Nature*, Feb. 9, 2023

Mushrooms are infamous for mushroom poisoning, yet in reality, most kinds of toxic mushrooms cause only temporary physical discomfort when eaten by humans.



Victoria Seed Bank

Of all the reported fatalities from mushrooms worldwide, 90 percent are due to just one particular species from Europe: the "Death Cap" mushroom (*Amanita phalloides*).

Researchers have now figured out how this species has spread across parts of North America with such speed and apparent ease, causing numerous fatalities along the way as people mistake it for food.

As it turns out, Death Caps don't need a mating partner to reproduce. A study led by researchers at the University of Wisconsin-Madison on *A. phalloides* in the U.S. has found the mushroom can produce spores using the chromosomes of a single individual.

The discovery is based on the genomes of 86 mushrooms, collected in California since 1993 and parts of Europe since 1978.

Among the U.S. samples, Death Caps appear to have been able to reproduce both sexually and asexually for at least 17 years, and possibly as long as 30 years.

Specimens collected in 2014 from two different spots were found to contain the exact same genetic material, effectively making them the same individual mushroom. Another "individual" was collected once in 2004 and then again a decade later.

"The diverse reproductive strategies of invasive Death Caps are likely facilitating its rapid spread, revealing a profound similarity between plant, animal, and fungal invasions," the researchers write in their new paper.

# Spore Prints

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## CALENDAR

- Mar. 12 PSMS officer and board election ends at midnight
- Mar. 14 PSMS annual membership meeting, in person and via Zoom, 7:30 pm, CUH
- Mar. 20 Board meeting, 7:30 pm, CUH
- Mar. 28 *Spore Prints* deadline

## BOARD NEWS

Marc Sarracino

**Elections** for the 2023–2025 term are upon us. If you haven't voted yet, head to the "Members' Page" on [psms.org](http://psms.org) or use this link: <https://mms.psms.org/members/elections.php?mid=325509929>. There are only five trustee spots and eight people running, so help determine the fate of the future board, but you only have until March 12th at midnight. We will announce the results at the March meeting, which will also be our Annual Meeting, so bring any questions, concerns, and congratulations for the board members for 2021–2023. I would like to express appreciation for Randy Richardson for leading this society for the last four years. Also, a big thanks to Wren Hudgins, Bruce Richardson, Molly Watts, and Joe Zapotosky for their contributions during their tenure.

The recipient of our highest honor, the **Golden Mushroom Award**, will be announced at the March meeting. Drum roll, please.

Lastly, the board has finally adopted **Scholarship Guidelines** which will be published on the website soon. There are two scholarship funds available. The Ben Woo Scholarship, named after PSMS's inaugural president, is for academic research pursuits as well as any projects that would benefit PSMS or the field of mycology. The K-12 grant is for teachers to boost their budget to include fungi in their curriculum. More information is available on the PSMS website Foundations and Grants page.

## MEMBERSHIP MEETING

Scott Maxwell

The general membership meeting on March 14, 2023, will once again be a hybrid including both in-person and Zoom at the Center for Urban Horticulture. We will start letting in-person attendees in at about 7:00 pm and Zoom attendees at about 7:20 pm. In the past, the March meeting has included the annual Survivors Banquet and has been for members only. However, last year because of COVID-19, we postponed the banquet until June and made it a PSMS-provided finger food and beverage event. Everyone liked it so well that we have decided to switch to June permanently. Thus the March meeting will be a standard general meeting, open to all.

This month Dr. Paul Przybylowicz will be presenting "What's the deal with white-rot fungi? Are they really going to save us?" Per Paul, this presentation will examine various claims in light of scientific studies and data.



Paul's interest in fungi started early in life, mushroom hunting with his grandmother. He has been studying and working with decay fungi for over 40 years. Paul has worked as a consultant in the specialty mushroom industry where he ran a spawn laboratory and wrote *The Shiitake Growers Handbook* with John Donoghue. Paul recently went to Guatemala by invitation through the USAID Farmer-to-Farmer program to work with mushroom growers there. He has been a faculty member at The Evergreen State College for over 30 years where he generates a great deal of excitement amongst his students in regard to the study of fungi, human biology, wilderness medicine and outdoor leadership. For additional information about Paul, please refer to the following link:

<https://www.evergreen.edu/directory/people/paulprzybylowicz>

## ADDING FUNGI TO ROSEMARY MAKES IT MORE TASTY

Royal Holloway

<https://phys.org/>, Feb. 20, 2023

Research from the Royal Horticultural Society, Vitacress Herbs, and Royal Holloway-University of London has shown that the addition of mycorrhizal fungi to soil leads to increased production of essential oils in rosemary, making the plants more aromatic and flavorful.

Mycorrhiza are beneficial fungi that grow in association with plant roots, increasing the area from which plants can absorb nutrients

and water. The fungi are widely available commercially for gardeners to add to their soil to help plants become more vigorous, overcome plant problems, and cope with conditions of drought, among other uses. The research also found that the fungi more consistently colonized the root area when they were mixed in with soil prior to growing on it.

Adding mycorrhizal fungi did not affect the shape or structure of the plant, just the production of the compounds that enhance the flavor and taste of rosemary. This means that home gardeners and trade growers will be able to produce rosemary plants with a consistent appearance but with the potential for extra flavor.



## **CANTHARELLUS CALIFORNICUS COULD BECOME CALIFORNIA'S OFFICIAL MUSHROOM**

**Jacque Porter**

<https://www.kget.com/>, Feb 18, 2023

(KTXL) - California could soon have an official state mushroom thanks to a bill introduced in the state legislature last month.

Assembly Bill 261, introduced by Assembly member Ash Kalra (D-San Jose), would make the Californian Golden Chanterelle (*Cantharellus californicus*) the official state mushroom.



*Cantharellus californicus*.

The mushroom was chosen in a poll by the California Institute for Biodiversity which pitted five other mushrooms against the winning chanterelle: the Black Trumpet, the Candy Cap, the King Bolete, the Lion's Mane, and the Western Jack-o-Lantern.

The website for the poll said that the six mushrooms were nominated by "mycologists, mushroom societies, and other fungus lovers from around the state" and then were voted on by the public.

"By naming the Californian Golden Chanterelle as the official state mushroom, AB 261 will give the public the opportunity to learn more about their state's fungi and the great biodiversity, traditions, and innovation they support," said Kalra.

## **FIELD TRIP SAFETY COMMITTEE Wren Hudgins**

*This will be the first of several articles on standing committees inside PSMS. We will talk about what our committees do, have done, plan to do, and in general paint a picture of committee functions both to educate members and to possibly serve as a recruitment tool. We almost always need more volunteers. A number of our committees have only one member, the chair person. A few have none.*

## **History**

Many years ago PSMS had informal field trip guiding. Experienced members sometimes agreed to take out newcomers on the spur of the moment at a field trip. That practice ended perhaps around 1980, and for the next 30 years we had no guiding program.

About 10 years ago we started to reconstruct it and improve it at the same time. We made forest navigation training mandatory for guides and instituted a shadowing requirement such that new guides have to shadow experienced guides at least once, and then, on a different field trip, be shadowed by an experienced guide.

Today, we have about 20 guides total, but at any given field trip we may have three to five guides available that day. Once we had only one.

The goal is to have enough guides to take out all the beginners who want to be guided. If we have room to spare, then we are willing to take out nonbeginners. That goal is met, on average, once every five or six field trips, so we have a way to go before we can take out every beginner who wants to go

This month we are starting the training of another class of guides, the only one in 2023, in order to increase availability.

## **Guide Priorities**

Our first priority is bringing everyone back out of the woods safely. To this end, guides have radios (walkie talkies) and first aid kits. Everyone in a guided group must have a whistle and respond to guide signals. We have a bin of guide gear which includes radios, first aid kits, bright orange vests, chargers for walkie talkie batteries, spare batteries, paperwork including sign up sheets for guided groups, clipboards, and pens. That bin of gear goes to every field trip and guides may borrow from it as they need.

Our second priority is educating about habitat such that beginners can start to hunt on their own with friends and not need a club guide. We don't guarantee finding mushrooms and don't do much ID out in the woods. Regardless of how adverse conditions are, we can always educate on appropriate habitat.

## **Future Plans**

We have a few ideas for the future as well. The PSMS board has recently started discussing possible outreach to underrepresented groups so that we can introduce populations in those groups to our hobby and our club. We may be able to do that by offering a particular group a field trip just for that group.

Another idea is to arrange for a pop up field trip. If we have a guide willing to lead a group, we could announce the field trip via the email distribution list a week or less in advance. Interested members could show up at the designated time and place for a guided but otherwise bare bones field trip. There would be none of the usual coffee and breakfast goodies and little ID of specimens. The idea is to offer a spur-of-the-moment field trip when conditions warrant and a guide is available. There are some details yet to work out with both of these ideas, but we hope we can implement them.

If you have ideas for us or want to help out, email [wren.hudgins@gmail.com](mailto:wren.hudgins@gmail.com).



*Wren Hudgins*



*Dave Weber*

Co-Chairs

## FUNGI AND BACTERIA ARE BINGING ON BURNED SOIL

Jules Bernstein

<https://news.ucr.edu/>, Feb. 7, 2023

Researchers at the University of California-Riverside (UCR) have identified tiny organisms that not only survive but thrive during the first year after a wildfire. The findings could help bring land back to life after fires that are increasing in both size and severity.

The California Holy Fire burned more than 23,000 acres across Orange and Riverside counties in 2018. Wanting to understand how the blaze affected bacteria and fungi over time, UCR mycologist Sydney Glassman led a team of researchers into the burn scar.

“When we first came into fire territory, there was ash up to my shins. It was a very severe fire,” Glassman said.



UC Riverside researcher sampling Holy Fire burn scar soil for analysis

The researchers visited the scar nine times over the course of the next year, comparing the charred earth with samples from nearby, unburned soil. Their findings, now published in the journal *Molecular Ecology*, show that the overall mass of microbes dropped between 50 and 80 percent after the fire and did not recover during that first year.

However, some things lived. “Certain species increased in abundance, and in fact there were really rapid changes in abundance over time in the burned soils,” Glassman said. “There were no changes at all in the unburned soils.”

It wasn’t just one type of bacteria or fungi that survived. Rather, it was a parade of microbes that took turns dominating the burned soil in that first post-fire year. “There were interesting, distinct shifts in the microbes over time. As one species went down, another came up,” Glassman said.

In the early days, they found microbes with high tolerance for fire and high heat. Later, fast-growing organisms with a lot of spores—able to take advantage of space with little microbial competition—seemed to dominate. Toward the end of the year, organisms able to consume charcoal and other post-fire debris high in nitrogen tended to dominate.

Certain microbes called methanotrophs regulate the breakdown of methane, a greenhouse gas. Fabiola Pulido-Chavez, UCR plant pathology Ph.D. candidate and first author of the study, noticed that genes involved in methane metabolism doubled in post-fire microbes.

“This exciting finding suggests post-fire microbes can ‘eat’ methane to gain carbon and energy, and can potentially help us reduce greenhouse gases,” Pulido-Chavez said.

The researchers continue to test whether the fungi and bacteria they found were able to thrive at different points in time as a result of their unique and varied traits or whether there is another reason for the shifts they saw in the soil.

“We think one organism can’t be good at all the skills necessary to thrive in a burn scar,” Glassman said. “If you’re good at tolerating heat, you’re probably not as good at growing fast.”

What the researchers saw in the soil bears some resemblance to the human body’s response to a major stress. People suffer an illness and take antibiotics. The medicine destroys bacteria in a person’s gut, and new organisms begin to show up that either weren’t there before or did not previously have a large presence. Eventually, a person’s gut bacteria might return to something like its pre-infection state, but there is no guarantee.

“We are also trying to understand what gets the land back to where it was before the disturbance, which in this case was an enormous fire,” Glassman said. “A lot of what we’re studying could be transferable to a human microbiome setting.”

For a century, scientists have known about ways that plants are able to adapt to wildfires, and eventually re-colonize a burn scar. As this new research shows, fungi and bacteria may have developed similar coping strategies.

“It’s exciting because we’ve only developed the technology in the last couple of decades to really understand what microbes are doing in the soil and how they contribute to regeneration,” Glassman said.

What is now being learned about post-fire microbe behavior could change older theories about plant behavior, since microbes were not factored into them. “To me, this is exciting, as microbes have long been overlooked, yet they are essential for ecosystem health,” Pulido-Chavez said.

One open question that remains is whether adaptations that plants and microbes have developed in response to wildfires will adapt again to megafires or recurrent fires. Whereas there might have been a period of several decades before a plot of land burned more than once, it is increasingly common for the same soil to burn again in fewer than 10 years.

Particularly in the West, climate change is causing rising temperatures and earlier snow melt, extending the dry season when forests are most vulnerable to burning. What does the increase in size, severity, and frequency of fires do for natural burn recovery?

“Things can recover, but it takes time, and whether or not the land recovers after super-frequent megafires is another story. Can recovery time keep pace with megafires? We don’t know yet,” Glassman said.

*A fungus has a wondrous side,  
With oil and garlic it’s sometimes fried,  
But on leaves of rose,  
And between the toes,  
Its treated with a fungicide.*

—Boris Subbotin, via *The Sporeprint*,  
L.A. Myco. Soc., Dec. 2001

## BRIGHT ORANGE LICHENS CAN USE THEIR PIGMENTS AS A “SUNSCREEN”

<https://www.eurekalert.org/>, Feb. 13, 2023

Lichens are curious plant-like organisms that consist of one fungus species and at least one alga or cyanobacterium living in a symbiotic relationship. A family of lichens known as Teloschistaceae, are often brightly colored orange—a rare trait compared to closely related species. The pigments responsible for the intense hue often have toxic effects on the organism itself, causing scientists to wonder how it protected itself while synthesizing its orange coloration.



Flickr user Björn S...

*Elegant sunburst lichen, Xanthoria elegans.*

Research has shown that fungi in orange lichens are able to avoid the toxic effects of bright pigments by transporting them out of their cells, creating a “sunscreen effect.” A new meta genomics study published by researchers from Imperial College-London and the Royal Botanic Gardens-Kew now reveals how lichens can use their orange hue to reflect sunlight, while avoiding their toxic effects.

The study, published in *Genome Biology and Evolution*, reveals that the fungi in this class of lichen has a gene responsible for transporting the orange pigments out of the cell shortly after they are created.

Lead author Theo Llewellyn, a Ph.D. candidate from the Department of Life Sciences at Imperial, says that the unexpected discovery came from a gene survey that isolated sequences from the algae and fungi that make up lichens. The fungi in orange lichens had evolved to handle toxic pigments. He says: “What we were really excited and surprised about was that we saw that right next to the gene that is responsible for making these pigments, there’s a second gene, which is specialized to be able to transport that pigment and get it out of the cell.”



Wikipedia

*Teloschistes chrysophthalmus, Golden Wolf Eye.*

These transporter genes allowed the fungi to rid themselves of the pigment before it could accumulate and become toxic, researchers explain. The transporter gene was not found in non-orange lineages/lichen groups.

The study was conceived, led, and partly funded by an RBG Kew project. Dr. Ester Gaya, Senior Research Leader in Mycology at RBG Kew and a Teloschistaceae expert, says that she is pleased with the group’s findings. She says: “We had worked for years in this group of lichens, and after unveiling that an adaptive radiation into arid habitats had been mediated by these orange pigments, I always wondered why. Why did they evolve to produce such toxic pigments that could kill themselves?”

Pigments that are responsible for coloring lichens from a golden yellow to a crimson red are known as “anthraquinones,” which also have UV-protectant properties.

RBG Kew natural product researcher Dr. Tom Prescott, who is also a co-author on the study, concurred, adding “anthraquinones have

long been recognized as being quite toxic, including to fungi, so it’s always been a mystery as to how they make these compounds without poisoning themselves.” This study helps explain this.

“These pigments that they produce are insoluble in water,” Llewellyn says, “Once the lichen produces them, they start to crystallize and they form a layer on top of the lichen.”

This enables the lichen to reflect UV and visible blue light. The scientists say that, while it is still not clear which organisms in the lichen benefit the most from this sunscreen effect, they speculate that both the fungi and the algae are protected. The algae use sunlight to photosynthesize and produce sugars for the lichen system, but too much of it can be harmful since it can cause DNA damage.

The thick layer of crystals can reflect harmful radiation while still allowing some solar radiation to pass through for photosynthesis.

Co-author Dr. Timothy Barraclough, professor of the Department of Biology at the University of Oxford and a visiting professor in the Department of Life Sciences at Imperial, says that understanding these mechanisms can help shed light on how these orange lichens are able to fare in different habitats.

“This particular group has been especially successful and has spread out into challenging habitats with high UV loads,” Barraclough says—pointing to how the family contains more than 1000 species and can be found in countries like South Africa, Namibia, and Australia.

Barraclough points to the unique structure of lichens that make them difficult to study: “They’re widespread but slightly unusual forms of life that are made up of a collaboration between fungi and algae, and possibly many more partners. In the presence of all of these partners, it makes it very complicated to pull out information about genes.”

The metagenomic study that the group produced sequenced small fragments of DNA from the lichen and mapped it to databases of known organisms. By analyzing which DNA sequences most closely resembled those found in fungi and algae, the researchers were able to identify which sequences belonged to each partner.

Llewellyn says that the next stage of research will try to investigate the other qualities of anthraquinones, such as their potential antimicrobial properties that allow lichens to out-compete other fungi and microbes.

## NEWLY DISCOVERED FUNGUS CASTRATES MALE SPRUCE FLOWERS

Beate Kittl et al.

<https://phys.org/>, Feb. 15, 2023

### A Rare Discovery

During a midday walk, an employee of the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) discovered not only a new species of fungus, but also a genus previously unknown to science. The parasite feeds on the spruce pollen and destroys the male flowers in the process. It is unclear whether it is an introduced species.

WSL fungi expert Andrin Gross made an extraordinary find in 2018, practically on the doorstep of his office: he saw small,

*cont. on page 6*

## Fungus Castrates Male Spruce Flowers, *cont. from page 5*

gray-beige cupules on the male flowers of a Himalayan spruce in the WSL gardens. The WSL fungi team conducted an extensive search in worldwide fungal archives and genetic databases, which did not uncover any similar fungi.

This is not only a new species of fungus, but also a new genus. The researchers christened it *Microstrobilinia castrans* and now presented it to the scientific community in the journal *Mycological Progress*. “It is rare to discover a new fungal genus in Switzerland or even in Europe,” says WSL researcher Ludwig Beenken, who specializes in small fungi and is first author of the publication.

The species name “*castrans*” indicates the unusual way of life of the fungus: it decomposes the tissue of the male flowers and thus gets hold of the nutritious pollen. It does not occur on other parts of the trees. After the initial find on the Himalayan spruce, the WSL fungi experts launched a search, with volunteers also helping. “I even searched the spruces along the way during my hiking holidays,” says Beenken, who works at the WSL advisory service Forest Conservation Switzerland.

The search operation has now detected the fungus at around 130 sites, both on planted Himalayan spruce (*Picea smithiana*) and Serbian spruce (*Picea omorika*) in settlement areas and on native spruce (*Picea abies*) in forest pastures and mountain forests in the Jura, the Alps, and the Black Forest. It has not been found on other spruce species so far.



*Microstrobilinia castrans*: a–e On *Picea smithiana*: a *P. smithiana* tree at type location, two *P. omorika* trees in the background; b fresh infected pollen cone showing first symptoms like deformation and brown discoloration; c infected pollen cone with apothecia in the first year after infection; d, e several years old pollen cones overgrown with mosses and lichens with fresh apothecia and remnants of last year’s apothecia.

### Imported or Native?

Researchers are still puzzling over the origin of *Microstrobilinia castrans*, which is... a member of the Family Sclerotiniaceae but differs morphologically from the other genera of this family in having an ascus without apical apparatus containing four mainly citriform spores with 16 nuclei each. Furthermore, it is the only known cup fungus that parasitizes pollen cones of conifers by stromatizing their tissue and infecting pollen grains... Some assume that it has been overlooked so far. Beenken, however, rather suspects that it was introduced with park trees at some point.

The main reason he gives is that in the last 200 years, mushrooms have been searched for so assiduously in Europe that such a conspicuous, quite large cup fungus would hardly have remained undiscovered. Moreover, the Himalayan spruces, of which there are only a few specimens in parks in Switzerland, were all colonized with this fungus. “It may be that the fungus has jumped from this to native spruces, or, if it is native after all, that it has only recently become more widespread—favored by environmental changes.”

What does this discovery of a new fungus mean? “Forest Protection Switzerland monitors diseases and parasites of forest trees. That’s why we want to keep an eye on as many organisms as possible that can damage forest trees,” says Beenken. You never know if a fungus will suddenly cause bigger problems, for example if it spreads more widely with global warming. *Microstrobilinia castrans*, however, does not currently pose a threat to spruce trees, as the fungus only ever attacks a few flowers of a tree.

## THAILAND UNIVERSITY’S “PLANT TREES—GET MUSHROOMS” STRATEGY CONVINCES FARMERS TO SAVE THE FORESTS

Chulalongkorn University

<https://www.newswise.com/>, Feb. 17, 2023

Thailand’s forests are sadly dwindling. Many of the areas in the country are denuded and degraded forest areas where restoration seems to be impossible. Although many sectors have tried to campaign for reforestation, it has not been easy. This is because reforestation takes a very long time and, most importantly, requires the cooperation of local villagers to continue the task of planting and maintaining the forests. The Faculty of Science and the Center of Learning Network for the Region (CLNR) at Chulalongkorn University (nicknamed Chula) have tried to find ways to motivate villagers to become a coalition of growers and forest guards.

The answer to this problem lies in ectomycorrhizal fungi.

“We asked villagers to plant a forest with trees of the family Dipterocarpaceae that will not only grow into forests but also produce many kinds of mushrooms around the base of the trees as by-products to help better the livelihoods of villagers and Thai farmers,” said Assistant Professor Dr. Noppadol Kitana, Director of CLNR, on the success of ecological restoration projects in forest areas in Nan and Saraburi provinces with a seedling innovation that has ectomycorrhizae.

### The Beginning of Ectomycorrhizal Seedling Innovation in Forest Restoration

Nan is one of the northern provinces that used to have abundant forests. But in recent years, as a result of modern development, the forest area has been encroached on and denuded. More than 2,000 rai (3.2 square km) of Chula’s property in Wiang Sa district, Nan province, used to be a deciduous forest as well.

Asst. Prof. Dr. Noppadol Kitana, CLNR, reveals that the concept of forest restoration started in 2008 with a local science project to study applied environmental solutions. At that time, Assist. Prof. Dr. Jitra Piapukiew, Department of Botany in the Faculty of Science at Chula, came to research and experiment with seedlings containing ectomycorrhizae to restore forests in Nan Province.

“We started with the culture of ectomycorrhiza in the laboratory and then propagated them to Dipterocarpaceae seedlings in the nursery. After 4-5 years of growing Dipterocarpaceae trees, mushrooms appeared at the base of the trees. Later in 2011, we expanded the research project to Chula’s property in Saraburi province, where there are degraded forests as well,” said Asst. Prof. Dr. Noppadol Kitana.

### **Mycorrhiza and Trees—An Inseparable Relationship in Ecosystems**

Asst. Prof. Dr. Jittra Piapukiew, an expert and researcher on ectomycorrhiza for more than 20 years, describes the uniqueness of mycorrhizal fungi and explained that the name is derived from the word “mycor” meaning “fungus” and “rhiza” meaning “root.” Mycorrhiza, therefore, refers to the symbiotic relationship between fungi and plant roots. Mycorrhizal fungi find water and minerals, deliver them to plants, while plants photosynthesize them, and then create food and send it down to the roots where fungal fibers abound.

Apart from feeding the plants, fungi also keep plants healthy by preventing diseases from microorganisms. And it has been found that plants with mycorrhiza grow well, are drought and acidity resistant, resulting in a high rate of survival. According to current research, it is known that mycorrhiza plays a very important role in forest ecosystems because the underground mycorrhiza fibers that spread throughout the forest are a network through which trees in the forest communicate with each other about food and various chemicals used for growth and survival. This is also known as the Wood Wide Web which allows us to learn that the forest ecosystems communicate through these mycorrhiza fiber networks.

Mycorrhizae can be divided into two types: ectomycorrhiza, a fungus that grows around the plant root and the plant root cells, and endomycorrhiza, a fungus that grows into plant cells.

“Ectomycorrhiza is essential to the ecosystem as it cohabitates with the roots of forest trees like Dipterocarpaceae—resin trees (Yang Na/*Dipterocarpus alatus*), Yang Daeng (Garjan/*Dipterocarpus alatus*), Hiang (*Dipterocarpus obtusifolius*), Ta-khian (*Hopea odorata*), Pluang (*Dipterocarpus tuberculatus*), Payom (*Shorea roxburghii*), Teng (Siamese Sal/*Shorea obtusa*), Rang (*Shorea siamensis*), etc.,—Fagaceae trees, Pinaceae trees, and Myrtaceae (Eucalyptus) trees. Moreover, these fungi create mushrooms, which are the sexual reproductive structure from the right moisture and temperature as their flowers, creating spores to propagate and perpetuate in the circle of life,” explained Jittra.

### **Plant Trees for Mushrooms—A Strategy for Sustainable Forest Restoration**

Asst. Prof. Dr. Jittra Piapukiew explains that after 4 years of planting Dipterocarpaceae plant seedlings with ectomycorrhiza there will be mushrooms around the trees. At first, there will be mostly the sickener mushroom (*Russula emetica*). In the following years, when the trees become larger, the number of mushrooms will decrease, but there will be more variety on a seasonal basis. For example, barometer earthstar mushrooms (*Astraeus hygrometricus*) will be found in late summer, early rainy season, or around May. In the rainy season, the most common mycorrhizal mushrooms are various types of Amanitas, the sickener toadstool, boletes, chanterelles, etc. The moisture content in the soil determines the type and variety of mushrooms. In addition, when the

forest is more fertile, other mushrooms that are not mycorrhizal are formed, such as *Termitomyces* spp., *Lentinus polychrous*, and *Lentinus squarrosulus*, etc.

“...mycorrhizal mushrooms are expensive because they cannot be grown but only develop around tree roots in the forest. These mushrooms grow in deciduous forests with Dipterocarpaceae trees, so if you want mushrooms, you have to plant these trees,” said Asst. Prof. Dr. Jittra Piapukiew.

In addition to the northern region, Asst. Prof. Dr. Jittra Piapukiew said that the reforestation methods in this project can be applied to reforestation in many areas throughout Thailand.

For Asst. Prof. Dr. Jittra Piapukiew, Dipterocarpaceae are a “magical trees” that not only generate additional income for villagers but also help to cope with climate change.

### **Forest Mushrooms—Humans in a Symbiotic Relationship**

The villagers’ lives are already tied to the forest, and mushrooms are part of the community’s lifestyle. The villagers know mushrooms, the characteristics of edible mushrooms, the seasons for collecting mushrooms, where to find mushrooms, etc. It is not difficult to connect the knowledge of the villagers with forest conservation. Asst. Prof. Dr. Noppadol Kitana said that CLNR has held workshops for the villagers on this topic on how to plant trees and then get mushrooms in 4 years. Moreover, the center also cultivates Dipterocarpaceae seedlings which are home to mycorrhiza mushrooms, and many villagers have obtained them to plant.

“We want the villagers to be able to live in harmony with nature. When they understand the relationship between fungi and trees, they will help to grow and preserve forests and benefit from the forest. Mushrooms can also be eaten and sold for a living,” concluded Asst. Prof. Dr. Noppadol Kitana.



### **FUNGUS REPAIRS ON HISTORIC FRENCH SHIP REQUIRE FURTHER €6.5 MILLION**

**Brian McCulloch**

<https://www.connexionfrance.com/>, Feb. 9, 2023



*L'Hermione.*

A replica of the ship that carried the Marquis de Lafayette to America in 1780 to support the revolutionaries in their war against the British needs to raise €6.5 million to undertake essential repairs.

*L'Hermione* took 17 years to build between 1997 and 2014, but a new effort is now required after wood-destroying fungi infected

*cont. on page 8*

## ***L'Hermione Repairs*, cont. from page 7**

40 m<sup>3</sup> of its structure, around 7 percent of the total surface area of the ship.

€5.5 million has already been spent on identifying the problem and initial repairs, thanks to funding from the state, a bank loan, and the ship's home department and region, Charente-Maritime and Nouvelle-Aquitaine.

The Hermione-La Fayette association is now calling for an international campaign of donations to save this "symbol of France and of freedoms."

*L'Hermione* sailed for just six years after a year of sea trials ended in 2015.

### **Badly Rotted Wooden Planks**

The three-masted ship was built using 18th-century techniques, with the rhythm of work dictated in part by fundraising efforts.

The damage was discovered by carpenters during routine maintenance work in La Rochelle in 2021.

Experts were called in and confirmed the worst fears of the carpenters and the volunteers who worked on the ship—it was so badly rotted that the frigate was dangerous to sail.

Emergency repairs, using sheets of copper to strengthen the wooden planks, were needed for *L'Hermione* to make its way slowly to the Basque port of Bayonne, where a dry dock was available for it.

### **Several Potential Reasons for Fungus Attack**

Association spokesperson Marion Adnot said: "No one knows why the fungi has attacked and spread as it has.

"We carried out a full audit in 2022 and the conclusion of the experts is that it is impossible to say. It was probably the result of many factors."

Possible reasons put forward include parts of the ship having a double hull, making inspection difficult; the use of tongue and groove joints for the hull; the long construction time; the time spent in fresh water at Rochefort, its home port; and time spent at anchor during summer port visits in hot and humid conditions.

"We do not think there was a step in the treatment of the wood which the old builders did which we did not know about," said Adnot.

"The one thing we can be thankful for is that the damage was found when it was, and not during a storm on high seas."

### **Public Visits Will Help Fund Repairs**

Workers in Bayonne are ready to begin repairs—the dry dock is open to the public as part of the fundraising effort—and it is hoped the ship will return to the ocean in 2024.

The association, which has 3,000 members, is also hoping more people will join.

Prices for a year's subscription range from €30 to €100 for adults and €15 for under-18s.

### **Played Part in American and French Revolutions**

The original *L'Hermione* needed a major refit, including work on her hull, in 1789, after 10 years at sea in the French navy.

This included taking part in two vicious battles against the British off the coast of America, where France was supporting the Revolution, and a trip around Africa to India.

After the work, she sailed under the tricolor flag of revolutionary France, mainly in and around the Loire, where she protected merchant convoys.

She sank in 1793 at Croisic, just north of the mouth of the Loire, after an inexperienced crew drove her on to well-known rocks. The crew were able to get off safely.

## **TACOMA MUSHROOM HUNTER FOUND DEAD**

**Jay Barmann**

<https://sfist.com/>, Feb. 23, 2023

A 71-year-old woman who was out foraging for mushrooms in a Northern California forest earlier this month and got separated from her husband and daughter was found dead after being missing for two weeks.

Vana Sisopha of Tacoma, Washington, was hunting mushrooms with her husband and 44-year-old daughter in the Smith River National Recreation Area near Gasquet, CA. On February 3rd, Sisopha's husband reported that both his wife and daughter were missing after they'd become separated.

A search for the daughter the next afternoon was successful, although she was found suffering from hypothermia.

A subsequent search for Vana Sisopha and the family dog involved "dozens of agencies, some from the Bay Area" as the news group reports, and it included "helicopters, airplanes, drones, dogs and infrared imaging equipment."

The search had to be called off February 14 because of a snow-storm. When the search resumed on February 18, the woman's body was found "in a hollow under a log." The Sisophas' dog was never found.

## **MUSHROOM ASTROLOGY**

**Bob Lehman, LAMS**



**Pisces** (Feb. 19–Mar. 20): You love the idyllic romanticism of hunting mushrooms. You like mushrooms for being part of the wonder of nature and are little concerned about their details. Your examination of a mushroom is more apt to lead to a poem or a song than a taxonomic description. You don't have the physical endurance of other mushroomers and so you don't end up with as many mushrooms, but it doesn't matter because you can rhapsodize about one mushroom as well as about ten. Besides, you find plenty of wonderful mushrooms in your fantasies



**Aries** (Mar. 21 – Apr. 19): You are energetic in your mushroom hunting and love to explore new territory. You visit several sites in the course of a day's foraging even if the first site had more than enough mushrooms for you. You are confident and enthusiastic, and you act on inspiration. When everyone else knows it's too dry for mushrooms, you go find them. You like to make quick identifications and you risk poisoning yourself.



*Prof. Daniel E. Stuntz, co-founder and guiding light of PSMS, passed away 40 years ago this month. As a special tribute, we are appending the following recollections by PSMS Field Trip Chair Brian Luther in honor of his memory,*

## **DR. DANIEL E. STUNTZ A Tribute**

**Brian S. Luther**

Dr. Daniel E. Stuntz, PSMS co-founder and our first Scientific Advisor, passed away on March 5, 1983, 40 years ago. Only a handful of current PSMS members knew him and fewer yet were students of his. I thought it would be nice to provide a brief review of who he was for our membership.

In 1964 Ben Woo and Dr. Stuntz founded PSMS, initially with the help of Dixie Lee Ray, who at that time was the Director of the Pacific Science Center (where we first held our meetings and the annual exhibit). In the early days all members were sent a hard copy of the PSMS membership roster every year. Dr. Stuntz was listed as “C-2,” meaning he was the 2nd charter member of our club.

Dr. Stuntz was a Professor of Botany at the University of Washington and at the time one of the few experts on PNW macrofungi. His research focused specifically on the gilled-mushroom genus *Inocybe*, on which he was a world authority, having described many new species. Earlier in life, after graduating from the UW, he was encouraged by one of his botany professors to pursue an advanced degree at Yale University, with a ‘dangling carrot’ that he would be given a position at the UW afterwards. He accomplished that and started out as an instructor in the Dept. of Botany in 1940, then became a full professor in 1959. He also received the UW Distinguished Teaching Award in 1974.

He was deeply involved in PSMS, scientifically and socially. He was always at the monthly membership meetings doing mushroom ID before and after the program (which he sometimes gave), often went to some of the field trips, and offered basic mushroom classes to members. In 1971 he helped to revise and enlarge Margaret McKenny’s book *The Savory Wild Mushroom*, the most popular PNW mushroom guide at the time.

Dr. Stuntz had very myopic vision and in doing mushroom ID he’d drop down one ear piece on his glasses, so they were hanging on just one ear, then put a specimen right up to his eyes for a closer look. He claimed to have 10× vision that way. For many years he was the expert guest of honor at large mycological forays, which were named after him.

He never married. PSMS members and his UW botany students were his family, and he was generous to



them. My wife and I first met him in 1971, when we joined PSMS. After doing my first two years of undergrad studies at Shoreline Community College, I transferred to the UW and had the fortune of being a botany undergrad and then post-grad student for two years (but not a formal grad student) in the early and mid-1970s, where Dr. Stuntz was my first mycological mentor. I took all his basic and advanced courses, some of which he only offered every few years. I could talk for a long time about my personal experiences with

him over the years, but I thought I’d share just a few of these here.

Once a week Dr. Stuntz had microscopy lab sessions for the students in his courses. Besides presenting selected specimens to study, the majority of the lab counters were covered with fresh baked pies, cakes, cookies, cheeses, crackers, fruit and a wide range of other delicious hors ‘d oeuvres and drinks. He spent over a \$100 per lab session back then (a lot of money in the 1970s), getting most of these delectable goodies from Schumacher’s Tasty Home Bakery in the Roosevelt District, just north of the UW. Dr. Stuntz was apparently deprived as a student during his higher education and was determined that no student of his would ever be hungry. He was also, exceptional, I’m tempted to say unique, when he’d ask adult students at the beginning class whether they liked beer or wine.

Dr. Stuntz loved very rich food and as a result was quite portly in his older years. He also got little exercise and sometimes I’d cross paths going in Johnson Hall and he always took the elevator, never the stairs.

Besides his students and PSMS members, he spent a large portion of his income on rare and valuable old mycology books—he was an avid antiquarian. After his death, many of these books were incorporated into the UW Library’s Special Collections.

Dr. Stuntz’s office and lab on the 4th floor of Johnson Hall was a hub of activity, with students and professors coming and going for a visit throughout the day. Several grad students had offices there, and Dr. Stuntz had quite a menagerie of caged and uncaged creatures, ranging from parrots to an Iguana named Caligula, and all kinds of tropical plants in pots.

For years Dr. Stuntz used to tell us in his classes about an old Russian man, Mr. Kozlov, who would bring him the oddest things thinking they were fungi, and upon



presenting these items, would always inquire “De fungies?” Some of the notable items he brought included sticks with seagull poop on them, old wads of buried bubblegum, and an assortment of many other things, few of which actually ended up being fungi! Dr. Stuntz related that Mr. Kozlov (who spoke poor English) came once and said “Wife he say, no more de fungies in kitchen.” So, apparently Mr. Kozlov collected all this stuff and had it in his kitchen, to the dismay of his wife. Sometime around 1976, as a post-grad, I was doing some mycological work in Dr. Stuntz’s lab by myself and guess who shows up? Mr. Kozlov. He presented to me a stick with spider eggs on it and asked if it was de fungies. Hilarious, and true to what Dr. Stuntz had always told us.

Dr. Stuntz headed some PSMS research projects, one being the Morel Committee, which continued for years, studying the local species of *Morchella*. Select PSMS members also often celebrated his birthday by inviting him over and having a birthday cake, etc., and sometimes he’d give personal slide shows, using a very old one-slide-at-a-time projector that took forever! Many years ago PSMS paid for and surprised him with a trip to Prague, Czechoslovakia, so he could meet with the well known mycologist Dr. Albert Pilat. Dr. Stuntz spoke German and I remember him carrying on conversations with some of our German speaking members in the early 1970s.

Early noteworthy students of his who became prominent North American mycologists include Robert L. Gilbertson (d. 2011), Jim Trappe, and others. Dr. Stuntz had several fungi named after him, with some of these being *Ramaria stuntzii*, *Psilocybe stuntzii*, and the gastromycete genus *Destuntzia*.

Below I’m including a photo I took of Dr. Stuntz at the 1981 PSMS annual exhibit, which was held in 1980 & 1981 at the Flag Pavilion in the Seattle Center, an original 1962 World’s Fair Building. The

other two photos below were taken by Joy Spurr, a professional photographer and PSMS Charter Member #169.

As I already said, this can only be a brief discussion of just a few of my many memories of and experiences with Dr. Stuntz. Dr. Stuntz and I shared some of our background, both having graduated from Queen Anne HS (no longer a high school) and both having lived for years in the Seattle neighborhood of Magnolia. I last remember having seen him while working on campus sometime in late January, 1983 and he stopped to chat with me. After retiring in the late 1970s, his position was filled by Dr. Joseph Ammirati. Dr. Stuntz had not shown up at the lab for a few days (very unusual), so one of Joe’s grad students (Steve Rehner) went to his house to check on him and found him dead.

I have a color slide presentation about Dr. Stuntz that I put together many years ago after his death (still in slide form) and last presented it more than once at PSMS meetings decades ago. Maybe it’s about time I showed it to the membership again?

As we note the 40th anniversary of Dr. Stuntz’s passing we reflect with gratitude on all that he contributed to our club, his students, and the study of mycology and what a warm, kind friend he was to many of us.

#### Relevant Literature

1. Stuntz PSMS obituary, *Spore Prints* 191 (April, 1983, p. 1).
2. UW student newspaper *The Daily*, Wed., April 6, 1983, vol. 90, no. 84.
3. *Mycena News*, Vol. 33: 4, April, 1983.
4. Hosford, David Ramon. 1979. Daniel E. Stuntz—A Distinguished Professor and Friend. *Mycotaxon* IX (1): 3–16.



Dr. Stuntz at his 71st birthday celebration with a cake presented by Margaret Dilly and George Rafanelli both former PSMS presidents.



Dr. Stuntz at the PSMS 18th Annual Exhibit Oct. 1981, Seattle Center Flag Pavilion.



Dr. Stuntz, August 1974.