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The Potomac Sporophore

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How would a mushroom write poetry? Find out on page 8.

In This Issue

Q&A With Mushroom Observer

Willow Nero
Sporophore Editor

In late 2014, Willow Nero spoke with Jason Hollinger and Nathan Wilson, the two amateur mycologists who run the Mushroom Observer website, a shared, online field book for fungi. The site's more than 5,000 users post data points (images, location information, descriptions, and more) about fungi, with the hopes of making scientific contributions in the field of mycology (and learning more mushrooms!) Mushroom Observer (MO) has become a prominent meeting place for mycologists working with macrofungi and likely will play a major role in the North American Mycoflora Project.

MAW is in the process of developing a complementary mycoflora program with Martin Livezey serving as the committee's chair. NAMA also has created a Mycoflora Committee, and its first reports are expected to be released by summer.

All answers in the following interview were provided by Jason, except where otherwise indicated.

Q: Describe the site for the absolute Web/mycology layperson.

A: I'd call it a specialized forum where mushroom lovers of all levels of expertise can post and discuss photos of mushrooms. It is particularly focused on helping folks share "observations" of real mushrooms encountered in the field.

Q: What do you see as obstacles for a first-time user, and how can they ignore obstacles to successfully make a post?

A: I think the site throws a lot of information and links at you right from page one. But really 99 percent of the site is all about just posting and viewing and commenting on observations. All you have to do is choose a user name and password and give us your email address (just so we can weed out spammers and send notifications). Then posting an observation of an unknown or neat mushroom is as simple as clicking on "Create Observation," filling in a few form fields, attaching an image or two, and clicking "Submit." It looks much harder than it is. The thing that surprised me the most early on was how quickly I would hear back from expert users!

Why should amateur mycologists engage with this website as opposed to other

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Meeting File: Millman Divulges Fungal Customs of Remote Cultures

Nicole Reid
MAW Member

Dr. Lawrence Millman joined MAW Nov. 4, 2014, for a delightful conversation about uses of fungi by native northern peoples. Millman is an ethnographer specializing in the lore, myths, customs, and taboos of arctic peoples. He is the author of 16 books including *Giant Polypores and Stoned Reindeer* (2013), *Hiking to Siberia: Curious Tales of Travel and Travelers* (2012), and *Northern Latitudes* (2000).

Millman revealed northern native peoples actually do not eat fungi. Every native group has a disparaging name for fungi including language that translates roughly to "that which makes your hands fall off" and "caribou food." In the central Canadian Arctic, native people consume a round gall that grows on rhododendron and azalea plants in the spring and summer — but they consider this part of the plant and do not recognize its classification as a fungus. One theory explaining this abhorrence of fungi as food is the low caloric return. Due to fungi's high protein and negligible fat content, body metabolism is accelerated and can lead to starvation if fungi is used as a major source of calories.

William Needham

Dr. Lawrence Millman holds up a small polypore he found inside a log while on a foray in Maryland.

Amanita muscaria (fly agaric) was among many species of use to native peoples across the Ameri-

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naturalist sites?

A: To my knowledge, this and shroomery.org are the only forums devoted exclusively to mushrooms. Among our regular users are a large number of world authorities and highly experienced amateurs covering an extremely broad part of the fungal kingdom (and slime molds!) I think MO has proven particularly successful in hooking up amateurs with professional researchers. This should be particularly attractive to "serious" amateurs who'd like to make a modest contribution to science but who are understandably daunted by the extremely steep and long learning curve.

Q: What's the best way to get attention on a post?

A: Post pretty pictures! With good detail of the important features — and even better, show due diligence in recording habitat, substrate, texture, odor, etc.

Q: Why did you originally create the site, and has it morphed beyond that purpose?

A: I originally created the site primarily to make a relatively small collection (about 750 images) of my own available on the Web and to see if others would like to make their images available as well. It has grown way beyond my wildest dreams when I first created it. The most exciting things for me are the interactions with the professional mycology community and the resulting acknowledgements in scientific papers.

Q: Is MO part of the North American Mycoflora Project — or do you hope that it will have a place in the project?

A: MO has been included from some of the earliest discussions of the North American Mycoflora Project. Tom Bruns was a MO user long before he wrote the article in *Inoculum* (the newsletter for the Mycological Society of America) calling for the project, and he has always envisioned a component of the project very much along the lines of MO. Once the Mycoflora really gets off the ground, I expect there will be significant change to MO to support those efforts.

Q: What's the weirdest thing on there?

A: "Weirdest" is a matter of opinion. Some of my favorites are "*Calvatia indigo*": http://mushroomobserver.org/name/show_name?id=25984 and more seriously the rediscovery of *Hypocreopsis rhododendri* in North America after it not being observed there for nearly 100 years (http://mushroomobserver.org/139637). It's also a pretty weird fungus!

Q: As the creators, has the site proven its effectiveness to you personally? Have any posts of your own spurred previously difficult collaboration — or opened up whole new areas of interest for you?

Jason: I have contributed a handful of specimens from Los Angeles, the Great Smoky Mountains, the Florida Keys, and Tierra del Fuego to professional mycologists around the world. I don't know if any have wound up being used in describing species or been cited in papers, but just having researchers contact me to ask for specimens is a huge step above where I was pre-MO.

Nathan: I can't think of any specific posts that inspired new collaborations, but the site was key to my getting my current job leading the technical team for the Encyclopedia of Life (http://eol.org) and was important in creating an ongoing collaboration with Deborah McGuinness, a very well-known computer scientist at Rensselaer Polytechnic Institute.

Q: Where do you see the site in five years? Is there any talk of an app?

A: There are multiple users working on mobile apps as we speak. One in particular has made good progress and looks promising.

I also see [MO] as the digital meeting place for the North American Mycoflora Project and potentially even larger global projects of a similar nature. I hope it increases in value for the scientific community while remaining well-connected to its roots in the amateur community.

Q: I haven't seen any ads or sponsorships. How is MO funded?

MAW Board of Directors

Corrections:

Gerry Barton was misidentified on page 7 of the October 2014 edition of *The Sporophore*. In the identification of mushrooms, we sometimes encounter legitimate disagreement as to the correct or current names. With mushroom hunters, there is far less latitude. We regret the error.

The October issue also included a recipe for "Pidpenyok." While this was the original name of the recipe as found in the cookbook *Hot Off the Grill: Family Favourites* (2013), it probably is derived from the Eastern European nickname for honey mushrooms (*Armillaria spp.*), making the name's use in a recipe for chicken-of-the-woods a bit odd. A more accurate name for mushrooms in this preparation is "Ukrainian-style Dill Mushrooms in Sour Cream."

A: MO is funded mostly out of pocket by Nathan, although donations from the last couple of years have helped defray the costs, too. It is surprisingly low-cost; I'd say the cost in time to develop and maintain the site is far more onerous of a burden.

Q: Are any new features or anticipated releases on the horizon?

A: Yes, we very much want to improve how the mapping works and how the naming system is managed. I also want to improve how name changes get propagated through the system. Ultimately I want to provide a way for people to better describe species in a way that automatically support a computer-aided identification system.

Q: Sometimes MO is a little slow. Is a fix in the works?

A: Our primary focus in the near term is to improve performance. We have recently moved to new hardware and have updated the software running the site. More is definitely in the works in this regard.

Q: Is it easy for developers to get involved?

A: Easier than ever! We've recently made huge improvements in this area. It takes less than an hour from start to finish to download and install a development environment on any platform, from which any user with any level of programming experience will be able to start working on countless issues from minor bug fixes to major feature development, graphic design, language translations, etc.

Q: I've heard some criticism (possibly unfair) of the open voting system and user-chosen naming system. Anyone can supposedly come along and gunk things up. Do you stand behind those features or hope to clean up the process eventually?

Nathan: I definitely have a lot of ideas about how to improve the naming system. I would be interested in any clear cases where someone has actually gunked things up. My general impression is the system has actually worked remarkably well, but there are some deeper conceptual issues that I hope to address in the near future. The idea is essentially to switch to a "last one wins" model similar to how determinations work in professional herbaria. To deal with cases where users are not confident in applying a name, they would have a way to suggest potential names without having that name "win." The biggest question with this model is at what point a name is considered accurate enough to share it with other biodiversity sites. I plan to make the exportability status of an observation much clearer, and I think there will need to be some sort of waiting period for unknown users before they can make official determinations.

Q: Do outdated species names in old posts automatically update?

A: No, by design. Instead we "deprecate" old species names. Observations of deprecated synonyms are still available for searches and range maps and such. We hope to add a tool some day which will allow users to formally propose more current names in place of old ones in bulk, but there are still some issues to work out, odd cases we don't know how to deal with yet.

Martin Livezey

While Mushroom Observer mostly is used for scientific purposes, a few jokes like this bright blue and curiously ceramic "*Calvatia indigo*" have propagated on the site, too.

Q: How do you stay interested in posting to the site while also developing it, being plugged into the mycology community, maybe working a day job, and anything else you do?

Jason: One of the advantages to being a developer is that you can work on the features *you* are interested in. Obviously, the overall vision is all Nathan's, and he has final say in any controversial policies or development directions. But by and large, we're happy for any help we can get, and developers have a great deal of latitude in deciding what to work on and how to implement it.

Nathan: It's a passion. The time I have for it changes over time, but it is part of my life and I know I'll always be adding to it.

2015 Board Members Elected, 2nd Vice President Confirmed

Willow Nero
Sporophore Editor

At the MAW monthly meeting Dec. 2, 2014, a quorum of members voted in the slate of board members recommended by the nominating committee.

Three newcomers to the board are Elizabeth Hargrave, Sean Sully, and Chandler Wiegand, who will serve as secretary, culinary chair, and membership chair, respectively. Other board members are as follows: Mitch Fournet, president; William Needham, vice president; John Harper, treasurer; Willow Nero, editor; Daniel Barizo, programs chair; Jon Ellifritz, foray chair; and Bruce Boyer, NAMA trustee.

The nominating committee made several bylaw change recommendations, including adding the board position of second vice president, for which they nominated Connie Durnan, outgoing NAMA trustee. Among the other proposed changes are updates to several nonvoting positions such as media, digestor, and displays; incorporation of professional conduct rules into regular monthly meetings; and establishing board member term recommendations. Full bylaw changes will be introduced at a future MAW meeting and subsequently voted upon by the membership.

Rather than immediately amend the MAW bylaws, board members voted at a late December meeting to approve in the board rules for 2015 the addition of second vice president to the roster of officers. As suggested by the nominating committee, Durnan was confirmed for this role in 2015.

MAW members can access minutes of the recent board meetings at regular club meetings. Historical board meeting minutes are available at www.mawdc.org.

Gastronomy

From Field to Fridge and Beyond: Special Treatment Required

Ray LaSala
MAW Member

Editor's note: This article is a continuation of "From Field to Fridge and Beyond: Handling Fungi," which appeared in the Fall 2014 issue.

Several types of mushrooms need special treatment. Mushrooms with sticky or slimy cap cuticles, such as slippery jacks, will stick together if simply refrigerated straight from the field, and the dried material that adheres to the cuticle will be even harder to get off later on. The remedy is simple: just peel off the cap cuticles with all the crud still on them before refrigerating them. I've given up trying to keep fresh oyster mushrooms or umbrella polypores in the refrigerator; all too often they develop infestations of larvae that thrive even after being chilled. Instead, I clean them and heat them to the boiling point to pasteurize them before any critters have a chance to grow before I refrigerate them. Shaggy manes will rapidly deliquesce once their caps have popped open and their gills are exposed to oxygen. The high-tech solution to this is to keep them refrigerated under an oxygen-free gas blanket such as carbon dioxide, nitrogen, or even argon; the low-tech solution is to rinse them off and pasteurize them immediately upon getting them home. However, shaggy mane buttons whose rings have not yet popped can successfully be held completely immersed in water (to exclude air); and really tight, young shaggy mane buttons can be treated just like any other button because they simply will not mature enough to pop open and expose the gills.

Finally, a few words about cleaning. Conventional wisdom says mushrooms should never be washed, only gently brushed or wiped with a damp towel. Water is said to wash away flavor, but I don't subscribe to that school of thought. No matter how carefully you brush or wipe them, there's always going to be some grit and maybe even fine or hidden detritus. I find grit really distasteful and impossible to ignore, so I almost always rinse mushrooms before cooking them. However, I've never found it necessary to rinse milky beefsteaks or fresh, crisp morels. Dirt just doesn't seem to adhere to them very well or can be knocked loose simply by letting them bounce onto a countertop from a height of a few inches. By all means, do remove what dirt you can from the caps and the stems of mushrooms with a dry brush or a damp towel first; but believe me, you'll be better served by also giving them a quick rinse before they are cooked. The trick is in knowing how.

Sturdy mushrooms such as unexpanded buttons, polypores, and golden or cinnabar chanterelles that have relatively a small surface area relative to their weight can be briefly immersed in several changes of cold water and then immediately spin-dried in a salad spinner. Very little water will be retained, and I've never noticed any difference in flavor. If you're a real fanatic, you can put them on a dehydrator (or under a hair dryer set on low) for a few minutes just until the surface moisture has evaporated but before they dehydrate. I treat oyster mushrooms the same way even though they are not very dense. They will absorb a large amount of water, but they're going to throw off water in the pan whether you give them a bath or not.

The undersides of the caps of mushrooms that have gills, tubes, or teeth absorb so much water that it is not a good idea to get them wet. Trimming off the dirty base is usually all that is needed to clean the stems. You can rinse the tops by holding the mushrooms under a spray of water in their upright position like little umbrellas, gently rubbing the cap cuticles with your fingertips to free any attached dirt — but that can be really tedious. I like to clean such mushrooms en masse by arranging them in a tall wire rack with the undersides of the caps flush with the top of the rack and the stems extending down between the bars of the rack. The rack needs to stand tall enough to provide clearance for the stems beneath it. I place the loaded rack underneath a spray of cold water in the kitchen sink, giving several dozen mushrooms a shower all at once. The gills, which generally do not need to be cleaned, will stay dry under the caps.

If you follow these guidelines, you can enjoy perfect mushrooms for days after they've been harvested, from field to fridge and ready for your favorite recipe. Happy hunting, and *bon appétit*!

Portobello Cheesesteaks

1 6-ounce package sliced portobello caps
Salt
Vegetable oil
½ large onion, thinly sliced
½ teaspoon dried oregano
4 slices American, Romano, or Mozzarella cheese
2 long sandwich buns or hoagie buns (6-8 inches)
⅓ cup sliced cherry peppers or banana peppers

Preheat the oven to 350 F.

Place the mushrooms in a large saucepan and liberally sprinkle with salt. Add ¼ cup water, turn the heat to medium, and cover. After 6 minutes the mushrooms will have released most of their liquid. Salt again so the mushroom flavor is very strong, and remove and place the mushrooms on a towel-lined plate.

Place about 2 tablespoons of oil in an 8-inch saute pan and add the onion. Fry the onion until very limp and browned, about 10 minutes. Turn down the heat to low, and season with a little salt and the oregano. Form the onion into a rectangular shape and cover with the cheese. Cover the saute pan, and keep on the heat until the cheese melts. Remove the cover and cut the onion-cheese mixture down the middle so you have two thin, narrow halves.


Willow Nero

Cut the buns almost in half lengthwise, making sure the "hinge" stays fully intact. Place half the onion-cheese mixture onto each bun with a spatula, and add half the mushrooms. Cover with the warm sauce, and finally add the hot peppers.

(MAW Second Vice President Connie Durnan made this dish for the 2014 fall tasting, using this recipe from Phillips Mushroom Farms.)

The Scoop on Phillips Mushroom Farms

Anthony Waisanen
MAW Member

Editor's note: This is a continuation of the article "Inside Phillips Mushroom Farms" from the Fall 2014 issue of The Sporophore. *In August, Waisanen picked up Phillips Mushroom Farms' donation of cultivated mushrooms for MAW's tasting meeting. Waisanen toured Phillips' facilities and got a chance to chat with Kristine "Tina" Ellor, Phillips' technical director.*

Q: Do wild mushrooms have more or better flavor than cultivated mushrooms?

A: It depends. Wild mushrooms are higher in solids (drier), grow more slowly, and have much higher vitamin D levels. Exposing commercial mushrooms (e.g., portobellos) to direct outdoor sunlight improves their vitamin D content! Outdoor grown shiitake have a more intense flavor than indoor ones. Some people prefer a milder flavor.

Commercially grown can also be more tender (e.g., maitake).

Commercial mushrooms are bug-free, too.

Q: In your opinion, what is the value of amateur cultivation? Is it like owning a boat — a black hole for time and money?

A: There's no reason why people shouldn't grow mushrooms in their backyards like they grow tomatoes. I'd like to see more people growing more of all kinds of food.

Q: How and where can people buy Phillips mushrooms?

A: You can buy them directly from the Woodlands at Phillips, 1020 Kaolin Road, Kennett Square, PA 19348 (about 100 yards down the road from the farm). [Phillips mushrooms also are sold in grocery stores across the country.]

Q: Why does Phillips contribute to MAW? What's in it for you?

A: I have a long-time relationship with MAW, and I hope the club will support my forays.

Q: Is Phillips Mushroom Farms associated with Phillips Seafood Restaurants?

A: No. In fact, the Phillips Seafood sued Phillips Mushrooms for trademark infringement.

Q: What is your greatest challenge?

A: Phillips must comply with multiple regulatory agencies and is subject to many inspections by many different organizations, both government and by our suppliers.

Of all healthful foods, mushrooms have and provide natural protection against "bad bacteria." In fact, a succession of microorganisms are grown to create the perfect food for growing Agaricus mushrooms. There has never been a case of someone getting a foodborne illness from fresh cultivated mushrooms, so it seems a shame to be pouring so much money and time into solving a problem that never was.

Q: Why are there so many mushroom farms and why is there so much interest in mushrooms in Chester County, Pennsylvania?

A: Chester Country is the Mushroom Capital of the World!

Chester County has some of the best agricultural soil in the world — Chester Loam. It is near big metropolitan areas like Philadelphia, Pennsylvania; Washington, District of Columbia; and Wilmington, Delaware. At the time that mushroom cultivation started in this area, horses were still the main source of transportation and horse manure was a problem for those cities. There was also a good transportation structure in place in the form of roads and rails. So horse manure could be transported to Chester County, and fresh mushrooms, which have a limited shelf life, could be easily shipped to cities up and down the eastern seaboard. There was a long history of farming in the area, which was predominantly settled by Quakers. Quakers already had a strong greenhouse industry established, and John Swayne found that he could grow mushrooms under his greenhouse benches. He found that mushrooms were more profitable and started putting up special houses to grow just mushrooms. Italian laborers found the work in mushroom houses more pleasant than working in the stone quarries and soon owned many mushroom farms themselves. Both of those groups had a strong agricultural background and great work ethics.

It's not likely there will be new farms. Most farms are multigenerational. Phillips is third generation. Today, Chester County land is selling for $100,000 an acre!

To start a mushroom farm here now would be cost-prohibitive.

Photos Courtesy Kristine Ellor

Agaricus bisporus buttons (above) and golden oyster mushrooms (top) are nearly ready to be picked after several weeks of growth at Phillips Mushroom Farms.

Q: Why are mushroom doubles [the rooms where mushrooms are grown] called "doubles"?

A: Originally, growing was done in buildings with one door under one pitched roof containing two tiers of beds. These buildings were built into hills to take advantage of geothermal stability. To maximize volume of product without linear increase in costs, buildings were widened to have a single pitched roof but two doors and four tiers.

Meeting File

Aug. 5 — Tovi Lehmann Introduces Fungus-Tree Specificity

Jon Ellifritz
MAW Foray Chair

Editor's note: Please excuse the interrupted coverage of lectures. A full summary of Lehmann's presentation was not previously available.

The speaker at the Aug. 5, 2014, MAW meeting was MAW member Tovi Lehmann, who addressed the issue of fungus-tree specificity, i.e., the degree to which individual species of fungi have mutualistic or other close relationships with a limited number of plant species. It has been estimated 90 percent of vascular plants have mycorrhizal partnerships with fungi, and these relationships might even be considered a type of "marriage," since the plant host and fungal parter usually engage in mutually beneficial exchanges of complex plant-produced carbohydrates for the fungus' access to a much broader area for the collection of water and minerals.

Some fungus-tree relationships are unequal, where one "partner" feeds on the other. When a fungus is essentially parasitic on its plant partner, it is considered a pathogen, although it usually doesn't kill the host. As an example of a one-sided relationship in the opposite direction, virtually all orchids (the largest plant family) are dependent on fungi for their survival, at least some of the time in their first few years. Their seeds are tiny and lacking in food reserves, thus making them dependent on their associated fungi for nutritional needs, essentially a parasitic relationship.

The apparently conventional view of evolutionary biologists and others is that because the symbiotic relationships between plants and fungi co-evolved over millions of years, there should be a great deal of specificity in these relationships — if not one fungus species per plant species, at least something close to that. In actuality, such specificity is quite rare. As for endomycorrhizae (one-celled fungi living within the plant), there are only about 150 species of fungus available to form endomycorrhizal relationships with perhaps tens of thousands of plant species. The situation is much less extreme with ectomycorrhizae (large fruiting bodies whose subsurface mycelia form networks around tree rootlets), where there are probably thousands of mycorrhizal species, but still probably tens of thousands of associated plants.

Rather than monogamous marriage, these relationships may be more like "open marriages." We have learned from MAW speakers over the years that some individual trees may have 20 or 30 fungal species as partners at any one time, and some tree species can have a succession of partners depending on the age of the tree.

A relative lack of specificity in plant-fungus relationships is almost certainly beneficial to both partners from an evolutionary adaptation and survival perspective. If one partner disappears or wanes in number, the other will still have potential partners, whereas strong dependence on one single species from another kingdom would inevitably lead, if that species itself disappeared, to the extinction of the other.


William Needham

Dr. Jill Demers from the U.S. Department of Agriculture explains the importance of U.S. border quarantines on plants and fungi.

Oct. 7 — USDA Scientist Explains the Quarantine to Impede Invasive Rust Fungi

William Needham
MAW Secretary

On Oct. 7, 2014, Jill Demers from the U.S. Department of Agriculture Mycology and Microbiology Laboratory at Greenbelt, Maryland, provided an overview of rust

Upcoming Events

Jan. 24 — Mushroom Medicine: The Basics workshop. Smile Herb Shop, College Park, Maryland. 11 a.m. - 3 p.m. More information: (330) 606-6376, www.boulderm ushrooms.com.

Feb. 3 — monthly meeting with speaker Joyce Harman, an avid professional photographer.

March 3 — monthly meeting.

April 7 — monthly meeting.

MAW's April, May, and June meetings will be held at the Davis Library, 6400 Democracy Blvd., Bethesda, MD. Unless noted, meetings are held at 7 p.m. on the first Tuesday of the month at the Kensington Park Library in Kensington, Maryland. Attendees are encouraged to bring mushrooms for sharing and identification. Members of the public are welcome to drop in.

Save the Date. Don't miss these big events in 2015!

July 30–Aug. 2 — North East Mycological Federation (NEMF) foray at Connecticut College. More information: www.nemf.org/foraynext.htm

Aug. 28-30 — MAW's 4th Joint Appalachian Foray at Graves Mountain Lodge in Syria, Virginia.

Sept. 18-20 — MAW's Camp Sequanota weekend foray in Jennerstown, Pennsylvania.

Sept. 24-27 — NAMA 2015 foray in Black Mountain, North Carolina. More information: www.namyco.org/events

fungi with an emphasis on invasive species.

Rust fungi are outside the purview of most MAW member activities. The presentation by Demers from USDA Beltsville provided an introduction to the Pucciniales that was both interesting and informative. To impart enthusiasm for what may seem a mundane subject, she started with

Willow Nero

Dr. Jonathan Reisman started his talk with descriptions of mycotoxins such as ergot, which can necrotize tissue if ingested in large quantities.

the notorious wheat rust fungus (*Puccinia graminis*), which has a complex life cycle that includes barberry (*Berberis vulgaris*). When an airborne spore germinates on a wheat plant, the fungal mycelium spreads over the individual grains (which renders them inedible), producing more spores that can infect other wheat plants during the growing season. At the end of the season, the fungus produces a second type of spore that does not infect the wheat but requires the barberry alternate host. The sexual union on the barberry leaf produces yet another type of spore that completes the cycle, i.e., it germinates on wheat grain where its immediate host, barberry, is immune. To protect the vital wheat crop, a comprehensive federal program to eradicate barberry was established by the USDA in 1918. Over the next two decades, over 120,354 properties in 17 states were cleared of almost 300 million barberry plants. This affirmed that rust fungi are important. The most common rusts in Maryland are *Allodus podophylli* on mayapple, *Puccinia mariae-wilsoniae* on spring beauty, *Gymnosporangium juniperi-virginianae* on cedar and apple, and *Coleosporium solidaginis* on goldenrod.

The program concluded with the most significant plant pests intercepted at U.S. borders by the USDA Animal and Plant Health Inspection Service (APHIS). *Puccinia horiana* or chrysanthemum white rust was originally from Japan and is now the most common rust fungus intercepted at the borders (about 600 per year), which results in the destruction of more that 50,000 plants per year. The other intercepted rust fungi were *Uromyces transversalis* (gladiolus rust), *Puccinia buxi* (boxwood rust), and *Puccinia hemerocallidis* (daylily rust).

Demers summarized the presentation by noting rust fungi are serious threats to agricultural products in the U.S. and quarantines are needed to prevent their spread.

Nov. 4 — Lawrence Millman Divulges Fungal Customs of Bygone Cultures (Cont.)

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-cas. The Big River People of the Yukon region used *Amantia muscaria* during religious rituals to allow one's consciousness to enter the spirit of an animal. The preferred method of attaining this experience was to select a girl who would eat the mushroom. Then her urine would be collected and ingested by those who sought the religious experience. In the 1920s, Gordon Wasson, the father of ethnomycology, introduced psilocybe to North America from Mexico and developed a passion for *Amanita muscaria*. Wasson was the author of a book titled *Soma*, in which he argued that the Oracle at Delphi owed her predictive abilities to the consciousness altering properties of *Amanita muscaria*. However, the responsible substance was most likely ergot, as *Amanita muscaria* does not grow naturally in Greece.

Travelling further back in time, Ötzi, the bronze age Tyrolian ice-man who was defrosted in 1992, carried two polypores on his person — the birch polypore (*Piptoporus betulinus*) and the tinder polypore (*Fomes fomentarius*). Both specimens were thought to be used medicinally as antiparasitic agents. They are also excellent insect repellents when dried and ignited and allowed to smoke and burn. Similarly, in Siberia the tinder polypore and the false tinder polypore (*Phellinus ignirius*) were utilized by shamans to get rid of evil spirits. The shaman would burn the polypore and chant to the spirit of the dead who is "trapped" in his or her home in this world, allowing the spirit to be released into the next world. Additionally, it was believed that burning the polypore could dispel the invisible, six-legged polar bear that would sometimes haunt the native people. *Phellinus ignirius* (also known as the false tinder conk or false birch polypore) is also used in Alaska as an efficient delivery system for nicotine. The fruiting body is burned to ash and placed in a leaf of tobacco that is then chewed. This is known as "iqmik," and the alkaline ash enhances both the effects and addictiveness of the nicotine in the tobacco. In the 17th century, iqmik was developed in this form when whalers brought tobacco leaves to Alaska, however, the practice is ancient, and prior to access to tobacco, the leaves of willow trees were used. This was likely a medicinal method to access the salicylate (aspirin) found in the willow tree.

The importance of ethnomycology is likely fairly obvious to MAW members, but it is tragically illustrated by the winter dance ritual of certain Northwest peoples. This dance ritual was possibly related to finding food during the tough winter months or appeasing winter gods. As part of the dance, a ganoderma would be painted with a grinning face. Unfortunately, this dance has not been performed for 80 years and both the meaning of the dance and the significance of the polypore have been lost.

Learn more about Millman's travels and fungal studies in an excerpt from and a book review of Giant Polypores and Stoned Reindeer, *page 9.*

Dec. 2 — Dr. Jonathan Reisman Reviews Serious Mycotoxins and Fungal Infections

Willow Nero
Sporophore Editor

Dr. Jonathan Reisman, M.D., an internist and pediatrician from Massachusetts General Hospital, was able to blend two of his interests — mycology and medicine — in his Dec. 2 presentation to MAW members about mycotoxins and fungal infections.

While the mycotoxins Reisman introduced can be life-threat- Continues on page 8

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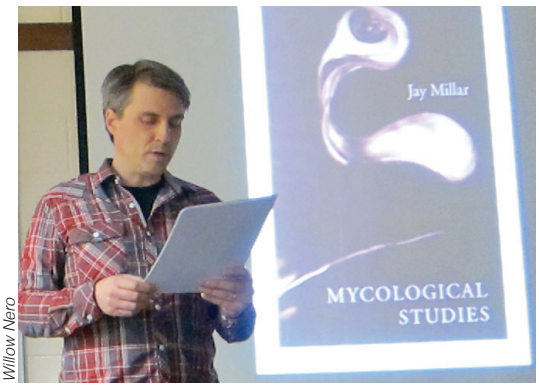
ening, some are showing promise in the treatment of various medical disorders. Extracts from ergot, for example, have been used as an experimental migraine treatment and also help the uterus contract after childbirth. Phalloidin, one of the toxins present in *Amanita phalloides*, will destroy your liver, but it's also helpful in medical research because of a novel effect it has on the filamentous protein, actin, which makes up a skeleton of protein inside cells. When phalloidin is injected into a cell, it illuminates the actin and allows for a better view of cellular processes.

Worringly, fungi can inhabit cavities such as the sinus and lungs and develop a mycetoma or fungal ball. "All the IV antifungal drugs in the world are not going to get into the cavity because there is no blood flow in that cavity," said Resiman.

For immunocompromised individuals undergoing steroid or chemotherapy treatment or those who have TB, infections of the bone marrow, HIV/AIDS, and other problems, common fungi can enter the body and grow to dangerous sizes in organs, cause tissue to necrotize, and wreak other havoc. "Without our immune systems, we are basically agar," Reisman warned.

Intravenous drug users also are at risk to fungi and yeasts that take advantage of immunosuppression. Reisman recalled one patient in his care who had injected with his heroin swamp water containing enough microbes "to make a microbiologist giddy with the variety of fungi and yeast." When these everyday organisms enter the blood stream, they can make their way into the eyes, the brain, and plenty of other critical organs and multiply at alarming rates.

Jan. 6 — Writer Jay Millar Introduces Mushroom Enthusiasts to Mycologically Assisted Poetry



Willow Nero

Jay Millar reads excerpts from his book *Mycological Studies*, in which he says he allowed the idea of mycological growth to permeate his poetry.

Willow Nero
Sporophore Editor

If given the chance, how would mushrooms communicate or express poetic urges through human language? MAW guest speaker Jay Millar tackled the topic Jan. 6, drawing on his 2002 book *Mycological Studies*, which was inspired by studying the growth of mushrooms.

Before introducing his unique "mushroom form" poems, Millar set the literary stage for the MAW members in attendance. At the time of *Mycological Studies*, Millar says, Christian Bök's *Eunoia* had just been released to wide reception. Bök experimented with language and produced poems using only a single vowel per chapter to illustrate those vowels' personalities. Millar says this inspired him to explore constrained form, but he wanted to stay true to nature, which likely has its own, unexpected language.

"At about this time, I started considering could there be such a thing as an organic constraint?" he said.

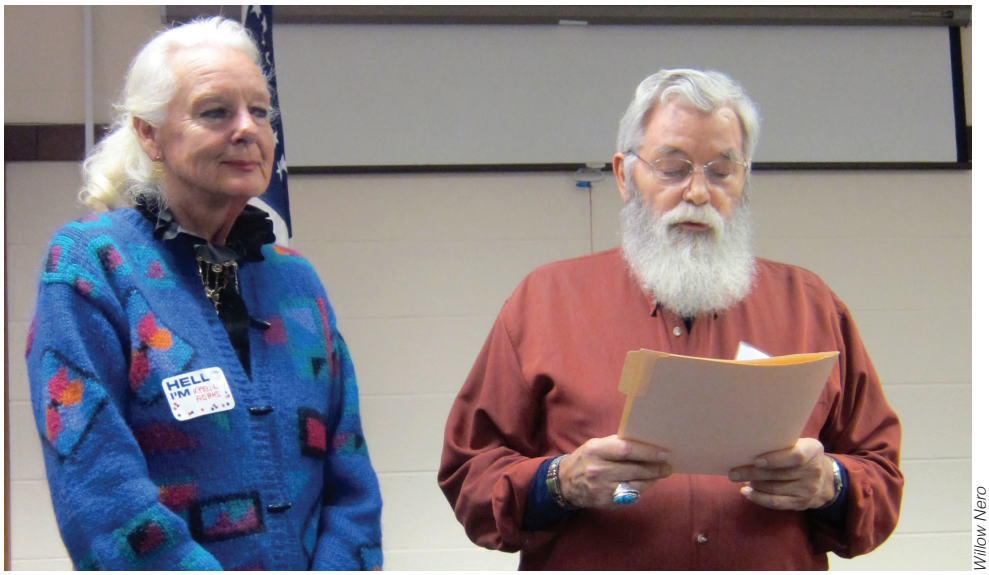
A chance occurrence cemented mushrooms as the media; one day Millar stumbled into an immense patch of wild mushrooms in an area where he says he never saw as many specimens before or after. Stirred, Millar read up using mushroom field guides. He considered John Cage's comparison of poetry to foraging — Cage would spend a day ambling and then suddenly the poem — or the mushroom — would appear. *How would a mushroom write a poem?*

"This also seemed at the time to be a very natural way of exploring writing," Millar explained. "There is this thing that rises in one and requires a poem to develop."

Further, the word *mushroom* contains *room*, Italian for "stanza," a little room. Millar then imagined the effects of mushroom growth and reproduction as a poem. "Would different texts be able to infect each other and produce new texts?" he challenged himself.

The result is three very different chapters of mushroom-infected poetry. Some poems evoke fungi primarily in the hallucinatory experience Millar hoped would come of a mushroom-language hybrid as "language itself is a hallucinogenic experience." Other poems spawned and mushroomed from these, sometimes relying on source texts from mushroom field guides. The final poems alight from the others, pulling in common words and pieces to become almost prose-like poems that fill pages leaning heavily on repetition and the reader's imagination to make sense of the fungally assembled and inspired fragments of thoughts.

Longtime Hospitality Chair Receives Life Membership



Willow Nero

MAW member Karin Adams listens as then-MAW President Bruce Boyer reads a letter outlining Adams' dedication to MAW and its members. The MAW board of directors voted unanimously in October 2014 to grant Adams a life membership in the association.

Collecting for the Table: A Polemic

Lawrence Millman
MAW Guest Speaker

Editor's note: This excerpt comes from Lawrence Millman's recent book Giant Polypores and Stoned Reindeer *and also appeared in* The Mycophile*, the newsletter of the North American Mycological Association.*

Increasingly, I object to the idea of collecting mushrooms for the table. The table to which I'm referring is not one's dinner table, for I have no objection to the harvesting of wild edibles. No, I mean the collection tables that occupy pride of place at local and regional forays of several days' duration.

Here's the scenario: a brigade of mushroom hunters lights out for the woods, each of them armed with a capacious basket. Into these baskets they'll toss every specimen they find, *Amanita* or *Mycena*, *Russula* or *Crepidotus*, polypore or cup fungus, then bring back their booty for the foray's experts to sort out and identify. The specimens will be accompanied by a dearth of data. What's the substrate? "Under a tree" or "on a log," the collection notes might say.

At this point, the experts — often thirty-something males eager to brandish their egos — will put names on the specimens with such alacrity that they could easily be tossing confetti. Never mind that many of the specimens on the table can be identified only with the assistance of a microscope.

The tables in question will have hundreds of paper plates on which the mushrooms rest forlornly while they wait to have names put on them. At a Pennsylvania foray I recently attended, there were perhaps a dozen plates piled high with the same Boletus species. If I were a mycelium, I'd be greatly disturbed by this sort of thing. I might even try to evolve a different, scarcely visible fruiting body, the better to keep it from ending its life on a collection table.

But there's worse to come. All during the foray, the specimens will remain on their plates, becoming "dehydrated, shriveled, and stanched from releasing spores," in the words of mycologist Nick Money. In the end, virtually all of them will be dumped into a plastic garbage bag. Not set aside for an herbarium. Not spreading any spores. Not oven-dried for future use. Not even dined upon. Simply turned into trash. Hardly a fate that any self-respecting mycelium would wish on its creation.

Well, at least that mycelium itself is not disturbed, you might say. But not so fast. The mycological jury has not yet come up with a verdict on this subject. For much of a mycelium's biomass and an undetermined portion of its energy is transferred to its fruiting bodies, which are in effect its reproductive organs. How would you like it if someone came along and yanked off your genitalia? I suspect the mycelium might feel the same way.

To collect or not to collect, that is the question. Personally, I think it's nobler to study the objects of one's interest in the field rather than watch them dessicate on a table. And if mycophiles do that, they might find out how different species relate to their respective environments. They might also ask themselves some important questions: Why, for example, are insects congregating on a certain species? What's the smell of a particular species when fresh? And what the blazes is the tree under which a particular specimen is growing?

So, please, let's try to collect a little less promiscuously. If you don't pounce upon every frog, possum, warbler, butterfly, maple sapling, or trillium you see and toss it into your basket, then you shouldn't engage in such pouncing with mushrooms. In fact, mushrooms — more than almost any other organism — are essential for environmental health, climate control, and the maintenance of biodiversity. Vastly more than a certain brash hominid I know ...

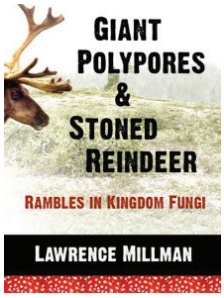
In the end, too much collecting might mean fewer mushrooms, which could result in less genetic diversity, which in turn might result in even fewer mushrooms. With too few mushrooms, there's always the possibility a species might become critically endangered or even extinct. And, to quote Oscar Wilde, you don't want to kill the thing you love, do you?

Willow Nero

A "forlorn" group of unidentified and quickly perishing mushroom specimens waits to be scrutinized and assigned names at a foray.

Short, Lively Stories Abound in Millman Text

Bruce Eberle
MAW Member



Giant Polypores & Stoned Reindeer: Rambles in Kingdom Fungi by Lawrence Millman. Komatik Press, 2013. $17.50

This book truly deserves the exceptional accolades given it by mycologists Elio Schaechter and Britt Bunyard. It is a joy to read the short, lively stories and learn a lot about whatever you did not realize you really wanted to know about.

Lawrence Millman is a world traveler. He has an encyclopedic knowledge about what is going on in the technical side of the field of mycology. Yet, he is able to make the details both accessible to the reader and to make them entertaining to boot.

From fungal infections of some varieties of platypus, to a symbolic trip up Mount Everest, to an unusual Asian fungus' mystertious appearance in New England, Millman traverses the globe and kingdom fungi. The reader is indeed in for a treat!

Fungus Notebook: The Ceramic-Smooth Artist's Conk

Willow Nero

Ganoderma applanatum has a smooth white pore surface that is easy to inscribe with a blunt object.

William Needham
MAW Vice President

Common Name: artist's conk, giant shelf fungus, tree tongue, white mottled rot fungus, kofukitake (Japan), flacher lackporling (Germany), Трутовик плоский (Russia, pronounced troo-to-vik plo-skeye). The white pore surface stains brown when compressed according to the applied pressure creating an image that persists in perpetuity; it is a natural artist's canvas. Conk is a term for any fungus that is attached to a tree like a bracket (an architectural shelf support).

Scientific Name: *Ganoderma applanatum*. The generic name is a combination of the Greek words *gano* "brightness" and *derma* meaning "skin." *G. lucidum*, which has a shiny upper surface, is the type or characteristic species for the genus. The name *applanatum* is derived from the Latin planum meaning "plane" to describe the flat, bracket configuration of the fungus.

The artist's conk is a global species that subsists on both hardwood and coniferous trees as a parasite, sometimes killing its host, and as a saprophyte when its host dies. It is a white rot fungus and consumes both the structural cellulose and the binding lignin of the wood. (Brown rot fungi degrade only the cellulose, leaving brown, block-like chunks.) The plurality of common names is evidence of the artist conk's presence on every continent except Antarctica, which, among other things, has no trees. It is readily recognizable for its ceramic-smooth, white-pored underside and for its wrinkled brown cap surface that looks like the furrowed brow of J.R.R. Tolkien's Treebeard; it is nearly as old. The perennial *G. applanatum* can live for over 50 years. The notoriety of *G. applanatum* is due in no small measure to its canvas-like pore surface, an artist's easel that needs no paint. As is the case with many of fungi, the application of pressure causes a color change, in this case from white to brown (known as "staining brown" in the lexicon of mycology). What is unusual about the artist's conk is the delicate application of pressure with a blunted stylus results in gradations of brown that can produce the chiaroscuro effects of portraiture — so much so that, according to *In the Company of Mushrooms* by Elio Schaechter, a church, Nuestra Señora del Honguito, in the Mexican state of Puebla is dedicated to a fragment of ganoderma showing what is believed to be the image of Christ on the cross. While religious pareidolia is not uncommon, this may be its only manifestation on a fungus. These remarkably detailed scenes that can be created with a modicum of effort and a little imagination are indeed characteristic of the artist's conk.

The almost vitreous smoothness of the pore surface is due to the miniscule size of the pores, which are impossible to visibly discern without magnification; their 200 micron diameter is about twice the width of a human hair. The large collective pore surface area combined with the small individual pore size results in many pores — and a barrage of spores. According to David Aurora in *Mushrooms Demystified*, a large artist's conk "liberates 30 billion spores a day for 6 months of every year, or more than 5,000,000,000,000 (5 trillion) spores annually." The astronomical spore count relative to the paucity of mature conk fruiting bodies is ample evidence of the infinitesimal probability of a single spore succeeding in reproduction. The billions of brown spores permeate the air around the fungus as they are carried by the wind in all directions, including up. The envelopment of brown spores results in the cap surface becoming haggard with age; it's an "old man of the woods" in both age and appearance. (*Stobilomyces floccopus* is called the old-man-of-the-woods due to its shaggy, scaled, and venerable-looking cap surface, but it is an ephemeral, bolete-type pored mushroom that rises from the ground only on occasion and has longevity of weeks, not years.)

Ganoderma applanatum is a polypore (literally "many pores"), which is a general term that refers to the presence of pores (instead of gills) on the underside of the cap in a bracket or shelf presentation. (Boletes have pores but a cap and stem configuration.) Polypores have traditionally been placed in the order Polyporales, the family Polyporaceae and the singular genus *Polyporus*. However, the systematics of the polypores has been subject to significant revision, and there are now about 50 genera of "polypores;" those that remain in the genus *Polyporus* are, according to Gary Lincoff in *The National Audubon Society Field Guide to North American Mushrooms*, "annual and stalked, with pale-colored flesh and cylindrical, colorless spores." The confused taxonomy of polypores is evident in the variety of scientific names that has been used for the artist's conk. In addition to *Ganoderma applanatum*, *Polyporus applanatus*, *Boletus applanatus, Fomes applanatus, Fomes vegetus*, and *Elfvingia applanatus* have been used and are still found in some references.

The types of hyphae are one of the key taxonomic determinants to the new genus assignments for the once predominant *Polyporus*. The hypha is the essence of a fungus; it grows from the originating spore and extends in a filamentous tendril in search of nutrients much like the roots of a plant. As hyphae that are "sexually compatible" meet, they combine their nuclei in a double-nucleus cell called a dikaryon and separate into segments as they

grow; a configuration that is called septate. The plexus of the many hyphae form the epigeal body of the fungus, which is called the mycelium. Polypores are made up of three types of hyphae: generative, skeletal, and binding. Generative hyphae are as described above in that they grow in the assimilation of nutrients. Skeletal hyphae are thick-walled and are not separated into segments (nonseptate); they provide rigidity to the polypore. Binding hyphae are also nonseptate but are thin-walled to intertwine with the generative hyphae or with both the generative and the skeletal hyphae. Polypores can therefore be monomitic, dimitic, or trimitic. Monomitic fungi that only have generative hyphae, such as the White Cheese Polypore (*Tyromyces chioneus*), are relatively soft and pliable. Dimitic polypores that consist of both generative and binding hyphae, such as the chicken-of-the-woods or sulfur shelf (*Laetiporus sulphureus*), are also pliable and soft, but they can be broken into segments readily. Dimitic polypores that consist of generative and skeletal hyphae (e.g., the artist's conk) are very hard and tough. Trimitic polypores in which all three types are present, such as the turkey tail (*Trametes versicolor*), have some pliability when they are young but grow stiff and rigid with age.

Ganoderma applanatum is not considered an edible fungus, as its dimitic skeletal hyphae make it too tough for human consumption. This is apparently not an issue for our fellow primates. In the book *Gorillas in the Mist*, Dian Fossey offers the observation: "Still another special food [for the gorillas] is bracket fungus. ... The shelf-like projection is difficult to break free, so younger animals often have to wrap their arms and legs awkwardly around a trunk and content themselves by only gnawing at the delicacy. Older animals who succeed in breaking the fungus loose have been observed carrying it several hundred feet from its source, all the while guarding it possessively from more dominant individuals' attempts to take it away. Both the scarcity of the fungus and the gorillas' liking of it cause many intragroup squabbles, a number of which are settled by the silverback, who simply takes the item of contention for himself."

As the behavior of animals in the wild is governed by the successful adaptations that have withstood the test of time, the observed attraction of the gorillas to the impenetrable conk must be based on its taste or aroma. These sensory perceptions did not transfer to the *Homo sapiens* branch of the primate tree, as the artist's conk is rock hard and, when ground up and made into a tea, has a taste that is at best bitter or "earthy." Perhaps gorillas pursue the fungus for another reason: health. This is not as far-fetched as it sounds.

The fungi of the genus *Ganoderma* are noted for their historical use by the various Asian cultures. *Ganoderma lucidum* is known in China as either *ling zhi* or *ling chi*; the word ling in Chinese translates with some license to "spiritual, miraculous, and/or divine," intending to convey its efficacy and provenance. In Japan, *G. lucidum* is called *reishi*, which means something like "auspicious plant" or "immortality plant," and also *mannentake*, which translates to "10,000-year mushroom." The latter is a metaphor regarding the increased life of the person and not to the life of the fungal fruiting body, which lasts for only one season a year. This is not the case with *Ganoderma applanatum*, which is sometimes called the ancient reishi due to its near sexagenarian longevity. There is no indication that the artist's conk was historically used for medicinal purposes by ancient people (gorillas don't count); however, relatively recent research revealed this was a matter of omission and not commission. The ancient reishi has been shown experimentally to have potential as an antibiotic to deter bacterial infections, as an agent to inhibit the growth of tumors, as an antioxidant, and as a treatment for diabetes.

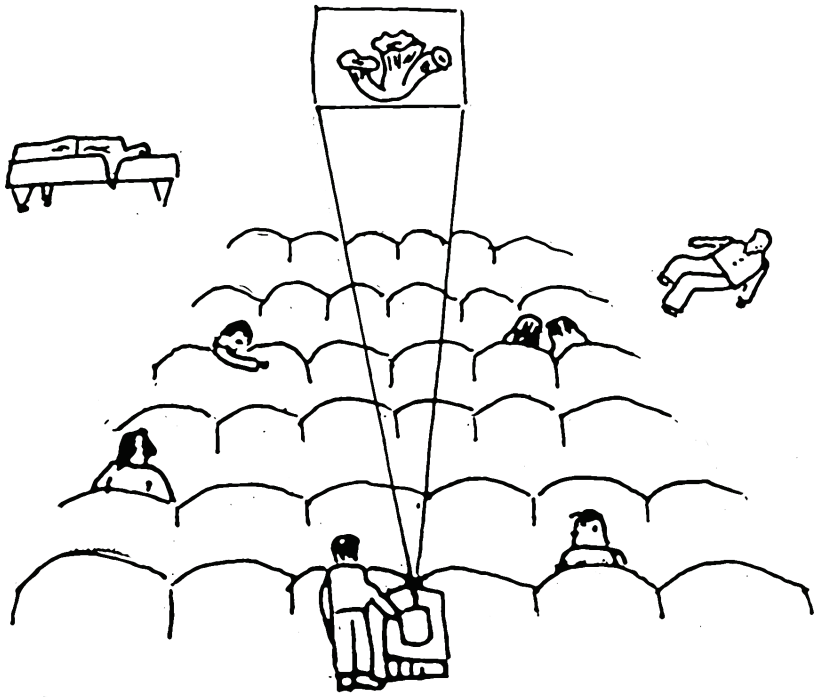
The increasing virulence of drug-resistant bacteria coupled with the dearth of antibiotic research and development is one of the existential concerns of modern society, portending a pandemic in the making. Fungi in general and *Ganoderma applanatum* in particular offer some hope in this regard. An article in *The Journal of Biomedicine and Biotechnology* in 2014 found an exopolysaccharide preparation from *G. applanatum* (called GpEPS) resulted in 82.8-percent cell damage to the bacterium *Vibrio fisheri* (associated with seafood poisoning) and showed antibacterial properties against the *Staphylococcus aureus* strains. *S. aureus* is one of the primary concerns of the U.S. Centers for Disease Control and Prevention due to its ubiquity and history of becoming increasingly drug resistant. Staph infections were originally treated with penicillin after the "miracle drug" (also a fungus) was discovered in 1943; now 98 percent of *S. aureus* is resistant. Newer antibiotics, first methicillin then glycopeptides and now Vancomycin, all have been compromised by bacterial mutations that result in antibiotic resistance. Further fungal research is clearly warranted in the interest of epidemiology.

William Needham

Neil Dollinger

The underside (top) of *G. applanatum* provides a stark contrast to its wrinkled brown surface (above) that often is covered in algae or moss.

The so-called War on Cancer that began auspiciously with the National Cancer Act of 1971 has become a synonym for bureaucratic hubris; 40 years later, cancer still is the primary cause of death for people of middle age and older. Coincidentally, the seminal paper "Antitumor Polysaccharides From Some Polyporaceae, *Ganoderma Applanatum*" appeared in *The Chemical and Pharmacological Bulletin* in 1971. Polysaccharides are long chains of hydrocarbon molecules that are the primary constituents of the chitin that forms the cell walls of fungi. (Another polysaccharide forms the cellulose of plants.) In the case of *G. applanatum*, the polysaccharide β-glucans has been shown to stimulate macrophages that kill the tumor cells, and, probably more importantly, inhibit the formation of new blood vessels (a process called angiogenesis), which the tumor requires for growth. The gorillas probably knew all along.



I'm afraid this is my last mushroom picture Jim Sherry