



Speaker for the April 21 MSSF Meeting



Peter Werner

Psilocybe and Allies of California

Peter Werner is a long-time member of MSSF and has been involved in mycological pursuits since the early 1980s. His academic study of mycology began at University of Washington and continued as a graduate student at San Francisco State University, where he was working on a thesis project, a

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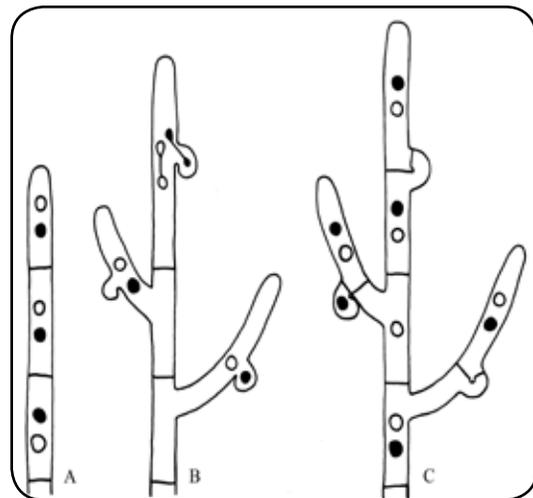
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MycoDigest: Nuclei—the Core Values in a Mushroom's Life

“Birth, copulation, and death. That’s all the facts when you come to brass tacks” (T.S. Elliot), but not when you are a mushroom. Mushrooms are unique in many ways but no other organism has a life cycle like a fungus. As if the standard fungal life cycle were not fascinating enough, the exceptions are even more mind boggling.

Let’s recapitulate the standard life cycle (see fig. 1 below), starting with the spores.

Fungal spores are single cells, each with one nucleus containing one set of chromosomes—that’s called haploid. When conditions are right and a spore germinates, it forms a network of threads, made up of cells each still with one nucleus: the monokaryon (mono = 1, karyon = nucleus). This is a rather short-lived affair, and it depends on the following event for survival: meeting up with a mate. Either a spore with a different mating type (think sex) lands on it, or it meets another monokaryon with a different mating type, then the two merge and the newly formed cells contain two nuclei, one from each parent. This phase of the life cycle is called either a dikaryon (with two distinct haploid nuclei) or a heterokaryon (when there are two or more different nuclei). This phase does not occur in animals and plants, where following the merging of two cells with



The standard life cycle of a mushroom species. Spores are formed on a basidium (situated on the gills or on the pores), each with one nucleus (indicated as black or open circles). Spores germinate, and form monokaryotic mycelia without clamps, that once met form a dikaryotic mycelium, with clamps at the septa. The dikaryotic mycelium forms the fruitbody.

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MycoDigest is a section of *Mycena News* dedicated to the scientific review of mycological information.

PRESIDENT'S POST

What a strange year it has been! Weather-wise, I mean.

First, we have a summer where we saw California nearly completely burn up (I'll come back to this later). Then the autumn season began hopefully with a couple of storms in November, but soon the spigot stopped and dry conditions set in for the long haul. I was a bit worried about the Fungus Fair since there was no rain at least two weeks beforehand. Fortunately, there was enough residual moisture, plus lots of terrific volunteers who brought fungi from as far away as the Sierra Nevada foothills and Salt Point State Park, that we had a very good collection of material—over 300 species that were identified at the Fair—with significant quantities of some species (*Amanita calypttrata*, coccora, comes to mind). I also have heard that several people had a decent bolete season. Then, nothing in terms of precipitation for two months! Temperatures in the 80's at times. Yow! Finally, in February we had significant rain. The main casualty seems to have been chanterelles. I think they just gave up after awhile with no precipitation and couldn't recover even after it started raining again. The word is that black trumpets are popping in places, so at least the season isn't a total bust.

So, about those fires. As you probably know, the western United States' best morel fruitings occur in spring the mountains that had burned the previous summer or fall. As expected our club will take advantage of the multitudinous potential morel locations this spring. The first weekend in May is our annual San Jose Camp Foray. San Jose Camp is located off Highway 120 west of Yosemite. The accommodations are tent cabins and all meals are provided by the camp kitchen. See the notice in this newsletter and/or the website for more information. Our Foray Chairperson, Norm Andresen, has scheduled a camping foray the following weekend at a location to be announced, depending on where morels are being found at the time. Again, details are elsewhere. So, get out there and find the little devils.

Speaking of San Jose Camp, I'd like to make a note of tremendous gratitude to a member who has been one our most reliable volunteers, Tom Sasaki. Up until this year Tom has organized the San Jose Camp Foray for a long time (can't tell you exactly but a long time). Councilor Phil Harben has graciously taken the job this year. Tom was the President of the Society in 1976, has always been a great help with the Fungus Fair and other events, for two

Continued to the right

ANNOUNCEMENTS

ANNUAL ELECTIONS COMING IN MAY

Elections for next year's officers will be held at the May 19th "Annual Meeting" of the MSSF.

The Nominees are:

President: Dan Long

Vice-President: Lou Prestia

Secretary: Phil Brown (incumbent)

Treasurer: Henry Shaw (incumbent)

Councilors: George Willis (incumbent) and David Gardella

Other nominations may be made in writing, signed by 5 members of the MSSF, and presented to the Secretary on or before May 19th.

Retiring President J.R. Blair will take a seat on the council as Past President. The other council seats are filled by committee chairs who are appointed by the President.

MUSHROOM HUNTING TALK AND WALK APRIL 8, 10

Cal Hiking and Outdoor Society presents the 4th sort-of-annual slideshow and hike (or foray, as we foragers call it)

Hunting the Wild Mushroom

Tips for Beginners on How to Get Started and Not Get Poisoned

Slideshow:

8pm Wed. April 8th, 101 Wheeler Hall, UC Berkeley Campus

Beginner Mushroom Hike:

10am Sat. April 11th, Joaquin Miller Park, Oakland

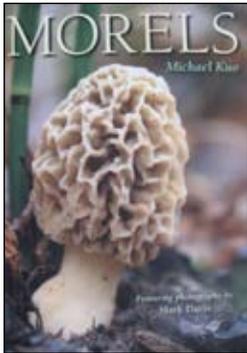
If you are an experienced mushroomer willing to lead a small group on the foray, please contact Dave Lubertozzi at dluber1@berkeley.edu

or three years he arranged mushroom identification slide shows, courtesy of the North American Mycological Association, before our General Meetings, and I'm sure he's done many things of which I am unaware. Thank you, Tom. You're an inspiration and a gentleman.

Good hunting!

J.R. Blair

What's Bookin'?



This month I am presenting a great book. "Morels" by: Michael Kuo. It is published by the University of Michigan Press.

"Michael Kuo offers an engaging survey of a diverse group of fungi whose fruiting bodies are among the most prized edible mushrooms. Morels is a lavishly illustrated poem that will be relished by amateur and professional mycologists alike."

Michael Kuo, an English teacher in Illinois, is the developer of mushroomexpert.com, a popular online resource for mushroom identification and morel hunting.

This book contains over two hundred color photographs.

This book will be available for sale for \$5.00 at the next MSSF general meeting. Don't forget to mention you are a MSSF member in good standing and receive your 10% discount.

~Curt Haney
MSSF Book Chairperson

San Jose Camp Spring Morel Foray Is Coming Up

This year the annual MSSF event will take place May 1-3. Cost is \$120 / person for members, \$140 for non-members, half price for children 4-12 years old, and free for children 3 and under. The fee includes a tent cabin for 2 nights, Friday dinner, all meals on Saturday, and breakfast & lunch on Sunday as well as all activities.

On Saturday night Brian Perry will be our featured speaker. He will speak about his current work on fungal bioluminescence, and will also discuss the Spring Ascomycetes of the Sierra Nevada. More information on Brian's research interests and background can be found by following the link: <http://userwww.sfsu.edu/~baperry/biolumin.html>.

The late rains and reasonably large snowpack this year bode well for the timing of the foray. As further details on the event are worked out they will be posted on the MSSF web site.

To reserve, send checks payable to MSSF to Phil Harben, 817 South G Street, Livermore, CA 94550. Please include an email address for reservation confirmation and follow-up details.



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Past issues of *Mycena News* can be read on-line at www.mssf.org.

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An Adventure in Novice Mushroom Hunting

Robin Gao and Kristopher Woysner

As novices, we are as much into discovering where mushrooms grow as we are into creating dishes for the variety of mushrooms that we do find in and around Boston. On one frosty day last October, we took a trip out of the city to hike a mountain in New Hampshire. We had two friends and our standard hunting gear: a reusable shopping bag and a small paring knife.

Not long after we started crunching through layers of radiant autumnal leaves, our eyes fell on what looked to be shelves of oyster mushrooms growing on tree trunks all around us. Our excitement redoubled and our stomachs tingled at this first hint of an imminent, delectable feast. But when we went to pick them, we were surprised that they were as hard as rocks! Confused, we quickly realized that the mushrooms had succumbed to the frigid autumn. We picked them anyway, and with the help of our friends who soon got caught up in the excitement of the hunt, had the opportunity to pick many more as they appeared along our path.

Our ascent into the coniferous zone of the mountain brought us to the end of our hunting luck; fortunately, our bag was filled halfway and we were quite satisfied with our haul. We took opportunities to relish other aspects of this day: we shed our coats and basked in sunlight upon flattened grasses, and at the summit, we enjoyed a simple picnic of rice noodles with vegetables, and took a siesta on sun-drenched rocks overlooking western New Hampshire. After the descent, and in anticipation of the preparation of our oysters, we purchased a block of cheese in a small country store just over the border in Vermont.

Though we were fairly confident that we had collected oyster mushrooms, we did not have a field guide during our hunt, so we returned with the intention of making a positive identification using online sources. This technique provided inconclusive results because of our lack of experience in mushroom identification. Determined to not let our hard work and excitement go to waste, we both agreed we would cook the mushrooms anyway. We did the responsible thing by preparing handwritten living wills, allocating possessions of questionable worth to our friends and loved ones.

A simple and quick meal was prepared by sautéing the mushrooms with garlic and olive oil, and tossing them with pasta and tomato sauce. There was an air of uncertainty as we sat down to eat, not knowing if this was going to be our last meal or the start of a major appreciation for the melt-in-your-mouth oyster mushroom. Happily, our intuition proved correct and not only did we enjoy a delicious and nourishing dinner,

we have secured a new spot to gather mushrooms. And soon after this adventure, we acquired a mushroom identification guide which now accompanies us on our trips! ☘

Mushroom Risotto

By: Kristopher Woysner

Serves 4 - 6

Ingredients:

3 Tbsp butter (for cooking onions)
 1 ¼ C chopped onion
 1 ¼ C Carnaroli or Arborio rice
 ¾ C dry white wine
 3 ½ C mushroom stock
 1 pound sautéed fresh wild mushrooms
 ½ C grated parmesan cheese
 3 Tbsp C heavy cream
 2 Tbsp cold butter (to stir in at the end)
 ¼ C chopped fresh herbs (parsley, chervil, tarragon)
 Salt and pepper to taste

Instructions: First, prepare your mushroom stock. This can be made any number of ways, but I like to take whatever mushrooms I have in abundance and simmer them for a few hours in water with a carrot or leek and a few parsley stems. Alternately, you can make a stock by re-hydrating some dried mushrooms, which also works well.

Next, prepare your fresh mushrooms by sautéing them in vegetable oil until they are tender and then letting them cool.

To start the risotto, use a heavy bottom pan and set it over medium heat. Melt the butter in this pan and gently cook the chopped onions. Do not brown the onions, but cook until the onions start to become translucent.

As soon as the onions are done cooking, stir in the rice and cook for a couple minutes—this will toast the rice a bit. Then add the wine all at once, and it will sizzle and bubble in the pot. Once the wine has evaporated, begin adding the heated mushroom stock in small batches, while constantly stirring the rice throughout this process. Continue to slowly add batches of mushroom stock until the rice becomes al dente.

Thanks to Robin Gao for getting in touch and sharing a glimpse of mushrooming in New England!

Excerpts from a Recent Discussion About Morels on the MSSF Yahoo Group

Conditions:

Park ranger stations should be able to tell you where controlled burns and logging areas are, and perhaps most importantly, the condition of the unpaved roads in those areas.

I went looking last May in the Angora burn, and found none, and later around Ice House lake, where we found a few. It was a very dry spring, however, so pretty much the only water available was from snowmelt, and with high temps and sunny days, it seemed like the soil went immediately from too cold to too dry, without a phase in between at the proper temp and moisture.

Angora Ridge looked like a moonscape—ashes and charcoal, only a few saprophytic plants (although we did find some tasty *Gyromitras* at the edge of the snowfields) whereas at Ice House the trees were just a bit toasted, and there was lots of half-burned downed wood and new greenery under foot, even some surviving pine duff—found some Spring Kings also.

The fact that we did find some fungi near Ice House in a lightly burned area, vs. almost none in Angora makes me wonder—can it be too burned?

-David Lubertozzi

Regarding too burned: where a large pile has been burned, such as at a logging project landing site, I never find morels in the middle—only at the edges and in the disturbed areas nearby. I think it can be too burned, but I'd be interested to hear experience to the contrary.

-Sam Longmire

The degree of burning is less important than the moisture and temperature. I have picked morels from ash, but the humidity and soil moisture were just right. I think that ground cover, from needles or leaves, does give the morels a better shot at surviving low humidity. The down side to picking in ash is that large rain drops splash ash onto the morels, which can make them dirt balls on a stick.

-Norm Andresen

First Year Burns, Second Year Burns, and Logging Areas:

I have done much more hunting in second year sites than first year sites. I agree that moisture is key. I've even found several dozen [morels] in a burned-over, peat-like wetland where every step made an oozing, squishing, sucking sound. North slopes are typically better, in my experience.

-Sam Longmire

I go to second year burns out of desperation, like when there are no first year burns. They are a better bet than unburned woods, in general, but will likely have diminished production compared

to the first year, all things being equal, which, of course, they never are. Logging activity certainly increases potential for the second year, but there you have it, now we are talking more about morels responding to logging disturbance as opposed to morels growing directly as a result of fire aftermath. As a side note, "natural" morels are often the morel of record in logging debris. They fruit at colder temperatures than "burn" morels, thus tending to show up earlier in the season. This can be important when we're suffering our all too frequent too cold or too dry springs. The naturals

have bailed my morel season more than once with their ability to fruit with earlier rains, as presumably prime burn habitat later ended up laying fallow when Sierra rains petered out prematurely. In any event, given viable habitat, morel fruiting is all about having sufficient moisture present when soil temperatures come up to snuff...

-David Campbell



Morchella deliciosa. Photo by Fred Stevens

These posts have been edited for clarity and grammar. Every attempt has been made to maintain the writer's own voice and intended meaning. -Eds. ☘

MycoDigest continued

single nuclei from different parents, the nuclei fuse and the genetic material is mixed to form an offspring that differs from the parents.

A mating type can be compared to gender as we know it in animals, but in many cases there are not just two mating types in equal proportions, but many, increasing the possibility of meeting a mate.

And a second note to the story above, the cells of the monokaryon are separated from each other by a simple wall; those of the dikaryon have a special structure that makes sure that with every cell division a copy of both nuclei gets moved on to the new cell, this is the clamp (see fig. 2 below). Monokaryons lack clamps.

When two compatible monokaryons meet, the cells merge, and the nuclei of one of them moves into the mycelium of the other, cell walls crumble, and the 'invading' nucleus divides and moves quickly along, a speed of two mm per hour has been noted, until all the cells are provided with two nuclei, and a truly dikaryotic mycelium continues to grow, with the proper use of clamp connections to move the two nuclei into new cells. (And don't be awkward and ask me what happens when two mating events happen at different parts of a monokaryotic mycelium and propagating dikaryotic waves meet in the middle.)

The two nuclei in the cells of the dikaryon work together to get the cell's machinery going. This dikaryotic mycelium is long lived, and can form the fruitbodies – our mushrooms – when the conditions are right. And that is where genetic recombination – a reshuffling of the genetic material of the parents – takes place. Place of action is in the basidia, the special cells on the gills of your *Amanita*, inside the tubes of the porcini or red belted conk, or on the branches of a *Ramaria* species. The two nuclei of the dikaryon fuse to form one nucleus with two sets of chromosomes—now we can call the cell diploid

—recombination happens, and two new nuclei are formed. Another nuclear division, this time without changes in the contents of each nucleus, produces a total of four nuclei which are moved to the four budding spores each on top of a little prong (sterigma) of the basidium. The life cycle is complete.

For many species we do not know the details of this life cycle; it is not too hard to count nuclei in the cells of a fruitbody, but mycelium is harder to find, and in many cases hard to grow. And, what it actually means when there are two (or three or ten) nuclei in a stipe cell is another issue.

We do know, just from observations, that there are quite a few exceptions to the standard life cycle described above. Even the 'lab rat' *Coprinopsis cinerea* has variations on this life cycle, as

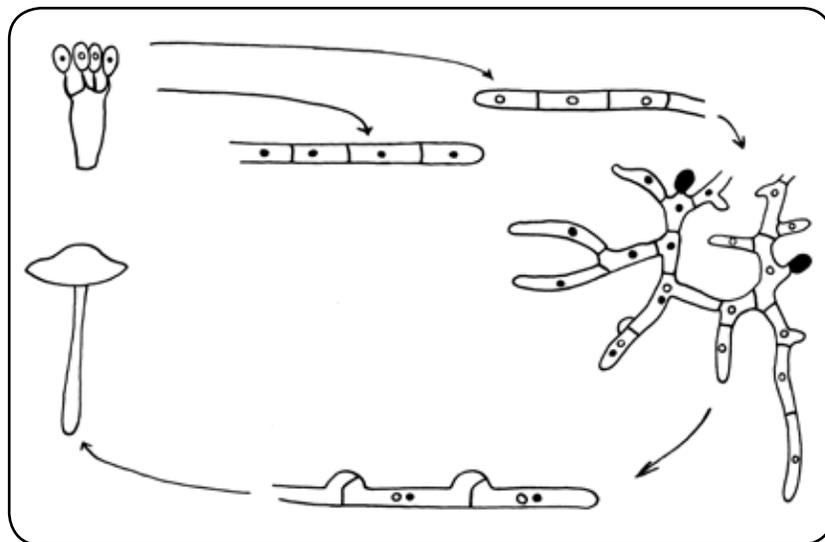
it can form asexual spores on the monokaryon and the dikaryon, it can also sit out bad times as a sclerotium, an asexual resting structure, or a thick-walled resting spore, again sprouted from both stages, and, the four spores on the basidium have two identical nuclei each.

Honey mushrooms have not read the text books either and follow strange and different paths (see Brian Perry's article on genetic mosaics); one aberrant road they follow is that the nuclei can fuse already in the mycelium phase, making the mycelium diploid

(the spores of 'normal' mushroom species are haploid, and the mycelium is provided with two separate haploid spores per cell), long before the formation of fruitbodies, the place where diploidization takes place in other mushroom species.

A meeting between a monokaryon and a dikaryon can also result in a happy ending—with one of the two nuclei of the dikaryon moving into the monokaryon, but migration in the opposite direction has also been observed, resulting in a trikaryon.

Just like *Coprinopsis cinerea*, most *Lepiota* species have an



The role of clamps in the distribution of the nuclei. A. A hypha that has just been provided with a second nucleus per cell, and does not have clamps. B. The cells are growing and dividing, and so are the nuclei, one of the two daughter nuclei moves into the clamp. C. Cells have divided, and the clamps have moved the nuclei into the next cell. After Buller (1930).

MycoDigest continued

additional division of the nuclei inside the spores, and two identical nuclei are present in each spore. This is a widespread phenomenon among mushroom species. The situation in which two *different* nuclei per cell are present happens too, but is much rarer.

The button mushroom, *Agaricus bisporus*, with only two spores per basidium, has spores with four nuclei each, of two different mating types; it produces mycelium with four nuclei per cell (but three or five nuclei also happen), and skips the mating of the mycelium part of the cycle as an unnecessary and messy procedure, as each cell has already two different nuclei. The cells just under the basidia and the basidia themselves have 2 nuclei, one of each type, and with a meiotic and two mitotic (normal) nuclear divisions, two spores each with four nuclei are formed. Clamp connections are absent—all *Agaricus* species lack them as a matter of fact—nevertheless, nuclei divide and are moved from one cell to the next without any problem.

Recent research on a species of Annosum root rot (*Heterobasidion parviporum*) shows that there can be even more going on. Monokaryons were grown in the lab and different types were mated in a Petri dish.

The heterokaryotic stage of this fungus, after the mating of the two monokaryons, has cells with a multitude of nuclei each. Furthermore, these nuclei do, in many cases, not occur in 1:1 proportions, but with one type dominant over the other. If one of the parents is a monokaryon that is sick and old, its nuclei dominate the heterokaryon heavily, and can outnumber the other type of nuclei nine to one. Asexual, monokaryotic spores (conidia) are formed on the heterokaryons, but the number of nuclei of one type in a heterokaryon is not a predictor for the type of nucleus that will make it into these conidia. Different growth media also may influence which nucleus type will be most numerous in a mycelium. And on top of all that, there is no correlation between the presence of clamp connections (which varies from 5 to 100%) and the skewedness in the proportions of nucleus types.

In fact, many fungi have a heterokaryotic phase, with cells with more than one copy of each nuclear type, but in most cases, they grow out of it, and when it comes to the formation of a fruitbody, the organism is back to the normal situation of two nuclei per cell.

All evidence in the *Heterobasidion* example indicates that selection does not work on the organism as a whole but at the level of the nucleus.

Of course, lots of questions are still open—how widespread is this phenomenon, what is the role of clamps, are these

imbalanced proportions maintained throughout the mycelium and other parts of the lifecycle, how do the nuclei operate the cell's daily life, is there a division of labour, would it be possible to follow the different nuclei in the mycelium?

And, still, this is only one aspect of the intriguing life cycle of mushrooms. ☼

Further reading:

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Speaker continued

monograph of the Psilocybe species of California under advisor Dennis Desjardin. Peter is also an avid photographer and microscopist, and recently completed a professional certification program in microscopy at Merritt College.

Peter will be speaking on Psilocybe and allies of California, as well as other psilocybin mushrooms of the state. His talk will include discussion of recently-discovered species from California, as well as the taxonomic issues surrounding the classification and naming of Psilocybe and its relatives.

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MSSF Calendar, April 2009

Monday, April 6, 2009, 7pm, Culinary Group Dinner. We meet at the Hall of Flowers, Golden Gate Park, 9th and Lincoln, San Francisco. Reservations are required. Contact Pat George at (510) 204-9130 or plgeorge33@yahoo.com no later than Friday, April 3rd to make your reservation. Our always outstanding dinners are \$14.00 per person and include appetizers, punch, the main and sides, dessert and coffee. Do remember to bring your tableware, beverage and an appetizer to share. The dining area can be accessed from the employee parking lot located off Lincoln behind the building. The entrance to that parking area is just past 9th going west. The dining area can also be accessed from the front area of the Hall to the left as you face it. Our next dinner, the last of this mushroom season, will be on May 4th.

Saturday, April 18, 2009. Cal Day at UC Berkeley. MSSF will have a display at the herbarium in the Life Sciences Building. Many other free events will take place at UC Berkeley on this day.

Tuesday, April 21, 2009. MSSF General Meeting. Randall Museum. 7pm, mushroom identification and refreshments

provided by the Hospitality Committee. 8pm, Peter Werner will discuss the *Psilocybe and Allies of California*.

Friday, May 1–Sunday, May 3. Annual San Jose Camp Spring Morel Foray. Cost is \$120 / person for members, \$140 for non-members, half price for children 4-12 years old, and free for children 3 and under. The fee includes a tent cabin for 2 nights, Friday dinner, all meals on Saturday, and breakfast & lunch on Sunday as well as all activities. To reserve, send checks payable to MSSF to Phil Harben, 817 South G Street, Livermore, CA 94550. Please include an email address for reservation confirmation and follow-up details. See article on page 3 for more information.

**Deadline for the May 2009
issue of *Mycena News* is
April 15.**

**Please send your articles,
calendar items, and other
information to:
mycenanews@mssf.org**