



Speaker for the April 15 MSSF Meeting



Dr. Tom Brunns

Update on the Point Reyes Myco-Blitz

Dr. Tom Brunns heads the research of fungal ecology and evolution at UC Berkeley. Specifically, his research centers on the molecular systematics central to these disciplines. He is also involved with the Point Reyes Myco-Blitz project, an effort to catalog the fungal biodiversity at Point Reyes National Seashore.

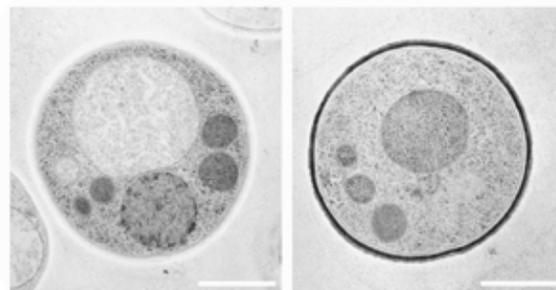
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MycoDigest: Radioactive Fungi—A New Extreme

Kabir Peay

For those of us that collect mushrooms, fungi can seem fairly fragile and ephemeral. Most fungi certainly do seem to thrive in relatively benign conditions (think wet, dark, and warm). As a kingdom though, fungi have displayed an incredible adaptive flexibility that allows them to end up in some fairly unlikely places. This flexibility is based primarily on a biochemical and metabolic arsenal that allows fungi to make food out of almost any substrate. Combine this with the ability of some fungi to withstand incredibly harsh environmental conditions, and you have the fungal equivalent of the X Games. The most common fungal extremophiles are probably lichens, the symbiotic association between fungi and algae. Lichens are among the first colonists of the harsh landscapes left after large disturbances, such as volcanic eruption or glacial retreat, where they often colonize bare rock and withstand extreme temperatures, desiccation, and exposure to ultraviolet radiation. In recent decades, however, fungi have been discovered growing in a panoply of extreme or odd environments. Some of the more spectacular examples include fungi that grow actively beneath snow (Schadt et al. 2003), fungi that use jet fuel as a food source (Edmonds & Cooney 1967), underwater mushrooms (Desjardin et al. 1995), and space fungi found devouring metal polymers on the Russian space station Mir (Alekhova et al. 2005). However, one recent study has been particularly noteworthy for expanding the list of fungi in extreme environments and our understanding of how fungi make their living (Dadachova et al. 2005).



Albino (left) and melanized (right) strains of *Cryptococcus* yeast used in the Dadachova et al. study. The melanized strains were able to grow up to 3 times faster when exposed to ionizing radiation 500 times background levels, suggesting that the melanin (seen in the dark cell wall in the yeast on the right) may allow these fungi to convert normally harmful radiation into energy for growth. From Dadachova et al. (2005), courtesy Kate Dadachova

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

PRESIDENT'S POST

As I read Dimitar Bojantchev's excellent article in the last edition of *MN*, I found myself thinking about my own experiences with mushroom identification. I was a student at the Evergreen State College (yeah, I'm a Greener) in Olympia, Washington. Evergreen is a very progressive college with no grades and no degree requirements. There are terrific opportunities for independent study, and they have incredible "immersion" courses that may be 16-, 32-, or even 48-quarter units (one, two, or three quarters in one class!). That's how I learned my fungi—I took "Mushrooms of the Pacific Northwest," a 16-quarter unit course taught by Dr. Michael Beug in the fall of my senior year. Wow! What a learning curve! Even then, with nearly two and a half months of intensive identification work (plus another couple of months of independent study), I still had a lot to learn. My next great opportunity came when I was accepted as a graduate student with Dr. Dennis Desjardin, MSSF's science advisor, at San Francisco State University (SFSU). My thesis was on the fungi associated with the genus *Arctostaphylos* (manzanita). I made over 400 collections in two winters and identified about 135 different species—a nice, well-rounded identification experience. And I'm still learning...

Of course, this level of passion is not for everyone. There's no shame in just wanting to know how to tell your favorite edible species from their toxic look-alikes. In fact, if you intend to collect your own mushrooms for cooking, then you'd better be able to do just that. So, how can one enter the identification game?

One way is to become self-taught, much like Dimitar has done (with truly remarkable speed). You would want to pick up a good field guide or two. For the western United States, you'll want to get David Arora's *Mushrooms Demystified*. Although, not completely definitive (you need a substantial library of resources if you want to identify every single species you encounter, and even that may not be sufficient), it is by far the best single field guide you can find. There are other field guides that are adequate, but not nearly as complete or easy to use.

In addition there are many great online resources. Last month's speaker, Nathan Wilson, has developed one such resource—the Mushroom Observer at www.mushroomobserver.org. There you can access photos and location information for many species of fungi, plus submit your own photos. A unique feature of this website is the ability for its registered members to make identification suggestions and vote on the name of the fungus in any given image. Nifty.

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ANNOUNCEMENTS

MSSF ANNUAL ELECTIONS

The nominating committee has submitted the following slate of candidates for the elected officers of the MSSF for 2008-2009. Elections will be held at the Annual Meeting of the Society on May 20, 2008.

President: J.R. Blair (incumbent)
 Vice President: Dan Long (incumbent)
 Secretary: Phil Brown (incumbent)
 Treasurer: Lisa Bacon (incumbent)
 Councilors: Henry Shaw and Phil Harben

Other nominations may be made in writing and will be considered valid if signed by five members of the Society and presented to the Secretary at any time up to the Annual Meeting.

CAL DAY AT UC BERKELEY

MSSF is participating in the annual Cal Day on April 12 at UC Berkeley's Jepson Herbarium in the Valley Life Sciences Building. MSSF President J.R. Blair will lead a tour of the fungi specimens collection at 2pm that day. All MSSF members are invited to come by the Herbarium and learn about the collection.

Also, MSSF will have an information table about mushrooms. Volunteers are needed to staff the table from 10am until 4pm. If available, please contact Alice Sunshine at asun1@pacbell.net. Volunteers will team up with MSSF council members, so you don't need to be an "expert" to participate. Also, if you're interested in volunteering but concerned about missing the bulk of Cal Day, rest assured that we're planning on 2-hour shifts.

It is a fun day and this is the first time the fungi specimens will be highlighted at Cal Day. Hope you can join us!

- Alice Sunshine

HELP CREATE A POSTER OF FUNGI ON MT. TAM

The Marin Municipal Water District is seeking a volunteer to help create a poster documenting the fungi found on Mt. Tam. Assistance is available for plotting and mounting the poster. Please contact Janet Klein at jklein@marinwater.com if interested in contributing to this project.



What's Bookin'?

I have several nice, newly-obtained older books, which will be for sale, as usual, from 7–8pm on April 15 before the General Meeting. MSSF members in good standing will receive a 10% discount.

Curt Haney
MSSF Book Sales

President's Post continued

Our webmaster and past president, Michael Wood, owns an outstanding website, Mykoweb, which is invaluable for the serious amateur. By going to www.mykoweb.com, you can find tons of links to mushroom related websites, the Fungi of California, a gallery of over 500 species of California mushrooms—most with description notes, two republished books that are out of print, and much more. Many amateur and professional mycologists have their own photo galleries that are made available to the public (check out the Mykoweb links for several choices).

Our mycological neighbor to the north, the Sonoma Mycological Society, has taken that a step further and has a photo ID group, called UFO (guess what that stands for) that you can join. One word of caution: identification by photograph is a risky endeavor at best. Photographs cannot show all of the characteristics (odor, taste, subtle color changes, microscopic features, etc.) necessary to identify certain mushrooms. Color and texture can also be different in a photograph than what you would see if you had the mushroom in hand, potentially leading to false identifications.

But there is no replacement for hands-on learning from an expert (or at least someone who knows something you don't). There are many classes and workshops available to you throughout the season. We have begun a series of ID workshops for our members. In January and February, I taught two Beginner's ID workshops and an Intermediate ID workshop. We intend to continue these workshops beginning next fall. We will also sponsor some advanced workshops next year, perhaps focusing on a single genus or family, or breaking out the microscopes. Stay tuned.

In the meantime, an unbeatable opportunity is coming up: Dr. Desjardin teaches a week long class called "Fungi of the Sierra Nevada" at the SFSU Sierra Nevada Field Campus every summer (this year June 1–6) through the SFSU College of Extended Learning. This highly touted course is open to the public and is ideal for students of mycology at any level, from total beginner to professional mycologist. All you need is passion. They also have classes in birds, plants, insects, astronomy, and many other cool things. For more information, go to www.sfsu.edu/~sierra.

If increasing your knowledge of all things fungal strikes your fancy, then whatever route you take will surely be rewarding. Good IDing!

~J.R. Blair



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

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A Buyers Guide to Compound Microscopes for Mycology, Part 1

Peter G. Werner

For those of us who have gotten into the study of mycology beyond the simple “Can I eat it?” level, identifying mushrooms to species (or maybe even noting previously undescribed species) often comes down to noting differences in the fine anatomy of the mushroom. And many of these fine features cannot be seen without the aid of a microscope.

There are many serious amateur mycologists who would likely be interested in learning mycology on this level, but balk at it because of the perception that a microscope requires the investment of many thousands of dollars. To many people’s surprise, it’s actually quite possible to buy a good light microscope for well under \$1,000. While a microscope is a somewhat expensive investment, it is no more expensive than buying a good set of camera equipment.

However, like investing in camera equipment, it really helps to know what you’re buying. To that end, following my previous set of articles on camera equipment, I’m contributing a couple of articles that will hopefully demystify microscopes for those considering buying one.

Compound and Stereo Microscopes

The first issue that needs to be discussed is whether one wants a compound or stereo microscope, or both. A compound scope is probably what most people think of when they picture a microscope. This is a microscope where you view a highly magnified image of a thin object mounted on a slide, with light that is transmitted through the image. Many will also be familiar with stereo scopes (aka “dissecting scopes”). These are microscopes where a larger object is viewed in three dimensions using light reflected from the surface of the object (though stereo scopes are usually also capable of transmitted light illumination), typically at magnifications lower than those found on a compound scope.

As to what one needs for mushroom ID, I recommend having both. A good stereoscope can help one see the surface features of a mushroom in much finer detail and is also helpful to have for specimen preparation for a compound scope. However, if one has to choose just one, I’d say get a compound scope. The

features you can see with a stereo scope can also generally be seen (albeit with more difficulty) with a good hand lens; however, there’s no substitute for a compound scope for viewing features like spores, cystidia, etc.

Because of space limitations, the rest of this article will be on the features of compound scopes. At some point in the near future, I’ll contribute a compound scope buying guide, which really deserves an article in and of itself.

New vs Used

If one has \$400–800 to spend on a microscope, you can go either of two ways. You can buy a brand new scope from a source like Microscope-Depot.com, which will probably be a “generic” Chinese-made scope, or an older used scope of a high-quality make like Zeiss or Nikon. There are pros and cons for each. New scopes will be clean and without risk of prior wear-and-tear. However, “no-name” Chinese scopes are not manufactured to as high of quality-control standards as the better-known name brands and may come with built-in problems. If you buy from a reputable dealer and the scope is warrantied, you should be able to return a bad scope for repair or exchange. Another problem is that only a minority of generic Chinese scopes (typically the more expensive ones in that range) come with Köhler illumination systems, a feature I feel is essential in a good compound scope.

Older (circa 1960s–1980s or even older) compound scopes from high-end manufacturers, like old quality cameras, hold up well over time and are the workhorses of many university mycology labs to this day. The downside of buying these is that one usually doesn’t know the history of these scopes and whether they’ve been used carefully or abused. One can buy used scopes from professional microscope dealerships with a solid maintenance history; however, one will typically pay two or three times as much for a scope from this source (probably in the \$1500–2000 range) than one would from a source like eBay or Craigslist. (In some cases, eBay scopes are sold by microscope specialists who clean and refurbish the scope; this is a valuable perk in a used scope when available.) I think Köhler illumination is essential both for getting even



The author’s pride and joy: A Zeiss Standard 14 scope bought off of eBay, treated to some upgrades (also bought off eBay), and pressed into the service of mycological research! Photo courtesy of Peter G. Werner

illumination and, more importantly, for limiting stray light that actually can interfere with getting the full resolution possible from your optical system. A scope that's capable of Köhler illumination should have two essential components. One is an Abbe-type (or even better aplanatic or achromatic) condenser that includes a movable diaphragm, a carrier that can be raised and lowered, and centering screws or some other kind of centering mechanism. The other is a movable field diaphragm located somewhere adjacent to the light source itself.

Buying a Used Microscope

If one does decide to go the used route, ideally one should be able to see the scope before deciding to purchase it. However, since most such scopes will probably be found over eBay or through some other mail-order source, this may not be possible. Therefore, make sure your scope has a return guarantee, preferably without strings attached.

When evaluating a scope, the first thing to look for is whether the scope and its components are more or less clean, especially the lenses. If there is dust or dirt, is it extensive? Are any lenses or other components delaminating or otherwise loose? And if there is dust or dirt, is it found merely on the outer components (which are cleanable) or in internal components, where it may not be possible to get to?

First, try setting up the scope for Köhler illumination (see the link I give later on how to do this) and make sure it is possible to do so, up to the highest magnification. The objectives and the condenser should be able to focus properly and the optical components should be alignable. One should look at all of the objectives both in and out of focus to see if there is dirt in the light path. Remove the objective and eyepiece lenses and the condenser and examine the lenses individually for dirt and delamination.

Even if the scope is clean and in good shape, if you buy a used scope without a history of either regular maintenance or refurbishment, one should consider taking the scope to a microscope service for cleaning and alignment. This will probably run \$100–200 and should be considered in the cost of buying a used scope. (I provide a list of Bay Area services in the links I provide after the article.)

Brands

Based on overall build quality and the availability of Köhler illumination features, I'm pretty partial to used high-end scopes. The best are ones made by the "big four" manufacturers (Zeiss, Leitz/Leica, Nikon, and Olympus) or the excellent microscopes once made by the now-defunct Wild Heerbrugg. There are also a number of "second tier" manufacturers (many also now-defunct or merged into larger companies), notably Reichert, American Optical, Meiji, Lomo, and Vickers, that many people swear by, even if they don't have quite the reputation of the top-tier companies.

(Also, some clarification is needed concerning Zeiss, because during the Cold War there were actually two Carl Zeiss companies, a situation I'll explain more about in the link to my blog, provided below.)



A possible replacement condenser fails to make the grade – a close examination reveals dirt between the lenses in an area not easily accessible through simple disassembly. Examine your scope components and upgrades carefully! Photo courtesy of Peter G. Werner

Of course, as with cameras, the quality of the scopes by each maker varies considerably between models, and all of the major manufacturers made lines of simple "student" scopes that are generally not capable of Köhler illumination and are not generally "research" quality. Lines of quality compound scope that I often see selling on eBay for good prices (often under \$600) include the Zeiss Standard (which is what I have), Nikon Labophot, Reichert Microstar IV, and Meiji ML2000. American Optical 110 scopes are also good, though one must be cautious with these, as a disproportionate number of old AO scopes have ended up as "door stop" scopes in various university departments and I've seen some extremely dirty and abused-looking ones go up for sale.

In next month's *Mycena News*, I'll go into more detail about microscope components to look for, either as components of the system you're buying, or as upgrades. And since there is more useful information and links than I can provide on this subject here, I refer the reader to the following link on my new mycology blog:

<http://germpore.blogspot.com/2008/03/more-on-microscopes.html> ☼

Cultivation Corner: Far West Fungi Farm Field Trip

Ken Litchfield

On Sunday, April 13 from noon to 3ish, the Merritt Mushroom Cultivation Class joins the MSSF for our field trip and potluck to John and Toby Garrone's Far West Fungi Farm in Moss Landing near Watsonville. Please bring a potluck item to share during the social time at the end of the farm tour. The Garrones will be grilling their mushrooms, and you can bring other stuff for the grill, as well.

Far West Fungi distributes gourmet mushrooms at their Ferry Building shop and at many local farmers' markets. While they import and distribute many other types of mushrooms besides what they grow, at their farm you can see how they grow shiitake, maitake, lion's mane, and white, brown, pink, golden, and trumpet oyster mushrooms, as well as some others they experiment with. You can see the operation from raw substrate materials to finished mushroom harvest. They have a big operation with many warehouses, none of which, you may have heard through erroneous media reports, burned down in an electrical fire.

You may purchase farm fresh mushrooms there at the farm and, if you have a vehicle, you can haul away as much excellent spent mushroom compost as you can carry for your garden. You can also collect harvested mushroom kits that can still be fruited or added to your garden to continue growing. Far West makes a single harvest from their blocks and then recycles them. Though there is ample life for at least one, and perhaps as many as three more fruitings, the remaining flushes aren't temporally reliable to make it commercially predictable. ... Which is good for our recycling purposes.

If you want to recycle them, here's an easy way to start a small bed of mushrooms in your garden: select a shady, out-of-the-way nook in your garden with plenty of humidity cover, where you can spread a mulch of wood chips 6 inches to a foot thick and 3 feet by 3-feet or larger in size. The wood chips should be soaked overnight in a wheelbarrow of water to break their surface tension and penetrate water into them. If you don't have wood chips, then stacks of newspaper or cardboard can also work. Place five to six or more kits of the same kind, such as all shiitake or all lion's mane, in an unwaxed cardboard box oriented with the blocks cut-side-up and tightly packed side by side. The sides of the box can be the same height as the blocks or taller. Set one or more boxes of the same kind of mushroom on the bed of wood chips. If you don't have room for more than one bed of chips, you could mix the types by box, but it is best to keep the same type in the same box for competition considerations. If there is any room between the kits, you can cram wood chips in the pockets of space. On top of the boxes, scatter loose straw or close the box flaps for humidity cover.

Sprinkle the boxes once or twice a week with a rain nozzle depending upon the dryness, temperature, and natural rain you get. The blocks of mycelium will grow through the bottoms of the boxes into the mulch underneath and infiltrate the wood chips to pick up more nutrients. They will continue fruiting out the tops from the old cut zones for a much extended period beyond what it would be with just the nutrients left in the kits by themselves. Just check through the straw periodically to harvest more mushrooms. After a time, but while the mycelium in the wood chips under the boxes is still robust, you can refresh the bed with fresh soaked wood chips on top of the collapsing boxes. With periodic refreshing you can continue growing your mushroom bed indefinitely.

Please aresveepee me at litchfield.ken@gmail.com if you would like to attend I'll send you directions to the farm. ☘

What to Expect at San Jose Camp

Every year we rent this Camp from the city of San Jose. It is just off Highway 120, a few miles short of the entrance to Yosemite. There is a turbulent river with bridges snaking through the Camp. The Camp consists of a main dining hall with a movie screen, tables and benches, and a very large river rock fireplace with a few couches and chairs. We eat our meals there and use it as a general assembly place. You are assigned a tent cabin that has wood floors and 4-foot wood walls with a canvass tent above. There are 4 spring cots with thin mattresses, an electric light, and an electric reciprocal in each cabin. In addition, most cabins have decks outside the door. The bathrooms have hot water and multiple private shower rooms; there will also be a small group of cabins with a centrally located bathroom. I have never been inconvenienced.

Most arrive Friday afternoon, settle in their cabins, and have dinner around 6pm. You fill out an order form in the evening, so the cook staff can prepare Saturday's bag lunch. Most hang out around the hall after dinner and have a good time. Breakfast is offered Saturday morning, and then you pick up your lunch and go out in small groups and foray. The leaders have been picking mushrooms there for years and know good spots. The habitat is gorgeous, being so close to Yosemite. We return in the afternoon and look at every body's mushrooms or hang out till dinner. After dinner, there is usually some kind of entertainment.

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Mycodigest continued

The meltdown of the Chernobyl nuclear reactor in 1983 was one of the greatest cautionary tales of the nuclear age. The explosion of the reactor released a radioactive cloud that spread 1,000s of kilometers and left the soil, water, and vegetation in Chernobyl contaminated to this day. Despite the damaging biological effects of nuclear radiation, the fungus *Cladosporium sphaerospermum* has been found growing abundantly in and around the Chernobyl nuclear reactor. Researchers interested in this fungus' ability to thrive in the contaminated environment of Chernobyl noted that it was darkly pigmented with melanin—the same pigment responsible for skin coloration in humans.

Melanin is known to protect organisms against exposure to harmful radiation; however, researchers Kate Dadachova, Arturo Casadevall, and colleagues became interested in the idea that melanin might play a more complex role in the success of fungi exposed to ionizing radiation (i.e. radiation that can be biologically harmful). To do so, the researchers studied the effects of ionizing radiation on both fungal melanin itself and the effects of such radiation on the growth of melanized and albino strains of common microfungi such as *Cryptococcus* and *Wangiella* (see photo on page 1). By examining the electron spin resonance of melanin exposed to ionizing radiation, Dadachova and colleagues surprised the scientific community by showing that the exposed melanin had a fourfold increase in its capacity to do biological work (specifically the ability to reduce NADH, a key process in cellular metabolism). This is much the same as the way in which the primary plant pigment, chlorophyll, is able to capture energy from radiation in the visible spectrum (i.e. sunlight) and translate this into biological work.

Taking their research a step further, the team showed that melanized fungi exposed to radiation levels 500 times background grew approximately 3 times faster than under ambient levels of exposure. Non-melanized, albino mutants, however, did not show the same growth increases when exposed to the same levels of radiation. This suggests that melanin was indeed the critical factor. So, not only does melanin protect these fungi from negative effects of radiation, it also appeared to allow them to turn it into a positive source of energy for growth.

Looking at the bigger picture, these two pieces of evidence lead to a provocative conclusion: melanin may be the basis of a widespread, yet relatively unknown, form of energy capture that is in many ways analogous to photosynthesis. If true, this would have major implications for our understanding of biology. For example, does melanin in our skin cells capture energy from ultraviolet radiation? Could this explain why fungi are able to grow so well in space, where exposure to ionizing radiation is much higher? Any provocative finding is bound to be controversial, and the work of Dadachova et al. has not convinced everyone in the scientific community of

its generality. However, this research has certainly expanded our understanding of how fungi are able to thrive in extreme environments and will likely lead to greater insight into the biological world in general. ☼

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San Jose Camp continued

Do you have something to share that is fun or interesting? Sunday morning, breakfast is offered and I think another lunch for the road. We disband after breakfast and some go out again and hit a few spots while others go home. It takes me about 2 hours and 40 minutes to get there from Walnut Creek.

There is always a plentiful, broad assortment of spring fungi. Morels are found and depending on the year, sometimes spring boletes abound. This was my first event that I attended as a MSSF member 7 years ago. I didn't know anyone and I had such a good time, I joined the council and I'm writing this story. I look forward to partying with people that I haven't seen all year. It's a great tradition to get involved in. Hope to see you there.

To register, make checks out to MSSF and send to Tom Sasaki, 1506 Lyon St, San Francisco, CA 94115. Upon registration, you will be sent directions to get to San Jose Family Camp and a map of the camp grounds. Don't wait until the last minute to register, as Tom may not be around in mid-April and registration ends April 25.

~Dan Long

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MSSF Calendar, April 2008

Monday, April 7, 2008, 7pm, Culinary Group Dinner.

We meet at the Hall of Flowers, Golden Gate Park, 9th and Lincoln, SF. Dinner will be \$14. Contact Pat George at (510) 204-9130 or plgeorge33@yahoo.com no later than Friday, April 4 to make your required reservation. Remember to bring your own tableware, beverage, and an appetizer to share. Our next dinner meeting, the last of this mushrooming season, will be on May 5.

Friday, April 11, 2008, 8:30am–4:30pm, Mt. Tamalpais Watershed Symposium. A day of presentations and panels discussing responsible stewardship of the Mt. Tamalpais Watershed. Tickets are \$20. See <https://www.acteva.com/go/MMWD> for schedule and registration information.

Saturday, April 12, 2008, 11am, Cal Day at UC Berkeley. MSSF will staff a table at the Jepson Herbarium, and J.R. Blair will lead a tour at 2pm of the fungi collection. Volunteers needed. See announcement on page 2 for more details.

Sunday, April 13, 2008, 12pm, Field Trip to Far West Fungi Farm. Potluck lunch and tour of the farm. RSVP to litchfield.ken@gmail.com if interested. See article on page 6 for more information.

Tuesday, April 15, 2008, 7pm, MSSF General Meeting. Randall Museum. 7pm, mushroom identification and refreshments provided by the Hospitality Committee. 8pm, Dr. Tom Bruns will present an **Update on the Point Reyes Myco-Blitz.**

Friday–Sunday, May 2–4, 2008, San Jose Family Camp Morel Foray. Join leader-led groups to hunt for morels and other spring mushrooms in the Sierras near Yosemite National Park. Lodging and all meals are included with registration. To register, write check to MSSF and send to Tom Sasaki, 1506 Lyon St., San Francisco, CA 94115. Fee for members is \$121, for non-members is \$141, and each child is \$70. Directions and map of camp will be sent on registration.

**Deadline for the May 2008
issue of *Mycena News* is
April 15.**

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