34th Annual Fungus Fair

December 6th and 7th
By Ken Litchfield

The MSSF's 34th Annual Fungus Fair will be Saturday, December 6 from 10-5 and Sunday December 7 from 12-5 at the Oakland Museum. This year the regular museum entrance fee is $8.

On Friday, you and your friends are invited to join us for one of several Bay Area mushroom forays where you can learn proper collecting technique and help bring in the fungi that will be on display at the Fair. For Tom Sasaki's listing of the various forays to choose from, go to page 8. It helps to bring proper weather attire, a sack lunch, and wicker carrying baskets and waxy sandwich bags for the mushrooms. You may also bring in mushrooms on your own from your own collecting and get them ID'd.

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Mycena News

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MycoDigest

MycoDigest is a section of the Mycena News dedicated to the scientific review of recent Mycological Information

Fungal Taxonomy II: The Higher Fungi

By Peter Werner
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In my last article, I discussed how advances in molecular systematics had revolutionized our understanding of relationships among the fungi, and between fungi and other organisms. I also discussed some recent discoveries about the relationships of the basal fungi (the so-called "primitive" or "lower" fungi). In this article, I will discuss how molecular systematics has advanced our understanding of relationships among the fleshy ascomycetes and basidiomycetes that we are so familiar with.

The Ascomycota and Basidiomycota together form a monophyletic clade that is, in turn, a sister clade to the Glomeromycota, the newly discovered phylum that includes the VAM fungi and their relatives. Some long -accepted ideas about the relationships among ascomycetes and basidiomycetes have been confirmed by recent molecular data. For example, it has long been thought that the Ascomycota and Basidiomycota are more closely related to each other than they are to other fungal groups, sharing such traits as a spitzenkörper on the growing hyphal tip, and, unlike other fungal groups, completely lacking coenocytic hyphae. This relatively close relationship has been borne out repeatedly in molecular analysis.

The relationships within the Ascomycota were assumed to more or less correspond with the morphology of the fruiting structure, hence all ascomycetes with apothecia (a cup- or saddle-shaped fruiting structure) were classed as Discomycetes, all ascomycetes with perithecia (flask-shaped fruiting structures) were Pyrenomycetes, and so forth. Its now clear that this classification does not hold up well for at least several groups of ascomycetes. Cup-shaped ascocarps evolved independently at least twice, for example, and there is even evidence that the yeasts independently evolved at least twice. The majority of fleshy mushroom— and truffle— forming ascomycetes are found within one taxon, the Pezizales, which are distinguished by an operculate opening at the tip of each ascus. (This trait has been lost in the truffles, which, like most hypogeous fungi, are incapable of forcible spore discharge.)

Within the Basidiomycota, it has also long been hypothesized that the rusts and smuts form the more basal clades, and that the homobasidiomycetes (fleshy basidiomycetes) and the jelly fungi form a clade that is probably closest to the smuts. Basidial morphology pointed to the hypothesis that the homobasidiomycetes form a monophyletic clade derived from the jelly fungi. These ideas about basidiomycete evolution have largely been confirmed by molecular analysis.

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Fungus Fair *continued from page 1*

When you get finished with the foray, you'll take the mushrooms to the Oakland Museum around three or four in the afternoon to begin the ID process. The ID folks will need volunteers to help move the mushrooms from one station to another in the ID process. After all the mushrooms are ID'd and cataloged they are distributed to all the various specialty tables, taxonomic tables, and the woodland exhibit. Medicinal, edible, psychoactive and dye mushrooms, cultivation, ecology, toxicology, mushroom collectibles, SOMA, Lichen Society, and Sudden Oak Death are some of the specialty tables. The taxonomic tables have the various fungi organized according to family, genus, and species making it easy to learn the relationships of the various fungi to each other.

At 7:00 pm Friday evening we have a gourmet dinner for all the volunteers put together by Jane Wardinska. After dinner , we go back to finish setting up the displays. We also have book and T-shirt sales, Mushroom Market, and membership. (Don't forget to renew your membership! Now! Or at the fair! Or when your MSSF utilities get cut off!). Not to mention a place to ID the mushrooms you bring in during the fair, culinary demonstrations, commercial mushroom vendors, lots of speakers in two theaters, and a room for kids to create art from live mushrooms. Besides needing to be setup on Friday, all these tables and exhibits can probably still use volunteers to help staff them during the fair. And all during the show on Saturday and Sunday, Sherry Carvajal and the culinary folks will be preparing food, buffet style, for the volunteers.

If you would like to volunteer for any of these areas or be assigned where we need you, please contact Dan Long at danlong@speakeasy.net. We must have you on our master list so you can get your name tag for entrance. Help us make this a great fair and learn about mushrooms at the same time. If you don't know much about mushrooms, spending the weekend with us will make you a different person by the time it is over.

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MSSF Discussion Group on Yahoo Groups

The MSSF email discussion group facilitated through Yahoo Groups is a great way to keep in contact with other members and is one of the primary ways in which members keep up on news about the Society. The list features often-intriguing discussion of fungal-related topics, tips about current fungal activity, and up-to-the-minute news about MSSF functions.

The list is available in both individual-message and digest formats. Additionally, you can also subscribe to the group in "Special Notices" mode. That means that if you wish to receive only official announcements from the society and not email traffic from other members, you can subscribe using this method. (Subscribers to the list in regular and digest formats also, of course, receive official announcements in addition to posts from other members.)

To sign up, go to:

http://groups.yahoo.com/group/mssf/

Follow the link that says "Join This Group". (You will need to sign up for a free Yahoo Groups membership if you do not have one already.)

MSSF and Phytophthora ramorum

Now that the mushroom hunting season is upon us, MSSF members need to be reminded of the presence of *Phytophthora ramorum* — otherwise known as Sudden Oak Death — in Northern California. *P. ramorum* will have dramatic and long-lasting effects on the ecology and diversity of mixed oak woodlands.

All users of public lands should learn the signs of *Phytophthora* and methods to prevent its spread. At this time, it is highly recommended that leaves, soil and firewood should not be removed as they carry the highest number of spores.

The most obvious actions people can take are to avoid going to areas where the disease is present, consult with local resources, respect state and county quarantines and trail closures, and use disinfectants to remove spores when leaving infected woodlands.

It is especially important that MSSF members who collect and study mushrooms for personal use take special care not to cause *P. ramorum* to be transported into uninfected areas by taking the following steps:

If you visit a woodland with symptoms of *P. ramorum*, knock off any loose soil or mud while still in the area. Where practical, use a disinfectant spray or dilute bleach solution to kill any remaining spores and rinse off your hiking boots and vehicle tires with water.

When visiting areas with no visible symptoms of the disease, wear a set of "clean" clothing and boots to avoid inadvertently introducing the disease to a new area.

Further information about *Phytophthora ramorum* can be found at www.suddenoakdeath.org

Foragers' Report

December 2003 By Patrick Hamilton
email: mycochef@aol.com

Like an old wife doggedly chasing a tale, I, every year, head west towards the ocean about ten days after the first inch of rain has fallen to search for the beginning of the coastal bolete season. That axiom about 10 days after. . . , must have been conjured up for the chestnut forests of Italy, which, I presume, are not growing in sandy soil like our host porcini trees are here.

After a long and hot late summer, the porosity of the hillside and bottom land soil along Highway 1 was such that those first rains must have fallen right through. All the way down and out the other side of the world — perhaps wetting the sandal soles of a Taliban or two.

When it has been so dry before the first rains, it takes more time than 10 days for that precipitation to effect the fungus to fruit. At least there was nothing visible to Todd Humphries and me in Salt Point on this day — Nov. 12. (But for those of you who will be looking at mushrooms on Saturday, Dec. 6, at our fair, Todd and I will be doing a cooking demo under the big top — good free eats will be passed to the masses.)

I am fairly sure that by the time this is read, basketsful of mushrooms from the Woodlands and Salt Point forays (and elsewhere too) will have been gathered by those of you who actually get out and look.

One adage/axiom/maxim that is true is our old favorite, "If you don't go, you won't know." So get out and join one of our forays or just get out alone. Go — and tell this column writer what you saw. This is the time of year that we all have been waiting for.

Members who took part in the annual Yuba Pass foray reported *Albatrellus flettii, Albatrellus* sp. (*ovinus*?), *Albatrellus* sp. (?) (*piolida*?), *Armillaria ponderosa, Armillariella mellea, Boletopsisi subsquamosus, Boletus zelleri, Boletus rubripes, Boletus calopus, Boletus regius, Calbovista subsculpta, Cantharellus formosus, Cantharellus subalbidus, Chroogomphus vinicola, Fomitopsis pinicola, Ganoderma applanatum, Ganoderma oregonense,* Gardenia smelling mushroom, *Gomphus floccocus, Gomphus kaufmanii, Gomphus bonari, Gyromitra infula, Hebeloma* sp., *Helvella crispa, Helvella lacunosa, Hygrophorus hypothejus, Lactarius deliciosus, Laetiporus sulfureus* (real old group), *Lyophyllum decastes, Naematoloma fasciculare, Naematoloma capnoides, Nivatogastrium nubigenum* or *Thaxterogaster pinque, Phaelous schweinitzii, Pholiota aurivella, Pholiota terrestris, Pholiota* sp. (smooth cap), *Pluteus cervinus, Ramaria* sp., *Rhizopogon* (several?), *Rozites caparata, Russula brevipes, Russula cremoricolor, Russula densifolia* (?), *Russula dissimulans, Russula subnigracans* (?), *Russula zerampelina, Sarcodon imbricatum, Sarcodon* sp. (black cap, grey cracks), *Sarcodon*

sp. (maybe *scabrosum*?), *Scutellinia scutellata, Tricholoma flavovirens, Tricholoma saponaceum, Tricholoma zelleri, Tyromyces leucospongia, Suillus brevipes, Suillus riparius, Suillus tomentosus, Suillus umbonatus, Xeromphalina* sp. And, finally — a soft, fuzzy shelf mushroom and a fresh corn tortilla-smelling mushroom.

I realize that these foray lists can be exhausting to read through, for a few, but think of how industrious and diligent those were who compiled it for you in the field; it is a good way to just see the names of lots of mushrooms

Up north in Oregon and Washington, the rains did come, however late, and with it were lots of matsutakes and chanterelles.

There was one report from SOMA of boletes being found in Sonoma County.

That's all for now folks.

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Please send your articles, calendar items and other information to:
mycena-news@mssf.org

Check out the MSSF's Mushroom Grocery!

At this year's Mushroom Fair we will be selling nonperishable food items that feature mushrooms as a primary ingredient, candies and cookies shaped like mushrooms, as well as a selection of dried Asian mushrooms. These make great stocking stuffers and holiday gift ideas. Items are sold at little or no markup and any extra money goes to the MSSF. Hurry over for best selection!

MycoDigest Higher Fungi continued from page 1

However, when we examine the subject of the evolution of the homobasidiomycetes, we see an area where many of our old ideas are being subject to radical revision. Like early hypotheses about the ascomycetes, the different morphologies of homobasidiomycetes were presumed to each correspond to a distinct taxonomic group. Hence, agarics, gasteromycetes, polypores, and so on were each thought to be distinct monophyletic lineages. Detailed microscopic and developmental studies of many of these fungi have revealed that many outwardly-similar taxa in reality had very different underlying morphologies.

In the last several years, molecular analysis has revealed that many of these morphological states have in fact evolved numerous times. Agarics are a good example — while the majority of agaric species belong to one clade, the euagarics, it is clear that there are at least four other separate evolutionary lines that have produced agaric species. The most notable group is the Russulales (*Russula* and *Lactarius*), who's closest relatives are woody resupinate fungi like *Stereum*. Hence, *Russula*, which for all outward appearances looks as much like an agaric as, for example, *Tricholoma*, in fact represents a completely separate line of evolution from a polypore-like ancestor to an agaric morphology. Similarly, *Panus*, *Lentinus*, and *Lentinellus* each represent separate lines of evolution from closely-related woody fungi. The gasteromycetes also represent at least three separate evolutionary lines; the Lycoperdaceae turn out to be very close relatives of *Agaricus* and *Lepiota*, *Scleroderma* and *Pisolithus* are related to the boletes, and earthstars and stinkhorns are relatives of *Gomphus* and *Ramaria*. Woody fungi, such as polypores, turn up in five of the eight major evolutionary lines of homobasidiomycetes; this type of morphology may have evolved many times independently, or it may be an ancestral state in several of the evolutionary lines of fleshy fungi.

The relationships between the various clades of fleshy basidiomycetes is still, for the most part, not well resolved. There is a vague pattern that shows the club, coral, and cantharelloid fungi branching off early in the evolution of fleshy basidiomycetes. The russuloid fungi and their woody resupinate relatives branched off from the ancestors of the euagarics and the boletes some time after this. However, the close relationship of the euagarics and boletes is now very well-established. The two are sister taxa, descending from a relatively recent common ancestor. (Whether this ancestor was agaricoid or boletoid is unclear.)

The boletoid clade is notable for its extreme morphological diversity. This clade contains not only boletes, but also several groups of gastroid and hypogeous fungi, several groups of agarics, and even *Serpula*, the dry-rot fungus. These varying morphologies are scattered throughout the boletoid clade, and surprisingly, not all boletes are directly related to other boletes. *Boletus* and *Suillus* are on widely separate lines of boletoid evolution, with *Suillus* being a close relative of *Rhizopogon* and the gophidiaceous agarics. *Boletus*, for its part, shows closer affinity to several species of *Paxillus* than to *Suillus*. The bolete genus *Gyroporus* is very close to a gastroid clade that includes *Pisolithus* and *Scleroderma*. Rounding out this extreme morphological diversity are number of paxillaceous agarics that are found scattered at different points throughout the boletoid clade.

The relationships we are discovering within the euagarics are no less surprising and represent a complete revision of how we have viewed agaric "Families" in the past. I will cover this topic in my next article.

Further reading:

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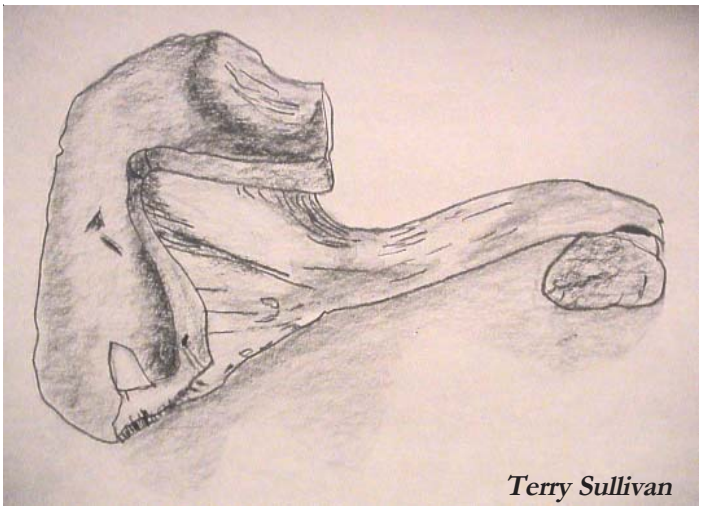

Terry Sullivan

WHY I NEVER MET A FUNGUS I DIDN'T LIKE

By Ed Mena
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Jeannette Bowers

For the last several years I have been collecting samples of basidiomycetes and ascomycetes from all over the country. I have even managed to visit San Francisco during the MSSF December Fungus Fair and struggle home to Connecticut with just about everything that of would have ended up in the trash (or recycled) after the Fair. As you can imagine, after the mushroom show, there are thousands of mushrooms lying about, already expertly identified, and now preparing themselves to become fertilizer. They are of little interest to anybody except the few club members who use a few species for dyeing purposes. Also, there are always a few samples of some oddball species that someone has not finished studying — and there the ever-present *Cortinarus* sp. (a species I always encounter) and the few persistent souls who have not quite given up the taxonomic challenge. With these few samples already spoken for, I eagerly await for the clean-up crew to start their work. This is the time that I get many questions (hardly unexpected) about what I plan to do with this many mushrooms. Although this is a very straightforward and simple question, it is very difficult to answer quickly and still be able to intercept the samples on their way to the trash. Luckily, in the great majority of cases, when I explain that I am collecting the samples for research purposes, the cleanup crew and others pitch in and lend a hand putting samples and their identification tags into zip-lock bags. While I try to respond the best that I am able to without being rude to anyone, most people have to be content with simple-minded one-phase answers like "they will be frozen soon" or "I'm interested in the chemicals that they make." I get some puzzled expressions and odd looks in return. This article and those that are to follow are my way of making up for the inadequate responses I've been forced to give.

I have a Ph.D. in biochemistry, but don't let this fool you. I am really a naturalist in disguise. I have always been trying to find ways to combine the two fields of study. In the past, I have worked on the venom of *Conus* snails (predatory snails from the Philippine area) and on spider venoms. I also spent time researching compounds from fungal cultures. Whoever said "Nature is the world's best chemist" has been proven correct time and time again. But why is there such a variety of chemicals in nature? And why have I decided to look at fungal fruiting bodies as a source of new and useful compounds? I wish I had a short answer for these questions, but I don't.

All living organisms produce an extremely varied list of chemicals. These chemicals fall into two very large (and arbitrary) groups. The first types of chemicals are those that are needed by the organisms for their basic cellular functions such as metabolism, energy production, breakdown of damaged molecules and synthesis of new ones. Cells also need the chemical machinery to make proteins, DNA, RNA and many other complex molecules that are absolutely essential for all life. Producing each of these large molecules is a complicated process that can include 50 or 60 different chemicals and a similar number of enzymes (large proteins). To make these different chemicals and enzymes, the cell requires yet another series of reactions, a list of which could become quite lengthy, depending on the organism. For example, most typical cells, from yeast (a fungus) to mammals, can oxidize sugar (glucose) and produce energy (ATP) in addition to more specialized tasks, such as dining on decaying wood or savoring fresh dung. You soon get the general idea that many chemicals are needed to keep the basic biochemical machinery of a cell operating properly. These chemicals that keep the cell going are referred to as "primary" metabolites.

If there are "primary" metabolites, then there also must be "secondary" metabolites. We hear about this class of compounds usually in association with plants, fungi, bacteria and other "lower" forms of life, such as invertebrates. (I really dislike the term "lower form of life," but elaborating here would digress too much.) The term "secondary" was originally given to this class of compounds largely because no "primary" role was known for most of them. They were chemicals that didn't seem to have any essential role for the organism. If the organism or cell did not produce these compounds, there was no reason to believe it would not continue happily onward. This was especially true if the organism found itself in a monoculture in some scientist's lab. This is still the case with many "secondary" metabolites. That is, scientists studying these organisms in isolation can find no (obvious) function for them. Most researches now believe that they play a critical role in the organism's life; it's just that frequently the function of these compounds may be difficult to ferret out among other activities that are being studied. For example, moth sexual pheromones are considered secondary metabolites. The individual moth does quite well without them. However, they are vitally important to the survival of the species. Another classic example of a secondary metabolite is the antibiotics produced by some fungi and bacteria. When growing a fungus as a sterile monoculture in someone's laboratory, the organism has little use for antibiotics and usually ceases to product them. However, in its natural habitat, their production is not a luxury.

The pheromones and antibiotics are examples of what I believe are the two major functions of all secondary metabolites made by lower life forms: defense and communication. These functions also help to explain another important observation. Most of the compounds classified as secondary metabolites are not synthesized continuously but are made by what could be described

as an "on-demand" fashion. A more textbook-like term is "inducible compounds." Perhaps one reason for them not to be synthesized continuously is that many of them are extremely complicated chemicals. Any cell that synthesizes complicated molecules such as ivermectin, taxol, and other secondary metabolites is investing a significant portion of its resources into that synthesis. The product of the synthesis must be essential for its survival. If the production of these compounds was not carefully regulated, there would be an enormous liability — those individuals that wasted such resources on their unnecessary synthesis would be rapidly squeezed out. So, instead, their production is turned off and on by environmental cues. It could be a communication from another mating type of the same species, contact with a particular food source, or attack by a predator. Some recent results indicate that secondary metabolite production peaks at the time of sporulation, a critical time fungus. If we restrict our study to fungus, we are discussing organisms that can't see, smell, hear, or feel. So how do they detect their surroundings? How do they become aware of essential events such as moisture in their surroundings or the presence of friendly and not-so-friendly companions? These events are likely mediated by chemical communications.

Defensive Chemicals

Let's first consider fungal fruiting bodies and their defense. Fungi live in very intense environments, surrounded by other fungal types, bacteria, and all manner of predatory soil inhabiting invertebrates. Chemical warfare among organisms with clearly different agendas is the rule, not the exception. I'm sure that everyone is familiar with the story of the discovery of penicillin. With the benefit of hindsight, it seems obvious that soil microbes would be synthesizing antibacterial compounds. They are literally surrounded by billions and billions of bacteria that are doing their best to find their next meal. Without antibacterial weapons, soil fungus would have a tough and short existence. By now, thousands of antibacterial compounds have been identified from soil microbes, and it's a good bet that all fungi have some type of antibacterial response. So, how do these bacteria that are being slaughtered by antibiotic-producing fungi respond? Fungi may be clever chemists, but so are bacteria. When this warfare was getting started a few hundred millions years or more ago, some bacterial enzyme that split proteins modified itself to split an important chemical bond in penicillin, making it harmless to bacteria. The code for the enzyme, penicillinase (also referred to as beta-lactamase) ended up on a piece of DNA called a plasmid. A plasmid can be spread through bacteria populations rapidly and even be transmitted to different species of bacteria. The result was that the party was over for penicillin-producing fungi. They were back on the defensive. Over the course of an eon or two and after probably many chemicals were synthesized and found wanting, a fungus hit on the compound, clavulanic acid. This compound was an inhibitor of the bacterial enzyme penicillinase. With the clavulinic acid in its chemical arsenal, their penicillin was now once again a potent weapon. There are many other examples of chemical warfare and co-evolution combatants.

The full appreciation of this process is also important for the medical treatment of bacterial infections. Initially, few human pathogenic bacteria carried the penicillinase plasmid. These bacteria were concentrating on more important issues, such as how to combat our immune system, and not penicillin resistance. However, the widespread use of penicillin created strong selection pressure for a pathogen that managed to pick up the penicillinase plasmid from a soil bacterium. This eventually occurred, and the plasmid rapidly spread through pathogenic bacteria, severely impairing the effectiveness of penicillin. Between 1941 and 2002, penicillin resistance in *Staphylococcus aureus* rose from less than 1% to greater than 99%. It took fungi millions of years to come up with clavulanic acid. Luckily, the pharmaceutical industry found a fungus that produced it a lot sooner. Beecham introduced it as Augmentin (clavulanic acid plus amoxicillin, a semisynthic penicillin-like compound) in 1981. I think we would be discounting the creativity of bacteria if we did not assume that for every naturally-occurring antibacterial, there is a bacterium somewhere that has figured out a way to beat it. Bacterial resistance to antibiotics has been around for a long time; it didn't evolve because of our use of antibiotics. Our rampant use of antibiotics created a strong selection pressure for pathogenic bacteria that learned new tricks from soil bacteria.

Some compounds from fungi that are used as drugs don't seem to have a ready explanation. For example, the first cholesterol-lowering agent, mevalonin (lovastatin, Merck) came from a fungus. This might initially seem odd, because there seems to be little if any reason for a fungus to make this compound (we all know that mushrooms are cholesterol free). The secret is that the fungus needs a chemical named ergosterol which, as it turns out, is very closely related to cholesterol (which means that mevalonin is also an ergosterol-lowering agent). Nearly every cell in a human body needs cholesterol for proper membrane functioning and has the ability to manufacture it. Humans are also fortunate (and sometimes unfortunate) enough to be able to obtain significant amounts of it from dietary sources. All fungi cells need ergosterol and can also make it. If a fungus can't make ergosterol, it dies. It does not have the option of going out and consuming the fungal equivalent of a Big Mac. So if one fungus is able to stop ergosterol production in its neighbors, it ends up with a bigger piece of the pie. This fungus uses its mevalonin-like compound to block its neighbors ergosterol production (another fungus), and the neighbor dies, so the fungus has fewer competitors for the food supply. Even Lipitor, which everybody on the planet is taking or probably will take, is a derivative of a natural product. Other types of drugs that are natural products are the immune-suppressant drugs, which have been a major factor in the increase in the number of, and the success of organ transplants. Seventy-eight percent of the antibacterials and 74% of the anticancer compounds are natural products or are derived from them, and the majority of the compounds in these two therapeutic classes were isolated from fungi. Additional examples could easily develop into endless and boring list. How-

ever, there is another interesting category of molecules produced by fungi and other organisms, knowen as communication molecules.

Communication among fungi

What are communication molecules? The air we breathe, the water in a lake, and the soil and leaf litter, are highways through which all sorts of communication molecules course. We as humans are challenged, to say the least, at detecting all but a scant minority of these chemicals. Many species of insects use them to advertise themselves to mates. Plants attract (or repel) insects with chemicals. Various species of animals announce their presence with communication molecules. Take your pet dog for a walk and witness first hand the signs of an olfactory world from which we are excluded. The lives of millions of animals are synchronized by chemical signals. I'm sure that many of you have seen the remarkable scenes of millions of coral spawning on the same night from one of David Attenborough's shows from "Life on Earth". I can't resist one more example, that of the stinkhorns, which we have the (mis)fortune to detect, as do many insects. Clearly, the chemical signal emanating from the stinkhorn has a very different meaning to you and I compared to the many species of insects encircling its tip.

We live in a sea of chemicals. I heard an analogy once that I've become very fond of. Communications chemicals can be looked at like postage stamps. You put a stamp on a letter or package to communicate something to the addressee. The stamp insures that the message will be received but says nothing about the message or the reaction of the addressee. Communication molecules also insure that a message will transmitted; the exact meaning of the message will depend on the "sender" and "recipient". Another interesting feature of communication molecules is that once Mother Nature found a chemical that could be used for communication purposes, she stuck with it. Similar classes of molecules are used throughout a wide phylogenic range. Communication chemicals can act to send a message from one part of an organism to another (e.g. hormones), or they can send communications to organisms of the same species (pheromones), or to different species (stinkhorns and flowers say "come here", a skunk's smell says "go away", etc).

Since we are talking about mushrooms, what are some of the things that are likely to be mediated by communication chemicals? Let's start at the beginning. A spore responds to certain chemical cues to germinate. It may need to know if it has landed on a suitable substrate. These mycelia respond to other mycelia of the correct mating types of the same species to form diploid mycelia organisms. The growing mycelia need to be able to detect and utilize proper nutrients. Additionally, the mycorhizal species need to colonize (or be colonized by) the appropriate type of tree root for survival and growth. The selectivity of many types of mushrooms has always amazed me. How does *Suillus granulatus* tell the difference between a pine and maple tree? How do the many other mycorhizal species recognize their hosts? However, also consider the selectivity of the wood rot polypores. *Piptoporus betulinus* always colonizes dead birches. It is rarely found on other species of trees. What signal(s) allows this fungus to selectively grow on this wood? Many species are selective for with hardwoods or conifers. When we speak colloquially about these interactions, we make statements like, "They are attracted to dead birch trees", or "*Suillus granulatus* prefers to grow in association with pine". Statements like these seem to give decision-making qualities to organisms that consist of a very limited number of cell types. While they do make a "decision" in a manner of speaking, it is their responses to the various chemicals that they encounter, either positively, negatively, or both, that underlies this apparent decision. These chemicals interact with cell surface or intracellular receptors and induce metabolic changes in the fungus. As I mentioned above, Mother Nature is very fond of the communication systems that fungus developed a billion or so years ago. Many of them have been refine and elaborated upon as more as eukaryotic systems increased in complexity. Once evolution found some molecules that were good "postage stamps" and some receptors that were good "mailboxes", it stuck with them and refined them over an eon or two.

The result is that many chemicals that are used by higher organisms have their "roots" in fungal metabolism. In fact, recent phylogenetic analysis has shown that the fungal kingdom is part of the terminal radiation of the eukaryotic groups (sometimes eloquently referred to as "the great eukaryotic radiation"). This is assumed to have occurred one billion years ago when prokaryotes and eukaryotes separated (my calendar doesn't go back that far). There is evidence that fungi are more closely related to animals than to plants. The prevailing opinion is that that plants diverged from the lineage that then went on to give rise to animals.

Mammals, of course, have many more pressing communication needs than fungus. In the central nervous system, at least 40 to 50 chemical transmitters have been identified. In the immune system, many types of communications proteins, such as the cytokines, have been discovered. These are two broad examples of mammalian communications molecules. What is also true with higher organisms is that the type of message that a molecule sends depends on the receptor that the cell has. An organism may have many different types of receptors for chemicals and the message that a cell receives depends on the receptors on that cell. For example, compounds that interact with mammalian serotonin receptors have been isolated from fungus. The introduction of Prozac has made many of us experts in neuropharmacology and we

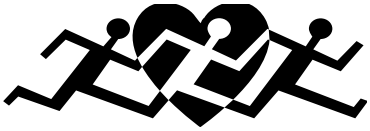
all know about serotonin's involvement in mood and depression. There are several types of serotonin receptors in our central nervous and others throughout our body. Serotonin and/or its receptor are apparently also involved in some aspect of fungal communication and may have been used as a communication molecule long before people realized that they were depressed. The cholinergic system provides another example. At one time, before the cloning of receptors became commonplace, there were two types of mammalian cholinergic receptors: nicotinic and muscarinic. The nicotinic receptors were activated by nicotinic acid from tobacco, and the muscarinic receptors were activated by muscarine, from *Amanita muscaria*. *Amanita muscaria* is a particularly rich source of a variety of mammalian communication compounds. It also contains muscimol, which activates mammalian inhibitory transmitter receptors for gamma-amino-butyric acid (GABA) and ibotenic acid, which stimulates a mammalian excitatory receptors for L-glutamic acid and is a potent neurotoxin. While these chemicals act at mammalian neurotransmitter receptors, in the case of *A. muscaria*, they are probably defensive chemicals. Because of their immediate action, these compounds would probably persuade potential predators to dine somewhere else. The predators may include mammals, insects, soil nematodes and other fungi. We should resist the egocentric notion that these chemicals are directed at out species. As I mentioned above, when nature finds a way to do something well, it usually sticks to it. Fungi synthesize chemicals that act as cytokines, compounds that mimic various peptide transmitters and gut hormones; they produce compounds that release insulin from mammalian cells. No one believes that fungi had *Homo sapiens* in mind when these chemicals were first synthesized.

The take-home message from all of the above is that many receptors and metabolic systems used by fungi overlap with those used by more complex organisms (I'm resisting using the term "higher"). As a result, there are thousands and thousands of chemicals synthesized by fungus for their own purposes that will also affect mammalian systems, some for better, and others for worse. I'm trying to find the "better" ones.

Two other questions that I often hear are i) "Exactly what do you do with these mushrooms?" and ii) "What kind of compounds are you looking for?" I'll try to answer both of these questions in my next installment.

Ed received a Ph.D. in biochemistry from Washington University in St. Louis working in neurochemistry. He then ventured to the University of California at Irvine as a Postdoctoral Fellow and then as an Assistant Professor. He moved east because of a job offer from Pfizer, Inc. in Groton, CT, doing neuroscience drug development and worked on Zoloft and Aricept. He now teaches biology at the University of Connecticut at Avery Point in Groton and independently pursues his work on fleshy fungi. In the past he has received funding from the National Cancer Institute and the American Cancer Society.

Upcoming Forays



Fungus Fair Forays

Forays are scheduled throughout the Bay Area and beyond to collect specimens for the annual Fungus Fair held on December 6-7. Bring cardboard boxes, baskets, waxed paper and waxed paper bags. Only serious rain will cancel or delay these fungus collections. Call leaders if necessary. More forays may be scheduled which will be published in the December issue. Forays to date for the Fungus Fair are listed below:

December 4 and 5 (Informational and not a foray): Robert Mackler is training a group of high school students for the Natural Science people of the Oakland Museum and will lead the group on a foray to Joaquin Miller Park in Oakland. They will collect for the fair during the day and help with the set up on Friday evening. Robert Mackler would appreciate if individual members of MSSF would not foray there for the Fair.

Thursday, December 4, San Mateo County, Wunderlich Park and Junipero Serra Park: Meet at 10:00 AM at Wunderlich County Park, then later will go to Juniper Serra Park. Bring lunch. Leader: J. R. Blair (jrblair@outrageous.net or 650-728-9405)

Friday, December 5, San Francisco Watershed: Meet at Pulgas Temple entrance on Canada Road at 10:00 am and finish by 3:00 pm. Entrance is limited to 35 persons, no infants and by reservations only. Call, email, or fax your request to the leader. No response indicates acceptance. **PULGAS GATE IS CLOSED**. We will enter through the gate NORTH of the Pulgas Temple entrance. Bring waxed paper bags, cardboard boxes, instrument for digging up the base of the fungi, lunch, and fluids. Leader: Bill Freedman (650-344-7774 or email: loufreed@aol.com).

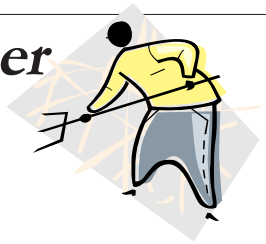
Friday, December 5, San Mateo County Memorial Park: Meet at 10:00 am at the park entrance. The park is close to the community of La Honda. Bring lunch, basket, and waxpaper. Leader: Fred Stevens (fstev@sonic.net or 650-994-1374)

Friday, December 5, San Mateo Co., Huddart Park: Meet in the main parking lot, just past the park entrance kiosk at 10:00 am and leave at 1 pm. Huddart Park is on King's Mountain Road in Woodside. Leader: Wade Leschyn at (650-591-6616/home or 650-678-1302 /cell or email: wade@belmateo.net).

Friday, December 5, Nevada City: Meet at 9:00 am at the creek in Pioneer Park in Nevada City. Call leaders for furthenformation Leaders: Daniel Nicholson (530-265-9328) and Jerry Bloom (530-265-9544).

contiuned on page 11

Cultivation Corner



By Ken Litchfield © 2003
klitchfield@randallmuseum.org

To All Ruff, Tuff, and Buff Duff and Stuff Collectors

When you're out and about collecting mushrooms for the Fair don't forget to bring in plenty of duff and other mushroom habitat stuff. We'll need enough bags of pine needles, oak leaves, and humus to cover a couple acres of table tops. Turkey tail and other polypore logs make a great basic structure for the display of other fungal fillers. Mossy logs, licheny twigs, ferns, and cool looking gnarly stumps all add an aesthetic and habitat appropriate atmosphere - and a humid atmosphere, too. Logs and sheets of mossy bark make it easy to prop up the mushrooms for display. Fern fronds draped over mushrooms nestled in the hollow of a rotted log set against the black and silver of duo toned lichens — Mmmm, now that's a Fungus Fair tasty morsel.

Remember to be careful with the living material. You want the ferns fresh and moss unmussed. One way to collect moss is to pull sheets of mossy bark from a rotten tree trunk and stack them in a plastic bag with empty plastic bags sandwiched between to keep the green moss from getting crud from the underside of the next bark sheet above it. A mossy cobble can be protected with the bottom of the rock in the bottom of the plastic bag, and the top-covering moss undisturbed. At the end of the fair we will relocate the living lichens, mosses, ferns, and polypore logs into one of our mushroom gardens.

And when you are collecting mushrooms, don't forget to bring in really large and impressive specimens for the woodland exhibit. Clumps or stumps of honeys, big gym, and jack-o-lanterns are really awesome along with big red muscarias, bright mounds of sulfur tuft, and monster polypores, Satan's boletes, or porcinis. Some smelly lattice stinkhorns would attract a lot of attention, too. Remember the woodland exhibit is for dramatic effect and photo opportunities. Bring your biggest, brightest, weirdest, and coolest trophies to display there.

Our Duff Tsar once again this year will be Jim Miller. If you would like to coordinate with him in bringing in bags of duff, we can be delivering them to the museum and storing them there during the week before so we don't have to rush at the last minute on Friday.

Please Renew Your Membership for 2004

We have made it so easy for you. Three ways easy.

1. Cut this box out of your newsletter. Fill out the required information on the reverse side. Write a check for the appropriate amount, made out to "MSSF Membership." Then mail your renewal to MSSF Membership, c/o The Randall Junior Museum, 199 Museum Way, San Francisco, CA 94114

2. To save postage, you can give bring this renewal form and check to Jane Collier at the MSSF Membership Desk at the entrance to the exhibit areas at the December 6th - 7th Oakland Fungus Fair.

3. You may also renew on-line by using the PayPal option on the MSSF website:

   http://www.mssf.org

   Note: If you use option 3, please send Jane Collier a personal email (at jcollier@stanford.edu) giving the information requested on the reverse of this form. PayPal provides only the name, mailing address, and email of those who enroll or renew. It does not give the name of a secondary member, telephone numbers, an alternate email address, or any indication of interests.

Please note: All memberships for 2003 expire at the end of December. You need to renew before the end of December in order to make sure you receive the 2004 publications and to continue your access to the MSSF website.

For those who have already renewed for 2004
—Thank You!!—

Be sure to check the mailing label on your December Mycena News to find out if your membership expires in December of 2003.

Also note: The MSSF treats membership information as private, but it does VERY occasionally release its membership list for mailings by mycological businesses. If you do not want your name included in such a mailing list, either contact the membership chair or indicate on your renewal that you do not want to receive commercial mailings.

The regular, adult/family membership fee is $25.00. For seniors over 65 and for full-time students, it is $20.00. For **e-members**, who will not receive the Mycena News by mail, but can download it for themselves from the website, the fee is $15.00.

If you have changed your name(s), mailing address, telephone number(s), or email address, please notify Jane Collier, the membership chair, so that she can update the database. You may notify her in writing at the time you renew or you may contact her by telephone (415-641-6068) or preferably by email at: **jcollier@stanford.edu**.

MYCOLOGICAL SOCIETY OF SAN FRANCISCO – Membership and Membership Renewal Application

New Members please fill out as much information as you can. Members who are renewing need to fill out only the blanks for which information has changed within the last year. Please check the current *Roster* to see if any of your address, phone, and email need updating!

Name 1:_____ **Home Phone:** _____

Name 2:_____ **Business Phone:** _____

Street/Apt#/PO:_____ **Cell Phone:**_____

City:_____ **Email 1:**_____

State:_____ **Email 2:**_____

Zip Code:_____ **Interests:** _____

New Membership?____ **Renewal?**____

Membership type: ____**Adult/Family ($25)** ____**Senior/Students ($20)** ____**Electronic ($15)**

Please return the filled out form along with your check made out to "MSSF membership." Or mail the form and check to: MSSF Membership, c/o The Randall Junior Museum, 199 Museum Way, San Francisco, CA 94114

To Celebrate the Holiday Season, the **Mycological Society of San Francisco** Invites you to the

Annual Holiday Dinner

MENU

APPETIZERS & EGG NOG

Buffet at 7:00 pm, dishes as provided by MSSF volunteers

WOOD NYMPH SOUP

Creamed morels with golden beets, sherry, and nutmeg

TRUFFLED GARDEN SALAD

With porcini bits

SCALLOPED POTATOES

With black and gold chanterelles

ROAST TENDERLOIN OF BEEF

With porcini sauce

or

WILD MUSHROOM STRUDEL

Vegetarian alternative (must be re quested with reservation)

CARROTS AND PEAS

With Shallots

ELODIE'S CHOCOLATE CAKES

Chef: *Michael Giacomini and his Merry Band of Elves*

Cost: *$30/member; $35/non-members Please bring your own dishes, silverware and beverages.*

Location: *Snow Building, Oakland Zoo*

Time: *December 15, 2003, Appetizers at 7:00 p.m., dinner at 8:00 p.m*

Reservations are required. *Please mail check, payable to MSSF, together with the names of those in your party to: George Collier/ MSSF Holiday Dinner, 1535 Church St., San Francisco, CA 94131*

Dinner produced by the Culinary Group of the MSSF.

Culinary Corner

By Alvaro Carvajal
alvaro.carvajal@sbcglobal.net

The Culinary Group's November dinner celebrated the chanterelle. With their ability to mix and match with a large number of flavors, chanterelles are among the most versatile of the wild mushrooms. There are several species of the chanterelle but all the varieties cook in similar manner and are known commonly as chanterelles. The November date selected for the dinner was a little bit early for the California coastal chanterelles because the rain had not arrived. Luckily, the rains were out in force to Oregon and chanterelles (as well as multitudes of other delectable mushrooms) were quite plentiful and low-priced in the stores.

As usual, we started with a some great appetizers that we put down with some excellent Mojitos, courtesy of Carol Hellums. After that we had a wonderful Green Salad with Persimmons and Citrus Dressing by Pat George. The salad went very well with a Pumpkin and Curry Soup with Yellow Foot Chanterelles prepared by Carol Reed (who also grows her own pumpkins). The salad and soup were served with Bill Hellums' Whole Wheat rolls and garlic-basil butter.

After a brief break, we moved to the main part of the meal: Golden Chanterelles with Roasted Chicken Breasts prepared by Dan Long and Mark Lockaby. Dan and Mark marinated the chicken breasts with spices and olive oil and roasted them together with golden chanterelles, onions and carrots. They then made a sauce with chicken broth, the roasting juices, the chanterelles and other vegetables. This dish was accompanied by Tom Sasaki's Steamed Broccoli with a light touch of Olive Oil and Potatoes au Gratin made by Sue Witt. We closed the dinner with a delightful Pumpkin Brioche Bread Pudding with Bourbon Whipped Cream made by MaryAnn Swazo and Julie Swazo and Remo Arancio's famous decaf coffee. It was a delightful evening with good company, good food, and good wine. What else can a man ever hope for?

The next culinary group dinner is also the MSSF Holiday Dinner on Monday, December 15. (See the ad on page 10 for more information.) I look forward to seeing you all there.

Forays continued from page 8

Friday, December 5, Salt Point State Park: Meet at the Stump Beach parking lot at 10:00 am for a foray up the Stump Beach trail. We will regroup at 1:00 pm at the parking lot. Leader: Anna Moore (510-231-9584 or 510-932-4034 or email: wade@bel.mateo.net).

Friday, December 5, Marin county, Roy's Redwoods and Point Reyes: Meet at the parking lot at 9:00 am. Take Sir Francis Drake west, into the San Geronimo Valley, to Nicasio Valley Rd. Turn right and go up the hill 1/2 mile – parking is on the right side of the road. We will collect here, then later carpool to Limantour Rd. in Point Reyes National Seashore, and finally move on to Tomales Bay State Park. This foray will sample fungi from coast live oak, Douglas-fir, and bishop pine woodlands. Be sure to pack a lunch and something to drink. Leader: Peter Werner (call 415-289-0168 or email: pgwerner@sfsu.edu).

Friday, December 5, UC Santa Cruz Campus: Meet at 8:30 am near campus. From Highway 17 south towards Santa Cruz, take Highway 1 north towards Half Moon Bay. Turn right on Bay Street. Go 1 mile and turn left on High Street. Continue 3.8 miles and look for our blue VW Passat Station Wagon at the side of the road. Leaders: Tina and Thomas Keller (E-mail tinakeller@covad.net or call 408-879-0939.)

Calendar continued from page 12

Sunday, January 11, Mushroom illustration class: with Jack Laws. Learn how to draw and paint mushrooms with a professional naturalist/illustrator. Jack is a regular contributor to Bay Nature, and designed this year's Fair poster and T shirt. Free to MSSF members, but you MUST pre-register with the Oakland Museum. For information, contact Dorris Welch at dwelch@museumca.org or 510-238-6641

Saturday, January 17, Tomales Bay State Park foray: Meet at 10:00 am at Bear Valley parking lot in Point Reyes National Seashore. We will then carpool to Tomales Bay State Park. Leader: Peter Werner (415-289-0168 or email: pgwerner@sfsu.edu).

Sunday, January 18, Beginner's Foray (not for collecting) at SF Watershed: Meet at 10:00 am at the Phleger entrance to the SF Watershed where the end of Edgewood Road joins Cañada Road. To get there, take Highway 280 to the Edgewood turnoff just north of the city of Woodside. Will finish about noon. Heavy rain cancels. Children not preferred at this function. Foray limited to 25 persons. Call Bill Freedman at (650-344-7774 or e-mail loufreed@aol.com for reservations).

Tuesday, January 20, MSSF General Meeting: Doors and mushroom ID at 7:00 pm. Speaker at 8:00 pm.

Monday, February 2, Culinary Group's Monthly Dinner: 7:00 PM. Meeting and dinner at Hall of Flowers in Golden Gate Park in San Francisco. For reservations or information, please contact Alvaro at (415-695-0466 or at alvaro.carvajal@sbcglobal.net).

Mycological Society of San Francisco
c/o The Randall Museum
199 Museum Way
San Francisco, CA 94114

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December, 2003, vol 54:12

MSSF Calendar, December, 2003

Tuesday and Wednesday, Dec 2-3, Mushroom Dinner at Lalimes Restaurant in Berkeley: For the 8th, year Lalimes will have a prix fixe mushroom dinner the week prior to the fair. The MSSF will have a display set up and will be there answering questions. For menu and reservation information contact http://www.lalimes.com/ or call 510-527-9838.

December 4 and 5, Forays for the Annual Fungus Fair: Forays to be scheduled throughout the Bay Area and beyond to collect mushrooms for the Fungus Fair. Details page 8.

Saturday and Sunday, December 6th-7th, 34th Annual Fungus Fair: Oakland Museum, 1000 Oak Street, Oakland. Saturday, 10:00 a.m. – 5:00 p.m. and Sunday, noon – 5:00 pm see Story page 1.

Saturday, December 13, Nevada City Fourth Annual Fungi Foray: Meet at 9:00 AM at the North Columbia Schoolhouse. To get there from Nevada City, go northwest on Highway 49 to North San Juan, turn right on North Columbia Road to North Columbia. School house is on the left side of road. Call leader for further information. Leader: Daniel Nicholson (530-265-9328 or email,danmadrone@yahoo.com).

Monday, December 15, MSSF Annual Holiday Dinner: 7:00 pm. At the Snow Building at the Oakland Zoo, located at 9777 Golf Links Road, Oakland. For information, please contact Bill Hellums at 415-255-4950 or at hellums@att.net. For reservations, please mail a check, payable to the MSSF, for $30 per person ($35 for nonmembers) and please include a list of the members in your party to: George Collier, 1535 Church Street, SF, CA 94131.

Saturday, December 20, S. F. Land's End Walk: Meet at 9:30 AM in the parking lot in front of the WW II monument to USS San Francisco at the north end of El Camino del Mar. To get there, go west on Geary Ave which becomes Point Lobo Ave near the ocean. At El Camino Del Mar, turn right and proceed to parking lot. Foray Leader: Tom Sasaki (415-776-0791or sasakitom@aol.com)

Monday, January 5, Culinary Group's Monthly Dinner: 7:00 pm. Meeting and dinner at Hall of Flowers in Golden Gate Park in San Francisco. For reservations or information, please contact Alvaro at (415-695-0466 or at alvaro.carvajal@sbcglobal.net).

Saturday, January 10, Beginners Foray at Point Reyes National Seashore: Meet at 10:00 AM at the Bear Valley parking lot. Rain will cancel. Limited to 20 people and by reservations only. Leader: Bob Mackler (510-799-6756 or email, Rdmackler@aol.com).

Saturday, January 10, Annual Mills Canyon Park Educational Foray (not for collecting): Meet at 10:00 am for a walk with Fred Stevens and Bill Freedman to last till noon or later. Foray is by reservation only and limited to 25 persons. Dress for light rain. Heavy rain cancels. Wear substantial shoes, the trails will be wet. Park perpendicular at the Adeline entrance, just south of Trousdale Ave, off Route 280. Please call Bill Freedman at (650-344-7774 or e-mail loufreed@aol.com for reservations).

Calendar continued on page 11