Mycena News

The Mycological Society of San Francisco October 2008, vol. 59:07

Speaker for the October 21 MSSF Meeting

Dennis Desjardin, PhD

Mushrooms of the Islands at the Center of the World

Dr. Desjardin will present wonderful data on his latest expedition to Sao Tome and Principe, the country in west Africa south of Cameroon and west of Gabon—as close to latitude 0° and longitude 0° as you can get without getting too wet!

Continued on page 7

Inside This Issue...

MycoDigest: Fungal Genomes

Else C. Vellinga

The publication of the human genome in 2001 was a milestone in our understanding of the human genetic make-up. The data shed light on the number of protein-coding genes (20–25 thousand, far fewer than expected), their position and composition, and the rest of the genome, which lies between the genes, and whose significance is still obscure. The data are a treasure trove for biomedical science. For example, they have been widely used to hunt for the genes that cause, or make us susceptible to, particular diseases.

What exactly is a genome sequence? It is the order, like letters in a text, of four different bases (bases being a particular kind of molecule) in a chain of millions, an order which scarcely varies from one individual to another in the same species. We say that this order is the genetic code of the species and different orders make different species. But the order is more than a name: it is a set of specifications for making the myriad chemical building blocks of life. The bases form the rungs of a twisted ladder which is the structure of the DNA molecule (the "sides" of the ladder, famously called the double helix, are made up of sugars and phosphates).

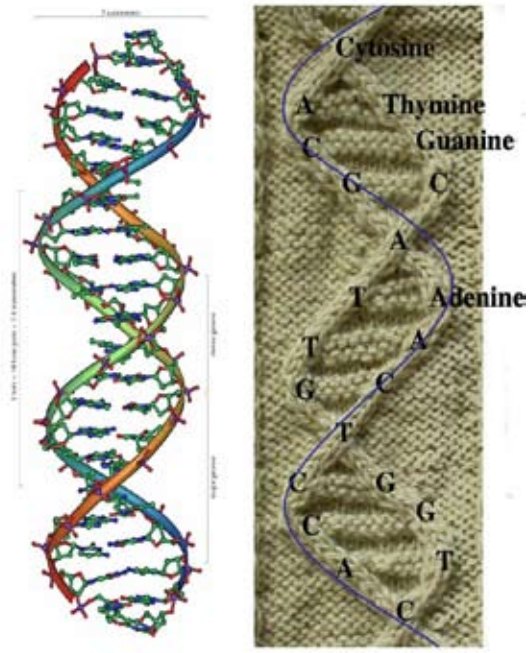

Fig. 1. Left: the DNA molecule, with helices connected by base pairs or "ladder rungs." Right: a knit rendition of the DNA molecule's double helix; the sequence along the line reads as: CACGT (behind the A) and AACTCCAG.

Left: image courtesy of Michael Ströck, http:\\commons.wikimedia.org/wiki/Image:DNA_Overview.png. Right: DNA cable pattern by June Ishira, knit by Else Vellinga.

Continued on page 8

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

PRESIDENT'S POST

Rain in the North Bay today. We got a bit of the fringes here on the Coastside. Nice.

As the autumn progresses we all get more and more excited about the upcoming mushroom season. Perhaps you'd like to expand your horizons in that direction? As you'll notice in the calendar we'll be offering some workshops on mushroom identification. There are two levels (so far—a third level to be offered soon), Beginning Mushroom ID and Intermediate Mushroom ID. The first will be a presentation on the various macroscopic characters (those you can see with little or no magnification) that are used to identify fruiting bodies. The intermediate class will be hands-on identification practice with fresh mushrooms using Arora's *Mushrooms Demystified* – still the best single resource available for the western U.S. and beyond. You'll need to take the Beginner's Mushroom ID Workshop in order to take the intermediate one, or get the instructor's approval (that would be me). Some of you may have fulfilled that prerequisite last January and February when I did the same workshops. I'd encourage you to take the intermediate class more than once. The more practice the better. Please note that we'll keep the class to about 15 participants. More details can be found in the calendar on the back page of this newsletter.

As I said, we will have more advanced workshops later in the season. These will likely entail identification methods such as using microscopes and technical literature. Stay tuned for more information. Our Foray Chair, Norm Andresen, will be working on this project. Why the foray chair, you say? Well, first of all, Norm is quite an accomplished amateur mycologist and is considered something of a local expert on the genus *Russula*. Secondly, we would like to have more people develop the skills to lead local forays. Not that that would be a requirement of our "graduates," but it is something to consider.

I hope to see many of you at our General Meetings and at our Mendocino Woodlands Foray in November. Pray for rain.

~J.R. Blair

ANNOUNCEMENTS

MSSF Scholarship

The Mycological Society of San Francisco offers scholarships to full-time graduate students majoring in mycology and attending colleges and universities in northern California. The scholarships vary in amount from $700 to $1,500 and are given in the name of Esther C. Whited and Dr. Harry Thiers. All research proposals are welcomed, but special consideration is given to taxonomic studies of the higher fungi of the Pacific States.

Requirements include two letters of recommendation—one from a professional mycologist, a brief statement describing the research project, and an agreement to present the results at a General Meeting of the MSSF. Note, $200 of the scholarship will be awarded at the time of this presentation.

Students reapplying or modifying previous proposals need not resubmit letters of recommendation. The deadline for applications is December 31, 2008.

Send inquiries and letters to:
Robert Mackler
157 Mesa Ct.
Hercules CA, 94547.

Request for Specimens of *Amanita aspera*

I need a little help collecting as much as possible of *Amanita aspera* (aka *franchetti*). Are you familiar with it? My records show that I've collected it from the West, including San Francisco and Eureka. Please contact me for my FedEx account number if you are able to ship any specimens.

Thanks,

Ed Mena
eemena@aol.com
University of Connecticut

860-405-9219 Wk
860-464-7458 Hm
860-460-4474 Cell

MSSF Mendocino Woodlands Foray • Nov 14–16

The annual MSSF Mendocino Woodlands Foray will be held in the mushroom-rich hills of Mendocino, California.

The Mycological Society of San Francisco is very pleased to announce that Gary Lincoff, author of the *Audubon Field Guide to North American Mushrooms*, will be the Foray Mycologist. Also in attendance will be University of Tennessee Professor Brandon Matheny, of the Fungal Tree of Life project.

The weekend includes lodging, meals, forays, classes, and special events. $150 for MSSF members, $175 for nonmembers. Under 12, half price (w/ adult), under 5 free. $90 with offsite lodging.

Registration form available online at www.MSSF.org, or by e-mail request to mendo@MSSF.org. The earlier you register, the closer your cabin will be to the main lodge. Questions? E-mail the above address, or call 707-829-2063.

David Arora's Annual Mendocino Foray

Nov. 28-30, 2008. Join David Arora and special guests for a weekend of mushroom hunting, feasting, lectures and workshops. Anthropologists and ethnomycologists recently published in the fall mushroom issue of Economic Botany will speak about mushroom hunting in different countries as well as locally. Begins the day after Thanksgiving. $200 per person includes lodging and most meals ($165 without lodging). To register, contact maxfun@cruzio.com or call (707) 884-3457.

SF Ferry Building Fungus Festival

SF Ferry Building Fungus Festival, SF Embarcadero, Saturday, Sunday November 8, 9 10-6. All kinds of mushroom related activities with Far West Fungi and mushroom related offerings from other vendors. Society tables for ID, sales, etc to promote our Fungus Fair. Info at ferrybuildingmarketplace.com or farwestfungi.com and volunteers contact Ken at litchfield.ken@gmail.com or (MSSF phone number).

Far West Fungi Tour and Potluck

Sunday, October 26, 2008 from noon to 3ish. Tour the Garrones mushroom farm in Moss Landing and have potluck lunch afterwards. They provide the grill and the mushrooms; you bring the grillables and/or potluck item. Sign up for directions and so we know how many are coming. Volunteers are needed to help with grill and potluck setup and cleanup. Contact Ken at litchfield.ken@gmail.com.

Mycena News

October 2008, vol. 59:07

Contributors:
Dorothy Beebee, J.R. Blair, Liana Hain, Dan Long, Tom Sasaki, Fred Stevens, Else C. Vellinga

Editing and Layout:
Cordelia Chadwick, Jeffrey Fisher

Mycena News is the member's newsletter of the Mycological Society of San Francisco, and is published monthly from September through May.

Please e-mail photos, comments, corrections, and correspondence to mycenanews@mssf.org.

To subscribe, renew, or make address changes, please contact Alvaro Carvajal: alvaro.carvajal@sbcglobal.net or (415) 695-0466.

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

MSSF Officers 2008-2009

About Drying and My Dryer

Dan Long

A few years ago, my plastic, round, stackable tray dehydrator mysteriously melted. As my occupation is cabinetmaking, I naturally considered making a replacement out of wood. I remember telling Else Vellinga that I would design a dryer that anyone could put together and post it on the web site. Well, I fell short on that promise as my dehydrator evolved into a rather large, difficult-to-make unit. Maybe my design will stimulate your own ideas, should you decide to tackle your own home made devise.

I have dried a lot of mushrooms in the last few years and I have had my share of failures in drying and storing. I have talked with and listened to anybody willing to share their experiences with me. There is always room for refinements, and I add or subtract things as I go along. I have not seen much written about drying mushrooms, so I wanted to write this article in order to share what I've learned thus far.

Your drying sequence starts in the field. Pick clean, trying to keep the debris out of your bag or basket. A quick brush will save you a lot of time when you get home. Grit in the gills is a culinary deal breaker and it's hard to get out once it's in. Don't be afraid to use water for a rinse, but use it sparingly.

Your finished mushrooms should be so dry that they snap when you try to bend them. For large porcini, I separate the stems from the caps and then slice them to about 1/4 inch. Most of my morels are cut in half in order to make sure the insides are free of debris. Some of the bigger ones are dried whole so they can be stuffed with various concoctions at a later date; however, they are problematic to store so they don't break. Candy caps, blacks, and other small- or thin-walled mushrooms are dried whole. Out of the dryer, I put them in glass jars that I purchase from Cost Plus World Market—the ones with a rubber gasket and a wire draw pull. That way I'm keeping them airtight but I can dip into them when needed. As I use them, I break the mushrooms up to the desired size before I reconstitute. I have found that mushrooms intensify their flavour when they are dried.

Front view of the dehydrator, with air outlet holes on the left and intake filter on the bottom right. Photo by Dan Long

Before I get into describing my dryer, let me share something about putting up chanterelles. While I don't dry them, I do dry sauté them. Put them into a frying pan with high heat. In a couple of minutes, the mushrooms will release their water. Some people will pour off this liquid and use it in cooking. The chanterelles will be ready when they lose most of their water. You can put a little olive oil in the pan at the end. When they are done, I let them cool, and then measure them into quart size zip-locks, 1 or 2 cups. I then lay them flat in the freezer and, when they are solid, I stand them up like a loaf of bread. Saves space.

Airflow is far more important than heat for drying things. In fact, if you just had a fan blowing across your mushrooms, they would dry eventually. Maybe that satisfies my pledge about designing a dehydrator that anyone can put together!

When I made my dryer, I used 3/4-inch maple plywood for the case and painted it inside and out with white paint. The tempered glass door allows me to see what's going on without opening it up. The door has a 1/4-inch tenon on the bottom that fits into a slot on the bottom of the case. The sides of the door have a 1/8-inch mortise on the inside face that mates with a 1/8-inch tenon on the case. This was my solution to keep the air from rushing out of the space around the door. The door latches at the top and lifts out completely to allow the trays to be inserted or removed. I used a RadioShack thermometer with a remote sensor that I installed in the roof of the drying chamber. A 6-inch hole at the bottom of the front and back are air intake ports. I knocked the inside out of a gallon paint container lid with a cold chisel to give me a rim that I could stretch cheese cloth across to be some kind of intake filter. I installed globe casters on the bottom so I can move it around as it's always in the way between uses.

The shelves dictated my design. Norm Andresen, in a generous mood, offered me some wire trays that he salvaged from a commercial refrigerator. They are 22-inches by 23-inches. Using all six trays gave me 21 square feet of drying area. I have three inches of space between the shelves. If I want to dehydrate

a watermelon or some huge mushroom, I can remove a tray or two.

I found a dual intake squirrel cage fan on eBay that was intended for a Viking kitchen hood. It was brand new and cost $30. I then bought a variable speed controller so I could regulate the airflow ($15 on eBay).

I mounted the blower so the airflow was directed to the top, where it bounces off the ceiling, and with the baffles, is directed to the drying area. I made another baffle between the airflow area and the drying chamber. This ensures that each shelf has a flow of air. The holes for the bottom shelves are smaller than the top ones because there is more pressure on the bottom. The outlet holes on the other side of the drying chamber are centered on the shelves and are all the same size. I guessed at the hole sizes and tested air distribution with little blocks of wood with bits of yarn taped on. I had to make both baffles twice but ended up with all the trays, including the corners, equal with the same airflow. When used there is an even ring of spores around all the exit holes.

For simplicity, I used light bulbs as a heat source. I bought four ceramic light bulb sockets at Ace Hardware along with two light dimmers. I mounted the sockets in the airflow area. Each dimmer has a 600 watt capacity. I hooked up two light sockets to each one, and chose 200 watt bulbs. If I turn the bulbs on full and reduce my airflow, it registers about 113 degrees. I run it like this for an hour or so to get a head start on any moisture that I added from lightly rinsing the mushrooms, and then I turn the airflow up until it reaches between 95 and 100 degrees. It takes about 30 hours to get everything potato chip dry. Whatever idea you might come up with, be sure to monitor your first few drying attempts. Mine works for me; but I still get nervous when I leave it unattended, and I make sure to put it in the middle of a concrete slab at my shop.

If anybody dries a whole watermelon, please send me a picture:

danlong@astound.net. ❁

Rear view of the dehydrator, with the airflow chamber uncovered.
Photo by Dan Long

© Dorothy Beebee

Calling all new MSSF members...

...request for fresh, original content...
...make your voices heard, share your vision of an ideal foray.

We love our faithful contributors, and we thank them for their hard work and commitment to filling *Mycena News* with some of the best amateur mycological content in North America.

But, as the forest floor is dense with duff and diverse of species, so too is our membership. New and old members alike, please write to mycenanews@mssf.com and share your stories, photos, news items, and recipes.

We'd love to hear from you!

Faithfully,
The Editors

A Personal View of the NAMA Foray at McCall, Idaho

Tom Sasaki

This year's annual foray for NAMA (North American Mycological Association) was held in McCall, Idaho from September 4–7, in memory of Dr. Orson Miller. He had a summer home there, which became his permanent home upon his retirement.

Usually I take the plane to NAMA forays, but fellow member Ron Pastorino, who also attends these annual forays, decided on taking his car; I asked to ride with him. His plan was to hunt for mushrooms in Oregon on the return trip. We were totally in agreement on that idea, and looked forward to hunting in Oregon.

We reached the foray facilities at Camp Wildwood, a church retreat grounds in McCall located not far from beautiful Payette Lake, on Thursday, September 4 at about noon. We registered and took one of the afternoon forays scheduled for early registrants. Our bus took us to a private ranch on a west facing slope of a mountain. Although a stream ran through the area, it was otherwise very dry and our finds were very minimal. We just hoped that this wasn't the forecast for the days to come. That night Ron and I talked to some local members about what foray areas might produce the best results, considering the recent lack of moisture.

Friday morning we hooked up with the bus going to Goose Lake, but in case that area didn't pan out, we took Ron's car as a means of escape. As it turned out, the suggestions received the previous night were very good. We found different species here and there, although not too plentiful of any one species, except one: *Boletus edulis*! The bus left early in the afternoon, but Ron and I stayed a little longer. At the end, we had found two big bagfuls of porcinis, which we gave to the mycophagy group for their use at the foray. Of course, we got to enjoy them at the next day's tasting.

That night we were rewarded with a wonderful dinner served at the town's golf course club house and at which time people paid tribute to Dr. Orson Miller. Some were former students who are now professors enhancing the study of mycology. Among them were Dr. Cathy Cripps, Assistant Professor at Montana State University and Chief Mycologist for the foray, and Dr. Tom Volk, Professor of Biology at University of Wisconsin at La Crosse. During the evening the winning photos of NAMA's photo contest were also shown. MSSF photographers Ron Pastorino and Hugh Smith were among the winners whose photos were projected. A silent auction was also held at which many old books were present. Ron bid on and won *Agaricales of California, Volumes 1–7* , edited by Dr. Harry Thiers.

On Saturday after inquiries were made, we decided to go on our own foray to Brundage Reservoir. It turned out to be a good decision. (As a side note, the Brundage name is everywhere in McCall. He is the same person whose Asian art collection started the Asian Art Museum in San Francisco.) We continued to find mushrooms found the day before, and also some new ones. In addition to porcinis, others boletes found were *B. calopus, B smithii, B. chrysenteron*, and *B. zelleri,* as well as others I could not name. There were also many corts. One which interested us was the *Cortinarius caperata*, formerly *Rozites caperata*. Among the *Amanitas*, the most copious was *A. muscaria*. There were *Agaricus* and *Russula* species which I could not name. *Lactarius deliciosus* was most prominent among the *Lactarii*. There were also species of *Laccaria*, *Chroogomphus*, *Hygrocybe*, *Albatrellus*, *Suillus,* and many more I could not identify or remember. We left early Sunday morning and were not privy to the number of species found during the foray.

NAMA instituted a voucher system where mushrooms are identified with location, habitat, substrate, the finder, and other salient features about the mushroom. The specimens were dried and stored at the Field Museum Herbarium in Chicago. Patrick Leacock of the Museum maintains the voucher system for NAMA. Thus, a list of the species found at the forays will be published in a future issue of the NAMA's newsletter, *The Mycophile*.

Saturday evening was the big night on which the mycophagy group presented their tasting of about 10–12 different dishes based on morels, boletes, milk caps, chanterelles and other mushrooms. The main feature, however, was the Power Point presentation of "Mushrooms of Idaho" by Dr. Michael Bueg. Dr. Beug has prepared many of NAMA's photo and slide programs on mushrooms. MSSF has shown many of them in past years. This was followed by an auction to raise money in memory of Dr. Orson Miller to help fund students studying mycology. One of the biggest items auctioned was a bed quilt covered with mushroom designs, sewn by Hope Miller that sold for $2,000!

Normally, when at NAMA forays, I attend some of the day programs presented by professional and amateur mycologists. But forays are held at the same time, so it's sometimes a difficult decision as to which to attend. At this foray, for the first time I spent all my time foraging. I enjoyed the activity but did miss attending the daytime presentations. Drs. Walter Sundberg and Steve Trudell also presented daytime programs. MSSF members attending the foray were Larry Stickney; Hugh Smith and his wife, Sand; Dimitar Bojantchev; Ron Pastorino; and myself. Hugh was ever present photographing and recording

Anna Rugani's Porcini Pasta Sauce

translated by Liana Hain

Ingredients

2–3 ounces dried porcini mushrooms

1 cup heavy cream or milk

2 cups water

¼ cup olive oil

1 medium white onion

Salt

Black pepper

Chili flakes

Anna Rugani is Liana's cousin who lives in Picciorana, Tuscany.

Soak dried porcinis for 30 minutes in enough lukewarm, good quality water to cover them.

Separate mushrooms from water, and set water aside.

Coarse chop soaked mushrooms into medium sized chunks (about ½–1 inch).

Fine chop onion, then sauté in olive oil until onion is translucent (use really good quality olive oil, preferably the kind with a buttery finish).

Add chopped mushrooms and more olive oil, and cook together for about 10 minutes.

Add the water in which mushrooms were soaking, then add salt, pepper, and chili flakes to taste.

Slowly stir in heavy cream or milk over medium low heat to prevent curdling, and serve over pasta of your choice.

NAMA continued

events, mushrooms, and people. Dimitar was hardly seen as he must have been studying the *Cortinarius* species, among others.

On Sunday with the NAMA foray essentially over, except for the display of the identified mushrooms, we ventured into our second phase of our trip. On Sunday morning we started for Diamond Lake, Oregon, reaching there in late afternoon. The next day we looked with great anticipation at what the area would produce. After visiting several sites at different areas and not finding much, we had to conclude that it was too dry and that it was time to head for home. We were able to bring some porcini home that we found in McCall by storing them in Styrofoam boxes fortified with dry ice.

NAMA is an organization whose membership is open to both amateurs and professionals, and provides a meeting ground for all persons interested in mushrooms. ❁

Speaker continued

Dennis Desjardin is a professor of biology and director of the H.D. Thiers Herbarium at San Francisco State University. He is also scientific advisor to the MSSF.

Deadline for the November 2008 issue of *Mycena News* is October 15.
Please send your articles, calendar items, and other information to:
mycenanews@mssf.org

MycoDigest continued

Does this mean that there are two orders, corresponding to the two sides of the ladder? Not really. Eukaryotes have four different DNA bases (adenine, cytosine, guanine, and thymine), which are paired (A-T and C-G) with one member of each pair on a different side (see fig.1). Because of this correspondence, the order of bases on one side of the ladder can be read from the bases on the other side. A part of the ladder that codes for the making of a particular protein or enzyme is called a gene; three bases in a row code for one amino acid, and many amino acids (often hundreds) make up proteins and enzymes. There are patterns in the code that mark the beginning and end of genes and the intervening regions are called "non-coding," though their significance is not understood. DNA is organized in chromosomes in the cell nucleus, but also in organelles within the cell, like mitochondria, which were once bacteria.

Humans were by no means the first species to have their genome sequenced. Bacteria, with their small genomes, were the forerunners, and the first eukaryotic (non-bacterial) organism was a fungus: baker's yeast (*Saccharomyces cerevisiae*) (fig.2). Next came three other genetic models: the first multicellular organism, the nematode *Caenorhabditis elegans* (colloquially called *C. elegans)* (1998); the fruit fly *Drosophila melanogaster* (2000); and the plant model, *Arabidopsis thaliana* (also in 2000). The *Homo sapiens* genome was ready in 2001.

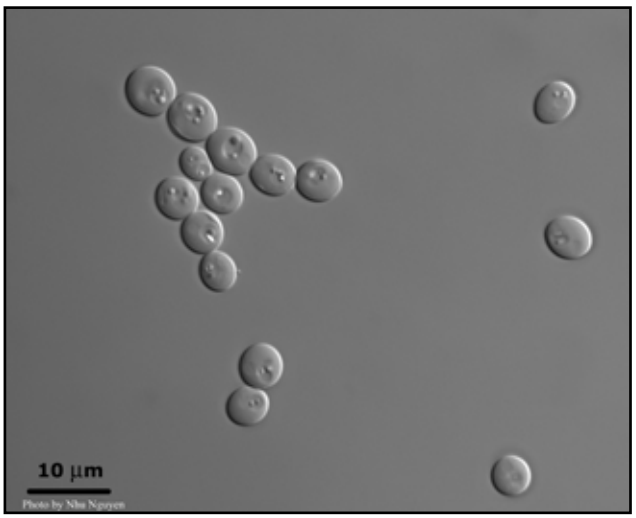

Fig. 2. Yeast cells. Baker's yeast was the first fungus, and the first eukaryote, to be sequenced. Photo by Nhu Nguyen.

The publication of the yeast genome in 1996, with the title *Life with 6000 Genes*, is still a very interesting read. The functions of many of its genes were not known at that time. In retrospect, the yeast genome seems very compact and low in non-coding regions. The work on that first sequencing project took many years, involved 600 scientists (only 16 of whom became co-authors of the paper), and many institutions worldwide. At that time it was daringly estimated that the human genome sequence would be ready in 2005. The invention of different, faster sequencing techniques, the development of faster computers and novel software, and the rivalry of two teams, sped up the process. The human genome was done in 2001. Now, 12 years after the publication of the first fungal genome, over 70 species of fungi have been completely sequenced—including several strains for quite a few species—and many more are in the pipeline. The choice of species to be sequenced was determined by several factors: those that cause human disease or considerable damage to crops were first, followed by some model organisms like baker's yeast, *Neurospora crassa*, and *Coprinopsis cinerea* (though the data for the ink cap are not yet publicly available). Now, costs have gone down considerably, and the time has come when almost anyone can dream of sequencing his or her favorite fungus (or even him or herself) starting at $15,000 for material costs. For this amount of money you'll get very raw data produced in a week or so. Mainstream sequencing, analyzing, and annotating of the data still adds up to around $400,000. Work is scheduled for the false truffle, *Rhizopogon salebrosus* and the dyer's puffball, *Pisolithus microcarpus*, and is well underway for the button mushroom, *Agaricus bisporus*.

Ascomycetes were the first fungi to be sequenced, as that group harbors many well known human pathogens, including *Aspergillus fumigatus*, *Candida albicans,* and *Coccidioides immitis*. Only a small number of basidiomycetes have been sequenced so far. The crust-forming fungus, *Phanerochaete chrysosporium,* was the first basidiomycete. This might be an unknown for the mushroomer, but it is a species with great industrial potential, both as a decomposer of lignin (that hard component of plants, trees in particular)—making it very useful in the paper and fabric industry—and in hazardous waste remediation. Number two was a human pathogen, *Cryptococcus neoformans*, another yeast. The disease it causes used to be rather obscure, but patients with AIDS, whose immune systems have been compromised are susceptible to this pathogen.

The corn smut, *Ustilago maydis*, and most recently an ectomycorrhizal species, *Laccaria bicolor*, have also been completely sequenced. For all of these, publications can easily be found (see the list under Further Reading), and the data are publicly available on the web. So, for a very varied but extremely limited group of basidiomycetes, the genome data are available.

At first the focus was to figure out what kind of genes there are and what they do. This is certainly a work in progress, as baker's yeast has 6,000 genes, and *Laccaria* around 20,000! Besides genes, the rest of the genomes contain lots of non-coding regions, repeated elements, and so-called junk DNA (all of which has to be sorted out, as well). These pieces can still be useful, though we do not know exactly why and how (that "junk" label may be premature).

The next step was to compare the genes of one species with the genes of others, and relate the differences to lifestyle. The four basidiomycetes, which represent totally different lifestyles, provide a good example. For instance, *Phanerochaete chrysosporium* has many genes involved in the breakdown of lignin, but these genes are lacking in *Laccaria bicolor*. These comparisons also showed that a species often does not have just one gene to perform such an important task, but several, and these might be derived from a single shared ancestor gene. There are also studies looking specifically at those genes that are involved in the decomposition of plant material. These include ones that code for laccases and different types of peroxidases (lignin peroxidases and manganese peroxidases) and indeed, *Laccaria bicolor* has not been equipped with genes for peroxidases. *Cryptococcus* cells are surrounded by a polysaccharide capsule, and this envelope is made by a series of 30 different genes, which are absent in the other basidiomycetes investigated so far. This information might be extremely useful in the battle against this fungus. The smut fungus, *Ustilago maydis*, has, again, a different lifestyle. In one stage it lives as a saprotrophic yeast, and in another grows inside a corn cob, forming the gall-like "huitlacoche," an enlarged part of the cob full of smut spores. It is not a very aggressive pathogen and lacks the genes to make the enzymes that degrade the plant cell-wall and give it access to the contents. But its genome sequence did reveal an unsuspected set of small genes that play a role in its virulence. In contrast, the rice blast fungus, *Magnaporthe grisea*, an ascomycete, is well-provided with genes that encode for cutinases, the enzymes that decompose cutin (the first barrier the plant uses to keep intruders at bay). Comparing the genetic composition of phylogenetically different fungi with similar lifestyles (e.g. the ectomycorrhizal *Tuber*, an ascomycete, and its basidiomycete counterparts, such as *Boletus edulis* and *Amanita muscaria*), is another interesting research field.

Evolutionary histories of species can be determined by comparing complete genomes, but the small number of fungal genomes available means that these studies still have limited power. One such study, which was published a few years ago, was based on 42 different genomes, of which only four represented basidiomycetes. It would be great if whole-genome studies could indicate which single-gene sequences gave the same results as the more reliable genome-wide phylogenies, in order to validate which sequences to use in future phylogenetic studies. Gene phylogenies are not by definition the same as species phylogenies, as depending on the environmental pressure, genes undergo different changes. The current favorites are LSU and a few protein-coding genes for phylogenetic studies, and ITS as a fungal "barcoder."

Whole genomes can also reveal aspects of evolutionary history that no single gene can. For instance, they reveal where and when genome duplication took place (as happened once in a group of ascomycete yeasts, close to the baker's yeast), and they also show that a switch in the interpretation of the code of the base sequence "CTG" has occurred—in most species this translates into the amino acid leucine, but a group of *Candida* species makes serine out of it.

But up to now, only the surface has been scratched. Coming are more in-depth questions concerning gene function. Does a gene work on its own? When is it active? Does it always have the same function, or does it depend on the circumstances? And of course, many more whole genomes will be sequenced. I'm looking forward to seeing the secrets of my own pet fungi, the beautiful parasol mushrooms, revealed! ❁

Further Reading:

Dujon, B. et al., 2004. Genome evolution in yeasts. Nature 430: 35-44.

Espagne, E., et al., 2008. The genome sequence of the model ascomycete fungus *Podospora anserina*. Genome Biology 9: R77. [22 pages; open access at http://genomebiology.com]

Fitzpatrick, D.A., M.E. Logue, J.E. Stajich & G. Butler, 2006. A fungal phylogeny based on 42 complete genomes derived from supertree and combined gene analysis. BMC Evolutionary Biology 6: 99. [15 pages; open access at www.biomedcentral.com]

International Human Genome Sequencing Consortium, 2001. *Initial Sequencing and Analysis of the Human Genome*. Nature 409: 860–921.

IHGSC, 2004. Finishing the *Euchromatic Sequence of the Human Genome*. Nature 431: 931-945.

Kämper, J. et al., 2006. Insights from the genome of the biotrophic fungal plant pathogen *Ustilago maydis*. Nature 444: 97-101.

Loftus, B.J. et al., 2005. The genome of the basidiomycetous yeast and human pathogen *Cryptococcus neoformans*. Science 307: 1321-1324.

Martin, F. et al., 2008. The genome of *Laccaria bicolor* provides insights into mycorrhizal symbiosis. Nature 452: 88-93.

Martinez, D. et al., 2004. Genome sequence of the lignocellulose degrading fungus *Phanerochaete chrysosporium* strain RP78. Nature Biotechnology 22: 695-700.

Morgenstern, I., S. Klopman & D.S. Hibbett, 2008. Molecular evolution and diversity of lignin degrading heme peroxidases in the Agaricomycetes. J. Mol. Evol. 66: 243-257.

Venter, J.C. et al., 2001. *The Sequence of the Human Genome.* Science 291: 1304–1351.

http://fungalgenomes.org/blog/

http://fungalgenomes.org/wiki/Fungal_Genome_Links

http://www.jgi.doe.gov/sequencing/statusreporter/psr.php?projectid=99190 for updates on the *Agaricus bisporus* sequencing project

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

First Class Mail
U.S. Postage
PAID
Oakland, CA
Permit No. 1451

October 2008, vol. 59:07

MSSF Calendar, October 2008

Monday, October 6, 7pm, Culinary Group Dinner. We meet at the Hall of Flowers, Golden Gate Park, 9th and Lincoln, SF. Reservations are required. For this dinner contact Jeannette Larsen, at (510) 524-9473 or e-mail larkhorn@att.net to make your reservation. Don't forget to bring your own tableware and favorite beverage. This dinner will center around goat cooked in the caja china. Dinner will be $14 per person. Membership in the MSSF is required to join the Culinary Group. Dues for the Culinary Group are $12.00 or $6.00 for seniors. Most of our meetings are on the first Monday night of the month. Our next meeting will be November 3.

Tuesday, October 21, 7pm, MSSF General Meeting. Randall Museum. 7pm, mushroom identification and refreshments provided by the Hospitality Committee. 8pm, Dennis Desjardin will present **Mushrooms of the Islands at the Center of the World.**

Wednesday, October 22, 7pm, Beginning Mushroom ID Workshop. San Francisco State University, Hensill Hall 401. This workshop will introduce participants to the macroscopic features and terms used in the identification of mushrooms. Instructor: J.R. Blair. Please sign up by contacting J.R. at jrblair@mssf.org or by calling 650-728-9405. Limited to 15 participants.

Thursday, November 6, 7pm, Beginning Mushroom ID Workshop. San Francisco State University, Hensill Hall 401. This workshop will introduce participants to the macroscopic features and terms used in the identification of mushrooms. Instructor: J.R. Blair. Please sign up by contacting J.R. at jrblair@mssf.org or by calling 650-728-9405. Limited to 15 participants.

Friday-Sunday, November 14-16, MSSF Mendocino Woodlands Foray with Gary Lincoff. See full description on page 3.

Wednesday, November 19, 7pm, Intermediate Mushroom ID Workshop. San Francisco State University, Hensill Hall 401. This workshop will utilize popular field guides to identify fresh mushrooms. The Beginning ID Workshop is a prerequisite for this course. Instructor: J.R. Blair. Please sign up by contacting J.R. at jrblair@mssf.org or by calling 650-728-9405. Limited to 15 participants.