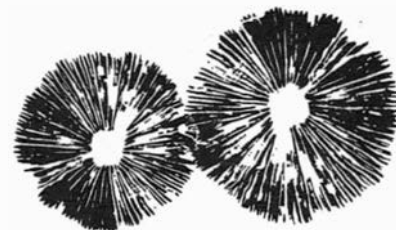


SPORE PRINTS

BULLETIN OF THE PUGET SOUND MYCOLOGICAL SOCIETY

Number 282

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JEKYLL-HYDE MUSHROOMS

[Condensed from an article by George Barron
in *Natural History*, 3/92]

Each year, microbial degradation of plant debris, most of which is done by fungi, returns 85 billion tons of carbon to the atmosphere in the form of carbon dioxide. Where do mushrooms get all this energy?

We now know that hundreds of species employ a remarkable arsenal of weapons that allow them to lure, trap, lasso, paralyze, colonize, or enzymatically dissolve a host of microscopic life forms. Among the organisms attacked and consumed are nematodes, rotifers, amoebas, copepods, and bacteria (nematodes, for example, are a food source for over 150 species of fungi).

Arthrobotrys oligospora sprouts net-like traps of hyphal threads coated at intervals with adhesive. Standing up from the surface like croquet hoops, the traps release a chemical siren that lures nematodes to their death. A protein on the surface of the net recognizes specific sugar molecules in the nematode's cuticle. On contact, a physically unbreakable chemical bond forms between the net and the nematode. Strands of hyphae invade its body, releasing paralyzing toxins; then the invasive fungus digests the nematode from inside.

Arthrobotrys anthonia produces hyphal branches that circle back upon themselves to form three-celled rings baited with a chemical attractant. Responding to the lure, a nematode blunders into a ring, whose cells expand with dramatic speed (up to three times their original volume in a tenth of a second), crushing the nematode.

The fungus *Zoophagus*, which grows in ponds and ditches, produces what Howard Whisler of the University of Washington calls lethal lollipops — slightly swollen ends of short lateral branches that are extremely attractive to microscopic animals called rotifers. The rotifers try to swallow the "lollipops" and become stuck by their mouths. The tip then sprouts hyphae that invade and colonize the hapless victim.

Why have these fungi evolved the capabilities of active predators? Like higher life forms, fungi need a balanced diet that includes both carbohydrate and protein. A good ratio between carbon (in carbohydrates) and nitrogen (in protein) is about 30:1. Wood has a carbon/nitrogen ratio of up to 500:1. No wonder fungi that live on wood have evolved ingenious mechanisms for capturing small creatures that can serve as nitrogen sources.

Oyster mushrooms (*Pleurotus ostreatus*) produce tiny secretory cells, each bearing a droplet of potent toxin. When touched by a nematode, the cells splash this fluid over the worm's head. The worm jerks back as if it had touched a hot stove, but is soon immobilized by the toxin. The fungus senses its location, and hyphal threads home in on its body orifices, grow into its body, and digest its still-living tissues.

In another Laboratory study, a *Hohenbuehelia* used hour-glass-shaped adhesive cells to capture nematodes. When graduate student Greg Thorn tested available species of

Hohenbuehelia and related fungi, he found a whole cluster of mushrooms, previously thought to be passive saprophytes, that were aggressive carnivores.

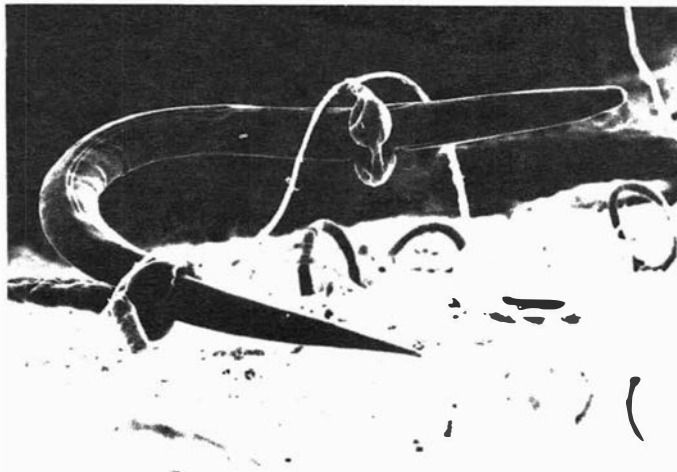
When bacteria accidentally contaminated our fungus cultures, hyphae of the oyster mushroom and the wood blewit sought out, attacked, and destroyed them, just as they did with the bacteria-feeding nematodes. Why would fungi attack bacteria? Several bacterial species inhabiting decaying wood can fix nitrogen gas to form biologically useful nitrogen compounds. Perhaps the fungi were simply cutting out the middleman.

Another graduate student, Susan Madzia, has discovered more than 20 species of mushrooms, normally associated with wood decay, that can attack and destroy bacterial colonies in the laboratory. These fungi include shaggy manes, small puffballs, *Mycena leaiana*, the turkey tail bracket fungus, and bird's nest fungi.

These tactics represent only a few among an enormously diverse array of strategies. Some fungi produce helicoid spores that screw into the esophagus during ingestion. There are zoosporic fungi that produce myriads of tiny swimmers that track down their moving victims by homing in on leakage products from body orifices. One fungus acts like a microscopic tapeworm; it fastens to the gut wall of a nematode and feeds on the food flow until it completely fills the gut. Another species has fungal spores like grappling hooks; their incredibly sharp points impale rotifers on contact. Most remarkable of all, however, is *Haptoglossa mirabilis*. When triggered by contact with a rotifer or nematode, it shoots a harpoon-shaped "hypodermic" through the wall of the victim and pumps an infective spore into its body. All in a fraction of a second.

For microbial life forms, life span is measured not in years or days but in hours or minutes. In soil or inside rotting stumps, dramatic scenes of life and death are played out every minute of every day.

Scanning electron micrograph by Nancy Allen and George Barron



Captured by rings of the fungus *Arthrobotrys anthonia* (magnified 750 times), this nematode worm will be crushed as the nooses constrict.

Spore Prints

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CALENDAR

May 12 Membership meeting, 7:30 p.m., CUH
May 16 Field trip, Crystal Springs
May 18 Board meeting, 7:30 p.m., CUH
May 22 *Spore Prints* deadline
May 23 Field trip, Kaner Flats
May 30 Field trip, Indian Creek
June 9 Membership meeting, 7:30 p.m., CUH
June 14 Mushroom i.d. hike, Grand Ridge
June 28 Cultivation meeting, 1-4:00 p.m., CUH

SPRING FIELD TRIPS

Mary Lynch

We still need PSMS members to host the spring field trips. Please call Mary Lynch (391-5379) or come to the meetings to sign up. We also need someone to pick up the key on Friday at the Naches Ranger Station for the field trip Memorial Day weekend at Kaner Flats. You are welcome to join us for one or all days at the camping area. The \$30/day fee for the entire camp will be split among those attending each day. There will not be a potluck dinner Friday but plan on Saturday and Sunday potlucks. Some morels have been collected, but it is still cold at night in the mountains, so the field trip to 29 Pines should be a good one.

May 2 Twenty-Nine Pines Forest Camp
May 16 Crystal Springs Campground
May 23-24 Kaner Flats
May 30 Indian Creek Forest Camp

See the April *Spore Prints* for instructions and details.

MEMBERSHIP MEETING

Tuesday, May 12, at 7:30 p.m. at the Center for Urban Horticulture, 3501 N.E. 41st Street, Seattle



Morels and More Morels. Once again, it's your opportunity to learn a bit more about hunting the mysterious morel mushroom. Those of you who are successful hunters already know that you find morels exactly where they grow, but if you are not fully aware of this, then this program is especially for you. By the end of the highly informative panel discussion, you will have all the skill, knowledge, and confidence for successful morel hunting. In fact, you will have everything but the elusive little mushroom itself. Learn the varied nuances of where, when, how, and why to hunt morels from the best of the best. All audience questions will be accepted, although not necessarily answered.

Would all people who are grandparent please bring a snack for the social hour after the meeting?



MEET THE DiGIOVANNIS

Inga Wilcox

Members of PSMS since 1987, Marsi and Magda DiGiovanni enjoy hunting mushrooms. Their favorites are chanterelles, matsutake, boletes, angel wings, oyster mushrooms, and the cauliflower mushroom. They sauté them in oil and then pressure seal them in glass jars, ready for serving. Lucky friends often receive such gifts. Marsi first became acquainted with mushrooms in his native Italy, in the province of Abruzzi, when he and other children picked the two or three species that grew along the river in their small village.



Having graduated from Wayne State University in Michigan, Marsi became an electronics engineer working in the aviation industry in California. His job consisted of trouble-shooting missile launches, specializing in inertial guidance systems. He also worked on the preliminary flight manual for the Apollo spacecraft. His job took him many places. While in Puerto Rico, he met Magda. After a long romance, they were married in 1965. They settled in Seattle after Marsi joined the Boeing Company, where he served as test engineer for the Lunar Orbiter Program. In 1968, the Lunar Program was completed. That year was a bad one for Boeing, and many layoffs occurred. Marsi lost his job. He then became a broker in commercial real estate, owning his own company.

Magda did not look for mushrooms as a child but truly enjoys hunting now. When their two daughters were little, the whole family went on forays. Now Magda runs and owns a day care center for about 60 children. She loves to grow flowers and garden. Her special forte is floral arranging. Do you remember the lovely flower baskets at the 1991 Survivor's banquet?

Both Marsi and Magda are gracious hosts to foreign students of middle or high school age. They are still in contact with some of the Japanese students who stayed at their house.

Both have hosted forays and wish to emphasize, "If you are not sure what you have found—don't eat it."

BOARD NEWS

Agnes Sieger

This month's board meeting was devoted to a brainstorming session on where we should be going and how to get there. As he did two years ago when Kern Hendricks assumed office, Denis Benjamin graciously agreed to lead the "story-board session." This year's topic was ways to ensure long-term survival as a mycological (as opposed to a pot-hunting) society and strengthen existing programs. After an hour of free-wheeling association where members voiced anything that occurred to them, the board took a short break while Denis broke the ideas generated into related categories. After weeding out projects already planned or in the works, the board then voted on what they considered to be the top five priorities. The winners were (1) restructure the field trips so they are more of a learning experience (suggestions on how to do this took up a whole board), (2) institute advanced classes for people wanting to learn more about mycology, (3) hold educational forays, (4) start a scientific project, (5) organize a special-interest group for advanced people, perhaps on the order of the cultivation group. Some items already planned are putting more emphasis on habitat at the annual exhibit, helping out with the UW herbarium, starting a data base of members' interests and abilities, and adding scientific literature to the library.

CULTIVATION WORKSHOP

Mike Hess

Fifteen minutes east of Vancouver, B.C., lies Bill Chalmer's Western Biologicals Ltd, one of, if not the, largest suppliers of spawn for British Columbia. On April 11 and 12, Bill and his wife, Cindy, ran a Cultivation of Specialty Mushrooms Workshop, attended by about 15 people. The sessions flowed at an easy pace, but when it was all over an amazingly large amount of ground had been covered. Discussions ranged from cultivation hygiene and sanitation to mushroom biology and appropriate substrates to commercial-scale spawn preparation, chemical sanitation, and commercial applications in general. As a bonus, we toured a nearby button mushroom farm to witness the entire operation from composting and inoculation to cropping. A local shiitake farmer talked about commercial shiitake growing and the relative merits of log and sawdust systems.

Attendees came from as far away as Bakersfield, California, to learn and compare notes. In fact, the people that attended the seminar provided much of the fodder for discussion. One fellow operates a *Pleurotus* farm; another is about to open a farm after just leaving one behind in Poland; yet another runs a brokerage buying and selling mushrooms. Still others were just interested in finding out if cultivation might be their bag.

There was something for everyone: Small things — a handy trick for making nearly sterile spore prints and an alternative to expensive micron filters — and big things — automated machinery for filling, tamping, and dibbling jars; a six-person machine for doing the same for "space" bags; machinery for digging out jars, scraping off the tops, sifting sawdust, chopping straw, and steam generation; an ingenious farm machine conversion for preparing 500 lb (dry weight) batches of spawn. There was even a walk-in autoclave 5 ft on a side.

There was opportunity for hands-on work, including preparation and inoculation of Petri plates, sawdust-and-grain "space" bags and plastic bottles, rye grain and millet in jars, straw sanitized chemically, and commercial straw/grain spawn. I left with cultures or spawn of three *Pleurotus* species, some *Pholiota nameko*, shiitake,

Reishi, Enoki, and Lion's Head mycelium. The cultures alone were worth the \$150 fee, and there was so much more. I took 11 pages of notes to supplement the 32 pages of handouts I've yet to get a chance to read.

I'm not sure when another workshop will be scheduled, but you can always give Bill a call at Tel./FAX (604) 856-3339 or 856-3118 (evenings). That's a good number to know. Bill welcomes visitors to his lab all the time, but please do call before coming or you may only get to see the top of his head leaning into a hood 50 ft away. You can also write to

Western Biologicals Ltd
P.O. Box 283
Aldergrove, B.C., V0X 1A0.

By the time you read this, the new catalog should be out. It's \$2.00 and chock-full of helpful information. Western Biologicals carries over 50 strains of mushrooms, including 10 oysters (*Pleurotus*), 7 shiitake (*Lentinus*), 5 champignon (*Agaricus*), and many others, with equipment to boot. I'm hoping we can get one for the PSMS library or you can borrow a catalog from me. (Naturally, I'm hoping there'll be one in my hot little hands as well.) I've got 43 pages of information and I'm still excited about getting more. Hopeless.

MUSHROOM MISSIONARIES

Agnes Sieger

Dr. Annirati addressed the Kitsap Peninsula Mycological Society at their Annual Banquet in March. His subject was forest conservation. Dick Sieger spoke about Morchellaceae and *Helvella* to the Tacoma Mushroom Society on April 13th and to the Northwest Mushroomers' Association in Bellingham on April 16th.

MUSHROOM HIKE

Bill McFerren and Mary Lynch will lead a 4-hour mushroom i.d. hike to Grand Ridge for the Trails Club on June 14. Call Mary at 391-5379 for details.

CULTIVATION GROUP FIELD TRIP

Milly Meyers



Our March meeting did not turn out as planned owing to the last minute cancellation of our original field trip. Not wanting to waste a beautiful sunny day or lose a chance to learn about field culturing, we decided to relocate to Discovery Park. However, one of our members advised that they had just been there and found no mushrooms. Being flexible, we quickly changed our location to Tiger Mountain.

Twelve of us traveled to Tiger Mountain, where we found a plentiful supply of oyster mushrooms to use for culturing (and eating). Bill Bridges brought the necessary equipment and media to do field cultures, and we thank him for sharing his knowledge and for patiently taking each one of us through the field inoculation process. We will be anxiously waiting to see how successful we were. We had our lunch in a nice wooded area and enjoyed the company of three new cultivation members. What started out as a disappointment ended up being a successful and fun field trip.

There is no meeting in May. Our next meeting will be Sunday, June 28th, from 1:00-4:00 p.m., in the Douglas Classroom at CUH. The project of the day will be shiitake. Hope to see you there.



FAITHFUL DROP TRUFFLES IN THE PLATE

[The Catholic Sentinel, via NATS Current News]

Richerenches, France - Once a year during mass, the faithful in this southern French village drop a fungus into the collection plate — and Father Pierre Gleize loves to see them do it.

It's not just any run-of-the-mill fungus they put the plate. Not that kind you hate to see growing on aged leftovers in the refrigerator.

In fact if you are a connoisseur, you might want to see this growth in your pantry — and that's the source of Father Gleize's smile.

For the past 30 years during the special mass, the parish gets truffles in the collection and has a licensed truffle broker sell the delicacies on the spot for a hefty sum. The proceeds go to the parish maintenance fund.

This year's truffle service packed the church and yielded a bumper offering, with nearly 11 lb of "black diamonds" bringing in \$2,200. Immediately after the service, the congregation gathered in the church hall where the precious collection was weighed and sold.

"My predecessor had the idea 30 years ago, and we've stuck to it," Father Gleize, whose village lies in the heart of French truffle-producing country, told Reuters, the British news agency.

"Christians should embellish the world the way truffles embellish a meal," he told the churchgoers earlier from the pulpit. "Love transforms everything. Isn't that just what a good truffle does to an omelette, pâté, or poultry dish?"

GLEANED FROM THE NEWS

To control that country's teeming hordes of wildcat "fungaroli," a law is being drafted in Italy that imposes fines of up to 100,000 lire (\$85) on anyone taking over 2 kg (4 lb) of porcini a day, with heavier fines for people making excessive use of rakes, hoes, and spades.

Until this year, charter flights between North Korea and Japan were limited to 20 a year, most carrying cargoes of highly prized mushrooms from North Korea to Japan.

Golf-course designer Robert Trent Jones Jr. began negotiating to build Russia's first 18-hole course 18 years ago. One of the troubles encountered along the way was irate neighbors objecting that their mushroom-hunting grounds were being fenced off. Jones solved the problem by giving them the felled timber from the land.

The Russian Information Agency reports 33 cases of botulism — two of them lethal — in January and February 1992 from improperly preserved mushrooms, vegetables, and smoked fish sold at makeshift food markets.

With the help of wild plants gathered in South America, scientists have developed 53 lines of beans that ward off all 55 identified strains of the fungus that causes bean rust.

Seed companies are working with a new corn that repels the aflatoxin fungus, *Aspergillus flavus*. Under federal rules, raw grains or finished products cannot be sold across state line for consumption by humans or animals if they contain at least 20 parts per billion of aflatoxins, powerful carcinogens.

PRESIDENT'S MESSAGE

Dick Sieger

Scientific Projects: Thanks to all of you who volunteered, our old growth survey is ready to start when the weather permits. Those of you who offered to help catalog the herbarium collection will be invited to an orientation meeting when we get clearance from the U.S.D.A., which needs to ensure that the repellents used to preserve the collection are benign.

New Directions: Board members at our last meeting mapped some ambitious directions that PSMS will be taking in the next few years. Each of us adopted programs to nurture. Please read about our plans in "Board News" and get ready be leaders and workers. Your help will make our hobby even more enjoyable, if that is possible.

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