MushRumors

The Newsletter of the Northwest Mushroomers Association

Volume 21 Issue 1 January - February 2010

Northwest Mushroomers Association Ends 20th Year in Style at Cama Beach

The Northwest Mushroomers Association was established in the summer of 1989, and to commemerate this event and celebrate our 20th anniversery, we threw a weekend of relaxation, food and drink, as well as mushroom hunting, at Cama Beach State Park on Camano Island, November 6th & 7th, 2009.

photo by Vince Biciunas

An idyllic backdrop for mushroom hunting

Our November Foray was special this year because we made it a weekend overnight trip to Cama Beach State Park on Camano Island. Some of us rented cabins in addition to the club's main bungalow and spent Friday and Saturday nights on the saltwater shores of Saratoga Passage, in warmth and comfort in historic cabins under unique quilts handmade by the Friends of Cama Beach.

Thank goodness for that Olympic rain shadow because while the weather at Bellingham and on the mainland was rainy and windy, on the west side of Camano Island the seas calmed by mid-morning and the rains desisted in time for us to head into the woods. Some of us walked the bluff trails above Cama Beach and towards Cranberry Lake while others walked or drove a mile south to the campgrounds and trails of Camano Island State Park. We all came back with a generous assortment of typical late fall Northwest mushrooms, including Suillus, Agaricus, Coprinus and more.

photo by Vince Biciunas

It was great to see Julie and Lance Toomey who brought over our club's new large tent with awning for outdoor shelter. We put it to good use in front of the bungalow over picnic tables loaded with mushroom specimens. Thanks to Corinne Hughes, Dan Heimbigner, Evan Sanford, Claude Dilly, and Dick and Marian Tobias and their extended family for helping set it up and take it down the next morning. Margaret Dilly and Buck McAdoo had fun, with the rest of us, identifying the mushrooms. We all kicked back and enjoyed a leisurely lunch in the relaxing salty air.

In the evening, we gathered again for a delicious potluck supper. The bungalow was rocking with

warmth and good cheer, and some reminiscing about the early days of our club, assisted by flipping through our old photo albums.

We all agreed that Cama Beach is a great place to visit again next fall, and indeed, we were invited to do so by the resident Park Rangers.

Happy anniversary, Northwest Mushroomers!

By Vince Biciunas

photo by Vince Biciunas

November yields an impressive catch at Cama Beach

photo by Vince Biciunas

photo by Vince Biciunas

Not only the mushrooms were beautiful here...

Northwest Mushroomers Association Officers and Contact Information

President: Doug Hooks 360-715-0729 or doug41hooks@hotmail.com
Vice President: Linda Haynes 360 366-3432 jlhaynes@nas.com
Treasurer: Cris Colburn 360-738-3067 or crisc@ridewta.com
Secretary: Margaret Sulllivan 360-724-3158 or Maggie@fidalgo.net
Book Sales and Membership: Vince Biciunas 360-671-1559 or vbiciunas@comcast.net
Mailing Address:
NMA
P.O. Box 28581
Bellingham, WA 98228-0581

The Northwest Mushroomers Association meets on the second Thursday of the months April, May, and June and September, October, and November. *Meeting Location is NEW: CEAEE - Center for Expressive Arts and Experiential Education, 1317 Commercial Street, Suite 201, Bellingham, WA 98225.* We will inform you in advance of any changes of venue. Membership dues are $15 for individuals and families and the special price of $10 for students. Please make checks payable to NMA and forward to: Cris Colburn, membership, at the mailing address above.

Fien is our field trip coordinator. Field trips are scheduled for the Saturday after each meeting.

MushRumors is published every other month (roughly). Deadlines for submissions are the 15th of odd-numbered months. (Of course, exceptions will be made in the event of fungal finds of unusual import!)
Editor: Jack Waytz
Phone: 360-752-1270 or gandalf5926@comcast.net
MushRumors c/o Jack Waytz
P.O. Box 28581
Bellingham, WA 98228-0581
www.northwestmushroomers.org

Mushroom of the Month:
Tricholomopsis decora (Fries) Singer

photo by Buck McAdoo

Tricholomopsis decora

In 1939 Rolf Singer created the genus Tricholomopsis to represent those species with yellow gills, stems, and basic ground color of the cap, white, smooth, inamyloid spores, large cheilocystidia, and the habit of growing on wood. *Tricholomoposis decora* (meaning 'beautiful' in Latin) is an important member of this genus. It appears every fall on our club forays but never in great quantity. It is one of those species that Margaret Dilly is referring to when she says 'let's label all the easy ones first just to get names on the table. We can circle back later for the tough ones.' It is the only species in *Tricholomopsis* that has dark grayish-olive to blackish squamules on the yellow cap surface. Up until now we just got it out on the table and forgot about it. But after reading about a severe poisoning case in the summer, 2008 issue of Mushroom the Journal, *T. decora* deserves a little more thought.

Known as 'The Queen's Coat' by Schalkwijk-Barendsen, 'The Black Tufted Wood *Tricholoma*' by McKenny & Stuntz, 'The Decorated Mop' by Gary Lincoff, and 'The Yellow Rider' by the McKnights, *Tricholomopsis decora* is found throughout northern Europe and North America on conifer wood, being especially fond of hemlock and spruce. In Europe it is mostly found in the mountains.

If you are a little put out by the plethora of common names, consider its nomenclatural Latin history. Fries introduced the species as *Agaricus decorus* in 1821. Gillet moved it to *Clitocybe* in 1874. Karsten moved it to *Cortinellus* in 1879. Quelet moved it to *Tricholoma* in 1882 and to *Gyrophila* in 1886. Saccardo moved it to *Pleurotus* in 1887. Kuntze moved it to *Dendrosarcus* in 1898. Maire declared it a variety of *Tricholoma rutilans* in 1916…. All this before Singer moved it to *Tricholomopsis* in 1939.

Moser describes the caps as measuring 5-10 cm. wide, but Roger Phillips lists them up to 17 cm. wide with stems up to 18 cm. long! They are generally smaller than Moser's measurements in our area. Convex to domed at first, with incurved margins, the caps become depressed to umbilicate in age. The ground color is golden yellow, adorned with the olive-brown to dark grayish concentrically arranged scales, always more crowded at disc. The gills are a brighter yellow with entire edges that can become crenulate or pruinose in age. They are adnate, often with decurrent tooth, and readily secede from the stem. Stems run from 5-8 cm. long and up to 1 ½ cm. thick. They are solid at first, then hollow in age, sometimes centrally attached and sometimes eccentric. They are yellow with faintly pruinose apices and grayish fibrils or scales on a yellow ground near base. The odor is mild and the taste mild to slightly bitter. The spores are white, inamyloid, smooth-walled, and elliptical. A.H. Smith gives the measurements as 6-7.5 x 4.5-5 microns. In California, Arora reports them on rotting redwood. They seem to prefer downed hemlock branches and logs further north, causing a white rot of coniferous wood. Most authors report them as widespread but rather rare, never found in quantity.

This is a taxon that probably would not have been a candidate for a 'mushroom of the month' profile if not for one event. A lady named Kathy Richmond, an articulate nurse from Idaho, got extremely poisoned by it. Since *Tricholomopsis decora* is more common here than where she found it in the wilds of Idaho, I thought it worthwhile encapsulating her story. She was foraying in a remote wilderness area late in the

afternoon when she thought she found *Armillaria albolanaripes* (see photo below). This was a species she hadn't seen in years but always wanted to try. She picked three or four specimens as darkness fell and looked forward to a gourmet breakfast. Her husband Dave is a physician. He didn't think the mushrooms looked right for *Armillaria albolanaripes*. There was no ring on the stem and no appendiculate velar material on the cap margin. Kathy reckoned that snow could have destroyed the ring. She cooked them up anyway.

About half an hour later she noticed a hot flash coming on. This was no normal hot flash. Her skin became beet red and she began salivating excessively. She couldn't swallow it fast enough. Then she began sweating so heavily that she had to change clothes every five minutes three different times. When she started seeing double she knew the mushrooms were the cause. She and her husband, who had declined the meal, soon realized she was experiencing parasympathetic nervous system toxicity. She induced vomiting to flush out any undigested pieces, but it was already too late. Her blood pressure dropped to 60/40 and her pulse was at 50. She was on the verge of no return. Luckily, Dave had some atropine on hand. He started an IV right on the kitchen table. Soon the pulse and blood pressure normalized. The hot flashes were replaced by chills so bad that she couldn't get warm under four wool blankets. After an hour of the shakes, she gradually returned to normal.

They had no idea what Kathy had eaten. Luckily, Dr. Orson Miller had retired to Idaho, and two days later he identified the culprit as *Tricholomopsis decora*. There is no way that such an experienced mycologist could get this wrong. What happened here is rather unsettling and another example of the mysterious ways of mushrooms.

But first there are lessons to be learned from their identification process. First of all, it's never a good idea to try to identify mushrooms in a failing light. (In a tragic case that I can't quote a source for, a couple on their honeymoon in France died when they made an identification at dusk. They thought they had picked chanterelles. What they ended up eating was *Cortinarius speciossisimus*.) Secondly, if there is an important feature missing, such as the ring, pay attention to that. And thirdly, tone down the anticipation factor. The fact that Kathy wanted to dine on that species so badly might have affected her judgement. It goes without saying that we are grateful she decided to publish her misadventure with *Tricholomopsis decora*. We wouldn't want this happening to anyone else.

Now comes the rather mysterious part. I looked up 48 sources on *Tricholomopsis decora* and not one used the term 'poisonous'. The vast majority made no comment on the edibility or wrote 'edibility unknown'. The most damning report came from Pegler & Spooner, the British authors of The Mushroom Identifier. They noted 'inedible and unpleasant'. Eight other sources deemed *Tricholomopsis decora* to be inedible or of no culinary value. Three thought it was edible but not very good. But Bruno Cetto, Phyllis Glick, A.H. Smith, and Rinaldi & Tyndalo all listed it as edible. I then remembered that during David Arora's identification session this past fall at Silver Lake, a fellow in our club came up to David with *T. decora* in hand and informed him that he had eaten it without problems. I then turned to Orson Miller's Mushrooms of North America for possible help in the matter. This was the first mushroom guide I owned. There in the margin next to *Tricholomopsis decora* I had penned 'good flavor'. I must have sampled it when I lived in California in the early 1980's, but I do not recall the experience.

Would I eat it again? Probably not. I am no allergist, but the reaction inflicted on Kathy Richmond seems worse that any allergy by itself could bring on. Only the *Armillaria mellea* syndrome comes to mind. There have been reports of people in the Pacific Northwest who have dined in the honey mushroom group for years without ill effects. Then one day they will become violently sick from it. Since the first reports came in, *Armillaria mellea* has been broken up into five or six different species, so it is hard to say if just one of these 'new' species is responsible or not. The substrate itself has been suspect. The *Armillaria mellea* group can parasitize conifers and hardwoods. Maybe certain trees are capable of striking back under certain conditions and inflict a toxin on the invader. The irony is that the invading fungus isn't hurt in any way…. only the people who eat it are.

Then again, *Tricholomopsis decora* is not a parasite. There really is no simple explanation here. Susan Goldhor points out in Mushroom the Journal that 'one shouldn't minimize idiosyncratic responses to wild

foods. Mushrooms are full of fascinating chemicals which give them unique colors, flavors, curative properties, and some properties that are not so friendly.' And then if you add people to the mix with all of our different chemical make-ups leading to different types of allergies furthermore affected by any prescription drugs, the combination with a marginal mushroom just might have led to Kathy's nightmarish experience.

- Buck McAdoo

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photo by Buck McAdoo

Armillaria albolanaripes

The Situation with Lepiota Rhacodes and its Variations *By Buck McAdoo*

For some years now Margaret Dilly and I have had prickly but amicable discussions over the concept of *Lepiota racodes* and its varieties. And while the arguments were going on, Else Vellinga of Holland has been hard at work at solidifying the concepts, often contrary concepts put forth by our popular guides. Armed with new DNA evidence, she discovered that *Chlorophyllum molybdites*, a poisonous species with green spores was in the same clade with *Macrolepiota racodes* and its allies. They belonged in the same genus despite the difference in spore color. Meanwhile, there were a lot of other Macrolepiotas, such as *Macrolepiota procera*, that didn't belong in this clade. For whatever nomenclatural reason, it must have made more sense to Else to move the *Macrolepiota racodes* group into *Chlorophyllum* than move all the other Macrolepiotas to a new genus so *Chlorophyllum molybdites* could join *Macrolepiota racodes* in its present genus.

photo by Buck McAdoo

Macrolepiota brunnea

The transfer of *Macrolepiota racodes* being a fait accompli, she then wrote a follow-up paper in Mycotaxon 85, (259-270), 2003, where she described the entire complex in Europe and North America. It includes a key to the species and corrections of past errors in some, but not all, of the popular field guides. I will now try to encapsulate her concepts, whether you agree with them or not.

Chlorophyllum racodes – This species has caps with contrasting red-brown to chestnut colored squamules on a whitish ground. It has a double crowned ring, bulbous stem base, which is not emarginated, and sphaeropedunculate cheilocystidia. It is considered rare in our area!

Chlorophyllum olivieri – This species, introduced by Barla as *Lepiota olivieri* in 1886, is our exceedingly shaggy version, the one with grayish-brown squamules on a slightly paler grayish-brown to olive-brown ground. (I had been erroneously calling this *Lepiota racodes var. bohemica* for years.) It is common in our area.

photo by Buck McAdoo

Chlorophyllum olivieri

Chlorophyllum brunneum – This new combination derives from *Lepiota brunnea*, introduced by Burt & Farlow in 1929. It swallows up both the former *var. bohemica* and the *var. hortensis*. Caps have dull red-brownish squamules on a paler brown ground, showing far more contrast than *Chlorophyllum olivieri*. It differs from *C. rachodes* by its clavate cheilocystidia, simple ring, and occasionally emarginate basal bulb. The *var. hortensis* was primarily known for this kind of bulb with a ridge on it, but this can be present or absent in the amalgamated concept. *Chlorophyllum brunneum* is probably the most common species in our area.

Chlorophyllum subrhacodes – This is a relatively small species found only in oak hammocks in Florida. It belongs in the same clade but differs microscopically from the others.

Chlorophyllum neomastoideum – This species was not included in the key. It differs by having basidia with

clamp connections, among other microscopic details. No indication where it occurs.
Macrolepiota venenata – This species was not validly published, and perhaps for that reason has not yet been transferred to Chlorophyllum. It is characterized by having a more radially fibrillose cap surface, a simple ring, and no clamp connections. It has been reported from France and Italy and is reported as poisonous in this article. (In an unexpected twist, it is listed as a synonym of *Chlorophyllum racodes* in the Index Fungorum.)
Chlorophyllum molybdites – We all know that this is the mostly poisonous *Lepiota racodes* look-alike that has green spores and is most likely to be seen in lawns in Houston and more southerly climes.

Now that we've got the concepts outlined, Dr. Vellinga kindly points out various misinterpretations in the popular guides. Most of them are European guides or references I am not familiar with. So, if you follow Dr. Vellinga and her system, you can make the following corrections in pencil in your own guides (ink will devaluate your book).

1.) *Lepiota rachodes var. hortensis* in Mushrooms Demystified is now *Chlorophyllum brunneum*.
2.) *Macrolepiota rachodes var. hortensis* in Fungi of Switzerland, Vol.4 is now *Chlorophyllum rachodes*.
3.) *Macrolepiota rhacodes var. hortensis* in I Funghi dal Vero, Vol.5 by Cetto is now *Chlorophyllum brunneum.*
4.) *Lepiota rhacodes var. hortensis* in Mushrooms and Other Fungi of Great Britain & Europe by Roger Phillips is now *Chlorophyllum brunneum*.
5.) *Lepiota rhacodes var. hortensis* in Mushrooms of North America by Roger Phillips is most likely *Chlorophyllum olivieri* but might be *Chlorophyllum rachodes* (since specimens appear to be old and it's hard to get a read on them).
6.) *Macrolepiota rachodes* in Fungi of Switzerland, Vol.4 is now *Chlorophyllum olivieri*.
7.) *Lepiota rhacodes* in I Funghi dal Vero, Vol.1 by Cetto is now *Chlorophyllum olivieri*.
8.) *Lepiota rachodes* in Mushrooms and Other Fungi of the Mid-continental United States by Huffman, Tiffany, & Gnaphus is now *Leucoagaricus americanus*.
9.) *Lepiota rachodes* in Lincoff's Audubon Society guide is correct except for the designation of a form in southern California with a ridged basal bulb under 'Comments'. This refers to *Chlorophyllum brunneum.*
10. *Lepiota rachodes* in Mushrooms of North America by Orson Miller in 1972 is now *Leucoagaricus americanus.*
11.) *Lepiota rhacodes* in Mushrooms and Other Fungi of Great Britain & Europe by Roger Phillips is now *Chlorophyllum olivieri.*

These are just the volumes Else Vellinga decided to review. I am guessing that with the genus change to *Chlorophyllum* for *Lepiota rachodes* and allies, hackles were raised around the globe. However, Article 62 of the International Code of Botanical Literature states that 'a legitimate name or epithet must not be rejected merely because it is inappropriate or disagreeable.' An appeal can be made to the Board that a former name be retained due to popular usage, but I imagine that would refer to a species name such as '*rachodes*', not the name of the genus. So I imagine that for the time being (names are always changing from one breakthrough to the next) we are stuck with *Chlorophyllum rachodes*. This means that every time we take a bite of this choice edible, we will be reminded of chlorophyll or 'green-ness' as in the poisonous *Chlorophyllum molybdites*. For nomenclaturalists, it may never taste the same again.

photo by Buck McAdoo

Lepiota rhacodes

Back in 2001 at the huge fall show of the San Francisco Mycological Society, held that year in Oakland, I noticed that Else Vellinga had the new Chlorophyllum names on the identification tables. About half an hour later

I ran into Gary Lincoff in the parking lot. Gary is the champion of the usage of common names for fungi. He is fed up with the seemingly constant Latin name changes and would like to see internationally recognized common names that didn't have to change at every new discovery. I walked up to Gary and asked what we should do with this new change to *Chlorophyllum*. He looked me straight in the eye and snapped, 'call them any damn thing you want!'

And he has a point. *Lepiota rachodes* has been *Macrolepiota rachodes* since Rolf Singer put it there in 1949. Yet how many of us run around in the parks, shouting 'there's a *Macrolepiota rachodes* over here!' The name never took root among most of us in the Pacific Northwest. We just call it '*rachodes*'. But that will have to change. 90% of the time, we will have to shout '*brunnea*' or '*brunneum*' if we accept the change to *Chlorophyllum*.

- Buck McAdoo

The Northwest Mushroomers Association is proud to kick off the 2010 season with our Annual Survivor's Banquet to be held on March 27th, 2010 at the Squalicum Boathouse from 4:00 -10:00 pm. This year the event will include our customary auction and election of officers for the NMA board. We are fortunate to have Jairul Rahaman of the Snohomish County Mushroom Club giving us a presentation on the mushrooms of Guyana.

The meeting dates for 2010 are: April 8, May 13, and June 10, then Sept. 9, Oct. 14, and Nov. 11. Additionally, we are looking for a new foray chair. If interested contact Vince Biciunas at vbiciunas@comcast.net

photo by Vince Biciunas

Wrapping up the Cama Beach weekend

Revelers devour the fine feast and Vince puts on the finishing touches to a most memorable event. All in all, a most satisfying first 20 years for the Northwest Mushroomers, may we have many more years to enjoy our friends in the forests!

photo by Fien Hulscher

Delectable Winter Mushroom Recipes *furnished by Buck McAdoo*

Black Trumpet Saute

1/2 lb. *Craterellus cornucopioides*
1 clove garlic crushed
1 bunch spring onions thinly sliced (I used shallots)
1 green pepper diced
1/2 lb. bean sprouts
olive oil
soy sauce to taste

Roughly chop the black trumpets and mix with diced peppers and sliced onions.
Heat olive oil.
Stir fry above ingredients one minute
Add crushed garlic, bean sprouts and soy sauce.
Stir fry for 3 minutes more.
Lick your chops.

photo by Buck McAdoo

Hedgehogs with Lily Blossoms

1 lb. hedgehogs
1 pkg. dried lily blossoms (Oriental market)
2 tblsp. butter
3 shallots sliced thin
1 cup coconut milk
2 garlic cloves chopped
1/4 cup dry white wine
2 tsp. dried marjoram
salt & pepper to taste

Saute shallots and garlic in butter until glassy. Add sliced hedgehogs and continue cooking until most of liquid is cooked off.
Add coconut milk and simmer for 5-7 minutes. Add lily blossoms and cook until blossoms have rehydrated.
Add salt & pepper to taste. Add wine and marjoram.
Serve hot over rice noodles.
Recipe also works well with *Cantharellus formosus*.

Both of these mushrooms are still available at Sosio's Market in the Pike Place in Seattle—get 'em while they last!

Irofulven – Halloween Trick or a Beacon of Light

by Elinoar Shavit

The history of Irofulven, MGI Pharma's novel anti-tumor drug-candidate, unfolds like a suspense story. It involves toxins, great expectations and crushed hopes, and a promise for a better future. The journey of Irofulven from a natural toxin isolated from a mushroom to a chemotherapeutic drug has involved people and places that have influenced American mycology in the 20th century, and has left its mark on mycological taxonomy.

In 2001, the Food and Drug Administration (FDA) granted fast track status to the novel anti-tumor drug-candidate Irofulven (also known as hydroxymethylacylfulvene, HMAF, and MGI-114). Irofulven is a chemically modified version of the fungal toxin Illudin S. It is a DNA-alkylating agent that has an unusual mechanism. Irofulven is a DNA and protein-damaging agent that targets rapidly dividing cells of malignant tumors, and in some cancers even poorly differentiating malignant cells. It enters the tumor cells where it interferes with DNA replication and cell division by binding to DNA and to protein targets. This leads the tumor cells to shut down and consequently die (apoptosis). A study conducted at the University of Texas Cancer Therapy and Research Center (2002) determined that at certain doses tumor cells were highly susceptible to Irofulven's dual damaging activity while normal cells showed only marginal response to the cell-killing drug. The Texas study concluded that agents with this unique dual mechanism could be the basis for the development of tumor selective anticancer drugs.

In Phase I and Phase II clinical trials, conducted by MGI Pharma and the National Cancer Institute, Irofulven exhibited particularly promising results in shrinking malignant solid tumors, including those of drug-resistant cancers. It demonstrated remark-

Supplemental material and bibliography are published online. Photos courtesy of David C. Work.

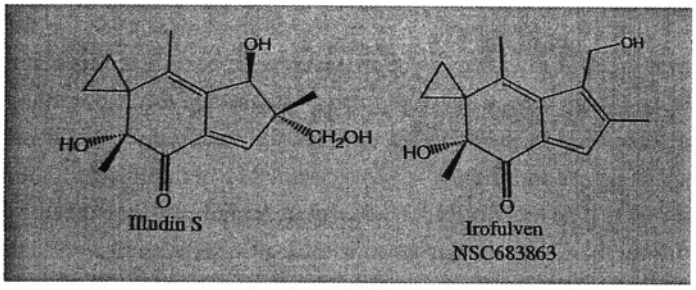

Figure 1. Structure of Irofulven and Illudin S

able results on patients with pancreatic cancer that had stopped responding to drugs, offering new hope for patients with this deadly disease. Based on these favorable results, a Phase III clinical trial of Irofulven for the treatment of pancreatic cancer was started. Gaining the FDA's fast track designation for an expedited review and approval process was an important milestone for the drug-candidate.

Irofulven is unique also for its remarkable history. It was developed by Trevor McMorris, Professor of Chemistry at the University of California, San Diego (UCSD), and Michael Kelner, Professor of Pathology at the UCSD School of Medicine. It is an acylfulvene, a family of potent semi-synthetic anticancer compounds, which was derived from Illudin S, a fungal metabolite too toxic to be used as a drug. The illudins were isolated over 50 years ago at the New York Botanical Garden in the Bronx from *Clitocybe illudens* (now *Omphalotus illudens*), the poisonous and bioluminescent Jack O'Lantern mushroom. They were found to be anti-bacterial (1950), anti-viral (1963), and anti-tumor (1979) compounds.

The story of illudins began in 1950 at the NYBG, when Marjory Anchel, Annette Hervey, and William Robbins first reported the isolation of two unique antibiotics, Illudin S and Illudin M, from *Clitocybe illudens* (Schw.). It was an exciting time at the NYBG. In his farewell to Clark Rogerson, Gary Samuels spoke of the extensive research devoted to the isolation of new antibacterials and metabolites from Basidiomycetes and Ascomycetes. Clark Rogerson collaborated with Anchel and Carey by identifying the fungi that were used to isolate the secondary metabolites. In 1963 Trevor McMorris, who had joined the NYBG, published with Marjory Anchel the proposed structures of Illudin S and Illudin M.

A few months earlier a compound called "Lampterol" was isolated from the poisonous and bioluminescent Basidiomycete *Lampteromyces japonicus* (Kawamura) Sing. This compound was soon found to be identical to Illudin S, isolated earlier from *Clitocybe illudens*. Chemotaxonomy and comparative morphology are the staples of classical taxonomy, and the discovery of Illudin S in both *C. illudens* and *L. japonicus*, while irrelevant to the immediate story of Irofulven, had an effect on the taxonomical fate of both species.

In 1983 Nair, Carey, and Rogerson published an article in *Mycologia* in which they suggested that the uniqueness of Illudin S and Illudin M, coupled with agreement among mycologists that the fungi known to produce these illudins are closely related, strengthened the view that they should both be placed in *Omphalotus*. Singer believed that, based on the presence of variegatic acid derivatives, both genera should be included in the Boletales. Both genera, however, were included in a newly established family, the Omphalotaceae Bresinsky, because both cause "white-rot" (catalysis of lignin), and because illudins were present in both genera. In 1999 Kirchmair, Poder and Huber reported the presence of illudins in the Australian *O. nidiformis* and the North American *O. olivascens* var. *indigo*. This confirmed the valuable taxonomic character of illudins for the genus *Omphalotus*. Employing a molecular approach, Thorn (et al.) suggested a close relationship of the genera *Omphalotus* and *Lampteromyces* and later noted that the two illudin-containing genera form a monophyletic group in the clade Omphalotaceae. In 2004, Kirchmair et al. published the phylogeny of the genus *Omphalotus*, based on nuclear ribosomal DNA-sequences. The writers, who set out to clarify the phylogenetic relationships within the genus *Omphalotus*, indicated that the presence of illudins in both *Lampteromyces japonicus* and species of *Omphalotus* had a hand in the placement of *L. japonicus* in the genus *Omphalotus*.

In 1987, after Trevor McMorris joined the University of California, San Diego, he and Michael Kelner published a pre-clinical evaluation of the illudins as anti-cancer agents. The illudins, in particular Illudin S, were found to be highly cytotoxic (cell-killing) against a number of human cancer cells. But there was a problem. While the illudins demonstrated marked antitumor activity, *in vitro* and *in vivo*, they also demonstrated poor therapeutic index. The therapeutic index compares the amount of a therapeutic agent that causes the measured therapeutic effect, to the amount of the same agent that causes toxic effects.

they were tested against solid tumors, where they have previously shown the most promise. Better understanding of their mechanism led to the development of a novel family of semisynthetic strong antitumor agents, acylfulvenes, which were derived by reverse Prins reaction from Illudin S. Acylfulvenes demonstrated far better therapeutic indices than Illudin S, while maintaining its marked antitumor activity toward solid tumors. Next generations of acylfulvenes proved to be even more effective antitumor agents, and their therapeutic indices kept improving. In an article published in 1999, McMorris and Kelner wrote, "acylfulvene is 100 fold less toxic *in vitro* and *in vivo* than Illudin S but possesses marked antitumor efficacy *in vivo*, thus displaying opposite properties from Illudin S."

In the late 1990s Trevor McMorris submitted a patent application for total synthesis of antitumor acylfulvenes to the USPTO. The compounds yielded by the patented process could be formulated as pharmaceutical compounds, used in different concentrations, and administered on their own or in conjunction with other pharmaceutical compounds to humans with malignant tumors. In the description of the patent, McMorris noted that in tests of Irofulven on human metastatic lung carcinoma in mice, complete tumor regression was observed in the animals. He also noted that Irofulven exhibited outstanding activity against breast, colon, and skin cancers.

In 2001, with the FDA's fast track status and a Phase III international clinical trial for Irofulven on refractory pancreatic cancer patients on the way, Irofulven generated much excitement. It showed promise in shrinking tumors of drug-resistant pancreatic cancer, a particularly deadly form of cancer with limited treatment options. The side effects associated with Irofulven were not much different than those of other chemotherapeutic agents. It had the potential to be the highly effective tool in the armament against cancer that its developers had hoped for.

However, MGI Pharma stopped the Phase III clinical trial a few months after Irofulven received its fast track status. MGI Pharma announced that a preliminary analysis by an independent safety monitoring board (DSMB) reported that the comparator agent (5-FU) demonstrated greater than expected survival benefit, making it statistically improbable for MGI to achieve its objective for the trial. It was a grave disappointment on many levels. Another problem became clear: patients enrolled in other Irofulven clinical trials reported serious visual disturbances. In a Phase II study of Irofulven in women with recurrent and heavily pre-treated ovarian cancer conducted at the Dana Farber Cancer Center in Boston in 2005, the Irofulven dose had to be lowered in mid-trial because of unexpected retinal toxicity. The retinal damage, in some cases significant, was associated with the dose and administration of the drug. This has been another stumbling block for Irofulven.

treatment of solid tumors of a variety of cancers, both alone and with other chemotherapeutic drugs. Its unique DNA damaging mechanism has been tried in combination with other DNA damaging agents and these trials have yielded favorable results. They indicate that the antitumor activity of Irofulven is enhanced by this method, particularly when combined with platinum-derived and select-alkylating agents. The FDA lists a number of Irofulven trials, involving a variety of cancers, including an open trial for recurrent, pretreated, ovarian cancer.

Any antitumor agent must first demonstrate that it is both effective and safe enough to be used on humans. Toward this end it has to pass a long and tortuous path of testing and clinical trials before it can be approved. Streptomycin, the first antibiotic to prove effective against Tuberculosis, was almost shelved because it also caused severe loss of hearing. The efficacy and safety of Irofulven, the drug derived from the toxin of the "glow in the dark" Jack O'Lantern mushroom that beacons Halloween, is still being tested. Only time and further clinical trials will tell if it will take its place in the armament against cancer. But whether it is called *Clitocybe* or *Omphalotus*, the Jack O'Lantern's place of honor in the annals of Pharmacological research is no Halloween trick.

Reprinted from the periodical *Fungi, Vol. 1:1,* Spring 2008 Blessed are the Mushroomers as well!