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Don't Pick Poison!

*When Gathering Mushrooms
for Food in Michigan*



MICHIGAN STATE
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Acknowledgement

The original bulletin, E-1080,
Don't Pick Poison, was written by
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Front Cover: *Amanita*

Back Cover: *Amanita muscaria*

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Amanita bisporigera

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Introduction

At least 50 of the larger species of wild mushrooms that grow in Michigan are known to be poisonous. There may be more.

The ultimate decision whether to eat a wild mushroom is yours. Michigan State University, the Michigan Department of Public Health, the authors of this publication and those contributing to the subject matter assume no responsibility for the safety or well-being of any mushroom collector.

What is a poisonous mushroom?

For the purposes of this bulletin, we define a poisonous mushroom as one that may be expected to have an adverse effect on a sizable percentage of the population the majority of the time. This definition excludes idiosyncratic reactions and allergies that may cause a person to have an adverse reaction to a usually edible mushroom. Just as some people are allergic to wheat or peanut butter, some people are allergic to certain mushrooms.

Approximately 2,500 species of large, fleshy wild mushrooms grow in Michigan. By "large and fleshy" we mean those fungi big enough to be seen and large enough to make a meal when collected in quantity.

The number would be increased by several thousand if microscopic fungi were included in the count. Within our approximately 2,500 large species, at least 50 species are known to be poisonous. Anywhere from 60 to 100 species are regarded as generally safe for eating.

How can you tell them apart? You cannot determine whether a mushroom is poisonous or safe by any easy, magic method. You must learn to positively identify each individual mushroom you pick for food.

Poisonous wild mushrooms grow in Michigan

From documented case histories and from the scientific literature, we have compiled a partial list of Michigan mushrooms known to be poisonous. Some are deadly; others, discomforting. Species that have caused rare deaths under special circumstances are marked with an asterisk; those that are frequently deadly are marked with two asterisks. Hallucinogenic species are marked with †.

Mushrooms that are predominantly poisonous

Agaricus praeclarosquamosus

*Amanita bisporigera***

Amanita cothurnata

*Amanita muscaria**†

*Amanita pantherina**

*Amanita phalloides***

Amanita sprete

*Amanita tenuifolia***

Amanita velatipes

*Amanita verna***

(continued on next page)

*Amanita virosa***
Boletus luridus
Boletus satanus
Boletus subvelutipes
Chlorophyllum molybdites
Clitocybe clavipes (with alcohol)
Clitocybe dealbata
Clitocybe morbifera
Conocybe filaris
Conocybe lactea
Coprinus atramentarius (with alcohol)
Coprinus insignis
Genus **Cortinarius**** (*Cortinarius* contains more than 1,000 species. Most have not been tested or are of unknown edibility; some, such as *C. orellanus*, are deadly poisonous.)
Genus **Entoloma**
Genus **Galerina****
Gomphus floccosus
Gymnopilus spectabilis[†]
Genus **Gyromitra**** (*Gyromitra esculenta*, *G. brunnea*)
Hebeloma crustuliniforme
Hebeloma sinapizans
Hypoloma (*Naematoloma*) *fasciculare*
Genus **Inocybe**
Lactarius pallidus
Lactarius scrobiculatus
Lactarius torminosus
*Lepiota subincarnata***
Omphalotus illudens
Panaeolus subalteatus
*Paxillus involutus**
Pholiota squarrosoides
Psathyrella foetidissima[†]
Psilocybe caerulipes[†]
Psilocybe (*Stropharia*) *cubensis*[†]
Ramaria apiculata
Ramaria formosa
Russula emetica

(continued on next page)

Sarcosphaera crassa
Scleroderma citrinum
Tricholoma pardinum
Tricholoma saponaceum
Tricholoma subacutum
Tricholoma vaccinum
Tricholoma venenata

Edible mushrooms that occasionally cause gastric distress

Armillaria mellea
Laetiporus sulfureus
Lepiota naucina
Verpa bohemica

In addition, most edible mushrooms can cause gastrointestinal distress if eaten raw.

Armillaria mellea, the stumper or honey mushroom; *Lepista nuda*, the blewit; and *Morchella* species, the morels, are particularly egregious in this regard.

Some mushroom myths

1. "If an animal eats it, I can eat it." This is not true. Squirrels and rabbits can safely eat the *Amanita* mushrooms, which are deadly poisonous to people.
2. "If I eat a little bit, wait for a while, and do not get sick, the mushroom is safe." The most dangerous mushroom toxins known have a delayed action. Amatoxins (deadly toxins in several mushrooms) cause painful symptoms only after 6 to 14 hours, but the onset of symptoms can be delayed for 36 hours or more. Symptoms of poisoning by *Cortinarius* toxins may take from 10 days to three weeks to occur.

3. "Cooking the mushroom will destroy the toxin." There is no way to destroy most of the dangerous mushroom toxins. Cooking is recommended for all mushrooms because it will break down some of the mushroom sugars that we cannot digest. A few fungal toxins are destroyed by cooking, but the majority of toxins are not.
4. "Tests" to distinguish poisonous mushrooms from wholesome ones are not to be trusted. Folk tradition has given rise to a number of tests: a poisonous mushroom is supposed to darken a silver coin; cooking mushrooms with silver is supposed to eliminate the poison; a mushroom is supposed to be safe if you can peel the cap; mushrooms growing on wood are supposed to be safe. These are invariably false. THE ONLY RELIABLE WAY TO DISTINGUISH A POISONOUS MUSHROOM FROM AN EDIBLE ONE IS TO LEARN TO IDENTIFY THE INDIVIDUAL SPECIES.

Why are mushrooms poisonous?

Sometimes the poison appears to serve a defensive role. Certain species of *Russula* and *Lactarius* are extremely peppery and will burn your mouth if you taste them. The burning, acrid taste effectively prevents people and animals from eating the mushroom, allowing it to mature and release its spores.

In other fungi, the purpose (if any) of the poison is not so clear-cut. The deadly *Amanita* species, unfortunately, are

reported to be good-tasting. This trait, in combination with the characteristic delay before any symptoms appear, would imply that the toxin is not a very good defensive compound – at least not against humans. The toxins may have evolved to discourage insect larvae.

Some toxins may serve some other, unidentified role in the fungus, and the physiological effect that the chemical has on us may be mere coincidence. And some toxins may have no role and may simply be waste products. The mushroom is the most disposable part of the fungal organism.

Why are people poisoned?

Many cases of poisoning occur in immigrants who are not familiar with the local mushroom flora. A person may have safely collected a familiar mushroom in his/her native land and then moved to a place where very similar-looking but poisonous mushrooms occur.

Children are particularly susceptible to mushroom poisoning, for a variety of reasons. Toddlers go through a “grazing” phase, in which anything the child can reach is put into its mouth. Slightly older children may not realize that there’s a difference between the mushrooms they eat on their pizza and the mushrooms that grow in the yard. Because children are smaller than adults and are still developing, the dose required to make a child ill is often smaller than that required for an adult. Symptoms of poisoning may differ and are often more severe in children.

Mushroom poisoning often occurs in those attempting to get high on “magic mushrooms”. This poisoning is usually due to mistaken identity, which results in highly toxic species being inadvertently collected. Most hallucinogenic species are little brown mushrooms and, as such, look a great deal like other little brown mushrooms, some of which can be deadly. Since the 1960s, there have been numerous severe poisonings of people who consumed *Galerina* species that they mistook for *Psilocybe* species.

Hunting and gathering wild mushrooms for food can be an immensely rewarding experience. You can enjoy pleasant excursions in the woods and experience the satisfaction of collecting wonderfully flavorful mushrooms for food. But you **MUST** take the time to learn about the mushrooms you collect before you risk your health or life for the sake of a meal.

What can you do to protect yourself?

Mushroom poisoning is eminently avoidable. The only way you can be poisoned by a mushroom is by eating a poisonous mushroom.

1. **Never eat any mushroom unless you know what it is.** You presumably would not pick wild raspberries unless you could tell a raspberry from deadly nightshade; by the same token, you should not collect mushrooms for food unless you can distinguish the food species from the poisonous species.

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- a) Use a reliable field guide that was written for your region of the country. Read the descriptions of the mushrooms carefully; do not just rely on the pictures. Colored pictures are aids to identification, nothing more. Many mushrooms are extremely variable. Most books can spare only one or two pictures per mushroom and cannot demonstrate the full range of appearances.
 - b) Participate in a class on mushroom identification. Both Michigan State University and the University of Michigan offer such classes in the fall; additionally, special workshops may be available. MSU Extension and Michigan Technical University have been offering a weekend-long workshop on edible and poisonous mushrooms of Michigan the past several years in September.
 - c) Go on mushroom hunts with knowledgeable persons. The classes and workshops mentioned above have a mushroom-hunting component. The Michigan Mushroom Hunters' Club is an amateur society that holds forays virtually every weekend throughout the mushroom season.
 - d) Dig up each mushroom you collect to get the entire base. Do not simply cut the stalk at the soil line. The sac at the base that enables you to identify a poisonous *Amanita* may be buried under the soil or duff.
 - e) Take a spore print of each species you collect (see page 13).

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2. **Never eat raw mushrooms.** Even mushrooms that are commonly edible contain sugars and enzymes that we cannot properly digest and that will cause problems unless they are broken down by cooking.
 3. **Never eat old or decaying mushrooms.** Many cases of "mushroom poisoning" are actually cases of food poisoning due to spoilage bacteria contaminating the mushroom. Always make sure your mushrooms are free of insect larvae. Slice through the mushroom from top to bottom to check for insect tunnels.
 4. **Be careful the first time you eat a mushroom.** Just as some people are allergic to wheat flour, strawberries or peanuts, some people are allergic to certain mushrooms. Do not assume that because you can eat some mushrooms safely, you can eat them all.
 5. **Any time you sample a new species, save a whole, uncooked specimen in your refrigerator to aid in identification in case you should get sick.** It is easier for a mycologist or physician to identify a whole specimen than to try to make an identification based on stomach contents.
 6. **Try new species one at a time;** if you do become sick, it is easier to identify the culprit if you ate only one type of mushroom rather than several types.
 7. **Do not overindulge.** Even the best, safest mushrooms may be difficult to digest if eaten in large quantities. The fungal cell wall is made of chitin, a sugar that we cannot digest.

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8. **Respect others.** Many people are very frightened of any mushrooms that do not come from the store. They want nothing to do with wild mushrooms, no matter how safe or delicious the mushroom is. Respect this and do not force your mushrooms on anybody else.

Mushroom biology/ mushroom anatomy

To be sure of the identity of a mushroom, we must have an understanding of mushroom morphology and anatomy. To safely identify mushrooms, we must learn to recognize the component parts that make it possible to distinguish an edible mushroom from a poisonous one. The diagram of the development of a poisonous *Amanita* at right provides an introduction to fungal anatomy.

White *Amanita* mushrooms are poisonous at all stages

- a) An *Amanita* spore lands on a supply of food in a suitable environment. It germinates and produces a vegetative growth called **mycelium** composed of many fine, hairlike threads called **hyphae**.
- b) A nodule develops in the mycelium, which will become a button, then expand into the **fruiting body** (mushroom) of the fungus.

Stages of white *Amanita* mushrooms



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- c) The egg-shaped button of the *Amanita* is encased in a thick membrane called a **universal veil**. At this stage, it can be mistaken for an edible puffball.
 - d) The developing mushroom pushes through the universal veil membrane, leaving a cuplike structure (the **volva**) at the base of the stalk. The volva may be below the surface of the soil or duff. As the stalk elongates, another membrane (the **partial veil**) is evident. It covers the gills beneath the cap, reaching from the stalk to the cap margin.
 - e) When the cap expands and begins to flatten, the partial veil breaks away at the margin of the cap but remains attached to the stalk. The soft membrane attached to the stalk forms a skirt called an **annulus** or ring.
 - f) When mature, the cap may be nearly flat. The spores have developed and ripened on the sides of the gills. The gills are exposed and the spores can drop freely into air currents to be carried off to continue the cycle of growth and reproduction. The partial veil hangs as a ring on the stalk, and the universal veil forms the volva at the base of the stalk, which may be out of sight beneath the surface of the soil. This beautiful, pure white mushroom has earned the titles "angel of death" and "destroying angel".

Other mushrooms follow a similar course of development, with some variations. *Amanita* species are the only fungi to possess both a volva (universal veil) and an annulus (partial veil).

One very important feature in the identification of many mushrooms is the spore color. This can easily be determined by making a **spore print**. Cut off the cap of a mature mushroom and set it on a piece of paper, gill surface down. It is helpful to put a bowl or a glass over the mushroom to keep the mushroom from drying out and to reduce air currents. Leave the mushroom for a couple of hours, then lift it off the paper. An accumulation of spores should be present. Use white or black paper (colored paper can give a distorted impression). Ideally, you could use a piece of paper that is half black and half white. Some amateur mushroom clubs have such paper available, or it is easy to make some yourself at a copy center. *Amanita* species and many other mushrooms have white to cream-colored spores that will not show up clearly on white paper. Other mushrooms may have colored, dark brown or black spores.



Spore print

Mushroom toxins

The vast majority of mushroom poisonings are not serious. Gastrointestinal symptoms shortly after ingestion of the mushroom are the most common symptoms. These may be quite severe and may cause great discomfort for a day or two, but they will usually pass on their own. In extreme cases, hospitalization may be necessary to combat dehydration. If symptoms occur within two hours following ingestion of the mushroom, it is a good sign because the most dangerous mushroom toxins rarely cause symptoms before six hours after ingestion.

Each of the major mushroom toxins is discussed individually below. Poisindex® numbers are listed, followed by the usual symptoms and treatment, if known. Poisindex® refers to the Poisindex® system widely used by hospitals and poisoning centers. This classification may mean nothing to you but will be of help to a poisoning center or physician.

The usual symptoms are listed next, followed by treatment, if known. **It is not within the scope of this publication to prescribe treatment. When treatments are known, they will be listed, but in all cases a medical doctor should be consulted. Many treatments are not available outside of a hospital, and self-treatment can be more dangerous than no treatment at all.** Further details about the poisoning follow, as well as the identifying features of the mushrooms and other useful information. Finally, look-alikes are discussed. If you are collecting mushrooms for food, make certain that you have not collected a poisonous species that resembles the mushroom you want.



Amatoxins (Class A/ Poisindex® group 1)

Mushrooms: Certain fungi in the genera *Amanita*, *Galerina*, *Lepiota* and *Conocybe*.

Symptoms: Severe gastrointestinal distress (stomach cramps, vomiting, diarrhea) begins *at least six hours following ingestion*. This phase lasts for a day or two, followed by a remission in which the patient feels better. In the third phase, the patient may fall into a coma or die as a result of liver and kidney failure.

Treatment: No known antidote. The stomach can be emptied (emesis or gastric lavage) shortly after ingestion; if more than two hours have passed, however, this will not be effective. Treatment is decided on a case-by-case basis and involves careful monitoring of the patient's liver



Amanita phalloides



Lepiota subincarnata



Galerina marginata



Conocybe filaris

(Photo courtesy Mike Wood.)

enzyme levels and general condition. Charcoal filtration of the blood may be performed. Liver transplant may be considered.

Description: Amatoxins are small chemicals technically known as bicyclic octapeptides. These are responsible for the vast majority of known mushroom fatalities. Amatoxins are found in fungi in four unrelated genera: *Amanita*, *Galerina*, *Lepiota* and *Conocybe*; all four occur in Michigan. Amatoxin poisoning is particularly dangerous because symptoms are delayed anywhere from 6 to 36 hours after the mushroom is eaten, with an average delay of 12 hours. By the time the patient feels sick, it is too late for emesis or gastric lavage to be of any use.

Amanita species cause the majority of poisonings because they are the only amatoxin-producing mushrooms that are large enough to be tempting to those seeking a meal. *Amanita* species are usually easy to recognize because of their possession of a **volva** (cuplike structure) at the base of the stalk, an **annulus** (ring) around the mid- to upper portion of the stalk, **white, free gills**, and a **white or light-colored spore print** (see diagram and photos). *Amanita* is the only genus to possess both an annulus and a volva. The volva may be buried in the duff. ANY mushroom being collected for food should be dug up out of the ground (not cut off at ground level) to determine whether it has a volva. In some species, the volva is fragile and may be lost or destroyed when the mushroom is removed. The annulus may also be fragile and may or may not be present in the mature mushroom. To be on the safe side, be wary of eating any mushroom possessing any of these characters.

Amanita species are usually associated with trees, though the association may not be immediately obvious – the tree may be several yards away from the mushroom. *Amanita* species are common in Michigan parks, woodlands and recreation areas from late June until the end of the mushroom season in November.

Amanita bisporigera, *A. verna* and *A. virosa* are known as the destroying angels. These are medium to large mushrooms that are often a pristine, satiny white. There is some debate about their classification, and they can be distinguished to species only with a microscope. **All white *Amanita* species should be considered deadly.**

Amatoxin-producing *Lepiota* species are small (the caps are usually less than 2 inches in diameter). They possess free gills, white spores and an annulus but lack a volva. The *Lepiota* annulus is loosely attached and can often be slid up and down the stalk. Young specimens may have reddish brown caps; older ones will have reddish brown scales on a white background. Small *Lepiotas* are difficult to identify, and none should be eaten. Despite their diminutive size, these species can contain up to 100 times the toxin of a much larger deadly *Amanita*.

Galerina and *Conocybe* species are little brown mushrooms and are not particularly appetizing. Both yield brown spore prints. *Galerina* grows on decaying wood, while *Conocybe* tends to inhabit lawns. *Conocybe filaris* is the only *Conocybe* species known to produce amatoxins, but other species may as well; they have not been widely tested. *Conocybe lactea*, common in Michigan, produces a related chemical and may produce amatoxins on occasion. Do not experiment! No Michigan

Galerina is safe. These fungi have caused fewer poisonings than *Amanita* because of their smaller stature and their drabber colors. *Galerina* is responsible for periodic poisonings of people wishing to get high on "magic mushrooms". Hallucinogenic species of *Psilocybe* are small to moderately large and brown with black spores, and some people have formed the mistaken opinion that all little brown mushrooms are hallucinogens.

Look-alikes: An edible puffball may be confused with an immature *Amanita* in the button stage. If you slice it open from top to bottom, the *Amanita* will show the beginnings of the stalk, gills and cap of the mushroom, while a puffball will simply be a uniform, slightly grainy white or contain a mass of yellowish to dark olive-green spores. Always slice open puffballs to be certain before eating them. Immature *Agaricus* species (meadow mushroom and horse mushroom) may resemble *Amanitas* because of the whitish free gills, annulus and general stature. The *Agaricus* will have pink and, eventually, chocolate-brown gills with deep brown spores on maturity, while the *Amanita* will retain whitish gills and spores throughout. *Lepiota* (*Leucoagaricus*) *naucina* can appear very similar to the destroying angels, but the *Lepiota* lacks a volva. Though some books list it as edible, *L. naucina* is not recommended because it has caused stomach upsets in some people. *Chlorophyllum molybdites* is a poisonous look-alike, with white, free gills, an annulus and a similar stature to the *Amanita* species. The gills turn pale green in maturity, and the spore print will be green. *Chlorophyllum* lacks a volva and possesses pale tan scales on the cap.



Cortinarius toxins (Class B/ Poisindex® group 1-A)

Mushrooms: Species in the genus *Cortinarius*.



A representative *Cortinarius*. Notice the cobwebby cortina covering the gills in these young specimens.

Symptoms: *Cortinarius* poisoning is characterized by an extremely long delay. A minimum of three days, or as long as 10 days to three weeks, may pass between eating the mushroom and the onset of symptoms. Symptoms include vomiting, diarrhea, loss of appetite, headache, a feeling of coldness and eventual kidney failure. Kidney failure may lead to death.

Treatment: Treat as kidney failure. Some patients spontaneously recover; others may require dialysis or kidney transplants.

Description: *Cortinarius* poisoning is particularly dangerous because of the very long delay before any symptoms occur. This delay has made it very difficult to identify precisely which species of *Cortinarius* may be responsible. The poisoning occurs so long after the ingestion of the mushroom that it is quite rare for the mushroom to be associated with the illness at all. The toxins responsible are unknown. Two toxins, both of which can produce disease in laboratory animals, are assumed to be responsible for human poisonings.

Cortinarius is the largest known genus of mushrooms, with well over a thousand species. None of them are particularly choice and, until we know considerably more about *Cortinarius* poisoning, none should be eaten. The distinguishing features of the genus are the presence of a cobwebby veil (the **cortina**; see photo, page 20) and the **rusty brown spores**. The cortina may wear away as the mushroom matures, but a few strands usually remain visible on the stalk, often highlighted by a rusty spore deposit. The gills become rusty brown in age, and a spore deposit may often be visible on the caps of adjacent mushrooms. Many (but not all!) *Cortinarius* species have a swollen, bulbous base. Most species are mycorrhizal and grow in wooded areas.

Look-alikes: The highly desirable blewit, *Lepista (Clitocybe) nuda*, is purple and resembles several purple *Cortinarius* species. The blewit, however, lacks a cortina and has a spore print that is creamy to pinkish to lilac, never rusty brown.



Monomethylhydrazine (Class C/ Poisindex® group 3)

Mushrooms: Members of the genus *Gyromitra* (false morels).



Gyromitra esculenta

Symptoms: A *latent period of six to eight hours* is followed by a feeling of fullness in the stomach, then vomiting and watery diarrhea, which may persist for up to two days. Headache, lassitude, cramps and intense pain in the regions of the liver and stomach may be followed by jaundice. Red

blood cells may be broken down.
Poisoning may be fatal.

Treatment: Emesis may help if employed early (more than two hours after ingestion it will have no effect, so it will be ineffective by the time symptoms occur). Fluid replacement may be necessary if patient is dehydrated. Patient should be hospitalized so laboratory tests can be performed to detect signs of hemolysis or liver or kidney failure.

Description: Monomethylhydrazine poisoning is among the most confusing mushroom poisoning syndromes. The amount of toxin can vary greatly from mushroom to mushroom, and susceptibility can vary greatly from person to person. The method of preparing the mushrooms makes an immense difference. The toxin is volatile and is destroyed by heating. The "safest" way to prepare *Gyromitra* species is to parboil the mushrooms (being careful not to inhale any of the vapors, which will contain the toxin), discard the cooking water and fry the mushrooms in a separate, clean pan. This removes the majority of the monomethylhydrazine. Other toxins, including an unidentified carcinogen, remain in the mushroom and can build up over time with repeated *Gyromitra* meals. Despite the fact that many people persist in deliberately gathering and eating these mushrooms, **we do not recommend eating any *Gyromitra* species.**

Mushrooms in this genus are very distinctive. The cap is some shade of brown and is on a whitish to pale tan stalk. The cap may be **wavy, convoluted or lobed**, but it is not pitted. **There are no gills.** *Gyromitra* is an Ascomycete; it

belongs to a very different group of fungi than the other mushrooms in this pamphlet and is related to the morels. No spore print will be obtainable. If you slice open the mushroom from top to bottom, the attachment of the cap to the stalk is distinctive. Unlike most mushrooms, which fruit in the late summer or fall, *Gyromitra* fruits in the spring.

Look-alikes: Morels (*Morchella* species). True morels are readily distinguished from the false morels by the possession of a pitted (not lobed or wavy) cap and by the attachment of the stalk. The stalk is attached to the base of the cap in the true morels but to the top of the cap in the false morels. See MSU Extension bulletin E-2755, *May is Morel Month in Michigan*, for more information.



Coprine (Class D/ Poisindex® group 5)

Mushrooms: *Coprinus atramentarius*, *Clitocybe clavipes*, other *Coprinus* species (rarely).

Symptoms: Symptoms may occur *shortly after the consumption of an alcoholic beverage plus the mushroom or on consumption of alcohol up to 48 hours after the mushroom is eaten*. Symptoms include a flushing of the face and neck, a metallic taste in the mouth, tingling of the extremities, rapid heartbeat and a feeling of swelling in the face and hands. The



Coprinus atramentarius

(Photo courtesy Tom Volk.)

initial symptoms may be followed by nausea and vomiting. Occasionally visual disturbances, vertigo, weakness and confusion occur.

Treatment: The symptoms will subside on their own in time. Reassure the patient, who may be convinced that he or she has been seriously poisoned.

Description: Coprine is interesting in that it is not, strictly speaking, a poison. Many people can and do eat these mushrooms with no ill effect. Alcohol, on the other hand, *is* a poison. The human body deals with alcohol by quickly degrading it into a series of less toxic compounds until it is no longer harmful. Coprine interferes with this process by inhibiting one of the enzymes used in alcohol processing. Alcohol is broken down partway, to acetaldehyde, but is not completely processed. The symptoms of coprine poisoning are due to the buildup of acetaldehyde in the blood. Incidentally, disulfiram, which is used to treat alcoholism, operates in the same manner.

Coprine poisoning is not serious, though it is unpleasant and can be alarming to the victim, who may believe that he or she has eaten a truly dangerous mushroom. The poisoning will usually run its course in a couple of hours without any additional treatment.

The mushroom responsible, *Coprinus atramentarius*, belongs to the black-spored mushroom group known as the inky caps. Shortly after the mushroom matures, the gills begin digesting themselves from the bottom edge up and the gills and cap dissolve into ink, colored black by the spores. *Coprinus atramentarius* is among the larger *Coprinus* species and possesses a smooth to finely silky, gray-brown cap. The cap doesn't expand nearly so much as that of many other mushrooms and always remains broadly conical. The mushroom commonly occurs in large groups at the bases of street trees or in grass, and we have frequently seen it fruiting on lawns and boulevards in East Lansing in the summer and fall. *Coprinus atramentarius* is edible and safe if cooked and if no alcohol is ingested within two or three days of eating the mushroom. All *Coprinus* species should be cooked and eaten very shortly after being picked, before they have a chance to autodigest.

Look-alikes: The black spores and the tendency to dissolve into ink are distinctive. *Coprinus commatus*, the shaggy mane, is a popular edible species, but it possesses a white, cylindrical, scaly cap and is not likely to be mistaken for *C. atramentarius*.



Psilocybin, Psilocin (Class E/ Poisindex® group 6)

Mushrooms: *Psilocybe* and *Stropharia* species, *Paneolus* species, some *Conocybe* and *Inocybe* species, *Gymnopilus spectabilis*.



Gymnopilus spectabilis

(Photo courtesy Mike Wood.)



Paneolus

(Photo courtesy Alexander Smith.)

Symptoms: A *change of mood* usually occurs beginning 20 to 60 minutes following ingestion of the mushroom. The patient may experience fear, excitement, hilarity, hallucinations, loss of coordination, dilation of pupils, rapid heart rate or rapid breathing. Children may develop a high fever and / or seizures.

Treatment: Reassurance and time are usually sufficient treatment. Children should be monitored and may require hospitalization in case of fever or seizures. Poisoning is rarely serious in adults, and, because of the disordered state of the mind, moving a hallucinating patient to the hospital may increase his or her sense of fear and confusion.

Description: With the exception of *Gymnopilus*, which is a large, yellow-brown mushroom growing in clusters on wood, psilocybin-containing species are small to moderately large brown mushrooms with dark brown to purple-black spores. Many of these species bruise bluish or are bluish at the base of the stalk. They can grow in lawns, meadows (particularly highly fertilized ones) or on manure.

Little brown mushrooms are not generally sought as food. Those who seek out and eat these deliberately are usually looking for hallucinogenic species. The primary danger is from toxic species that may look similar. Because these can fruit on lawns, they are also responsible for several child poisonings, though we have not heard any reports of this in Michigan.

Look-alikes: *Gymnopilus* is larger than most psilocybin-containing species. It grows in clusters on wood and is common

in Michigan. We have seen *G. spectabilis* mistaken for the honey mushroom, *Armillaria mellea*. The two can be distinguished by the spore color, which is yellow-brown in *Gymnopilus* and white in *Armillaria*. *Gymnopilus* also resembles the poisonous *Omphalotus illudens*.

The deadly poisonous *Galerina* species have been mistaken for *Psilocybe* species. *Galerina* grows on wood, not on soil or lawns (though there are rare reports of *Galerina* growing on buried wood in grass). *Galerina* has a bright brown to orange-brown spore print and may possess a small annulus.



Muscimol, Ibotenic Acid (Class F/ Poisindex® group 2)

Mushrooms: Primarily *Amanita muscaria* and *A. pantherina*, but similar toxins may occur in *A. cothurnata*, *A. frostiana* and *A. gemmata*.

Symptoms: A feeling of drowsiness 30 to 60 minutes after ingestion, followed by a state resembling alcoholic intoxication. Following this, a hyperactive state of confusion, muscular spasms, delirium and visual hallucinations occurs, lasting as long as four hours. Vomiting usually does not take place. Drowsiness and deep sleep follow, and recovery is usually quite rapid, though a fatality rate of 1 to 5 percent is reported.



Amanita muscaria

Treatment: Usually symptoms subside in time; overtreatment can be more damaging than none at all. Emesis or gastric lavage may be performed if the patient is brought in early on in the poisoning.

Description: Ibotenic acid occurs in the mushrooms. Muscimol, which causes the symptoms of the poisoning, is produced by the body's efforts to process ibotenic acid. Muscimol is thought to bind to receptors in the brain, causing disordered neurotransmission. *Amanita muscaria* contains less of the toxin and is therefore less dangerous than *A. pantherina*. The other species are less well studied and have rarely been eaten.

Amanita muscaria is the red-capped mushroom with white spots or patches commonly depicted in folk art. The red-capped variety is rare in Michigan, but a number of other varieties occur, including ones with yellow, orange or white caps. All varieties have whitish, removable "warts" on the cap when young, though these may wear off or be washed off in age. The volva is not obvious and cuplike,

as in the destroying angels, but appears as a series of concentric rings on the stalk, just above the swollen base. Like other *Amanita* species, it is mycorrhizal with trees and is thus usually found in the woods and clearings near trees, though we have seen *A. muscaria* under white pine in residential settings. *Amanita pantherina* looks similar to *A. muscaria* but has a grayish brown cap covered with similar whitish to grayish patches.

The people poisoned by these mushrooms are usually children, who may be attracted by the bright colors of *A. muscaria* and its "friendly", familiar appearance, and people deliberately seeking hallucinogenic substances. Rarely, people will mistake *A. muscaria* for the edible *A. caesarea*. *A. muscaria* occurs worldwide and has been widely used as a hallucinogen in parts of Europe and Asia. North American mushrooms have a somewhat different array of chemicals and are more likely to be seriously poisonous than Old World specimens; consequently, *A. muscaria* has not been so widely used as a hallucinogen here. Loss of muscular control may be pronounced. Fatal poisonings are more likely to occur with *A. pantherina*, which contains higher levels of toxin than *A. muscaria*.

Look-alikes: The edible and popular Caesar's mushroom, *Amanita caesarea*, has a reddish orange cap and may have white patches on the cap, though *A. caesarea* is likely to have one or two large patches and *A. muscaria* more often has many small patches. *Amanita caesarea* has bright yellow gills; those of *A. muscaria* are white to pale cream. Poisonings have occurred because of confusion between these two species, especially among European immigrants.



Muscarine (Class G/ Poisindex® group 4)

Mushrooms: Certain members of the genera *Inocybe* and *Clitocybe*.



Inocybe species

(Photo courtesy Mike Wood.)

Symptoms: “PSL” (perspiration, salivation, lacrimation) or “SLUDGE” (salivation, lacrimation, urination, defecation, gastritis, emesis) syndrome occurs beginning 30 to 120 minutes following ingestion.

Treatment: Atropine is a specific antidote for muscarine poisoning. Atropine is toxic and should be administered only by a qualified physician.

Description: The PSL syndrome is not usually particularly dangerous but is decidedly unpleasant. There are no recorded deaths due to poisoning by these

mushrooms. For severe cases, atropine may be administered by a physician. This is the only mushroom poison for which a specific antidote is known.

Inocybe species are often called "fiber caps". Their caps and stalks are often fibrous, with fibers radiating out from the center of the cap visible to the naked eye or with a magnifying glass. Sometimes the caps may look silky. Caps tend to be conical. The caps are mostly dull gray, tan or brown. The spore print is yellowish brown, and the mature gills will be tan to brownish. *Clitocybe* species have white spores. *Clitocybe dealbata* is a small, pale mushroom with a slightly rounded cap; other *Clitocybe* species often have an upturned, funnel-shaped cap with the gills running partway down the stem (**decurrent** gills). Both *Inocybe* and *Clitocybe* species may fruit in lawns.

Look-alikes: These are mostly small mushrooms, which are not likely to be eaten by most people. *Marasmius oreades*, the fairy ring mushroom, may resemble *Clitocybe dealbata*, and the two may grow intermingled. *Marasmius oreades* has relatively few gills, which are quite thick and widely spaced and may have visible veins between the gills, while *Clitocybe* has many, thin, crowded gills.



Unknown toxins (Class H/ Poisindex® group 7)

“Unknown toxins” is a catch-all term to cover any toxin that doesn’t fall into the above categories. These are gastro-intestinal irritants unless otherwise noted, and symptoms consist of abdominal cramps, nausea, vomiting and/or diarrhea starting between 30 minutes and two hours after ingestion. Because the exact nature of the toxin is unknown, no specific antidote can be recommended. Treatment is time and reassurance. The common Michigan mushrooms in this category will be covered.

Chlorophyllum molybdites (green gill)



Chlorophyllum molybdites

The defining features of this large, attractive mushroom are the **green gills** and **green spore print**. The gills turn green

as the mushroom matures, so young specimens may still have whitish gills. The green spore print is diagnostic – no other gilled mushroom in Michigan has green spores. *Chlorophyllum molybdites* also possesses a ring around the stalk but, unlike *Amanita* species, it has no volva. It can fruit on lawns, and we have seen a large fruiting on the Michigan State University campus in July. This mushroom is very similar to the edible *Lepiota racchodes* and *L. procera* (*C. molybdites* is sometimes called *Lepiota morganii*). The only observable difference between *C. molybdites* and *L. racchodes* is the spore color: the *Lepiota* has white spores.

Lepiota (Leucoagaricus) naucina



Lepiota (Leucoagaricus) naucina

(Photo courtesy Tom Volk.)

Many books list this species as edible, but many people are unable to eat it without stomach upset, so it should be avoided. It is dingy white when young, maturing to a tannish off-white color. It possesses a small ring on its stalk and can be mistaken for the destroying angels. There is no volva, but the base is swollen. Spores are white or rarely pinkish. It usually grows in grass and can show up in lawns. *L. naucina* should not be gathered because of the

chance of an adverse reaction and the more serious risk of accidentally gathering a deadly *Amanita*.

Omphalotus illudens (Jack o'lantern)



Omphalotus illudens

Mushrooms are medium to large and generally occur in clusters on wood or at the bases of trees. Fresh specimens possess the distinctive character of **bioluminescence** – their gills can glow in the dark. Gills, like the rest of the mushroom, range from orange to yellow-brown and may descend partway down the stalk. The spore print is creamy white.

These mushrooms have been mistaken for *Armillaria mellea*, the popular honey mushroom, which also occurs in clusters on wood or at the bases of trees. *Armillaria mellea* is part of an extremely variable species complex, but specimens usually possess a ring around the stalk, which *Omphalotus* lacks. *Armillaria mellea* has whitish (not orange) gills and forms black, shoestring-like organs called **rhizomorphs**, which may often be visible extending from the base of the mushroom.

Entoloma species

These species are characterized by a pink to red spore color and angular spores (visible under a microscope). Most species are poisonous. Many books will list as edible *Entoloma abortivum*, which occurs in association with the honey mushroom, *Armillaria mellea*. To make matters confusing, both the aborted and non-aborted forms (see picture) are called *E. abortivum*, but the aborted form is actually primarily the honey mushroom, which is being parasitized by the *Entoloma*. The aborted fruit bodies are edible; non-aborted *Entolomas* should not be eaten, because of the possibility of confusion with poisonous species. *Entoloma abortivum* grows on or near wood in the fall; other *Entoloma* species grow on the ground in humus in wasteland and fields, along edges of bogs and in woodland areas. Many small species grow on rotting wood. They can be found during all seasons from early spring until late fall.



Entoloma abortivum. Aborted form on left.

Paxillus involutus (roll-rim)



Paxillus involutus

(Photo courtesy Mike Wood.)

The cap is slightly depressed in the center and the edges of the cap roll over (see picture). Gills and cap range from yellowish brown to brown; gills run down the stalk, which is comparatively thick. The mushroom is common in lawns and in woods in the fall. *Paxillus involutus* is commonly eaten in eastern Europe, where it is pickled. It is frequently responsible for gastrointestinal distress and can also give rise to a rare but serious allergic reaction. In some few individuals – usually people who have been eating *P. involutus* for years – an antibody will form to an unknown antigen in the mushroom. The next time the person eats the mushroom, the antibody and antigen interaction will cause red blood cells throughout the body to break down.

Red-pored blue-staining boletes

Boletes differ from other mushrooms in having a spongy layer of pores instead of gills. Other fungi, such as the shelf fungi that grow on wood, may have pores but

are often too thin or woody to eat. The boletes are soft and mushroom-shaped with a stalk that is often thick or swollen. The stalk may possess netlike markings and ridges (reticulations). The cap is often velvety, though it may be smooth, felty or slimy. Boletes include many popular food mushrooms, such as *Boletus edulis*, known variably as the king bolete, porcini, cep or steinpilz. Boletes are enthusiastically collected by many Europeans.

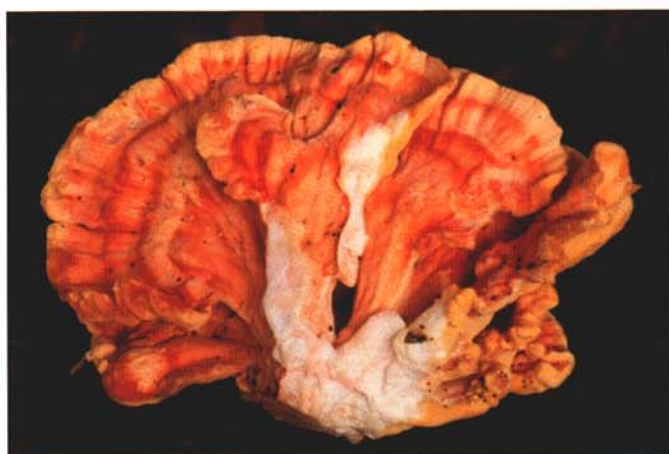
Boletes that have red to red-orange pores and/or stain blue should be avoided because most are poisonous. The staining reaction can be easily observed by cutting the mushroom or the pore surface with a knife. This reaction can be quite dramatic (see picture). See MSU Extension bulletin E-0926, *Best of the Boletes*, for further information.



Boletus subtomentosus

***Laetiporus sulfureus* (chicken of the woods; sulfur shelf)**

This is a shelf fungus rather than a true mushroom. When fresh, it is brilliant, bright yellow or yellow-orange and is very soft and often surprisingly heavy (much of its weight is water). In this young stage, it is often collected for food. Many people, however, are sensitive to some unknown chemical in the fungus and suffer gastric distress when they eat it. The mushroom grows on wood, and the substrate appears to have some effect on toxicity: those growing on conifers or locusts are frequently toxic. If you eat this mushroom, do not eat much the first time you try it. Do not serve *L. sulfureus* at large gatherings.



Laetiporus sulfureus

Should you collect wild mushrooms?

1. Not unless you are willing to study until you learn the positive identification of the mushroom you seek.
2. Not unless you assume the responsibility for your own safety and well-being. In addition to making sure

you know the mushrooms, be sure you are prepared for collecting. Carry a compass anytime you go into the woods, and know how to use it. Dress properly. Keep track of the time, and allow enough time to get out of the woods before dark.

3. Not unless you are absolutely certain the mushroom is safe to eat. Collect carefully and do not mix collections of different species. A shallow basket or a mesh bag is best for collecting, and individual collections should be wrapped in wax paper. Never use plastic – it causes the mushrooms to decompose quickly. Promptly clean, refrigerate, cook or preserve your collection upon returning home. Unless you intend to use the mushrooms, please don't pick them.

Report poisonings

It is important to report any case of distress from eating a mushroom, particularly if you can describe or identify the mushroom. In Michigan, report to the DeVos Children's Hospital, Regional Poison Center, 1300 Michigan, Suite 205, Grand Rapids, MI 49506; (800) 222-1222 (national number – will connect you to the nearest poison control center).

Human poisoning centers

Statewide and Western Michigan

1-800-222-1222

DeVos Children's Hospital

Regional Poison Center

1300 Michigan

Suite 205

Grand Rapids, MI 49506

Upper Peninsula

1-800-222-1222

U.P. Poison Crisis Center

Marquette General Hospital

420 West Magnetic Street

Marquette, MI 48955

Eastern Michigan

1-800-222-1222

Poison Control Center

Children's Hospital of Michigan

3901 Beaubien

Detroit, MI 48201

Additional resources

Amateur mycological societies provide a setting in which you can meet and learn from others who share your interest in mushrooms. The Michigan Mushroom Hunters' Club has forays nearly weekly throughout the mushroom season.

Michigan Mushroom Hunters' Club:

<<http://www.sph.umich.edu/~kwcee/mmhc/>>.

North American Mycological Association:

<<http://www.namyco.org>>.

Tom Volk's Fungi:

<<http://www.TomVolkFungi.net>>.

MykoWeb:

<<http://www.mykoweb.com>>

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Scates, Kit. 1983. Diagnosis and treatment of mushroom poisoning on basis of symptoms and mushrooms. Poster.

Spoerke, David G., and Barry D. Rumack (eds). 1994. *Handbook of mushroom poisoning: Diagnosis and Treatment*. Boca Raton, Fla.: CRC Press.



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