III. TOXIC CYCLOPEPTIDES

A. Fungi

Mushrooms containing toxic cyclopeptides are found in the genera *Amanita, Lepiota, Conocybe,* and *Galerina.* Of these, the amanitas are the most dangerous. They are widely distributed, attractive-looking fungi which because of their large size, contain large doses of toxin per mushroom. The other genera have predominantly small species which are not readily gathered for the table.

Amanita spp. usually have white spores and gills. An important characteristic of this genus is the "universal veil," a membrane that totally envelops the young fruiting bodies or buttons. At this stage of development, amanitas can be easily confused with common puffballs. A sliced amanita button, however, shows the outline of a stem and cap, whereas young puffballs are solid throughout. When the mushroom develops, the universal veil does not expand, but separates from the cap edge. The top of the veil usually adheres to the surface of the cap in the form of warts or patches, and the lower part is left as a membranous, sac-like structure around the bottom of the stem. It may easily break loose from the base when the mushroom is pulled out of the ground. This bottom part of the universal veil is called the volva. A second, or partial veil runs from the stem to the edge of the cap and protects the young gills while maturing. When the fruit body expands, the partial veil breaks loose from the cap margin and remains hanging from the apex or midportion of the stem, forming a ring or annulus. Both annulus and warts or patches may be washed off by heavy rains, making identification difficult. The toxic species of *Amanita* are:

Amanita phalloides (Fig. 1): *Cap* 7-15 cm broad, olive-green to copper-brown, convex, with or without patches. *Stipe* 8-14 cm long, 10-20 mm thick, white, smooth, at times enlarged at the base; volva membranous, persistent, sac-like, and free from the stipe. *Spores* White, round, smooth, 8-10 μm. *Habitat* usually under oaks; mainly Pacific Coast states but rapidly spreading.

Amanita verna, A. virosa, and *A. bisporigera: Cap* 3-10 cm broad, pure white, convex, patches rare. *Stipe* 14-24 cm long, 10-23 mm thick, white, finely fibrous above annulus, hairy below; volva as in *A. phalloides. Spores* white, round, smooth, 7-10 μm. *Habitat* under hardwoods or mixed woods; eastern United States.

Amanita ocreata: Cap 5-12 cm broad; white at first, turning pinkish to buff; convex; patches rare. *Stipe* 8-10 cm long, 15-20 mm thick, white, sometimes staining pale brown when handled, surface dry, finely fibrillose, scaly above annulus; volva loose with floccose patches, white to creamy tan. *Spores* white, ovate, smooth, 9-14 X 7-10 μm. *Habitat* under live oak (*Quercus agrifolia*); solitary to gregarious; known from California only. KOH will stain the cap and stipe of fresh material bright yellow. Tests with $FeSO_4$, HNO_3, and HCl negative.

The genus *Lepiota* has white spores and somewhat resembles *Amanita,* but can be separated from the latter by the absence of a volva and surface structure of the cap. Lepiotas have a bulbous base; the caps often have a small raised mound or boss on the center, called the umbo. The cap surface is often tomentose (covered with minute tufts of hair) or squamulose (scaly). Unlike the warts of amanitas, the hairs and scales of *Lepiota* caps are an integral part of the covering tissue, or cuticle, of the cap.

European studies have confirmed the presence of ama- and phallotoxins in the following species [50]: *L. helveola, L. castanea, L. griseovirens, L. rufescens, L. subincarnata, L. brunneoincarnata, L. heimii, L. clypeolarioides, L. brunneolilacea,* and *L. ochraceofulva;* α and γ amanitin have been found in *L. helveola* from California [11a].

Conocybe and *Galerina* species have brown spores and are small brownish mushrooms. Conocybes are usually found on or near dung, in grassy areas, greenhouses, or around natural or artificial compost piles. Galerinas are found in moss beds or growing out of decayed wood. Species of both genera have an annulus and lack a volva. The known toxic members are *Conocybe filaris, Galerina autumnalis, G. marginata,* and *G. venenata* [15, 34,86,99].

Conocybe filaris: Cap 0.5-2 cm broad, ochraceous to pale yellow, campanulate. *Stipe* 1-4 cm long, 0.5-1.5 mm thick, pale yellowish white, faintly striate, thin veil when young. *Spores* brown, smooth, ellipsoid, 10.5-12.5 X 5.5-6.8 μm for specimens with two-spored basidia, 8-10 X 4.5-5.5 μm for specimens with four-spored basidia. *Habitat* on lawns or other grassy areas; widely distributed.

Galerina autumnalis: *Cap* 2.5-6 cm broad, dark brown when moist, light tan when dry, convex, viscid. *Stipe* 3-8 cm long, 3-9 mm thick, light brown to fawn-colored, streaked with whitish fibrils, thin hairy veil on upper portion of stipe. *Spores* rusty brown, elliptical, minutely wrinkled, 8.5-10.5 × 5-6.5 μm. *Habitat* on well-decayed hardwood or conifer logs; scattered to abundant in groups, widely distributed.

Galerina marginata: *Cap* 1.5-4 cm broad, ochraceous brown to yellow-brown, convex to flat. *Stipe* 2-6 cm long, 2-9 mm thick, ochraceous brown to honey-colored, darker brown below. *Spores* rusty brown, egg-shaped, wrinkled, 8-10 × 5-6 μm. *Habitat* on dead conifer wood.

Galerina venenata differs from *G. autumnalis* in its habitat (grassy soil instead of wood) and the absence of a viscid cap cuticle. Galerinas can be mistaken for the psychoactive psilocybes, with whom they often share habitat. Psilocybes, however, have smooth spores, never roughened or warted as in *Galerina.* The spore color of *Psilocybe* is purple-brown and brown in *Galerina.*

IV. IBOTENIC ACID–MUSCIMOL

A. Fungi

Mushrooms belonging in this group are mostly amanitas: *Amanita cothurnata, A. crenulata, A. frostiana, A. muscaria, A. pantherina, A. smithiana,* and *A. strobiliformis* [71,86, 141]. *Tricholoma muscarium,* endemic to Japan, contains both ibotenic acid and tricholomic acid, a compound with insecticidal properties. Tricholomic acid is the erythro-2,3-dihydro derivative of ibotenic acid [141].

By far the most common and best known species are *A. muscaria* and *A. pantherina.* Ethnomycological studies on the use of *A. muscaria* as an inebriant in the rites of primitive peoples have been published [62,115,137]. *Amanita muscaria* and *A. pantherina* are also used as recreational drugs in the United States [34,78].

Amanita muscaria (Fig. 7): *Cap* 8-24 cm broad, red, orange to yellow-orange (depending on variety), white to yellow-white warts, convex to flat in age. *Stipe* 5-18 cm long, 2-3 cm thick, white, bulbous base with remains of volva appearing as concentric rings around upper part of bulb. *Spores* white, ellipsoid, thin-walled, smooth, 9-11 × 6-9 μm. *Habitat* under hardwoods and conifers, scattered to abundant; widely distributed throughout the Northern Hemisphere.

Amanita pantherina: *Cap* 5-12 cm broad, brown, pointed pyramid-shaped warts, convex to flat in age. *Stipe* 6-12 cm long, 1-2.5 cm thick, white; volva adhering to round bulb at the base of the stipe, with upper part forming a prominent collar. *Spores* white- elliptical, thin-walled, smooth, 10-12 × 7-8 μm. *Habitat* under conifers or mixed woods, scattered to abundant; widely distributed from the Rocky Mountains westward.

A special problem concerning toxicity in *Amanita* arises when toxic and nontoxic species hybridize. An example of this are the hybridized color forms of *A. pantherina* and *A. gemmata, A. pantherina-gemmata.* Benedict et al. [6] found no toxins in specimens identified as "pure" *A. gemmata.* There were, however, a number of specimens with cap colors ranging from brown (*A. pantherina*) to yellow-orange (*A. gemmata*) that did possess quantities of toxins intermediate to the amounts found in *A. pantherina* and *A. gemmata.* This quantitative variation of toxins in the hybrids may account for the widely varying reactions reported after ingestion of mushrooms identified as *A. pantherina,* which, in its pure dark form, is very poisonous.

V. MUSCARINE

A. Fungi

For almost a century, muscarine was believed to be the exclusive toxin in *Amanita muscaria;* however, this species contains only trace amounts of this compound (see Sec. IV. B). It is now known that muscarine is actually widespread in genera of the Agaricales and in certain boletes, but in many of these genera it is present in trace amounts only. On the other hand, most species of *Inocybe,* some *Clitocybe* spp., and two *Omphalotus* spp. contain toxin levels high enough to cause human poisoning. Stadelmann et al. [127] found muscarine and two of its isomers, epimuscarine and allomuscarine, in the following genera: *Amanita, Boletus, Clitocybe, Clitopilus, Collybia, Hygrocybe, Hypholoma, Lactarius, Mycena, Paxillus, Rhodophyllus, Russula, Tricholoma,* and *Tylopilus.*

Clitocybes have white to pinkish spores. The fruit bodies are firm, fleshy, and have decurrent gills (extending down the stipe). The mushrooms vary substantially in their sizes: caps 1.5-20 cm in width, stipes 1-10 cm in length and 0.1-4 cm in diameter. Clitocybes have a large color range, even within the same species; for instance, *C. aurantiaca* may range from nearly white to brown or orange-brown. The caps are convex to flat when young, becoming depressed in the center, with inrolled margins. Most of the species can be found growing directly on the ground.

Clitocybe dealbata: Cap 2-5 cm broad, pallid to dull white, convex to plane, center depressed in age. *Stipe* 4-7 cm long, 4-6 mm thick, white, smooth. *Spores* white, short elliptical, 4-6 X 3-4 μm. *Habitat* in grassy places or on leaves in open woods, solitary to abundant; smell and taste mealy.

Other suspected or muscarine containing species include *C. angustissima, C. aurantiaca, C. candicans, C. cerussata, C. ericetorum, C. festiva, C. gibba, C. hydrogramma, C. nebularis, C. phyllophila, C. rivulosa, C. suaveolens, C. truncicola,* and *C. vernicularis* [8,34, 86,99,127].

The genus *Omphalotus* closely resembles *Clitocybe.* The species of this genus can be found growing in large clusters at the base of hardwood trees. Because of their orange-like colors and decurrent gills, they have been mistaken for a look-alike edible species, *Cantharellus cibarius,* but this mushroom has decurrent ridges instead of gills.

Omphalotus olearius and the somewhat similar looking *O. olivascens* both contain muscarine. These species have been mistakenly called *Clitocybe illudens* in older books. *Omphalotus olivascens* is a Pacific Coast species which can be distinguished from the eastern and European *O. olearius* by its duller orange to yellow-orange colors, which have distinctive olive overtones or stains.

Omphalotus olearius: Cap 7-11 cm broad, bright orange to orange-yellow without olive overtones, convex to flat, depressed in center, often with a shallow knob, dry, smooth. *Stipe* 5-18 cm long, 5-22 mm thick, light orange, tapering to a narrow base, minutely downy or scaly in age. *Spores* white, round, smooth, 3-5 μm. *Habitat* at the base of hardwood stumps or from buried roots, growing in clusters. *Omphalotus* species are luminescent. This phenomenon can only be seen when the mushroom is taken into a totally dark closet.

The distribution of muscarine among species of *Inocybe* is widespread [96]. Detectable quantities of toxin vary from 0.01 to 0.8% in the fresh mushroom. Muscarine and its isomers can be found in at least 75% of all species tested [39]. Fatalities have not yet been reported from the United States, but *I. patouillardi* is listed in European literature as causing death [37].

Inocybes have umber-brown spores; spore dimensions range from small to large and their forms are quite variable, ranging from ovoid to ellipsoid to almost angular with nodulose swellings. Most inocybes are small to moderately sized mushrooms with conic, often umbonate caps (Fig. 11), 15-50 mm broad; most species have a cap surface which is fibrillose (covered with long hairs radiating from the center to the margin). The cap colors usually are some shade of brown, although a few are pure white to lilac to blackish brown. Inocybes are terrestrial and humicolous fungi and many species have an unpleasant chlorine-like odor.

VI. MONOMETHYLHYDRAZINE

A. Fungi

Mushrooms in this group are found in the genus *Gyromitra* and in suspected species of the genera *Helvella, Disciotis,* and *Sarcosphaera* [86]. These genera are all members of the class Ascomycetes.

Gyromitra and *Helvella,* or "false morels," have wavy or folded, often saddle-shaped caps; they lack gills. The colors of the caps are usually some shade of white, buff, or black. The species of these genera are all terrestrial fungi. A closely related genus, *Morchella* or "true morels," has geometrically pitted, rather than folded, caps. The caps, which are buff to brown, are conic to more or less rounded in shape. True morels are highly priced edibles, but even they should be well cooked. There have been some reports of poisonings involving raw morels; however, the toxic agent(s) have not been investigated or confirmed.

Gyromitra esculenta: *Cap* 2-8 cm broad, brown to red-brown, irregularly lobed, wrinkled, flesh brittle. *Stipe* 3-15 cm long, 10-20 mm thick, short and stout becoming hollow or chambered, surface slightly floccose, pale flesh-colored to grayish lavender. *Spores* white, smooth, elliptical, often containing two or more oil globules, 18-24 X 9-14 μm. *Habitat* under conifers, especially on sandy soil, solitary or in groups; widely distributed.

There is no doubt concerning the toxicity of this species (the toxic compound was originally extracted from *G. esculenta*); however, other species of the genus have been described as either toxic or edible in various mushroom guides. For instance, *Gyromitra gigas* is listed by Miller [97] as a good edible species, while Benedict [8] reports the existence of gyromitrin in this mushroom. The conflicting reports on toxicity may be the result of either misidentification, varying levels of toxin in identical species, or the occurrence of chemical variants in different geographical regions. The composition of the soil in which these mushrooms grow may also influence the chemicals found in the various specimens. Suspected *Gyromitra* species include *G. ambigua, G. brunnea, G. californica, G. caroliniana, G. fastigiata, G. infula,* and *G. sphaerospora* [86].

Helvella lacunosa, Disciotis venosa, and *Sarcosphaera crassa* have been reported as toxic when eaten raw; however, toxins have not yet been isolated from these species. It is speculated that these fungi may contain or can on occasion synthesize the same or similar toxins found in *Gyromitra.*

Helvella lacunosa: *Cap* 2-6 cm broad, dark brown to black, saddle-shaped with lobes, soon becoming undulate or convoluted, flesh brittle. *Stipe* 4-10 cm long, 15-20 mm thick, blackish to pallid, deeply ribbed, cylindrical or slightly swollen below, hollow or chambered. *Spores* white, elliptical, smooth, 17-20 X 11-13 μm. *Habitat* on soil, often on burnt areas, solitary or in groups.

Disciotis venosa: *Cup* large, up to 15 cm across when fully expanded, hymenial surface dark brown, in large specimens always more or less characterized by ribs and furrows radiating from the center, exterior whitish or cream-colored, minutely scurfy. *Stipe* short and stout, often sunk in the soil. *Spores* white, elliptical, 19-25 X 12-15 μm. *Habitat* on soil or on shady banks and lawns.

Sarcosphaera crassa: *Cup* of mature specimens can be large, up to 18 cm broad, develops under the soil surface as a hollow, smooth white ball, which splits open in a stellate manner to expose the violet-colored hymenium; flesh white, fragile, usually with fragments of soil attached. *Stipe* when present short and thick. *Spores* white, elliptical with abruptly truncated ends, 13-15 X 7-8 μm. *Habitat* under conifer or deciduous trees, solitary or clustered, widely distributed.

VII. INDOLES

A. Fungi

Mushrooms belonging to this group are found in the genera *Conocybe, Copelandia, Gymnopilus, Naematoloma, Panaeolina, Panaeolus, Psilocybe,* and *Stropharia* [5,7,60,61,63,64, 122].

Psilocybe and *Stropharia* species have been used in shamanic rites of certain Mexican and Central American Indian tribes [62]. The use of hallucinogenic mushrooms as recreational drugs in Western society has been increasing, especially among the young. Books on identification and cultivation of these fungi, as well as the availability of spores and equipment through mail order suppliers, has contributed to the popularity of these mushrooms.

Identification of species in this group is difficult; the majority are small, brownish to grayish, look-alike fungi that often share habitat and features with species of many other genera. *Psilocybe* spp., for instance, have been found growing together with *Galerina autumnalis,* a similar-looking fungus containing Group III toxins. This sharing of habitat and appearance should certainly discourage indiscriminate collecting.

Naematoloma, Psilocybe, and *Stropharia,* genera of the family Strophariaceae, have purple-brown, smooth spores with a pore at the apex, a central stipe, and attached gills. The stipe may or may not have an annulus, but none has a volva. The mushrooms are small to medium in size, except for certain species in *Stropharia* which can be as tall as 20 cm and with a cap width of more than 15 cm. The overlapping features of these genera have resulted in many name changes whereby identical species have been placed in different genera by different authors, e.g., *Psilocybe cubensis* (Earle) Sing. and *Stropharia cubensis* Earle. Others, e.g., Shaffer [119], considered *Naematoloma* and *Stropharia* as subgenera of the genus *Psilocybe.* A revision of the taxonomic principles and classification of the Strophariaceae is needed.

Psathyrella is a large genus that closely resembles *Panaeolus* in appearance. Toxic species have not been found in *Psathyrella* to date. The differences between the two genera are: concentrated H_2SO_4 will discolor or bleach spores of *Psathyrella* species, no color change is noted in *Panaeolus* spores; all *Panaeolus* spp. grow on dung, *Psathyrella* spp. grow on humus, grass, or wood. A macroscopic feature of *Panaeolus* is the mottled appearance of the gills caused by irregularly maturing spores.

Gymnopilus spectabilis has been suspected since the mid-1960s to be hallucinogenic [19], but initial searches for psychoactive agents were unrewarding. Another accidental poisoning in Michigan in 1976 initiated further research of the genus *Gymnopilus* by Hatfield and Valdes [60]. Nineteen species were assayed and five were found to contain psilocybin: *G. spectabilis, G. luteus, G. aeruginosus, G. validipes,* and *G. viridans.* The earlier assays which showed negative results should not be accepted as unequivocal evidence that "hallucinogenic" collections of *G. spectabilis* were devoid of psilocybin, since the assay procedure utilized may have precluded the detection of this compound. Hatfield found that extracts used contained pigments that obscured the chromatogram and prevented unequivocal identification of detected compounds. This made it necessary to isolate the constituent via ion exchange and cellulose chromatography, a method not used in the previous research.

Gymnopilus spectabilis: Cap 5-20 cm broad, buff-yellow to yellow-orange, convex, becoming nearly flat in age. *Stipe* 3-20 cm long, 8-30 mm thick, concolorous with cap, enlarged in center or club-shaped. *Spores* bright rusty to ferruginous, verrucose roughened, elliptical, thick-walled, 7-10 × 4.5-6 μm. *Habitat* on ground growing from buried wood or directly from stumps, single or in cespitose clusters. Taste very bitter.

Gymnopilus luteus is almost identical with *G. spectabilis,* but differs in having radial hyphae (cells) in the cap trama (interwoven hyphae in *G. spectabilis*). In *G. validipes* the cap color is ochraceous, the stipe yellowish white, and it lacks the bitter taste. *Gymnopilus aeruginosus* is the only species of the genus with a blue-green to pinkish buff cap, rarely exceeding 5 cm in width. The stipe is thick and striate. The spores are cinnamon-colored and smaller than those ot other species in the genus (6-9 × 3.5-4.5 μm). *Gymnopilus viridans* has an ochraceous cap which becomes green-spotted where handled.

Alkaloids other than psilocybin/psilocin have been found in a variety of fungi, many of these belong to the family Polyporaceae [81]. Bis-noryangonin, a stimulant also found in the rootstock of the kava-kava plant (*Piper methysticum*), has been isolated from *Inonotus hispidus* and *Phaeolus schweinitzii.* Hordenine is found in *Boletus zelleri, Fomes pini, Bondarzewia berkeleyi, Grifola gigantea, Polyporus guttulatus,* and *Laetiporus sulphureus.* Tyramine is present in *Boletus zelleri, Bondarzewia berkeleyi, Albatrellus cristata,* and *Laetiporus sulphureus.* N-Methyltyramine is found in *Boletus zelleri, Bondarzewia berkeleyi, Grifola gigantea, Laetiporus sulphureus,* and *Inonotus tomentosus.* Other alkaloids of unknown chemical composition have been reported from *Collybia confluens, Hygrophorus pusillus,* and *Amanita muscaria* [38,123]. Most of these compounds are present in trace amounts only, and it is doubtful that they play a role in human poisonings.

Naematoloma popperianum is the only indole-containing species of that genus and has only been found in San Francisco, the type locality [123]. Guzmán and Vergeer [57] indexed the taxa of the genus *Psilocybe,* recognizing 180 species and varieties. They list 73 psilocybin- and/or psilocin-containing members in the genus. Perhaps the best known of these are *Psilocybe cubensis* and another common species found along the Pacific Coast, *P. cyanescens.*

Psilocybe cubensis (Fig. 14): *Cap* 2-20 cm broad, reddish cinnamon brown becoming yellowish brown to pale yellow in age, conic-campanulate at first, becoming convex to broadly convex to plane, surface viscid when moist, universal veil remnants adhering to the cap surface when young only; flesh firm, bruising blue when handled. *Stipe* 4-15 cm long, 5-15 mm thick, white, at times thickened at the base. *Spores* purple-brown, smooth elliptical, 11.5-17 X 8-11 μm. *Habitat* on horse or cow dung, scattered to gregarious; widespread in the southern United States, Mexico, Central America, Cuba, South America, and southeast Asia.

Psilocybe cyanescens: Cap 2-4 cm broad, chestnut-brown when young, becoming caramel-colored in age, convex to nearly plane with undulated or wavy margin, surface smooth and viscid when moist, hygrophanous (color fades upon drying). *Stipe* 6-8 cm long, 2.5-5 mm thick, white and readily bruising blue when handled, surface silky, sometimes covered with fine fibrils, base often with long white rhizomorphs (compacted mycelium strands). *Spores* purplish brown, smooth, elliptical, 9-12 X 5-8 μm. *Habitat* in humus enriched with lignin among leaves and twigs, on wood chips, or well-decayed conifer or eucalyptus substratum; scattered to gregarious.

Conocybe cyanopus and *C. smithii* are the two indole-containing species of this genus. Both are small mushrooms, rarely exceeding 2 cm in width; the color of the cap varies from reddish brown to cinnamon-brown, and the spores are rusty brown. Conocybes have fragile, whitish to brownish stipes, which display a faint bluing at the base of indole-containing species. They closely resemble galerinas and the fact that one species, *C. filaris,* contains toxic cyclopeptides, makes this a potentially dangerous genus.

Conocybe cyanopus: Cap 0.3-2.5 cm broad, reddish-brown to cinnamon-brown, convex to bell-shaped, translucent-striate. *Stipe* 1-3.5 cm long, 1-1.5 mm thick, whitish at first, becoming brown to grayish at the apex, greenish to bluish toward the base, fragile. *Spores* brown, smooth, ovoid-ellipsoid, thick-walled, 7-10 X 4-5 μm. *Habitat* in grassy areas, on lawns or on moss (*Polytrichum*).

Conocybe smithii: Cap 0.3-1.3 cm broad, ochraceous tawny to cinnamon-brown, obtusely conic, expanding to nearly plane with a distinct umbo, translucent-striate when moist. *Stipe* 1-6 cm long, 0.75-1.5 mm thick, whitish, equal to slightly enlarged at the base, surface covered with fine fibrils at first, becoming smooth in age, fragile. *Spores* brown, smooth, ovoid-ellipsoid, thick-walled, 7-9 X 4-4.5 μm. *Habitat* same as for *C. cyanopus.*

Panaeolus, Panaeolina, and *Copelandia* all have blackish spores. *Panaeolina* is a monotypic genus with *P. foenisecii* as the type species. *Panaeolina* is close to *Panaeolus* and might be combined with the latter as some authors propose. In *Panaeolina,* however, the color of the spores is off black (purplish fuscous to brownish black) and the spores are ornamented.

Panaeolina foenisecii: Cap 1-2.5 cm broad, smoky brown to reddish brown when moist, hygrophanous, narrowly conic, becoming bell-shaped in age. *Stipe* 4-10 cm long, 1.5-3 mm thick, whitish, equal, minutely hairy at the apex, brittle. *Spores* purplish fuscous, ellipsoid, 12-17 X 7-9 μm. *Habitat* on lawns or other grassy areas, scattered to abundant.

The genus *Panaeolus* contains approximately two dozen species and has been monographed by Ola'h [103]. Based on TLC and gas chromatography, Ola'h divided the species in three categories: psilocybian, latent psilocybian, and nonpsilocybian. At first it was believed that psilocybin-containing species grew exclusively in the eastern part of the United States, while western species contained serotonin instead; however, it is now known that *Panaeolus* spp. can vary greatly in their chemical content and are not geographically specific. The psilocybian species recognized by Ola'h are *P. ater, P. cambodginiensis, P. cyanescens, P. subbalteatus,* and *P. tropicalis.* The latent-psilocybian species: *P. africanus, P. castaneifolius, P. fimicola, P. foenisecii, P. microsporus,* and *P. sphinctrinus.*

This form is also available for electronic reporting:
http://www.sph.umich.edu/~kwcee/mpcr.

Mushroom Genus_____
species_____

Toxic Exposure Report- Postal Form
North American Mycological Association Mushroom Poisoning Case Registry

This is only a reporting form. For emergency treatment, contact: your physician, the nearest poison center, or hospital emergency room.

Please answer all questions by checking the appropriate term or by writing in the information requested. Please check "don't know" if you do not know the answer. Please use a separate form for each patient.

I. Name of person filling out this form: _____
[Requested for follow-up] Address: _____
_____

Telephone: ( ) _____ E-mail: _____

This form is about:

Human adult__ child__ age___ male__ female__: animal (species)___

II. About the incident:

A. Was the mushroom eaten: Raw___ Cooked___ Don't know
B. How much mushroom was eaten? _____ Don't know
C. Was the mushroom eaten: accidentally___ for food___
intentionally for recreation___ Don't know
D. Was more than one kind of mushroom eaten? Yes ___ No ___ Don't know
E. Was the mushroom eaten at more than one meal? Yes ___ No ___ Don't know
F. When was mushroom collected?_____ Where?_____ Don't know
[List State or Province
G. When was mushroom eaten? Date?_____ Time?_____ Don't know
H. When was the first sign of illness? Date?_____ Don't know
Time _____ Onset interval _____ hours
I. Was any alcohol consumed with the mushroom, or within 24 hours after mushroo
was eaten? Yes ___ No ___ Don't know
J. How many persons ate mushrooms?_____ Don't know
K. Were all persons who ate mushrooms ill? Yes ___ No ___ Don't know
L. Were there ill persons in the group who did not eat mushrooms?
Yes ___ No ___ Don't know

III. About the patient:

A. What were the symptoms of poisoning? Check all symptoms that occurred:

chills___	drowsiness___	headache___	salivat
diarrhea___	fever___	intest. cramps___	sweatir

To see data collected ending in 2000 go to PDF file at class web site or NAMA web site (See next pg)

NAMA MUSHROOM POISONING CASE REGISTRY
1986-7 Annual Progress Report
Cases Reported 1 July 1986 - 30 June 1987

Kenneth W. Cochran

Departments of Epidemiology and of Pharmacology,
The University of Michigan, Ann Arbor, Michigan 48109
and Toxicology Committee,[1]
North American Mycological Association

Two hundred one incidents of actual or potential mushroom poisoning were reported to the NAMA Mushroom Poisoning Case Registry in the year ending 30 June 1987. Now in its fifth year of operation, the Registry has accumulated reports of 589 cases.

A brief review of the Registry's mode of operation is appropriate. Reports are invited and accepted from any and all sources in North America-including individuals, organizations, poison centers and health-care providers. Incidents need not be recent and can reflect events from as far back as the reporter is sufficiently confident of the data to complete the report form. In compiling the data no symptoms were rejected or interpolated. No corrections were attempted for observer, patient or volunteer bias. The reported species identifications were not challenged. However, when appropriate, synonyms were recorded and reported for certain of the species or symptoms actually reported. One should keep in mind the limitations of these data. The reporting is voluntary and irregular; therefore, the results cannot be interpreted as representing the actual incidence or distribution of human poisonings or mushroom species. It should also be emphasized that there may not be valid assurance that the ill effects experienced were due to toxicity of a memorable mushroom rather than an unrecognized incidental microbial infection, ingestion of chemical toxicant, or individual allergy or hypersensitivity. In some cases even exposure to a mushroom may be uncertain.

Most of the year's cases (118) represented misadventures with various wild mushrooms as food, but the most typical event involved a child (72 cases) and an accidental (66 of those cases) but asymptomatic encounter with, but not necessarily ingestion of, mushroom (59 cases). Most often such events were treated with ipecac (42 cases) with the dual benefits of prophylaxis and education, but 7 cases were only observed to confirm a continued absence of symptoms.

Only 8 reports of "bad trips", i.e. recreational use of mushrooms to achieve psychedelic effects but with unintended unpleasant consequences were received. Consumption of alcohol was reported in 32 cases, which may have contributed to unfortunate experiences associated with species generally regarded as edible, such as *Morchella esculenta, Grifola frondosa, Laetiporus sulphureus,* in addition to the predictable *Coprinus atramentarius*. Non-accidental, non-"recreational" ingestion of raw mushrooms accounted for 13 cases. Only 19 cases involved ingestion of mixed species.

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[1]Part of the 1987 Annual Report of the Toxicology Committee to the NAMA Board of Trustees

Table 1 lists the species of mushrooms involved in the 1986-7 cases associated with a single and named species. Nine species, underlined in Table 1, were reported to the Registry for the first time in the 1986-7 report-year.

Table 2 presents the symptoms of those new species represented by 2 or more cases and for additional species now represented by 2 or more Registry cases. While alcohol may have contributed to the effect of *Tricholoma pardinum* its toxicity has been recognized. *Ramariopsis lentofragilis* has not been listed in the common guidebooks. The remarkable aspect of its toxicity was the pain noted in all 3 cases, severe enough to have been treated with opiates. Only 2 other Registry cases, with 2 other species, record severe pain treated with analgesics.

Suillus granulatus, generally regarded as a choice edible, caused allergic dermatitis in 2 individuals; and a similar sensitivity had previously been reported with *Suillus americanus*. It is interesting that all those with allergic reactions to *Suillus* are mycologists. While the toxicity of *Paxillus involutus* is widely recognized, cases, including fatalities, have largely been in Europe. The present cases, 2 particularly severe, were from the Pacific Northwest. Deadly Amanitas have recently been most publicized on the East and West Coasts, but the Registry's cases involving *Amanita bisporigera*, from Michigan and Ontario, should serve as a reminder that the hazard exists throughout North America.

Recently there has been considerable discussion about the overpicking of wild mushrooms for commercial purposes. Along with this, and sometimes confused with it, is concern about the safety of domestic marketing of non-cultivated mushrooms. Concern is prudent and rational, particularly as the practice spreads and may be involving less knowledgeable participants. To date, however, no case has been reported to the Registry involving commercially sold or served wild mushrooms. Reports of such incidents are particularly invited.

The Mushroom Poisoning Case Registry continues to welcome reports of old or new cases. Special thanks is given to individuals and organizations who have submitted reports.