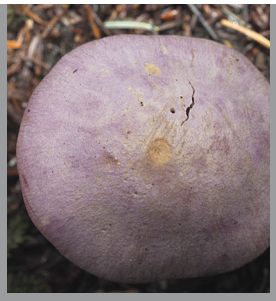
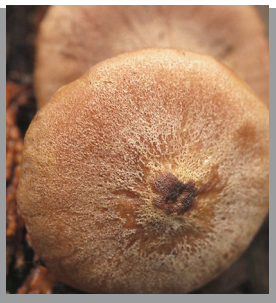
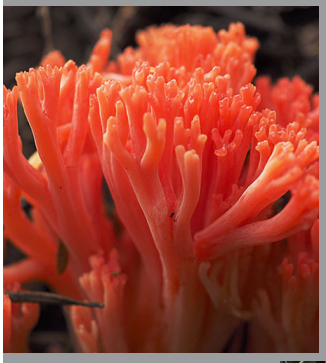





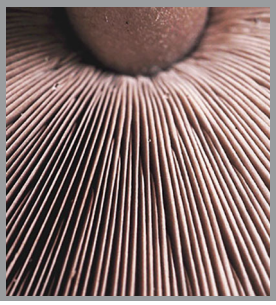


My Life Among The Mushrooms: A Beginner's Foray

By Susan McDougall





Life Among the Mushrooms

A personal story of trees and mushrooms

Studying the dark conifers and the leafy trees of the Pacific Northwest seems a natural extension of a childhood in Seattle, where the early suburbs included vacant lots populated by woods rather than weeds. A city defined as much by its trees as by the surrounding waters and situated closer to the North Pole than the equator, Seattle might be expected to be subject to cold winters, but thanks to a warm ocean current that penetrates the cold north Pacific, in the lowlands the waters of the ocean fall as rain rather than snow, thus ensuring a bounty of big trees, with a longevity that by comparison renders to humans a life span like a seasonal insect. There are trees everywhere; it is impossible to stop their natural presence. Humans figured this out long ago, and what began as reverence for these giant conifers has mutated into an exploitation upon which the local economy depends. Yet there is a heartwarming persistence to the native trees, which, undaunted, pop up wherever conditions permit, growing at a rate that always surprises.

Stout branches of an old Bigleaf Maple

This reality (and sometimes a bane for gardeners) holds even in suburban yards, including our small city lot, where a native Bigleaf Maple thrived at a corner near the street. I climbed that tree in the summer and tromped through its fallen leaves in autumn. This was a time of happy memories, when the shortening days were punctuated by the brilliant color of the leaves.

My childhood experience with trees has contributed to a lifetime of interest, in which an amateur's study was made easier by the paucity of species, at least compared to flowering plants. As a novice in the field of botany one soon learns what is hard and not particularly enjoyable at first, as opposed to what is easy. The hard part is the two-part Linnaean names. The easiest? Walking out the door, going hiking in a beautiful place where humans are visitors, and following an inclination to learn the names of what you encounter. It also helps that they come in two basic types, a dichotomy that is an initial aid to learning.

Thus I began my botanical forays amongst the trees, with my observations primarily at Mount Rainier, home to most of the Northwest's tree species. And if the scientific names were not always obvious, and the trees tended to resemble one another, it was possible to both memorize and observe throughout the seasons.

From trees to flowers, at the very least challenging by comparison because there are more species, and they are seasonal. In many ways, however, the flowers are accessible to identification, as the familial similarities promote a dichotomous recognition for the observer, supported by such an approach in botanical books. An aster is quite different than an orchid, and a rose than a violet. Nevertheless, there was (and remains) so much to learn and observe, a pursuit made easier by the beauty of the subject.

Life Among the Mushrooms

Fast forward several years and enter the mushroom. The year was 2001.

I went to Mount Rainier on a self-inflicted blind date. The purpose was to search for a couple of unusual tree species at the mountain, or at least that is what we agreed. It was a first encounter with a man who had the responsibility of purchasing books for the Tacoma Library System. He had ordered a book I had written about the trees of Mount Rainier National Park. This librarian had also recently published the first technical botanical book in 65 years whose subject was the Mountain's flora. But from my point of view this did not give him claim to "the mountain." After all, he had come to the Pacific Northwest from the Midwest by way of California.

Mushroom Mash

We saw one of the tree species, a small Ponderosa Pine growing inside the national park boundary. We shared a picnic lunch, and agreed to meet again, this time to dig plants for my garden. Out third encounter was back at Mount Rainier, and it was this walk in the forest that put mushrooms on my botanical map in a manner not previously experienced.

Was it a portend of dates to come? We bush-whacked through the forest searching for a tree species that had been reported, climbing over a log. It was here he said "oh, look at this!", accidentally smashing an already decrepit mushroom onto the log, and my pant leg. At the time I did not know that he was an expert on mushrooms, at least the California species. And he seemed more interested in identifying the mushroom than in any negative reaction I might have. I wasn't keen on the experience.

A year-and-a-half later the librarian and I were married. There was a living tree at the wedding site, and we gave little seedlings to the guests. As far as I know, mushrooms were absent.

Fungal Adventures

An introduction to the (sometimes) frustrating world of mushrooms

Sometimes beautiful, often not, but always intriguing in an otherworldly way, mushrooms are not even members of the plant (nor the animal) kingdom. They are ancient and, by comparison to trees, of nearly infinite variety. And the role they play in the world of plants (and therefore animals) is vital.

There are many common mushrooms, but mycologists tell us that thousands of species (separated by factors such as smell, form, and microscopic features) remain to be separated from their close relatives. Mushroom texts indicate that in some cases clearly separating one species from another is not possible. This may mean job security for mycologists, but it also implies frustration for someone who wants to identify all that she sees. Even for those mushroom genera and species that have been identified with confidence, doing so without a microscope in your backpack, and getting lucky enough to find the mushroom in prime condition, are sometimes formidable obstacles.

The real point is that there are many, many mushroom species, so prolific in their speciation over much of the history of life on earth that I occasionally wonder how I went from the easy trees to what seems like the impossible mushrooms. And tree names make sense! If a tree belongs to the Pine Family (the Pinaceae), visualization is easy. Mushrooms? The scientific names tend to be long, unrecognizable, and the mushrooms themselves, at least when viewed from above often tend to resemble one another.

Thus I have gone from the satisfaction of looking eye level at an easily identified Douglas-fir to the complex world of "little beigey-white things" that don't remain white for very long. The good news, however, is that given the right conditions new mushrooms might pop up where the old have so quickly decayed.

Yet it becomes an endeavor with a completely engaging aspect and having a mushroom expert for my partner is an obvious benefit. Not to mention the photography! The possibilities continue to seem endless; there will always be mushrooms, most often near the ground but occasionally at eye-level on trees and stumps.

The first mushroom I identified was not "beigey-white" but rather an infamous species, which, as it turns out is not deadly but undeniably unfriendly to the human digestive system. Easy to recognize, this is the "Fly Agaric", or in scientific terms, Amanita muscaria.

But all is not apparent. This is a photo of a prime, elegant mushroom. It has recognizable features – the little warty pieces on the top, the remnants of a ring on the stalk, the apparent gills showing from beneath the cap. The problem? The color. Not all Fly Agarics are alike, and the ones most common as subjects of artistic media, such as ceramics, postcards, drawings, have red caps, not orange.

***Amanita muscaria* (Fly Agaric) - a young mushroom**

Complicating matters, those little warts may be obscured, and the mushroom, depending on its age, may

take on the appearance of a salad plate or a drooping soft mass rather than a ball.

As with wildflowers, mushrooms can be tall or short, heavy or featherweight, nearly invisible or attention seeking, with arrangements in groups both large or small, or occasionally solitary. Most importantly, as with flowers mushrooms serve as the reproductive organs of their respective entities – the plants and the fungi. They may be constructed of different materials, and while the mechanics are different, the goal is the same — continuance.

Spore print

Mushrooms have evolved various structures for the reproductive process; some have gills, others utilize tubes, occasionally they are rounded or jelly-like, with the mushroom's version of the seed — the spore — hidden within. These organs are the reproductive business end of the fungus which, for the majority of its existence, continues its life processes out of sight. Why waste energy producing a visible mushroom at all, since so much of the work of the fungus transpires beneath the surface? Is this the fungal answer to the need for genetic fluidity, this place in the open where the mushroom can cast its spores?

Compared to most seeds, spores are tiny, with size measured in microns. They represent an ancient reproductive method, preceding the seeds while maintaining an evolutionary nitch that continues to the present time. And as with seeds, dispersal method so although the wind can aid dispersal, for the most part these miniscule pieces are cast close to the fruiting body. Sometimes spores go up and out, as with the puffballs, but for most mushrooms, they land close to the stalk, and often upon it. For evidence of their existence without the aid of a microscope, you must look at the stalk of the fruiting mushroom, or perhaps another cap nearby. Or take a cap home, set it right-side up on a piece of paper, cover it, and, when the spores drop, take a "print," revealing the spore color.

Spores come in various colors, an important feature in determining the family and genus to which the mushroom belongs. Color may range from white to grayish, to brown or black, or versions of each, such as "pale brown" and "rusty brown," or perhaps "pink," "dusty pink," or "grayish-pink" -- the list goes on. And with many mushrooms, the color of the dispersing surface is not sufficient to the determination of spore color.

Spores dispersed, the mushroom collapses

Their spores dispersed, most, although not all, mushrooms decay rapidly, the evidence of their existence

present in a flattened mass. If a tree collapsed and disappeared so quickly, trees would disappear from the Earth. The two are not strictly comparable, as a mushroom is a fruiting body, and a tree is a complex entity of growing parts, reproducing parts, roots, and more. Yet a tree cone will persist, and even the flowers most often (although there are exceptions) last for several days. When a daisy wilts, it little resembles the original flower, but stem and leaves often are recognizable, and the dispersing seeds visible. When a mushroom matures, sometimes with great rapidity, from prime to old, it may appear recognizable for a time, but then collapse totally, with not even an old leaf to mark its passing. The cycle finished, tiny and large alike the variable mushrooms meld into the substrate from which they sprouted, their mission fulfilled.

A persistent pine cone - *Pinus coulteri* (Coulter's Pine)

Fungal Adventures

What is a mushroom?

Mushrooms are the seasonal reproductive body of a fungus that spends most of its lifecycle hidden from view.This unobserved part is primarily composed of the hyphae, a threadlike cellular mass collectively forming a mycelium; rather like the roots of a plant, hyphae are the vegetative structure of the fungus. When conditions are correct, meaning that moisture and sufficient warmth are present, a small part of the hyphae coalesce into a ball-like mass, from which the mushroom is produced. Most mushrooms emerge and expand above the surface level, although there are notable exceptions. As the mushroom matures, it produces microscopic structures which are the site of spore production. It is the spore that is the fungal stake for continuance. These microscopic spores, typically dispersed by physical forces, represent for the fungi both an efficient and nearly timeless strategy.

Fungi include a wide variety of types, such as yeasts, mildews, and molds. Fungi are both terrestrial and aquatic, thriving in many if not most environments, including inhospitable places such as thermal hot springs, deserts, and, at the other extreme, the sub-freezing temperatures of the Antarctic. The majority do not reproduce with mushroom-like fruiting bodies but rather carry on the cycle within the expanding mass of fungal tissue.

Separate from plants and animals, scientists have placed fungi in their own biological kingdom. Although once considered to be plants, researchers now posit that fungi are more closely related to animals. The fungal kingdom is divided into nine divisions, two of which constitute the mushroom-producing fungi. With an estimate of over two million species, and possibly as many as four million, the fungal presence on Earth is indeed vast. Many of them play beneficial roles for the plant kingdom; mycorrhizal fungi in particular provide nutrients to plants, while some fungi are the source of antibiotics, important to animal health worldwide. Other fungi are the bane of farmers, spelling weakness or death to a variety of food crops. Trees benefit from mycorrhizal associations but can also be decimated by highly invasive fungi.

***Laetiporus sulphureus* (Chicken-of-the-Woods), a saprophyte growing on logs and dead trees**

Fungi can be parasitic, feeding on living matter, but a more common fungal role is saprophytic. These fungi provide a processing mechanism for dead material, both plant and animal. Animal waste products include manure, but the majority of saprophytic fungi species thrive on the accumulating humus of the plant kingdom. Many saprophytic species produce mushrooms, some of which are edible and eagerly south by “pot hunters,” humans with a taste for the seasonal offerings. Such mushrooms have long been known for their appealing flavor and nourishment.

The third type of mushroom-producing fungi are the mycorrhizal species. The spreading fingers of these fungal hyphae connect with plant roots in a symbiotic relationship beneficial to both. The plant offers carbohydrates and moisture, while the mushroom passes

beneficial nutrients. The evolutionary success of both kingdoms has been enhanced by this relationship, and to the gardener or commercial grower, the presence of mycorrhizal fungi specific to the plant augments growth and reproduction. However, it is estimated that only about ten percent of the fungi species are mycorrhizal.

Of the 150,000 or so species of fungi that have been described, approximately 31,000 are members of the Basidiomycota, one of the two major mushroom-producing phyla. The basidiomycetes include mushrooms with gills and pores, as well as smaller groups such as coral fungi and puffballs. Less beneficial to plant growth are rusts and smuts, pathogenic species; rather than utilizing mushrooms these Basidiomycetes produce spores on the surfaces of the host.

***Amanita vaginata* (Grisette) - classic white gills and elegant stalk**

Mushroom-producing Basidiomycetes bear their spores on microscopic basidia, club-shaped structures that mature on gills, tubes, and other mushroom reproductive surfaces. The spores are often borne in groups of four on miniscule "stalks"; as the mushroom matures, two drops of fluid are produced on the spore surface. As they expand both droplets and spore are "launched" from the basidium at a relatively high speed, but the distance covered is small, sufficient to release the spore into the air but not onto other surfaces.

The majority of Pacific Northwest mushrooms are Basidiomycetes. They include the edible chanterelles, the elegant if questionable Amanitas, the unusual and sometimes huge Boletes with their round tubes, and the many tiny beige mushrooms such as Mycenas. The distinctive Puffballs are Basidiomycetes, as are the beautiful, unusual spine fungi.

The second phylum that produces mushrooms – the Ascomycota – is composed of at the very least 32,000 species (or as much as twice that number depending on source). This phylum includes many pathogens such as yeasts and molds that are potentially harmful to animals and plants. Commercially grown crops such as apples are host to these detrimental ascomycetes. Thus, considerable attention has been devoted to fighting these invasive fungi. Ascomycetes also include species from which antibiotics

***Lycoperdon perlatum* – a puffball that emits spores from an opening at the top**

are developed. Additionally, some highly prized edibles, such as morels, are members of the phyllum. Many species serve as a fungal symbiont with the majority of lichens.

As with the Basiodiomytes, Ascomycetes fill the three major life styles of mushroom-producing fungi; these include parasitic, saprophytic, and mycorrhizal roles. Morels are saprophytic whereas a common round black fungus seen on Bigleaf Maple leaves is parasitic. A single Ascomycetes genus *(Candida*) is harmful to humans, producing what is often termed a "yeast infection." One of the most interesting parasitic Ascomycetes *(Hypomyces lactifluorum*) produces the brilliant orange of the "Lobster Mushroom" that colors the surface of Russula species. Lobster mushrooms are considered edible.

***Hypomyces lactifluorum* - Lobster Mushroom. A fungus on a fungus**

The most important mutually beneficial role played by the Ascomycota is the marriage with lichen, a very ancient joining in which the lichen provides carbohydrates to the fungus and receives nutrients and protection in return. The presence of the fungus is most evident in the spore-producing asci that grow on the surface of the lichen. Basidiomycetes also can form a symbiosis with lichens, but the Ascomycetes are more common partners.

Most Ascomycota genera produce spores inside a small sac (the "ascus") formed on the surface of the fruiting body. Others reproduce without the enclosure. Ascomycetes also use a catapulting mechanism for spore dispersal. As the asci matures it absorbs water via osmosis, causing swelling and eventual breaking open of the tip. The asci contracts and the spores are ejected.

Ascomycota species are frequently encountered in the Pacific Northwest. The Elfin saddles *(Helvella*) are autumn mushrooms, most often found in forest settings; *Helvella lacunosa* is the most common and is edible although not as

***Helvella lacunosa* - Fluted Black Elfin Saddle**

***Otidea onotica* - Donkey's Ears**

desirable as another Ascomycota group, the springtime Morels. Species of the *Morchella* genus are much sought after as desirable edibles, although some people do not tolerate them. “False morels,” members of the Verpa and Gyromitra genera, are similar and tend to mature before the “true” morels. They differ in the lack of attachment of the cap, and in the "true" morels the cap is more deeply ridged. False morels often grow in moist environments, such as alongside streams. Most should be eaten with caution, and some are poisonous.

Inedible or untested, cup fungi are Ascomycetes that are also well represented in the Pacific Northwest. Most of the species lack a stalk, and some of the “cups” have a lobed earlike form. Cup fungi grow in a variety of environments, including forests, around campfires on burnt ground, on dung, and even in moist house environments.

Unlike the small cups, which are primarily above ground, truffles are mycorrhizal forest dwellers that grow beneath the surface. There they develop distinctive odors as they mature, thus attracting animals that consume the mushroom, dispersing the ripe spores. Mammals and non-mammals alike are willing consumers, and some rodent species eat only truffles. Other animals have been trained to seek out the hidden mushroom, whether preferred as a food or not. Most famous are probably pigs that have been employed in the truffle search for centuries. In the Pacific Northwest, three species representing two genera are sought-after, and attempts to grow two of them commercially (the *Tuber* and *Leucangium* genera) have been successful. For the amateur, finding truffles can be a challenge, given the underground habit of these gourmet mushrooms. Some pot hunters train dogs to unearth the fungus. Although truffles can be consumed as a main course, the pricey nuggets are often used as an ingredient to a culinary dish.

There are “false truffles” as well, and as with the true truffles, more than one genus is included in the group. The true truffles are distinguished by their marbled interior and are generally considered by most consumers to be much tastier than the false. The false truffles have a tough interior and typically a potato-like form. One of the most widely represented genera (*Rhizopogon*) is considered more closely related to boletes than other false truffles. True truffles as well are most likely kin to members of the Basidiomycota rather than other Ascomycetes.

Fungal Adventures

Mushroom evolution

The presence of decrepit mushrooms on the forest floor reveals their ephemeral nature and most likely indicates a paucity of fossils. Mushroom cell walls are composed primarily of glucan, a glucose-derived compound, and chitin, known for its compositional importance in the exoskeletons of insects and other invertebrates. Chitin is in many respects comparable to the cellulose of plants. Fungal hyphae are exceptionally good at breaking down plant material; even cellulose can be altered by the below-ground hyphae, but the mushroom itself tends to disintegrate very quickly, sometimes nearly as rapidly as it grows.

The number of cells in a mushroom button is fixed. The button expands quickly by enlarging the existing cells with water; this process can be accomplished literally overnight; however, the water which enabled such growth also can result a quick disintegration. Not surprisingly, the softness of mushroom tissue means that only a handful of ancient specimens have been positively identified.

Fungi are considered to have Kingdom status, meaning that they are neither plants nor animals, although studies suggest that fungi and animals diverged from a common ancestor.

In the past, a few fossils as old as 460 million years had extended fungal evolution back to the Devonian period. This was a time when plants made the transition to dry land, with seed-bearing species evolving by the end of the period. Life on land undoubtedly included the fungi, these primitive organisms poised to take advantage of as well as contribute to the expanding presence of the vascular plant species.

More recent studies place the beginnings of terrestrial fungi back another 300 million years with the earliest appearing around 810 million years ago. This puts the presence of fungi in the Precambrian era. The evidence for the oldest fungi is based on finding mycelia in ancient rocks and analyzing it in situ rather than treating the organic remains with chemicals. Researchers have posited that there were small remains of chitin, the compound that is present in fungal cell walls. Other discoveries included a fossilized fungus that may date to a billion years ago. Possible fungi fossils are of course subject to scientific scrutiny and debate over their identities. Are they mushrooms or some other organism?

It is generally agreed that the Ascomycota and Basidiomycota diverged about 400 million years ago. Land-based fungi are believed to have evolved at a time when the terrestrial life forms consisted primarily of the earliest lichens, photosynthetic organisms which were formed from a symbiotic relationship with early fungi. The mushroom body came much later, about 90 million years ago, and at least one positively identified genus – the *Archaeomarasmius* – known from an amber specimen closely resembles the extant *Marasmius* genus.

Fungi evolution tended to speed up following “mass extinction” events, the latest occurring about 65 million years ago, most well-known for the extinction of the dinosaurs. The demise of animal and plant species provided an opportunity for increased fungal activity, as the fungi did not experience a massive die-off.

***Marasmius epiphyllus* - the genus represents an ancient specimen.**

Fungal Adventures

The flower and the mushroom

***Hesperochiron pumilus* - a beautiful seed-producing flower**

Flowers evolved not for human appreciation of form and color, but as a response to the presence of insects, particularly beetles, at least in the earliest times. At first flying insects were absent, but evolution of both flowering plants and their hosts went forward together as survival and diversification were enhanced with this unprecedented relationship. The presence of such a vast number of flowering plant species bear witness to the success of this partnerships; they are prolific additions to land-based life. From the mature flower comes the seed, and with it a new generation, hopefully ensured with the genetic fluidity for evolutionary response to constant change. While successful seed production may be possible because of the relative constancy of annual physical and biological forces, it nevertheless carries within the plant's response to change. There are other reproductive strategies, but hands down— at least on this planet — the seed dominates.

So successful in fact, that seed-producing plants range across the world, occupying habitats from hot to cold, amazingly dry to dripping wet.

With its tiny spores, fungi utilize a reproductive mythod that is the precursor to the seed. As with the opening of the flower, the above-ground mushroom, whether it be the classic shape with hanging gills beneath a cap, or the tight pores of a much harder "conk" on an old snag, its appearance is a sign that conditions are beneficial for reproduction. The success of the method is evident in both the antiquity of mushrooms and their continuing presence in environments occupied by seed-bearing plants.

Fungi have filled important multiple roles since the earliest times, beginning with ancient "primitive" plant associations – those that produced spores – and continuing with an adaptation to seed-bearing trees and vascular plants. Early fungi associations with terrestrial plants is theorized as an important factor to their successful evolution.

The most obviously beneficial fungi are those that form a mutualistic relationship with seed-bearing plants. These mycorrhizal associations are symbiotic, beneficial to both fungi and its host. Below the ground (although sometimes visible above) the fungi is composed of extensive strands of hyphae, fibrous stringy structures that surround the rootlets of its partner, to which it contributes nutrients. In return, the mycorrhizal fungus receives moisture and compounds produced by the plant. An ancestral joining, the co-evolution of plants and

Mycelium on old log

fungi assisted and spurred the success of both. For some fungi, a mycorrhizal relationship with a single symbiont served, while others were more generalized in their associations.

Other opportunistic fungi continued their evolution in response to the increased availability of decaying plant matter; in this saprophytic role fungi process the remains of decaying plants (or sometimes animals). Important for processing dead material, the role of another type of fungi — the parasitic — does not prove to be so beneficial; in this case living tissue and sometimes entire plants succumb.

Form and function are not necessarily related; saprophytic fungi may produce a gilled mushroom that is indistinguishable in structure from a mycorrhizal species. Parasitic species, such as the striking honey mushrooms, are often composed of stout gills and caps, much like more beneficial species.

Fungal species are everywhere, but unlike the encounters with most terrestrial plants, the observer sees the above-ground evidence only briefly. Leaves and woody stems are completely lacking, and the opening of gills or pores with their invisible attachments represents the sole purpose for the mushroom; it does not produce any nourishment for the mycelium below. Although the fruiting body may attract a variety of consumers — slugs and miniscule insects are a common observation — mushrooms do not produce attractive flowers and sweet nectar. But like the ephemeral blossoms, the visible mushroom is a seasonal phenomenon, sometimes present, often absent.

For as with flowering plants and trees as well, fungi reproduction can have “good years” and “bad,” with the determining factors not always apparent to the human observer. Moisture is a significant factor; mushroom hunters often begin their perambulations after the first autumn rains wet the earth and the emerging mushrooms appear as tiny caps alongside trails and other environments. Perennial mushrooms, such as conks, may increase their size quite dramatically in a good year, the new ring of growth softer and typically paler than the hardened old form. Although many fungi sprout their fruiting body at this onset of cooler weather, there are springtime mushrooms as well, and some are known to emerge throughout the year.

Fungal Adventures

Identifying plants and mushrooms – a comparison

The flowers of an individual plant species are most often nearly identical, even in different habitats. A dry site may be less conducive to growth than a wet one, but if conditions permit germination, the flowers are surprisingly consistent. And even if they vary, identifying the species macroscopically is still possible. The number of candidate species can be narrowed down by the size and form of the flower and its parts, and a ten-power hand lens can reveal details that help to secure confidence in identification. Flowering parts tend to be constant in size. Other features, such as hairs on stems, color, leaf shape, configuration, can also be determined in the field.

Mushroom identification is complicated by numerous factors, not least of which is the frequent close resemblance of related species. Two mushrooms of the same genus can resemble each other in minute detail, and as a preliminary attempt at determining what a “mystery” mushroom is, they are sometimes given the same name. In many cases accurate identification may only be obtained at the microscopic level. It is undoubtedly one of the reasons a multiplicity of names resulting from close similarities are specified in a mushroom book or in a technical species’ key.

Rings and gills color can aid in mushroom identification
Agaricus hondensis

The features of the spores, details only obtainable through a microscope, are often required for accurate specimen identification. Sometimes it is size alone that separates species, but often it is the shape and topography of the spore that makes naming possible. Spores can be elongated, spherical, cubic, with lines (“striate”), dimples, spines, and more. They might have a small pore of various shapes or appear divided with crossing lines. If a microscope is not available, and even if it is, accurately determining the mushroom in hand can be challenging.

This difference between flower and mushroom species’ separation can seem daunting, but as with the flowering plants, fungi specific to a region have been observed and identified for many years. In the Pacific Northwest, it is unlikely that encountering a mushroom known from eastern North America will occur. Much field work has been done, a definite aid to the novice and expert alike.

And macroscopic features can at the very least provide the means for identifying to family and often to genus. Mushrooms might have rings, veils, viscid caps, fibrous stalks, pores, scales – the list goes on. They vary from very small to weight measured in pounds. Spore prints are sometimes a necessity or at the very least a further aid to “keying out" the mushroom.

Fungal Adventures

Herbaceous plants are sometimes distinguished by the scents of leaves and flowers, but it is typically not a factor for determining the species. The same is true for trees; the needles may have a particularly distinctive scent, but the major attributes do not depend on this feature. However, a description of a mushroom often includes reference to its scent. Importantly, determination of edibility can be its smell; in general, a sweeter smell indicates a better chance of safe consumption, although this is not assured. Closely related mushrooms are sometimes differentiated by odor, which can vary from an almond-like sweetness to the unappealing scent of old fish, or decaying plants. Of course, this aid is dependent on the observer's olfactory abilities.

***Agaricus silvicola* - edible mushroom that resembles *Agaricus hondensis*, but has an anise scent when young.**

As an example, there are dangerous mushrooms that lack a distinguishable scent or are mild and innocuous. These include the Amanita species, some of which are poisonous, and others edible or unknown. The Destroying Angel (*Amanita ocreata*), a mushroom that has been the cause of as many deaths as the Death Cap (*A. phalloides*), reportedly has a mild odor when young, although mature specimens are stronger.

Distinguishing species from one another sometimes evokes words like "hopeless" in mushroom books, even when the fungi occupy similar habitats, and a scent is detected. Stature is not always reassuring either; as with flowering plants, the development of a mushroom can depend on local conditions. The stage of the mushroom can also be problematic as well; it can change very rapidly. And with similar species, edibility may depend on very subtle differences.

Sometimes olfactory sensitivity may aid in separating a poisonous species from an edible one. A close resemblance between *Agaricus hondensis* and *Agaricus silvicola*, including the tendency for each to stain yellowish when bruised and a native range that includes the coniferous forests of the Pacific Northwest, demonstrates this subtlety. Quite poisonous, *A. hondensis*, which resembles other Agaricus species as well, has an unpleasant phenolic odor, while *A. silvicola* is much sweeter.

Fungal Adventures

Types of fungi fruiting bodies

When most people think of mushrooms, they most likely envision a “toadstool”, with a cap, a stalk, and gills—the class form. Toadstool might also bring to mind a poisonous mushroom, and to many observers most if not all mushrooms are lumped into that category. This may be a good thing, for if identification cannot be made with certainty, it is best for the novice (and sometimes the expert as well) to leave a toadstool where it grows, passing it up in favor of mushrooms purchased in the local grocery store. Mushrooms also pass through a maturation and decaying stage, sometimes quickly, adding to the uncertainty.

Little Brown Mushroom (LBM)

Gilled Mushrooms

At its prime the gilled mushroom is easily recognized at least to form, and in autumn wandering through forest or field often provides the opportunity to encounter these ephemeral bodies. LBMs (Little Brown Mushrooms), with their small dingy caps, gills, and stalks may define the typical encounter, but also present are more brightly colored mushrooms, such as the stout russulas, or perhaps an amanita fit for a drawing, or sometimes a broad white *Agaricus*, a relative of the common market mushroom.

***Amanita muscaria* (Fly Agaric) - Poisonous and beautiful**

On the underside of a “classic” cap, gills reveal the reason for the expending energy to produce a mushroom. It is here, beneath the supportive cap tissue, that the spores are borne.

Platelike structures, gills play a vital role in fungal reproduction, and by hanging vertically, they contribute considerable surface area as spore factories. Gills can be closely or widely spaced, attached to the stalk or not, and crowded close to the cap or extended along the stalk in a “decurrent” configuration. The spores they produce are microscopic, and for many species the gill color changes as the mushroom matures, suggesting the color of the developing spore. What begins as pale brown gills may mature to a deeper hue.

Gilled mushrooms fill the three major fungal

ecological roles, and in some cases, a fungal family may include both mycorrhizal and saprophytic species. One such family is the widely occurring Russulaceae; with 1100 species the mycorrhizal *Russula* is the most numerous. Distinguished by its distinctive chalky stalk, in the Pacific Northwest russulas are one of the most easily identified genera. However, determining a particular species can be a challenge, as there are so many, and they are often present in a bewildering assortment of colors. Nevertheless, Russulas are common enough in some areas to rate the "JAR" designation ("Just Another Russula"). Russula species are mycorrhizal with both hardwoods and conifers and are almost exclusively terrestrial. Most are edible, although as with any mushroom, certainty in identification (which can be difficult with the so many Russula species) is paramount before consumption. For the host tree, however, the presence of a symbiotic Russula is a beneficial association.

A common name that suggests their color, Honey Mushrooms (genus *Armillaria*) play a dual role in the forest. Some species are sought by pot hunters, and the mushrooms often occur in large clusters on living trees or rotting wood. The fungi can persist for a very long time, with a few individuals believed to be the oldest organisms on the planet. In the Pacific Northwest they typically grow on living trees or rotting wood, often in large clusters. Honey Mushrooms are thus both parasitic and saprophytic, and from both the gardener's and plant's point of view not a welcome presence. For although they can play their part in decomposition, Honey Mushrooms can also spell death for living trees. In California, "oak rot" is particularly worrisome, with trees succumbing to below ground virulent runners of a Honey Mushroom relative. Honey Mushrooms occur worldwide; in the Pacific Northwest the presence of Dark Honey Mushroom (*Armillaria ostoyae*) indicates an undesirable pathogen, particularly for conifers.

***Armillaria ostoyae* (Honey Mushroom) - parasitic. Some are considered among the oldest organisms in the world.**

As an important taxonomic character, gills are a major dividing point in mushroom keys. It is interesting to note, however, that gilled mushroom families are not necessarily closely related. In the past, fungal identification was based primarily on macro-morphology, and gills are one of the most obvious common features. Today, the availability of DNA analytical tools has enabled a closer look at relationships. Some studies do reveal close evolutionary ties between the majority of gilled mushrooms, and that the form itself may have originated 90

million years ago. Many modern gilled fungi represent the success of a very ancient strategy, one that evolved multiple times, and gills are the ancestor to several other forms. This success and longevity may help to explain the relationship between some gilled mushroom families and other forms, such as puffballs.

Although gilled mushrooms may be the caricature of a typical mushroom, there are other fungi fruiting bodies that lack the toadstool appearance but fulfill the same role. These include mushrooms with tubes or pores, others that are jellylike, corals with colors that range from white to bright red and green, woody "conks," and rounded "puffballs," among others!

Pored Mushrooms

Members of the Boleteaceae and related families are most easily recognized by turning the cap over or getting down on one's knees for a look without disturbing the mushroom. Instead of gills, the underside of the stout cap is packed with short tubes that end in open pores; the tubes are often small and densely packed. As with the gills, the inner surface of the tubes are the site for the production of millions of spores; these are dispersed to germinate successfully or not according to the vicissitudes of biological and physical factors. Most will simply decay. But clearly the possible outcome is worth the cost, or the fungi would not produce the mushroom.

Spores are produced in tubes beneath the cap of this *Boletus zelleri*

***Dacrymyces chrysospermus* - a jelly fungus**

Jelly Mushrooms

Jelly mushrooms consist of a small to medium-sized fruiting body that may have a wiggle to it when touched but is often more rubbery than jellylike. The tubes may be so tiny as to require a hand lens to see them. These fungi grow on standing or fallen wood, and some are bright enough to add a splash of color to the dark forest. Jelly fungal life style includes the three major roles — mycorrhizal, saprophytic, and parasitic.

Fungal Adventures

***Polyporus badius* - Black-Footed Polypore**

Polypore Mushrooms

Another group that utilizes tubes as the site for spores, polypore mushrooms grow on wood or occasionally on the ground. They have a typical solid appearance, although sometimes they are fleshy. A stalk might be present, usually off-centered from the cap. Beneath the cap are the tubes in which the spores mature. There are many polypore species, although they are represented by fewer families than the gilled fungi. Polypores are often seen on forest walks, sometimes in eye-catching numbers but as likely as small forms sprinkled in the duff. Also known as bracket fungi, the polypores include the "conk" mushrooms, hard, woody structures that grow on living and dead trees, as well as fallen and decaying logs and stumps. Many are perennial, adding a layer of new growth each year, sometimes substantial, and often of a pale color. A conk may appear nearly inert, but it produces spores from small openings beneath the woody "cap." Conk fungi can give the impression of being as hard or more tough than the host. Some are crust-like, and others extrude colored water droplets when moistened by rain. Many persist after their reproductive life has ended, thus not decaying to a sloppy mass as so many mushrooms do but taking on a dense, nearly impenetrable form.

***Fomitopsis mounceae* (Red-belted Conk) - new growth**

One of the most common conk fungi in the Pacific Northwest, the Red-belt Conk (*Fomitopsis mounceae*) grows on living trunks and stumps. Its frequent occurrence hints at the important role this fungus plays in breaking down dead wood. Unfortunately, this conk can also cause a type of rot on a living host. Most often present on conifers, Red-belt Conk has very small pores and sometimes grows as a simple layer of tubes beneath a log or other woody debris.

Although they can be detrimental to a living host, polypores play an important role as wood-rooting fungi; without them the forest would collapse into a mass of unprocessed woody debris, the chance of tree seed germination and understory species alike nearly eliminated.

Fungal Adventures

Coral Mushrooms

The beautiful coral mushrooms resemble the branched corals of the sea, with a variety of colors and textures. They grow in terrestrial habitats, on rotting logs, and on needle and twig litter, in association with conifers or hardwoods, sometimes in large groups. They can be leathery or soft, and occasionally clublike with only a few stalks. The pale-to-brownish spores form along the “branches” on the upper half or sometimes over the entire surface.

***Ramaria sandaracina* - Sweet orange clump**

There are edible corals, with genera such as the relatively common *Ramaria* (“rami” means “branch”) collected for cooking, although the safety of most is unknown. Although Ramarias are usually considered mycorrhizal, some species may be saprophytic or occasionally play both roles in the forest. Ramaria is a member of the Gomphaceae family; other coral-like or club-like mushroom-producing fungi belong to the Clavariaceae, a small group that includes saprophytic and mycorrhizal species.

Spine Mushrooms

***Hericium abietis* - a beautiful spine fungus growing on logs and trees**

Resembling a coral fungus turned upside down, the narrow small “teeth” of the spiny fungi hang from their anchor rather than growing vertically. This groups includes some beautiful and edible species. *Hiercium abietis* is considered very tasty, although it is not particularly common. Hericium mushrooms can achieve considerable size where they grow on logs or standing dead wood, cut ends, and dying conifers as well. A particularly beautiful species, this Hericium nearly glows against the backdrop of a dark forest.

Hiercium abietis is confined to the Pacific Northwest; a few others

are eastern and southern species. All are considered edible.

Another spiny mushroom genus, Hydnellum species have the appearance of a pored mushroom, except that when looked at from below, small spines can be seen. The most common in the Pacific Northwest, *Hydnellum aurantiacum* is recognizable by the white border around the outside and orange tones over the rest of the cap. One other species — *Hydnellum peckii* — is particularly notable for its lumpy cap, decorated with what appear as dried fruit pieces, and topped with little red drops; with age the fruits tend to become more subdued. *Hydnellum* includes both saprophytic and mycorrhizal species; the fruiting bodies generally age slowly. Most are considered inedible.

With their cap and stalk, the "Hedgehogs" (*Hydnum* genus) resemble a gilled mushroom, but beneath the cap are delicate spines. Often bitter, most Hedgehog mushrooms are not sought by pot hunters. Some have distinctive scales or pits.

Puffball Mushrooms

***Morganella pyriformis* - Warted Puffball**

Puffball mushrooms protrude from the earth as rounded forms that extend to the base. Within, the developing puffball has a marshmallow texture. As the name implies, the fruiting bodies "puff", meaning that as it dries, the mushroom splits and the spores are cast upwards to be carried by air currents. At this stage they can be easily induced to disperse their spores; with a gentle squeeze the mushroom will release a small cloud.

A bewildering array of these interesting mushrooms includes the "true," the "stalked," and the "false" puffballs. These various forms are not necessarily closely related; some have affinities to gilled mushrooms and others to those with pores. In the Pacific Northwest, *Lycoperdon* and *Morganella* (formerly a *Lycoperdon*) species occur in a variety of habitats, including forest settings, lawns, and gardens. One of the most common, *Morganella pyriforme* is considered edible and remains white throughout much of its lifespan.

***Clavatia gigantea* - Giant Puffball**

The *Calvatia* puffballs include hefty

species, some warty and others quite smooth. Commensurate with their size, these giants produce spores that can number in the billions, and sometimes, as in the case of the Giant Puffball (*Calvatia gigantea*) which produces trillions of spores. This puffball is quite common, sometimes in gardens, and seems to prefer drier sites, including the sagebrush country of the east Cascades.

When fresh, the Giant Puffball is edible; however, many related species are not, and caution is always advised when selecting these mushrooms for cooking; immature puffballs can resemble a young *Amanita*. Mature puffballs decay from within, developing a gluey texture and eventually collapsing; appeal diminishes as the white rounded forms become less attractive. They can persist in this state for months, with a brown flattened broad sack indicating a former presence.

Puffballs are saprophytic fungi, growing on decaying wood and other dead organic matter. Some genera are closely related to the gilled Agaricaceae; the *Lycoperdon* genus is a member of that family. Puffballs vary in size from small to large and sometimes grow in wide "fairy rings."

Earthstars and Earthballs

The rounded Earthstars and Earthballs are puffball-like mushrooms when immature but differ as they open above the ground. Earthstars are quite unique, with the mature form appearing a bit like a butter cookie with petals, and a chocolate "kiss" in the center. The base is divided into eight sections and, as with the puffballs, the spores are released through a small hole at the tip of the center. Uncommon in the Pacific Northwest, the most likely earthstar to be seen — *Geastrum saccatum* — is reportedly too tough to be considered edible.

***Geastrum saccatum* - Bowl Earthstar**

Earthballs appear rather like a partially buried puffball. Members of the *Scleroderma* genus, they are firm when young and leathery as they age. Most often dark in the center, with maturity earthballs tend to open into an amorphous mass, although some reveal a starlike configuration, rather like an earthstar. With their collapsing, the decaying, bulbous-shaped earthballs are a perfect candidate for a horror story, with names like "Dead Man's Hand" contributing to the visual effect. Most have a preference for drier, warmer sites; earthballs can break through the surface in a variety of inhospitable habitats, from sand to asphalt, lawns and gardens. They do not seem to tempt people to collect and cook them which is probably a good thing — most are poisonous.

Fungal Adventures

Bird's-Nest Mushrooms

Nidula candida **- Jellied Bird's-Nest fungus**

Above the ground with its host of invisible fungi, in the spring tiny hummingbirds construct nests commensurate with size. In the Pacific Northwest, the smallest of these stunning birds — the Calliope — builds a home that measures less than an inch wide and tall. Nestled over nearly miniscule eggs, the female, weighing about .1 ounce, begins the job of brooding and raising her featherless, helpless young.

As with the hummingbird, within the tiny “bird’s-nest” mushrooms, the “eggs” are also the source of new life, with miniscule spores maturing as the moist mushroom dries. The mushroom begins with a cap over the eggs which peels back to reveal the small clutch. These mushrooms are easily overlooked but when encountered are truly one of the most interesting fruiting fungus forms. Some have a vaselike shape while others are tubular. Scattered or often in groups, they grow on woody and grassy debris as well as less appealing manure. Edibility is not really considered, as the mushrooms are so very tiny that probably more energy would be expended cooking them than is available in ingested calories.

Nidularia farcta

The color of spores

Spores play an important role in the fungal reproductive process. After discharge from a classic toadstool or other fruiting body, spores germinate directly into hyphae, a subterranean organ composed of threadlike cells, collectively known as a mycelium. Spores come in various shapes and with decorative touches that can include warts, knobs, a germ pore (indentation at the apex), dimples, and more. They are produced by the fruiting body (the mushroom or other fungal surface) when conditions are favorable. Although beneficial to the continuance of the fungi below, the above-ground mushroom is not necessarily present every year. There are "good" mushroom years and others where the fruiting bodies are mysteriously absent. Vascular plants also produce spores in their sexual organs, the carpels (female) and the anthers (male).

Without a microscope to see the features of the tiny spores, or the knowledge to identify them, a spore print is the best way to determine color, an important, often necessary, aid to teasing out the species. Spore color often matches gill color, but gill color alone is not sufficient to determine family or genus. However, the prints do help to eliminate other mushroom species from consideration and serve as an aid to identification. Occasionally, their color can be determined in the field with a close observation of the mushroom itself. Spores can stain the stalk of a mushroom, giving away the color. Although tiny, together they can form a dark smudge on an otherwise pale background.

Since spores are so small it is not surprising that they are produced in vast quantities. Given their size, numbers in the billions nevertheless seem staggering. The percent that will germinate must be small indeed.

White spores

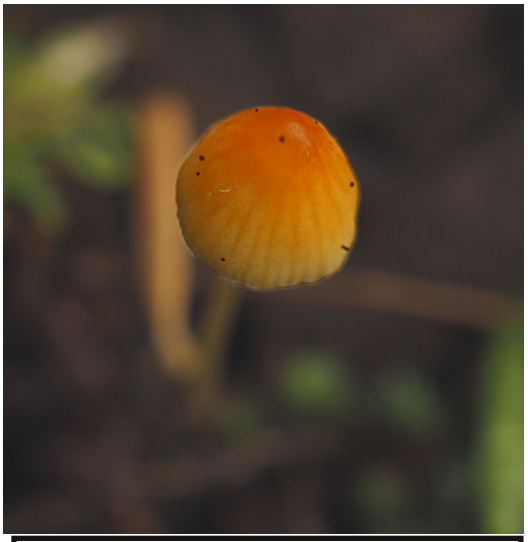
If it is suspected that the spores of a particular mushroom are white, using a black paper rather than white can readily reveal the pale color. Here are a few mushrooms with white spores.

Among the most easily recognized and elegant of mushrooms, most Amanita species have white spores and white gills as well. These include both poisonous and edible species. And whereas the edible Amanitas are sometimes very tasty, the species may closely resemble one another at different stages of their development. There are a few deadly Amanitas as well; some of them such as Death Cap (*Amanita phalloides*) can be mistaken for edibles, particularly in its white form. Unfortunately, spore color is not an aid, as this highly poisonous mushroom, which apparently can taste quite sweet, bears white spores.

***Amanita phalloides* – Death Cap - a dangerous white-spored mushroom.**

Fungal Adventures

The striking Amanitas are often seen and easily noticed alongside a trail or in shady woods, but the many small Mycena mushrooms are as likely to be passed over as noted, or, at the very least, thought to be lacking in interest. They vary from bright white spots to dusky browns and grays that blend in with the forest floor. Now and then a bright orange-capped Mycena pops up amongst the decaying needles of conifers, but the color does not last long, and soon the cap loses its brilliance. The gills of this aptly-named mushroom – *Mycena aurantiidisca* - are pale and the spores white.



The bright cap of *Mycena aurantiidisca*, a white-spored Mycena.

Another Mycena with white spores, *Mycena galericulata* is a dusty brown color, fading to a forgettable dirty grayish brown. This species is larger than many of its genus, with a cap up to four centimeters when mature.

Unknown tiny white mushroom

Spore color is an aid to identification of these “Little Brown Jobs”, but some small white mycenas are difficult to identify and tend to remain indefinitely in the "unknown" bucket. Here is one, clearly with white spores, tiny in size, and a mystery.

One of the most beautiful of the small, pale mushrooms, *Marasmiellus candidus* grows on the twigs of conifers and hardwoods as well as berry canes, often in large groups. The gills are widely spaced and the cap thin.

***Marasmiellus candidus* - small and beautiful.**

A member of the same family, *Pleurocybella porrigens* has quite a different form, with a rounded, wavy cap that sprouts directly from logs or stumps. It resembles the sought-after edible Oyster Mushrooms (genus *Pleurotus*) but is of questionable edibility.

Another white-spored genus, *Tricholoma* is perhaps best known for the highly desirable, edible Matsutake. Tricholoma species are medium to large in size with pale gills and white spores. They are mycorrhizal and associate with both conifers and hardwoods.

Most Tricholoma species have dry caps, but at least

***Tricholoma portentosum* (Streaked Tricholoma), a very edible mushroom.**

Russulas are stout mushrooms without veils and rings, and are most easily determined by the firm, chalklike stalk that will shatter when thrown against the trunk of a tree! Some break cleanly in half. Russulas can be quite large, and many have colorful caps. Spores vary in color from white to dark brown, but most in the Pacific Northwest are white-gilled and white-spored.

One of the easiest to identify is *Russula brevipes* (Short-stemmed Russula), a heavy mushroom with a stalk sometimes so short that the cap is nearly at ground level. The gills are

***Russula emetica* (The Sickener) – the hot taste serves as a warning. White spores.**

one, *Tricholoma portentosum* (Streaked Tricholoma), is slimy and rather unappealing. Nevertheless, Streaked Tricholoma is considered a very desirable edible. It grows in groups in coniferous forests.

Several Tricholomas have been assigned to other genera, including another very sought-after edible, the Blewit (*Lepista nuda*).

Not all Tricholoma species are as tasty as the Streaked Tricholoma and the Blewit; some are poisonous and as with all mushrooms, identification must be made with care.

An old Short-stemmed Russula (*Russula brevipes*) – not particularly tasty for humans, but obviously other critters find it delectable

"decurrent," meaning they extend down the stalk. Other easily (as easy as it gets) recognizable Russula include two with brightly-colored caps – *Russula sanguinea* (Rosy Russula) and *Russula emetica* (The Sickener); the scientific species name provides a clue as to the consequences of ingesting this handsome mushroom.

Most Russulas are bitter, although none are really poisonous. The recognition of one or a small group stokes the confidence of a novice; it is rather nice when you can say to your partner "Oh, Just Another Russula!"

Pink Spores

Leptonia serrulata **(Blue-toothed Mushroom) - beautiful, pink-spored mushroom**

Although less common than white, a few mushroom families include species that produce pink or pinkish-salmon spores. One with an unusual bluish-lavender cap color is *Leptonia serrulata*, the Blue-toothed Mushroom. This is a small mushroom with a bluish-gray cap, long stalk, and dark-edged contrasting whitish gills. It is a member of the Entolomataceae Family.

Another is the quite elegant *Pluteus cervinus*, the Deer Mushroom. As with the Blue-toothed, this mushroom is a saprophyte that grows on decaying wood, often in groups. The caps may reach a diameter of 15 centimeters, although they are usually smaller. When conditions are good, this mushroom can be found throughout the year, typically in forest settings, and is considered a good edible.

Pluteus cervinus **(Deer Mushroom) - often encountered in lowland forests.**

Brown Spores

Many mushroom species produce brown spores, and some large families are dominated by warm to cool brown hues. As with other mushrooms, gill color, particularly on young mushrooms, does not necessarily imply spore color, as pale gills often darken with age to a color that more closely matches their spores.

A shelf fungus that grows on logs and other woody debris, *Crepidotus mollis* (Flabby Crepidotus) grows in hardwood and coniferous forests. The gills are whitish when young but mature to brown. This mushroom lacks a stalk, and the gills flare upwards from the base of the cap. In moist conditions, the cap is gelatinous. Crepidotus species tend to decay quickly and are not considered tasty.

Crepidotus mollis

The largest of the mushroom families and distributed worldwide, the Cortinariaceae are mycorrhizal mushrooms that range from lowland forests to alpine habitats. The colors vary widely, from red to green, brown to blue. They are separated from other mushrooms by features of the spores, which are typically brown. Cortinarius species are quite common in Pacific Northwest forest settings as well as urbanized habitats. The genus is named for the "cortina" which is a veil of silky fibers. One of the more distinctive species, *Cortinarius*

***Cortinarius alboviolaceus* - forest dwelling stout mushroom with distinctive color and rusty-brown spores.**

Silky threads on a *Cortinarius* cap

***Pholiota mutabilis* (Sheathed Woodtuft) - clusters on logs and snags. Edible but resembles a deadly species.**

conical in fresh specimens, and an umbo — the little point at the top — typically remains, even as the caps flatten. To the beginner, inocybes rank as one of those "little beigey-white" mushrooms so common alongside trails. Mycorrhizal, they are most likely to be encountered in coniferous forests, often near young trees. Inocybes are generally quite small and thus not attractive to pot hunters. This is just as well, as most are believed to be poisonous. The odor is often unappealing, which should serve as a warning.

alboviolaceous produces rusty-brown spores. The cap and stalk as well as the immature gills are bluish-violet, pale in young specimens, and a white veil often leaves remnants along the stalk. It is an attractive mushroom, considered edible, although like many Cortinarius, not generally advised.

Another common genus in the Pacific Northwest, Pholiota species are typically encountered in lowland forests where they grow on rotting logs, snags, and other debris. They do not show the remains of a veil, although a ring-like flattened area may be stained by falling spores.

A genus that should never be represented at the dinner table, inocybe species also have brown spores, pale to a deeper hue. Inocybe caps vary from white to dull brown, and often turn darker when handled. The caps are

***Inocybe rimosa* - fairly large Inocybe with dark center; cap tends to split with age. Not edible.**

Black (or very dark) Spores

***Stropharia ambigua* (Questionable Stropharia) - an elegant mushroom, pale at first, then darkened by blackish spores. Found only in the Pacific Northwest.**

Most Stropharia species produce purplish-black spores. The mushrooms are small-to-medium in size and generally not edible although the palatability of many is unknown. At least one — *Stropharia ambigua* (Questionable Stropharia) — is confined to the Pacific Northwest (including northern California) and is considered by some to rival the Amanitas in elegant appearance. Stropharias are saprophytes and many grow in disturbed areas such as grass, or on dung. Questionable stropharia is most often found in coniferous or hardwood forest. As with the Amanitas, eating this mushroom is not advised.

Gomphidius mushroom species have decurrent gills and viscid caps. The base of the stalk is typically yellow. Thought to be closely related to Boletes, mushrooms that have pores

Gomphidius glutinosus

Gomphidius glutinosus - yellow stalk

rather than gills, Gomphidius caps are often quite colorful, varying from pale yellow to reddish. The spores are blackish, and the base of the stalk yellowish. These mushrooms are mycorrhizal to conifers and are edible but rather unappealing with their slime and off-putting smell.

A mushroom with fringes that match the

Coprinus comatus **(Shaggy Mane) - maturing from pink to black, delequiscing, bell-shaped, here growing in native grass habitat at an elevation of approximately 7,000 feet. Edible, and apparently delicious.**

spore color, *Coprinus comatus* (Shaggy Mane) is one of the most easily recognizable edible mushrooms. Genus members are called "Inky Caps" because of the tendency of gills and cap to self-digest, dripping "ink" in the process. It is rather unfortunate that *Coprinus* means "dung-dwelling" as these distinctive mushrooms, often observed in clusters, are found in a variety of habitat other than manure. They can be observed alongside trails, in grassy areas, and from the lowlands to subalpine habitats. Acclaimed to be delicious, and because of its distinctive shape and color, easily recognized, Shaggy Manes mature to a conelike or bell shape. The gills tend to deliquesce to a blackish mass after going through a progression of white to pinkish hues.

Fungal Adventures

Mushroom families: So many

If you encounter a large tree with needles in the Pacific Northwest, there is a good chance it is a member of the Pine Family, the Pinaceae. In fact, there aren't many tree families. It is easy, particularly when compared with the mushrooms.

There are many named mushroom families – *so* many. And until you have a lot of experience with mushrooms, knowing who belongs to which is more a matter of memorization than recognition. There are exceptions of course, but it often seems, at least to the novice, that many family members bear little resemblance to one another.

Gyromitra ambigua
A false morel, once a member of the Elfin Saddle family (Helvellaceae), now placed in the Discinaceae.

And the fungi might not retain their close relationship, whether similar or not, as familial affinity is a fluid arena, with "splitters" and "lumpers" well-represented. It isn't a simple process, of course, as the identifiable mushrooms in a particular family or genus are sometimes vastly outnumbered by those that cannot be determined with certainty. Mycologists sometimes devote a career working with a single family, which may undergo membership entry and exit with regularity. Even the most easily identified mushroom may have several close relatives.

But in spite of both the species' close resemblance and variability in appearance, mushroom identification can be a fun endeavor, and one in which a simple recognition of genus or family can be very rewarding. Nevertheless, mushroom viewing little resembles tree watching. The variety can be perplexing and the ephemeral nature frustrating. By comparison, a conifer needle gives the impression of nearly infinite duration; except for the rare deciduous conifer, the needles are there, rain or shine, persisting beneath the snow and in the wind. The new needles may be pale by comparison to the old, but their maturation from light to dark is assured, and they are always available.

Yet it seems that even little white ground-dwelling mushrooms have a tendency to turn beige, widen, and then in an instant, disappear altogether. Most often there is not even a trace. If you want to photograph a mushroom, or eat it, the time is now.

Fungal Adventures

Beautiful Color

Sometimes it is best just to acknowledge the temporary nature of a mushroom, considering it to be much like a flower, and enjoy the pleasure of discovery. In many cases, you know whether a mushroom is prime or not, and when it is the color can be as variable as the world of herbaceous blossoms. Color can be surprising!

Take, for example, the Blewit. At first encounter this edible mushroom does not really appear desirable at all. As the name implies, the color is sort of "bluish," with a warm brown cap, and cool pale blue stalk. True blue in nature is not especially common; even the flowers tend towards warmer colors. But in the fungal world, cool hues are certainly possible. A large Blewit is truly a beautiful mushroom, as inspirational for art as desirable for consumption.

Lepista nuda **- The common Blewit**

Yet the appearance of a Blewit alongside a trail such as the Olympic Discovery Trail is an exception in size and color rather than the rule. More typically, a jog between swaths of exotic trailside grasses is occasionally punctuated with the appearance of "beigey-white" mushrooms, not the Blewit's brown cap with its striking bluish gills. Often the small mushrooms are in groups, and in relatively short time they consistently fade from white (with accents of beige) to unimpressive brown tones.

But step away from a well-groomed trail into the forest, and a variety of colors, sizes, and different shapes are all possible. This is where mushroom hunting on a brisk or drizzly autumn day can be rewarded with a splash of surprisingly bright color. Now as the flowers fade, and the bright green new growth of a tall conifer has darkened, the time for the mushroom has come. For many, it means collecting and eating, but for me, it is color and form, the opportunity to photograph, the enjoyment of such ancient life before the cool gray winter returns it to the ground.