Potomac Sporophore

September 2006 Volume No. 21 Issue No. 3

Website: http://mawdc.org

GUEST SPEAKERS

The program schedule for guest speakers at the monthly MAW meetings for the remainder of 2006 is as follows:

SEPTEMBER 5: The featured speaker will be Amy Riolo, a lecturer, freelance food writer and cooking instructor based in the Washington DC area. She is a member of the International Association of Culinary Professionals and the Culinary Historians of Washington. The program will consist of a presentation entitled "Culinary and Medicinal Uses of the Egyptian Terfez and Arabic Desert Truffles." The cultural relevance, culinary significance and medicinal applications of the desert truffle in their countries of origin will be present

OCTOBER 3: Fall tasting meeting.

NOVEMBER 14: (NOTE: this is the second Tuesday in November, the first Tuesday is election day) – Dr. Anne Pringle who is an Assistant Professor the Department of Organismic and Evolutionary Biology at Harvard University will be the guest speaker. She received her Ph.D. at Duke University; her dissertation was “Ecology and genetics of arbuscular mycorrhizal fungi”. Her current research focuses on the invasion biology of the mycorrhizal fungus Amanita phalloides, which will be the subject of the presentation. The European death cap mushroom Amanita phalloides is hypothesized to be an introduced and invasive species in North America. Because A. phalloides is deadly, a rich mycological literature records the distribution of the mushroom on both the East and West Coasts. A comprehensive review of the available literature, and a formal (and molecular) evaluation of available herbarium collections, will be presented that confirms that A. phalloides was introduced to California. Population genetic data from mushrooms collected from both the East and West Coasts of North America, and Europe, will be used to elucidate the biogeography of A. phalloides.

At the November meeting the nominating committee will present its nominations for the 2007 MAW Board of Directors. At that meeting any member may be nominated.

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The Camp Sequanota October Weekend

Once again, maybe our 17th year, we’ll be spending a fall weekend at Camp Sequanota in the Laurel Highlands of west-central Pennsylvania, north of Somerset, from Friday, October 6 until midday on Sunday, October 8. In our best year, we found about 260 species of mushrooms, and sometimes vast quantities of choice edibles (perhaps a slight exaggeration). Our guest mycologist is Walt Sturgeon of Ohio, one of the most knowledgeable “amateur” mycologists in the eastern United States, and a veteran participant in many of our Sequanota and West Virginia weekends, along with a Mushroom Fair or two. J.E.

The cost is a very reasonable $102 per adult, which covers two nights’ lodging (double occupancy), five meals from Saturday breakfast

through Sunday lunch, and a Saturday evening program by Walt. We may also have a mushroom dish or two with the Saturday evening meal. If you prefer to participate in just part of the weekend (Saturday only, one night's lodging, etc.), or will bring children, please let me know the details and I'll provide the information about individualized costs.

To register, please send your checks or money orders, made out to MAW, to Jon Ellifritz, 1903 Powhatan Road, Hyattsville, MD 20782. We'll probably need to provide a final count for meals by Monday, October 2, but please try not to wait until it becomes a cliffhanger as to whether we'll have enough participants! If you're interested, but not yet certain, please let me know the details by mail or phone, or e-mail me at ellijon@earthlink.net.

Friday supper will not be one of the five meals provided, since participants arrive any time between mid-afternoon and midnight. You can get your evening meal on the way, or at one of several restaurants in the immediate area. We also encourage bringing food for a potluck buffet Friday evening – breads, crackers, cheese, beverages, chips, dips, salads, even casseroles – and that may be sufficient for some. If you need a ride, or are willing to share one, we may be able to coordinate an arrangement. Distance is about 190 miles, with travel time about 3-½ hours. J.E.

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MUSHROOM FAIR
Sunday, October 1st

Our annual Mushroom Fair will be held Sunday, October 1, at the Brookside Gardens Visitors' Center, 1800 Glenallan Avenue, in Wheaton Park, Maryland, from noon to 5 p.m. Newsletter editor Jim Sherry is once again managing the event.

We will need volunteers, especially for setting up, cleaning up at the end, staffing a table or spelling other volunteers for breaks, and distributing flyers. If you can spare an hour or two, or three or four or more, let us know at the September 5 meeting, or call Jim at (410) 531-2329, e-mail him at mjbolete@comcast.net, or call Jon Ellifritz at (301) 422-7517 or e-mail at ellijon@earthlink.net. And please let us know if you have a special relationship with any publicity outlet (newspapers, newsletters, etc.) with a likely audience of potential visitors to the fair. Program Chair William Needham made a valiant effort last year, but was apparently ignored by a number of such outlets.

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Fall Wild Mushrooms Tasting

Remember, our annual Wild Mushroom Tasting meeting will be Tuesday, October 3, at the Chevy Chase (Maryland) Library at 8005 Connecticut Avenue. We hope to have exotic mushrooms from Phillips Mushrooms for those unable to find a sufficient quantity of wild ones, but we encourage everyone to bring wild mushrooms if possible. Wild-picked mushrooms must be inspected before cooking, unless they're store-bought (in which case, please bring a receipt).

The May and October tasting meetings are the only MAW meetings at which we require MAW membership of all participants, for legal reasons. Memberships may be obtained at the door, and new members who join after June 30 receive membership coverage through the end of the following year.

More details about the tasting will be available near the end of September, through the monthly "presidential e-mail," on our voice-mail announcement line, (301) 907-3053, and at the MAW website, http://mawdc.org. J. E.

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LOVE THOSE CHICKEN MUSHROOMS
Waldemar Poppe

Over the years, I have been finding plenty of chicken mushrooms. I have tried them many times and they never impressed me. Also, many of you may not have had the best experience with them. Therefore, I would like to share with you my conversion.

This new appreciation occurred last year. As you may remember, we had a blistering, dry late summer. Very few mushrooms could be found. To my surprise, however, it seemed to be the year of the chicken mushroom. I found them on many logs where I had never found them before. This is good news because if you find them once they seem to continue to come back year after year for a very long time. If you locate old chicken mushrooms late in the year, make yourself some notes for the following year. When old chicken mushrooms turn white they can be easily spotted. For an adequate supply you only need a few logs. Chicken mushrooms are prolific. It is not rare to find upward of 20 pounds on a single log. There are a number of species of this mushroom. You can find them from May to November. I have never found them that early or that late. My prime time is August and September.

The main reason for changing my mind about this mushroom is that I finally discovered its great edibility. A young chicken mushroom is quite a delectable experience. To check for edibility just break off a small piece. If the broken piece is dark and oozes liquid then it is perfect. If it is white, dry, and tough, it will give you little enjoyment.

The Chicken Mushroom

Scouting for chicken mushrooms starts during the chanterelle season. Look for fallen logs and stumps that start to decay. The reason why chicken mushrooms seem to grow in a very dry environment is because decaying logs and stumps act as water reservoirs. This wood becomes a sponge for the mushroom. Occasionally you may find chicken mushrooms on living trees, however, they always grow on a dead part of the tree. I never experienced them to be parasitological. You can spot chicken mushrooms from a long distance. I have spotted them while driving in my car. Last year I located about 8 new producing logs. If I harvest them in time, I will share t hem with the club.

Long live the chicken mushroom.

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FASCINATING FUNGI
Jon Ellifritz

The word "fungus" usually conjures up distasteful images, especially for gardeners, homeowners, farmers, and foresters. Substitute words like toadstool, mold and mildew, dry rot and wet rot, rusts and smuts, blights and wilts, ringworm, athlete's foot, and yeast infection, and you will quickly get the picture. On the other hand, think of delectable morels, chanterelles, porcini, and truffles, bread and wine, beer and cheese, antibiotics and vitamins, and you will have a more balanced appreciation of both the good and bad aspects of the fascinating Kingdom of Fungi.

Would-be amateur mycologists may join a club or study on their own, hoping to learn how to distinguish poisonous "toadstools" from edible "mushrooms," and how and where to find and eat the latter. They soon find that there is no easy way to accomplish this goal, no foolproof acid test other than knowing exactly which of the thousands of species they have. Well, there is one method. Try some and wait a few weeks. If you survive unscathed, it's edible. At least for you. At least this once. Some mushroom toxins can require up to three weeks to act; others have a cumulative effect that may not kick in until and individual has eaten them in large quantities or for several years. And some individuals have idiosyncratic reactions or allergies to particular species.

There are few truly "common" names for mushrooms. In those field guides that have a common name for every described species, the authors created most of them at the insistence of their publishers. Let's take one example, Lactarius corrugis. The Audubon series field guide by Gary Lincoff calls it the corrugated-cap milky, and the Peterson series guide by Kent and Vera McKnight calls it wrinkled milkcap. These are rough translations of the Latin binomial scientific name, but some West Virginians call them "brownies" and Pennsylvanians use "milky beefsteak." Of all these common names, I prefer the last, but sometimes have to explain that I'm not talking about the beefsteak polypore (Fistulina hepatica), a totally different fungus. To facilitate clear communication, then, I usually prefer the scientific binomial, at least until "they," the taxonomic powers-that-be, decide that a mushroom needs a new species name or really belongs in a different genus.

Dedicated mushroom hunters use the term "mushroom" in more than one way. We go on "mushroom forays," not "fungal field trips," and we're looking for the fruiting bodies of large, fleshy fungi, i.e., those that are not single-celled and are visible to the naked eye. They could be 1/16-inch-wide yellow cup fungi on a rotting log or giant 10-pound puffballs in a lawn. We also use "mushrooms" for those with caps, stalks, and gills, and more narrowly focused general terms for other groups -- morels, chanterelles, tooth fungi, boletes, stinkhorns, polypores, and so on. We also use acronyms, particularly when there is little likelihood of identifying the species -- LBM (little brown mushroom), JAR (just another Russula), JADRR (just another damned red Russula -- there are scores, maybe hundreds of species of these), and BOP (boring old polypore).

A mushroom and a fruiting body of a fungus

Mushrooms – large, fleshy fungi – come in a multitude of sizes, shapes, and colors, and there are thousands of species. Cap and stem mushrooms may have a partial veil (tissue covering the gills when the mushroom is young) or a universal veil (a layer protecting the entire young mushroom), or both (or neither). When these veils break

apart as the mushroom expands, they may leave remnants in the form of warts or patches on the cap, a ring on the stalk, or a cup at the base. Spore print colors, color changes, odors, and tastes all may provide additional identifying characteristics, but sometimes microscopic examination is also necessary for exact species identification.

Fungi arise from spores, microscopic cells that are similar in function to plant seeds. The spores are produced by mature fruiting bodies as part of the sexual reproduction phase of the life cycle. (Most mushroom species have more than two "sexes" or breeding types, and apparently thousands in the case of one species.) Spores are dispersed by wind and water, among other means. If a spore lands in a favorable environment, it germinates, putting out a germ tube, which develops into a long, narrow cell called a hypha. The hypha develops, through budding, cell wall creation, and branching, into a much larger network of hyphae known as mycelium or spawn. When two different but compatible mycelia networks meet, their hyphae unite to form new hyphae, each with two nuclei. When nutritional, moisture, and temperature conditions are right, the mycelium forms buttons, which gradually expand and grow above the surface as fruiting bodies, or mushrooms. Spores are produced, and the cycle begins anew.

A fruiting body of a fungus, not a mushroom

Fungi obtain much of their food in one of three different ways – as saprobes, parasites, or mutualistic symbionts. Saprobes digest dead organic material; parasites rob nutrients from host plants, animals, or fungi, and may eventually kill them; and symbionts form mutually beneficial relationships with other organisms, usually plants. Saprobic decay may be rather mundane, but where would we be without fungi to play this vital ecological role? With only bacteria, insects, and worms, other major players, how soon would we be up to our necks in carcasses, tree trunks, stalks, leaves, and manure?

The honey mushroom (a good edible if well-cooked) is one of the few really virulent parasites of trees (leaving aside the single-celled fungal pathogens). Most of the other mushrooms parasitic on trees seem to be primarily opportunists – taking advantage of trees that are already sick or wounded, and staying on as saprophytes after the trees die. There are other fungal parasites, of course. Some mushrooms grow on other mushrooms, some on nuts and cones, and some on insects.

Finally, among the parasites, there are all those one-celled fungi that comprise the plant and animal pathogens – chestnut blight, Dutch elm disease, dogwood anthracnose, sudden oak death, corn smut (which, despite the name, is eaten as a delicacy known as huitlacoche in Mexico), and all the rest of the blights, rusts, smuts, wilts, and mildews that attack plants, plus the human mycoses like yeast infections, ringworm, and valley fever (Coccidioidomycosis).

The symbionts are much more pleasant to contemplate. In our area, the most visible symbiotic relationships are lichens and mycorrhizal mushrooms associated with trees. Lichens are extremely close partnerships between an alga and a fungus, so close that each two-species unit is considered one species of lichen. Apparently none of the fungal partners exists independently, although some of the algae can. The alga, having chlorophyll, contributes the products of photosynthesis, while the fungus extracts water and nutrients from the surface, often rock, on which the lichen grows, and provides protection from harsh conditions.

Mycorrhizal mushrooms, more specifically ectomycorrhizae, are the fungal partners in a symbiotic association between trees and the underground mycelium of mushrooms. The mycelium forms a sheath around tree rootlets and even enters the spaces between rootlet cells. The two species exchange the products of tree leaf photosynthesis and the water and minerals gathered by the far-ranging fungal mycelium. As lichen fungi do not exist independently, mycorrhizal fungi need a tree partner. Trees that have ectomycorrhizal relationships can exist without them, but would not grow nearly as well. Forestry specialists, particularly in the western U.S., now use tree seedlings inoculated with mycorrhizal fungi to improve the success of reforestation planting.

It is estimated that at least 90 percent of vascular plants have some kind of mycorrhizal partnership. There are several other types, including one in which single-celled fungi live entirely within plant cells. Rather than providing nutrients, this type might produce a toxin that helps to defend the plant against bacterial or animal enemies. Many orchids are dependent on mycorrhizal relationships and cannot live, or at least reproduce sexually, without them.

Numerous other useful roles exist for fungi. Leaf-cutter ants and mound-building termites cultivate fungus gardens for at least part of their food supply. Many antibiotics, as well as cyclosporin, the compound

used to prevent rejection of organ transplants, are derived from fungi. Yeasts and other fungi (assuming yeasts are still classified as fungi) are used not only to make bread, wine, and beer, and to flavor cheese, but also in the production of other foods and pharmaceuticals. Several fungi common in our area – hen of the woods/maitake, turkey tail, and reishi/ling chih – along with cultivated shiitake, are being examined for possible use in lowering cholesterol or fighting cancer. And finally, although we usually think of fungal plant diseases as harming the plants we grow for food and beauty, the U.S. Department of Agriculture is studying the possibility of using some species against ragweed, kudzu, and other noxious weeds.

For more mycological marvels, read George W. Hudler's Magical Mushrooms, Mischievous Molds (1998, Princeton University Press)

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THE MUSHROOM CHRONICLES
Edible Fungi and Nutrition
William Needham

Mushrooms or more generally fungi are neither plant nor animal; they do not synthesize their own food from the energy of the sun and they are not mobile. They are somewhat in between, though closer to animals according to their DNA. Some fungi are edible and some fungi are toxic, like wild plants and to lesser extent animals. However, the toxicity of some wild plants does not militate against the consumption of those that are recognized as edible. Wild mushrooms, on the other hand, are considered by most Americans to be poisonous toadstools. And as if this were not enough, it is generally believed that fungi have no nutritional value. So why would anyone want to eat them? The first reason is a gustatory matter; those who have tried wild fungi find them not only edible, but in some cases quite palatable. The second reason is a nutritional matter, also a reflection of what fungi are made of; they are relatively high in proteins and minerals. The fact is that there are many identifiable wild fungi that merit consideration as viable food alternatives to the plebeian meat and potatoes.

The consumption of edible fungi, though certainly of ancient origin, is not well documented in the historical record. Fungi were first used for medicinal and supernatural uses. The earliest known archaeological depictions of mushroom-like images are rock markings in the Tassilli Caves of the Sahara Desert that are about 7,000 years old. The dancing figures carrying mushroom-shaped objects are postulated to be members of a cult engaging in ritualistic activity. The Neolithic Oetzi was found after some 5,000 years of being frozen in ice in the Italian Alps with several pieces of Birch Polypore (Polyporus betulinus) on a thong around his neck, likely for treatment of intestinal worms and not for nutrition. Ancient Egyptian hieroglyphics suggest that mushrooms were thought to convey immortality, their use therefore restricted to the apotheosized pharaoh and his entourage. In ancient Greece in the city of Eleusis, the Temple of Demeter (the Goddess of Fertility) was the destination for pilgrims including Aristotle, Plato and Sophocles who participated in a yearly ceremony that involved the consumption of ambrosia that is thought to have been made from mushrooms. The resultant "Eleusian Mysteries" forever changed the participants in a manner that was never formally recorded, presumably hallucinogenic in nature. In Russia, eating mushrooms was believed to yield superhuman strength.

It is not known when the consumption of mushrooms (mycophagy) for nutrition began, though speculation is that trial and error during the "hunter-gatherer" epoch of human prehistory eventually led to the identification of those that were edible. However, there was cultural isolation and different regions became either mycophilic or mycophobic according to the ethnomycology theories of Gordon Wasson. The mycophobia of Anglo-Saxons is legendary, the noted herbalist John Gerard writing in his seminal "Herball or Generall Historie of Plantes" in 1597 that "Most of them do suffocate and strangle the eater." Venner, a British writer of the 17th Century, was a bit more subtle: "Many phantasticall (sic) people doe greatly delight to eat the earthy excrescences called Mushrums (sic).

They are convenient for no season, age, or temperament." On the contrary, continental Europeans were and are mostly mycophilic, as were the Native Americans. Vincent Marteka in "Mushrooms Wild and Edible" contends that mushrooms were a staple of Indian cuisine and that the Iroquois "ranked the pleasure of eating wild mushrooms as virtually equal to that of eating meat." This practice was not transferred to the colonists; the predominant British view that mushrooms were anathema had an overriding effect.

Most fungi have a cell structure that is comprised primarily of chitin just as plants cells are made primarily of cellulose. Chitin is the material that makes up the exoskeletons of insects and crustaceans; the chitinous structure of fungi imparts to them a texture and firmness that is reminiscent of meat. Chitin is a non-

soluble protein that forms an amino polysaccharide molecule that is highly polarized; the distribution of atoms results in high concentrations of positive and negative charge at separated points on the molecule. The positively charged region forms ionic bonds with lipids (fats and similar substances) and bile, the resultant large polymer compound cannot be digested and is excreted from the body. Bile is produced by the liver to aid in the digestive process; its loss must be made up for with new bile, a process that uses cholesterol. Recent clinical studies have found that chitin consumption reduced body fat by 8 percent over a four week period and reduced cholesterol by 32 percent over a five week period. The reduction in fats and cholesterol contributes to cardiac health and thus to longevity. This has long been recognized by the Chinese, who consume mushrooms as a matter of health rather than nutrition.

In addition to chitin, fungi are also an excellent source of protein which is both necessary and sufficient for the growth of human body cells. The protein content of commercially grown edible mushrooms ranges from a high of 35 percent of dry weight (White or Button Mushroom Agaricus bisporus) to a low of 4 percent (Tree-Ear Auricularia auricula). This compares to 25 percent for milk, 39 percent for soybeans, and 13 percent for wheat. Thus mushrooms have more protein than most other foods. Of equal importance to the amount of protein is the quality of the protein, as determined by the relative concentration of the amino acids from which they are constituted. Eight amino acids are considered essential, as they cannot be synthesized by humans from other sources; they must be consumed directly. For a food to be a good source of protein it must have all of the essential amino acids; any deficiency in one results in a reduction in the synthesis of the other seven. This is the fundamental argument of the balanced diet proscription. Consuming foods that are low in the essential amino acid lysine, such as grains like wheat and rice, must be balanced with foods that are high in lysine, like mushrooms. In fact, all eight of the essential amino acids are contained in the most popular commercial mushrooms, including button mushrooms, oyster mushrooms (Pleurotis spp) and Shitakes (Lentinula edodes). In "Mushrooms, Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact," Chang and Miles rank foods according to their essential amino acids according to adult dietary requirements in a quantitative index on a scale of 0 to 100. Mushrooms (98) rank just below meat (100) and milk (99), but well above spinach (76), and tomatoes (44).

Fungi have several other noteworthy nutritional attributes: they are rich in a number of important vitamins and minerals, they have low saturated fat, and they are low in calories. They are the best non-animal source of vitamin D and have relatively high levels of the vitamins niacin, thiamin (B1) and riboflavin (B2). Since one of the functions of fungi in mycorrhizal relationships with plants is the uptake of minerals, their high mineral content is not unexpected. Up to 70 percent of the ash content of mushrooms consists of minerals, notably Potassium. One medium sized Portabella mushroom (also Agaricus bisporus, the button mushroom) has more potassium than a banana, about twice as much as an 8 ounce serving of whole milk. The fat content of commercial mushrooms averages about 4 percent; of this, 72 percent are unsaturated or "good" fat that promotes HDL cholesterol. Animal fat is saturated or "bad" fat that abets LDL cholesterol. The most significant contribution to mushroom unsaturated fat is linolenic acid, one of the Omega 6 essential fatty acids. The caloric impact of mushroom consumption is nominal; 100 grams of mushrooms have about 25 calories.

While nutritional values have only been determined for fungi that are sold commercially, the similarity in the protein and vitamin content of the different cultivated types suggests that wild fungi would have similar levels. There are several readily identifiable wild mushrooms that offer unique flavor in addition to the nutritional attributes delineated above. For example, Chicken-of-the-Woods (Laetiporus sulphureus) is aptly named, as it looks like, cooks like and tastes like chicken; its distinctive sulfur orange coloring is mnemonically represented in the species name sulphureus. Chanterelles are readily identified by their yellow horn-shaped fruiting bodies; the genus name Cantharellus is from the Greek kantharos which means drinking vessel, the flagons of history being made in the shape of a horn. Puffballs range in size from a few centimeters to half a meter in diameter; their smooth, white, rounded exterior facilitates identification. The genus name for large puffballs is Calvatia, from the Latin calva, meaning bald, also an appropriate mnemonic. Small puffballs are in the genus Lycoperdon, which translates somewhat loosely as “wolf passing wind," a reminder that a puffball must be harvested when young. Otherwise, the soft, creamy interior turns into spores that puff out a hole in the top, the result calling to mind the namesake canine bodily function.

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It is a matter of record that the fast-food oriented American cultural diet has resulted in a host of weight and nutrition related maladies, among them diabetes and obesity. This is particularly troubling as it has now become apparent that children are increasingly at risk. The purveyors of children's programming once addressed the need to promote healthy eating with Popeye, a can of spinach providing him the strength to overcome everything from ogres to crocodiles. It may be time for a fungal variant to stimulate better nutrition; a soccer star named Luigi Crimini and his companion Portia Bella perhaps.

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The Smell of Mushrooms
Jim Sherry

Lots of mushroomers speak about the scent or smell of mushrooms. Perhaps the most often mentioned scent is that of chanterelles: apricots. Another is the fishy smell of *lactarius volemus*, which disappears with cooking. Other mentioned scents are the anise of the horse mushroom and the pleurotus, the raw potato smell of the *amanita citrina*, and the camphor smell of the *lactarius camphoratus* — and then there is the stinkhorn.

Not everyone smells all of these scents. Like hearing, vision and other senses, people vary in the extent to which they experience the different sensations associated with a particular sense. You could say, for example, that some people are very good smellers, just as some people see and/or hear exceptionally.

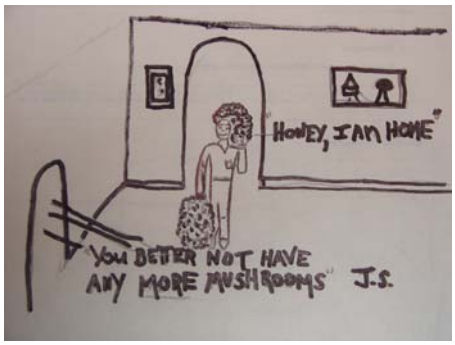
There are people who claim that they can smell the rain before it arrives and that they can smell mushrooms in the outdoors before they see them.

It may be, too that some people smell a class of odors (e.g. unpleasant) much better than another class of odors.

No theory of the olfactory sense has been totally accepted by scientists. The oldest theory states that we experience an odor because the object that we smell has given off a scent in the form of molecules that float up into our nostrils and fits into a particular site and because it fitted into that site it triggers a particular nerve attached to the brain which results in our scent experience.

Since this theory doesn't answer all the questions another theory suggests that the molecule in our nostril vibrates the nerve that results in the smell we experience.

It is said that our taste experience of food is determined largely by our sense of smell (head colds take away much of our taste of food). And William S. pointed out that that as we approach the later stages of life, it's "sans everything."



Rain

We haven't had a summer of rain. Many club members have not been foraying. But now the rain is here (9-6-06). This morning the Baltimore Sun indicated that we are about an inch and a half behind the average for Maryland; we had been over six inches behind.

It has become clear to me this year that looking at the average for MD does not tell a true story about the rainfall. When we had all that rain in late June, Harford County, northeast of Baltimore, got12 inches of rain in three days-more that the state had all year- at that time. And before all this recent rain the rain at Reagan Airport measured eight inches more than the rain in MD measured year to date. So, let's find some hen. J.S.

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