

The Amazing Lives of **Fungi & Mushrooms**

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Fungi are a mysterious group of species originally thought of as plants because of their immobility. But having many characteristics that are unlike species in the plant kingdom, such as their reliance on an external food source, also makes them animal-like. Because of this complex blend of characteristics, these creatures have been placed in their own category, Kingdom Fungi.

More than 140,000 species of fungi are known to exist, from single-celled to complex multi-cellular organisms, including yeasts, molds, mildews, rusts, smuts, and 14,000 species of mushrooms. All mushrooms are fungi, but not all fungi are mushrooms. A mushroom is the fruiting body of a fungus, the visible component of a vast organism that often stretches for long distances underground, found primarily in forests feeding on dead and sometimes living organisms.

ANATOMY OF A MUSHROOM

In general, a mushroom's anatomy is made of the top cap, seen in a variety of structures and shapes, supported by a stem. Underneath the cap, the mushroom has gills which hold spores, the reproductive units of the fungus. Some mushrooms have a skirt, or veil, under the cap and gills. Connected to the stem is a much larger network of filaments called hyphae, which as a group form a vast underground network called a mycelium.

When fungi reproduce, the mushrooms are formed. Mushrooms release spores, which are carried to a place in which they will germinate, combining sexually, asexually, or in other ways. Once the spores germinate, they form a hypha, which is a single filamentous body that eventually grows into a full network of connected hyphae, called a mycelium. When the conditions are right, the mycelium will form a new fruiting body, and the process begins anew. A fungus reproduces in all seasons, primarily in dark, moist conditions with moderate temperature. Mushrooms can appear at any time, but mostly in spring and fall.

MYCELIUM: THE HIDDEN SIDE OF FUNGUS

Mycelial networks form relationships with plants through their root system, providing nutrition to both plants and fungus. Mycelium was discovered with the invention of the microscope in the 17th century, enabling scientists who previously only knew

about fungi as fruiting bodies to see the hidden network of hyphae. This complex part of the mushroom makes a vast, concealed component. In fact, the largest and oldest living creature on earth is a mushroom and mycelial network found in the Blue Mountains of Oregon. The organism covers 2,384 acres, around 1,665 football fields. It is also estimated to be the oldest living organism at 2,400 years, based on growth rate, but could be up to 8,650 years old.

Mycelium provides nutrients to the fungi, as well as interconnected plant and tree roots, such as phosphate, nitrogen, and other micronutrients, as well as water and oxygen. In this process, called absorption, food in the form of sugar, water, and oxygen move through the hyphal walls into the mycelium.

To accomplish this, hyphae release digestive enzymes that break down organic material, called extracellular digestion, then absorb nutrients in solution leading to more growth and reproduction.

Recent studies suggest that mycelia create a form of communication network between plants through their roots. Plants in mycelial network are alerted to disease by a change in the movement of resources to an affected plant. This same process alerts plants within a mycelial network to pests and food availability in a system playfully called the Wood Wide Web.

PLANT RELATIONSHIPS

Plants and various species of fungi form different relationships based on how a fungus derives nutrition from its host. Saprophytic mushrooms digest the tissues of dead plants and trees. This is a beneficial relationship, as it breaks down dead plant material to create soil. Parasitic relationships form when a fungus breaks down living tissue, causing illness in the host. Commensal relationships are symbiotic; the fungus benefits, but there is no perceived change in the other partner. Mutualistic relationships benefit both partners, such as a lichen, in which a fungus receives food from an algae living as one organism.

The role saprophytic mushrooms play in making soil is essential. In the natural world, creating soil makes it possible for living organisms like trees to live and receive nourishment. In



addition to trees, all creatures rely on soil. It allows plants and flowers to survive, which gives insects such as pollinators food, assisting all plants on earth to grow. This process impacts the human world, too. Soils created by fungus make agriculture possible, and pollinators that feed on plants help food crops. Human civilization would not be able to thrive without the work of fungi.

OBSERVING FALL MUSHROOMS

Autumn is an abundant season for mushroom growth in Milwaukee and at Schlitz Audubon. In moist conditions with moderate temperatures, people will see many species appear. Mushrooms are important for the region's ecology as decomposers and for their plant nourishing mycelium.

Oyster mushrooms (*Pleurotus ostratus*) get their name from their oyster shaped cap, with gills that run beneath it, attached to the stem. This mushroom often grows in a shelf-like configuration and is white to tan in color. It lives year-round throughout North America in favorable conditions on many deciduous trees, especially willow and aspen, sometimes on buried stumps.

Hen of the woods (*Grifola frondosa*), also called maitake, grows primarily at the base of old growth oaks and maples and on stumps. It is a distinctive-looking fungus, with a mass of interlocking flat lobes and a dense core, with lobes radiating concentrically from their center that are gray, tan, to cream-colored. It grows September through November throughout the Midwest and Canada.

Turkey tail (*Trametes versicolor*) grows on dead or wounded deciduous trees (sometimes conifers) and logs throughout the forests of North America from May to December, starting out with a brown cap that turns bluish as it ages. It has white margins and grows in rosettes, with white to cream pores on its white underside, concentric bands on top, and radial folds.

Giant puffballs (*Calvatia gigantea*) are smooth, white spheres found in meadows, fields, and deciduous forests in late May to mid-July and August to October. Their range is the Eastern United States to the Midwest. They can be golf ball size to as

large as a beach ball and are known for their delightful 'puff' when they burst on contact and release spores.

Lion's mane (*Hericium erinaceus*), also called bearded tooth, grows on dead or dying hardwood trees throughout North America, most commonly on oak, beech, or maple, or on fallen logs. They are distinctive, with white hair or teeth-like protrusions covering a 4–10 inch pom-pom shaped body. They appear in cooler temperatures, especially in August through November in various regions of North America.

MUSHROOMS IN THE HUMAN WORLD

People who hunt for mushrooms should be cautious about handling them. At Schlitz Audubon, there is no mushroom foraging allowed on the property. It takes expert identification skills to safely know which mushrooms can be harvested in the wild, including confirmation of three specific attributes of the species made by three separate people. Foragers also use spore prints to provide an accurate reading to identify a fungus. There are many look-alike mushrooms that resemble edible varieties. This is important because though mushrooms are a culinary species, some are toxic to humans. Do not try to identify a mushroom on your own.

Mushrooms in their natural form and environment are essential to promoting a healthy ecosystem. They also have numerous functions in the human world, though their complex anatomy and physiology are still not fully understood. Mushrooms are a culinary treat for people who enjoy their earthy, umami flavor, and are also found in many supplements designed to harness their health benefits. Some mushrooms are believed to have medicinal properties. Because of their unique role in the environment, research into the uses of mushrooms and mycelium is ongoing. It even includes studies that involve using mushrooms to clean up toxins in the environment and break down plastic.

Mushrooms are a truly dynamic group of creatures that are indispensable to humans, and we will benefit from a better understanding of them. When you visit the Center this autumn, look for these wonderfully interesting species throughout our forest habitats and ponder their importance to the environment.

