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Abstract: Focuses on the characteristics of various types of fungi. Assertion that fungi are neither plants nor animals, but have characteristics of both; Examination of various types of fungi, including Pilobolus, Crucibulum, and Trichaptum; Discussion of their usefulness in decomposing plants and animals; Examination of the parasitic nature of fungi; Outlook for future use of fungi in medicine and cuisine.

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FUNGI

They are nature's little-known laborers, both creators and destroyers, relentlessly nurturing life or crippling it, or snuffing it out. One fungus ferments grapes into wine. Another kills them on the vine. Fungi make bread rise and tempt gourmets. They blacked bathroom times as mildew, cause and cure diseases, enrich soil, rot wood, and jump-start the workings of plant roots. These mushrooms, prized by connoisseurs, will propagate by gently launching spores from their gills, one of the intriguing ways that fungi reproduce as they insinuate themselves into every corner of life.

PLANTS OR ANIMALS? Fungi are neither, making up their own kingdom. They range in size from the microscopic to a species that is known to spread over 30 acres. Fungi lean toward an animal lifestyle in that they consume other organisms for nutrition, since, unlike plants, they can't produce their own food. Yet, like some plants, certain fungi cast their fate to the wind, sending forth spores to drift where they will, something that allergy sufferers feel all too keenly.

The energetic way one variety broadcasts its spores inspired the name of its genus, Pilobolus (right), which means "hat thrower." After landing on leaves and grass, its spores are ingested by a deer, horse, or other herbivore, pass through the intestines, then germinate in the animal's dung. Humans too are unwitting hosts to fungi, which cause athlete's foot, jock itch, and yeast infections. Fungus experts, called mycologists, estimate that the Earth may harbor as many as 1.5 million fungus species, but only a fraction have been described.

HUGE AND DIVERSE, the fungus kingdom holds many remarkable sights but is largely unexplored. A walk in the woods reveals fungus fruiting bodies, called mush rooms,

sprouting from soil and tree trunks. Some species hold the promise of "biopulping": They can decompose wood chips without the use of toxic chemicals. Diligent searchers might come across the lilliputian world of *Crucibulum* (below), which produces spore cases resembling eggs in baskets that measure a quarter of an inch across and look as if they are ready for gathering.

Most fungi are unseen varieties living in soil. There in their microscopic workshops they play a crucial role--using enzymes to break down organic compounds into nutrients for themselves, and inadvertently for plants and trees.

SHAMELESS EXPLOITERS, members of the huge category of parasitic fungi infest other life-forms. Each year agricultural pests such as smuts and plant rusts do untold millions of dollars in damage to crops world wide. One species has the unappetizing name corn smut (below), yet it is a delicacy in Mexico and is gaining popularity in the United States marketed as "Mexican truffles."

Trichaptum (below right) and other mushrooms that rot wood are sometimes hosts themselves for smaller species such as various ascomycetes, a group of fungi that includes truffles, yeasts, morels, and some molds.

Curiously, some rusts require more than one host plant to live out their life cycle. In temperate climates *Puccinia sparganioides* spends winter on cordgrass. Come spring, it produces small, delicate spores that are blown to nearby ash trees where they germinate on new leaves (above right). Their spores then infect the cord grass, completing the cycle.

Fungal pests can cause social turmoil. Some scholars suspect that the physical symptoms and erratic behavior that led to the Salem witch trials were caused by a toxic fungus consumed with cereal grains, especially rye. In the mid 1800s a fungus turned Ireland's potato crops into black gooey masses. About one million people died, and more than a million emigrated to North America and other lands.

SILENT STALKERS: Neither tooth nor claw arms the predatory fungi. They vanquish and consume through molecular stealth. For a doomed ant (below) the end begins when a *Cordyceps* spore lands on its exoskeleton. The spore finds purchase between skeletal plates, germinates, and grows, feeding off the dying ant's body. The traps of *Arthrotrichum* (left) are its hyphae, or filaments, that snare nematode worms as they wander through the soil.

Yet fungus and animal species can work in concert. Some fungi release spores after they are carried to the surface by termites. Leaf cutter ants cultivate fungi as a food source. The female southern pine beetle carries a fungus in protected pouches and distributes it as she tunnels beneath tree bark. The fungus then becomes food that the beetle larvae need to survive.

Fungi and plants form mutually beneficial partnerships too. Most plants are aided by fungi that supply minerals necessary for their growth and assist in water absorption. Fungi also provide us with valuable medicines such as penicillin as well as delectable cuisine. From harmless decomposers to insidious predators and pathogens, fungi fill many roles. And with so many species undescribed, there should be plenty of opportunity for scientific investigation to reveal more stars in the fungus among us.

PHOTO (COLOR): *Lactarius hygrophoroides*, up to 4 inches across

PHOTO (COLOR): A sunburst design emerged as a gilled mushroom dropped its spores onto paper. Dew clings to a shotgun fungus growing on rabbit dung. When mature, dark button-like spore cases soot six feet or more.

PHOTO (COLOR): *Pilobolus crystallinus*, about 0.3 in tall

PHOTO (COLOR): A vividly colored fungus is a thorough recycler, helping to crumble a forest log into compost: *Phanerochaete chrysorhiza*. each tooth about .06 in

PHOTO (COLOR): White-egg bird's nest fungi cradle tiny spore packets that scatter when splashed by raindrops: *Crucibulum laeve*, each basket .25 in across

PHOTO (COLOR): Scarlet profusion proclaims a reproductive phase of the British soldier lichen-marriage of a fungus and a green alga. It's a partnership, but the alga does the heavy lifting. Composing only a small percentage of the lichen's mass, the alga makes carbohydrates and provides them to the fungus: British soldier lichen, *Cladonia cristatella*, about 0.6 in tall; *C. pleurota*

PHOTO (COLOR): Piggyback riders: Bulbous growths of smut commandeered an ear of corn: *Ustilago maydis*, up to 6 in across

PHOTO (COLOR): Rust envelops the base of a green ash leaf: *Puccinia sparganioides*, about 1 in across

PHOTO (COLOR): Tiny mushrooms stick out like straight pins from a host mushroom stained by algae: *Phaeocalicium polyporaeum*, about .07 in tall, on *Trichaptum bifforme*

PHOTO (COLOR): It's all over for nematode worms trapped and soon to be digested by the looped filaments of *Arthrobotrys*: *Arthrobotrys* sp., magnified about 200 times

PHOTO (COLOR): The fruiting body of *Cordyceps* rise from a dead and that the fungus infected as a spore and then consumed: *Cordyceps myrmecophila*, about 0.5 in tall

PHOTO (COLOR): Eerie glow of bioluminescent mushrooms dapples a tree trunk like an alien armada. Mushroom enthusiasts use wood infested with such species to mark paths or even as bedroom night-lights. Intentional or not, humans and fungi are partners from cradle to grave: *Panellus stypticus*, each cap about 0.8 in across

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has photographed butterflies, moths, and parasites for the Geographic and is working on an article on spiderwebs for the magazine.

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