The Tree of Life

A Computer Database

SAMPLE ENTRY

11) SUBDIVISION EUMYCOTINA [TRUE FUNGI]

- Organisms
- Environments
- Gross Structure
- Material & Energy Intake/Output
- Internal Transport
- Internal Control
- Reproduction

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Organisms

(Note: Because of their distinct lifestyles and considerable variety, fungi are classified by many modern taxonomists as a separate kingdom of organisms, Kingdom Fungi; however, because they have a cell wall and often reproduce via spores, this traditional classification considers fungi as plants.)

Oomycetes [egg-forming fungi]: downy mildew pathogens, *Phytophthora* [potato late-blight pathogen], *Pythium* [including damping-off disease pathogen], water molds, etc.

Zygomycetes [zygote fungi]: *Rhizopus* [including bread mold] etc.

Ascomycetes [sac fungi]: brown-rot-of-peaches pathogen, cup fungi, ergot, jam & jelly mold, morels, *Neurospora*, powdery mildews, truffles, yeasts, etc.

Basidiomycetes [club fungi]: bird's nest fungi, bracket fungi, mushrooms, puffballs, rusts, smuts, shelf fungi, stinkhorns, toadstools, etc.

Fungi Imperfecti ["imperfect" (asexual) fungi]: *Aspergillus* [soy-sauce fungi], athlete's foot fungi, nematode-trapping fungi, *Penicillium* [including Roquefort cheese fungi], etc.

Lichens [fungi growing together with algae].

Environment(s)

In salt- and fresh-water, in and on the land (typically in moist habitats), and in and on other living organisms.

Growing together as the body of a lichen, the fungus provides a foothold (as on rock), moisture, and shade (from over-intense sunlight); and the alga provides food (via photosynthesis)—the alga (a bluegreen alga or typically unicellular green alga) can live alone (and often live better alone), but the fungus

(typically a sac fungus but sometimes a club fungus) cannot survive without the alga.

The mutually beneficial living arrangement of a fungus growing in close association with the roots of a higher plant is called a "mycorrhiza": The fungus helps control mineral uptake by the roots, which in turn feed the fungus.

Gross Structure

Sometimes (as in yeasts) unicellular but typically multicellular, forming often branched filaments ("hyphae"). The cell walls are often composed of cellulose, sometimes reinforced with the nitrogen-containing polysaccharide "chitin" (as in the exoskeleton of various arthropods); although the cross-walls within the hyphae are either porous or absent: Each hypha typically has many nuclei (Fungi are possibly descended from likewise "coenocytic" filamentous algae, such as certain green or golden-green algae.). The hyphae of the vegetative body typically grow together as a weblike or leatherlike structure, known collectively as the "mycelium."

Material & Energy Intake/Output

Heterotrophic, typically "saprophytic" (consuming dead or other nonliving organic matter and, thus, sometimes rotting valuable products but typically contributing immensely to the absolutely vital recycling of waste materials in the environment) but often parasitic (causing minor to life-threatening diseases of plants or animals).

Some fungi produce "haustoria," specialized hyphae that grow into and absorb materials from the cells of other organisms.

Large food molecules in the environment are typically broken-down by secreted enzymes into smaller molecules, which osmotically diffuse in.

Internal Transport

Cell-streaming, within each cell and hypha, throughout the mycelium.

Internal Control

Genetic. Hormonal, at least in multicellular forms (See note with "Bacteria".).

Reproduction

Asexual, via "budding" (the fission of unicellular forms), pieces of hyphae (such as the hardened, unicellular "chlamydospores" of various species), or spores (either mobile or nonmobile, either in "sporangia" or not encased—once again, depending on the species). Fungi for which no sexual means of reproduction has been observed (and may no longer exist) are arbitrarily classed as "imperfect fungi"—undoubtedly actually members of one of the other classes, which are typically identified by mode of sexual reproduction.

Sexual: Typically involving three life stages—a diploid stage produces (via meiosis) a haploid stage, which produces (via the fusion of cytoplasm) a "dikaryotic" stage (each cell or hypha containing twice as many (haploid) nuclei as normal), which reproduces the diploid stage

(via fusion of the nuclei, which must be compatible and thus, in some species, must be from different hyphae—because they appear and grow similarly, such hyphae are known as "plus or minus sexual strains," not distinctly male or female sexes).

In Oomycetes ("egg-forming fungi"), typically a diploid mycelium produces in close contact female and male "gametangia," in which haploid gametes (eggs and non-flagellated male gametes) are produced (via meiosis). After a "fertilization tube" delivers the male nucleus to the female nucleus, the diploid zygote becomes a durable, hardened "oospore," eventually germinating into a diploid hypha.

In Zygomycetes ("zygote fungi"), typically a haploid mycelium produces similar-looking (plus and minus) club-shaped gametangia, which, by fusing at their tips, form a zygote, which develops a thick wall and, thus, becomes a "zygospore," which eventually germinates into a haploid hypha.

In Ascomycetes ("sac fungi"), typically a haploid mycelium produces in close contact female and male gametangia, in which gametes are produced. The cytoplasm of the gametes fuses, but the male and female nuclei do not. A resultant dikaryotic hypha and the original haploid mycelium intermingle and grow to form a ball-, bottle-, or dish-like body (the "ascocarp"), which bears tiny dikaryotic sacs ("asci") on its inner layer. In each ascus, the nuclei fuse; and within this diploid cell are immediately produced (via meiosis typically followed by mitosis) haploid "ascospores," which (after being released) germinate into other haploid hyphae. In yeasts (unicellular), the ascus is typically just the diploid parent cell in which are formed (via meiosis) haploid ascospores.

In Basidiomycetes ("club fungi"), two haploid hyphae (or special cells from them) fuse, producing a dikaryotic cell. In mushrooms etc., the dikaryotic cell typically produces an inconspicuous mycelium that grows into the visible mushroom, puffball, or bracket-like body (the "basidiocarp"), on whose gills or in whose pores are borne club-shaped dikaryotic cells (the "basidia"), whose nuclei fuse. The then-diploid basidia produce (via meiosis) on their outer surface haploid cells ("basidiospores"), which, after being released, germinate into new haploid hyphae. In rusts etc., the original dikaryotic cell typically is a resistant "teliospore," which eventually germinates directly into the basidium cell (There is no "mushroom" or other basidiocarp.). The nuclei of the basidium fuse; and this diploid basidium forms (via meiosis sometimes followed by mitosis) the haploid basidiospores.