

Kingdom Fungi



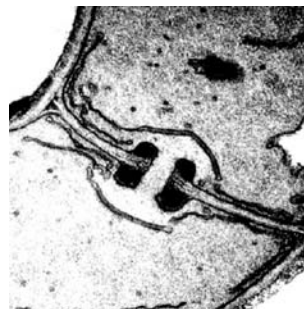
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Characteristics of Fungi

Heterotrophic saprobes – cells of hyphae secrete digestive enzymes and absorb products of digestion

Cell wall made of chitin - a polysaccharide with added nitrogen group

Hypha - filamentous body - forming mycelial mat - each hypha is composed of a chain of cells with or without separating septa



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Nuclear mitosis - all stages of mitosis go on within the nucleus - followed by nuclear division and then cell division

Some fungi have a dikaryon stage - cells of two different hyphae fuse and the nuclei of each remain distinct within the new hypha

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Reproduction in Fungi

- Differ from most animals and plants in that each compartment of hypha can contain one, two or more nuclei
 - monokaryotic - each compartment has a single nucleus
 - dikaryotic - two distinct nuclei within each hyphal compartment
- Possible for many nuclei to intermingle in common cytoplasm of fungal mycelium which can lack distinct cells
 - heterokaryotic – dikaryotic or multinucleate hypha has nuclei from genetically distinct individuals
 - homokaryotic – hyphae whose nuclei are genetically similar to one another

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Fungi have both asexual and sexual reproduction

Asexual -

- fragmentation (breakage) of hyphae can produce new mycelium
- production of spores by modified hyphae - spores dispersed by wind

Sexual -

always involves fusion of cells from different mating types (+/-)

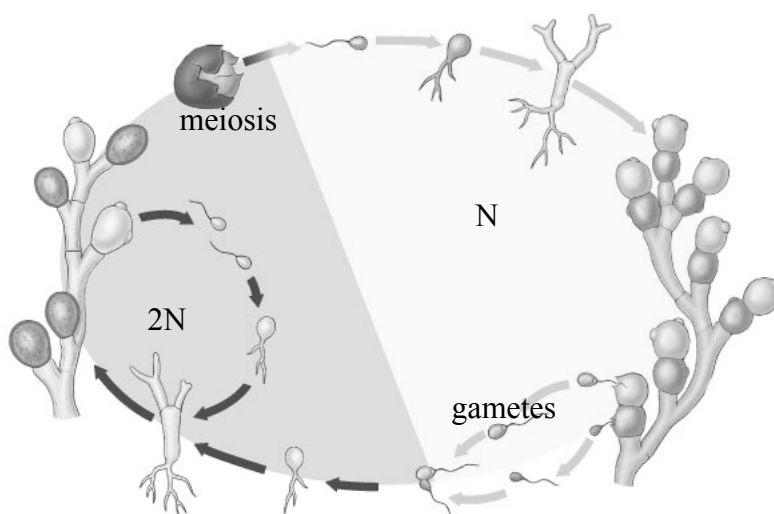
in some, the cells that fuse are gametes, in others the cells that fuse are part of hyphae

in some, fusion produces a diploid zygote, in others the fusion produces a dikaryon, or heterokaryon

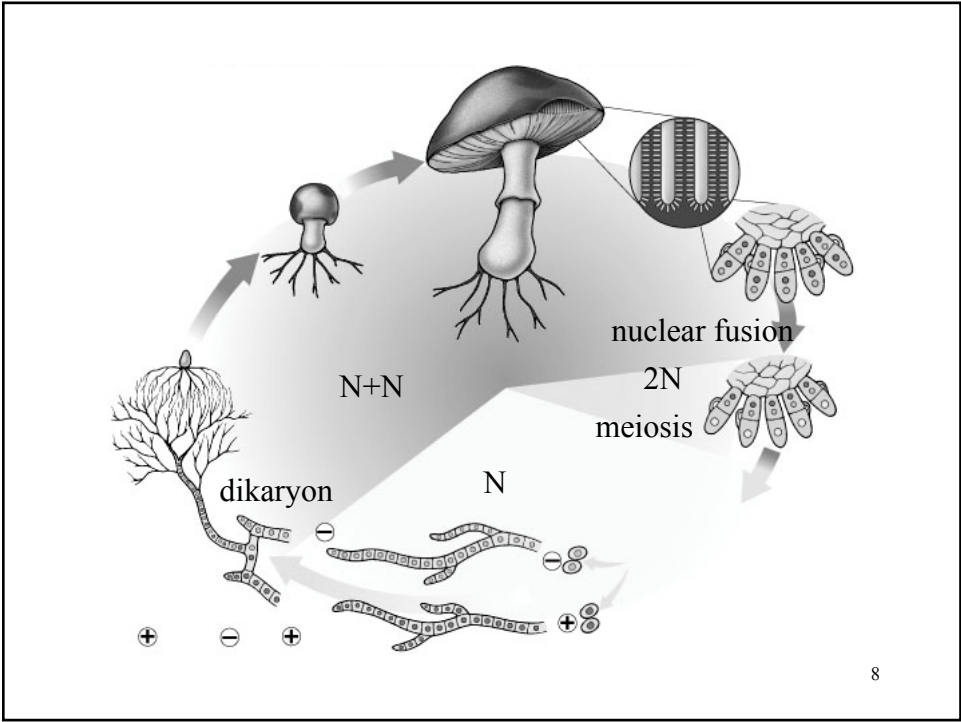
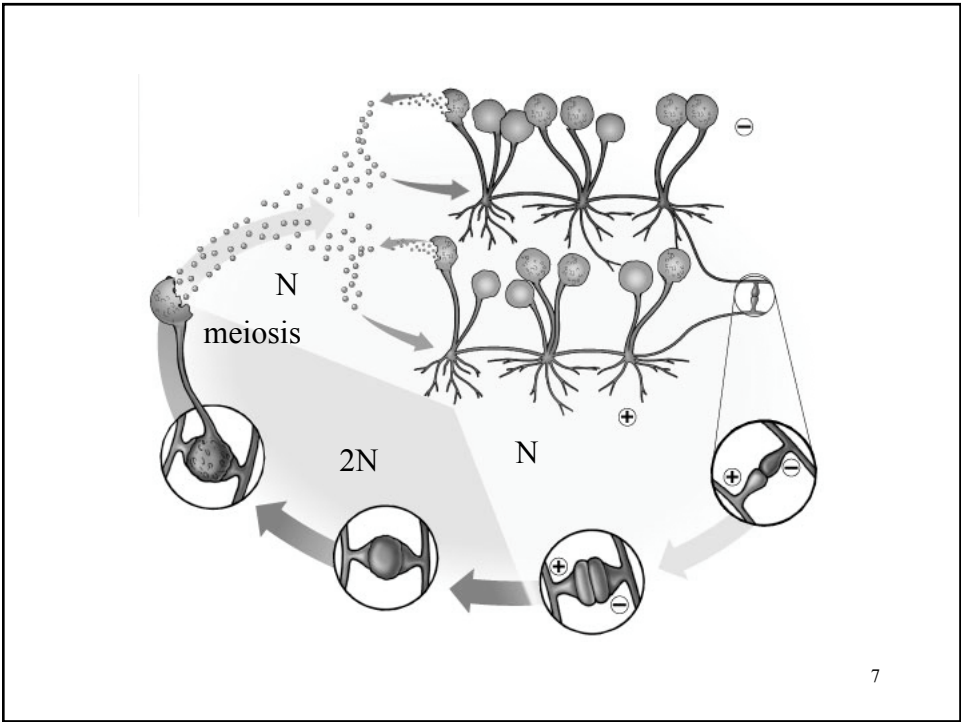
fusion of nuclei within dikaryon produces diploid zygote nucleus

meiosis of zygote produces haploid spores

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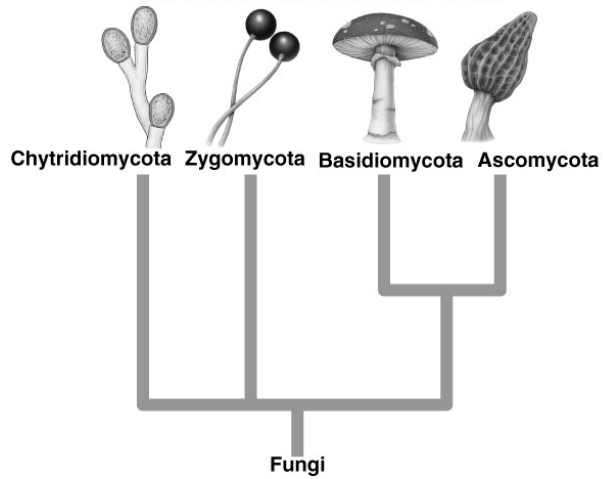
There are four major groups of fungi

Chytridiomycota

Zygomycota

Basidiomycota

Ascomycota

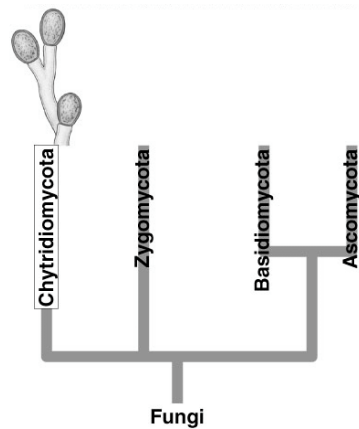


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Phylum Chytridiomycota - 1000 species

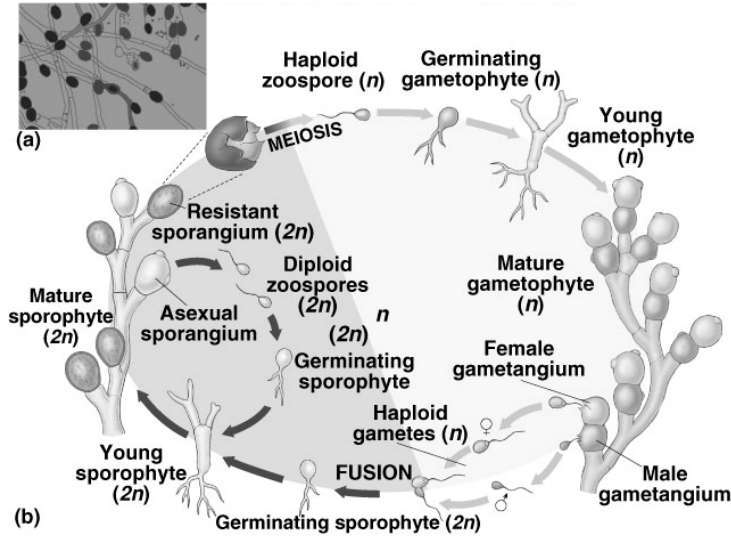
aquatic, flagellated fungi

- most closely related to ancestors of all fungi
- gametes are flagellated
- has well developed sporophyte (diploid) stage



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e.g. *Allomyces* - sporic meiosis with multicellular haploid stage (gametophyte) and multicellular diploid stage (sporophyte)



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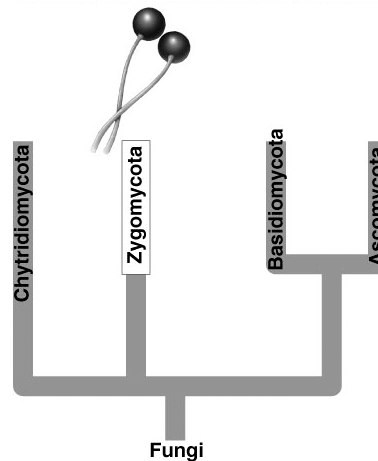
Phylum Zygomycota – 1050 species

Bread molds and relatives

Sexual and asexual reproduction common

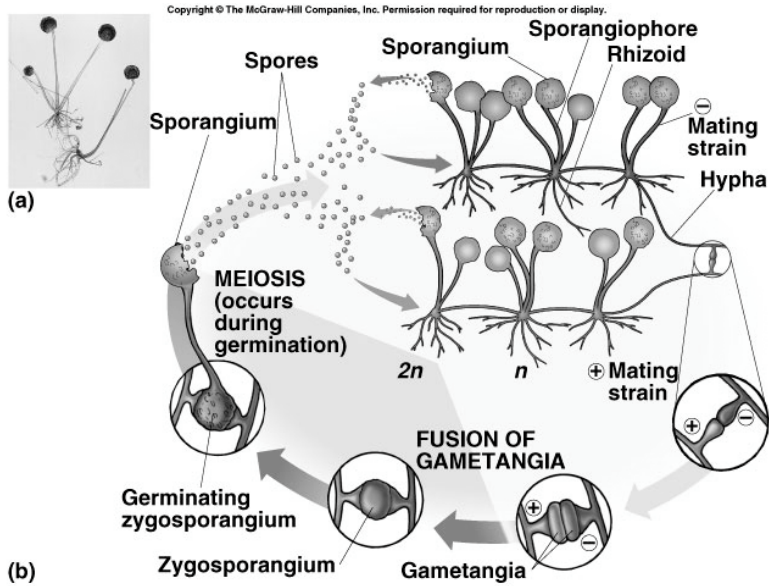
Hyphae without septa, except for separation of reproductive structures

Has short diploid stage (zygosporangium)



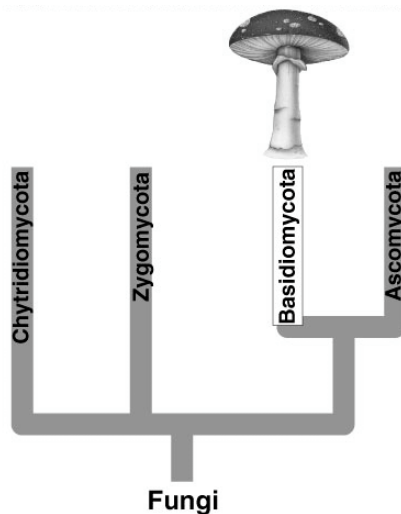
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e.g. *Rhizopus* - zygotic meiosis - multicellular haploid stage only

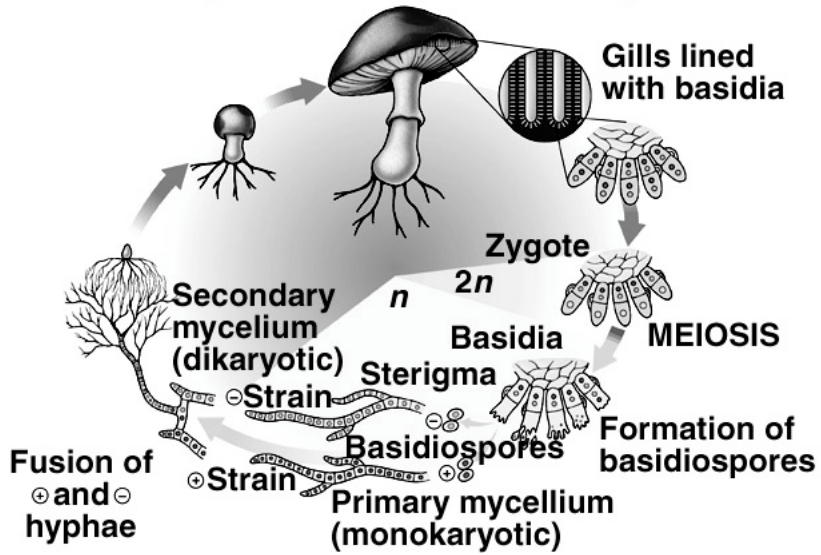


Phylum Basidiomycota – 22,000 species
 mushrooms, toadstools, rusts, smuts
 many species eaten
 many poisonous or semi-poisonous species

has well developed
 dikaryotic stage
 the basidiocarp (mushroom)
 carries basidia on gills or in
 pores
 nuclei fuse within basidia
 and then produce
 basidiospores by meiosis



Life Cycle of a Basidiomycete



Phylum Ascomycota – 45,000 species –

Most yeasts, truffles, morels

Great diversity - includes many plant parasites –
e.g. Dutch elm disease and chestnut blight

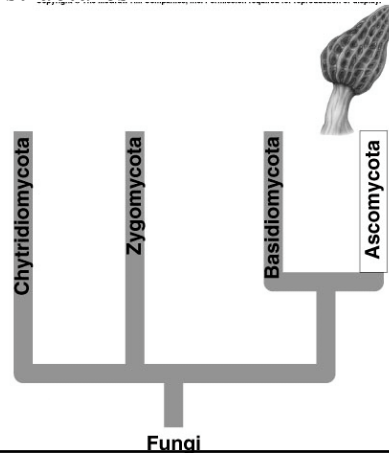
Sometimes called cup fungi because of the shape
of their reproductive structures

Has well developed
dikaryotic stage

The ascocarp carries asci
within cups

Nuclear fusion occurs within
ascus, meiosis follows
producing ascospores

Some species lack a sexual
stage (e.g. *Penicillium*)



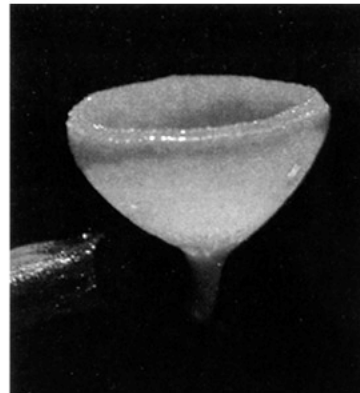
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Ascomycetes

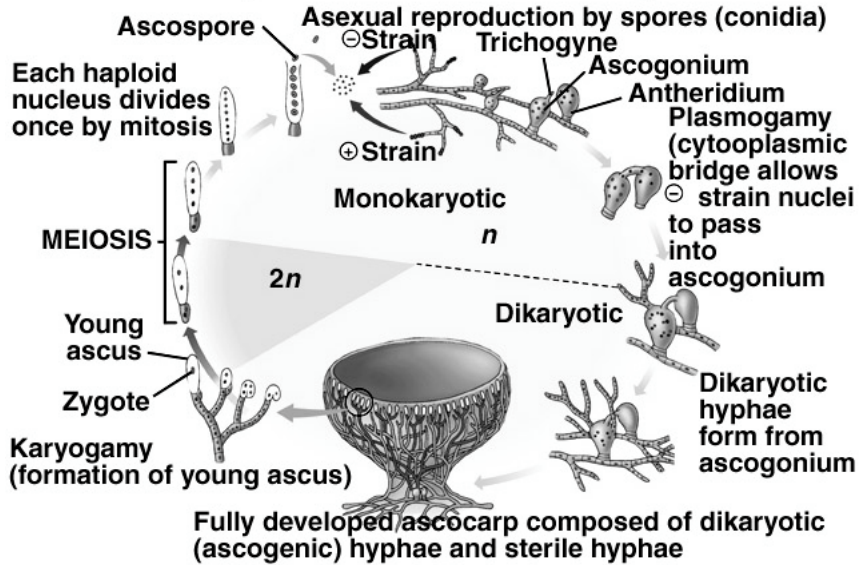


Morel



Cup fungus

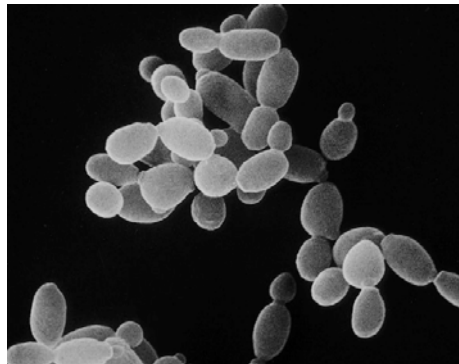
Life Cycle of an Ascomycete



- Yeasts

- unicellular - most reproduction is asexual and takes place by cell fission or budding

- ferment carbohydrates - produce ethanol as byproduct
- play a leading role in genetic research



Ecology of Fungi

- Fungi are saprobes - heterotrophs that secrete digestive enzymes and absorb products of digestion.
- some are important decomposers
can digest lignin and cellulose of wood
- some are parasitic on living organisms
athlete's foot, ringworm, corn smut, rusts

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- some are predatory - some can anesthetize and consume roundworms (our local oyster mushroom)



- some have mutualistic relationships with other organisms
 - lichen = fungus + green alga
 - fungus provides alga with some nutrients needed for photosynthesis - alga provides complex organic nutrients to fungus
 - micorhizzal fungi - associate with plant roots and absorb nutrients from soil to aid plant

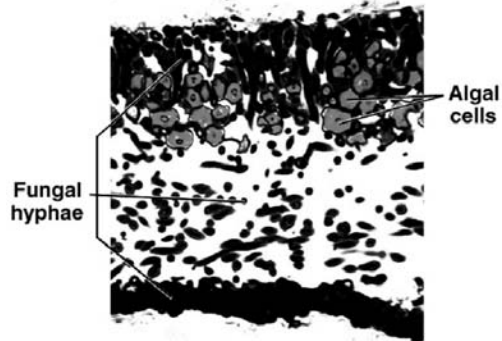
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Lichens



Lichen Micrograph

Fungus is usually ascomycete
Specialized hyphae penetrate photosynthetic cells and transfer nutrients.
Lichens are able to invade harsh terrains and climates.
They are extremely sensitive to pollutants



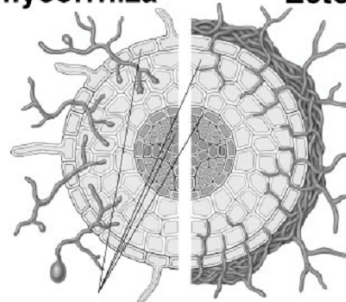
About 90% of all kinds of vascular plants are involved in mutualistic symbiotic relationships (mycorrhizae).

Fungi are able to extract raw nutrients from soil that plants can't
arbuscular mycorrhizae - fungal hyphae penetrate outer cells of plant root

ectomycorrhizae - hyphae surround, but do not penetrate, cell walls of roots

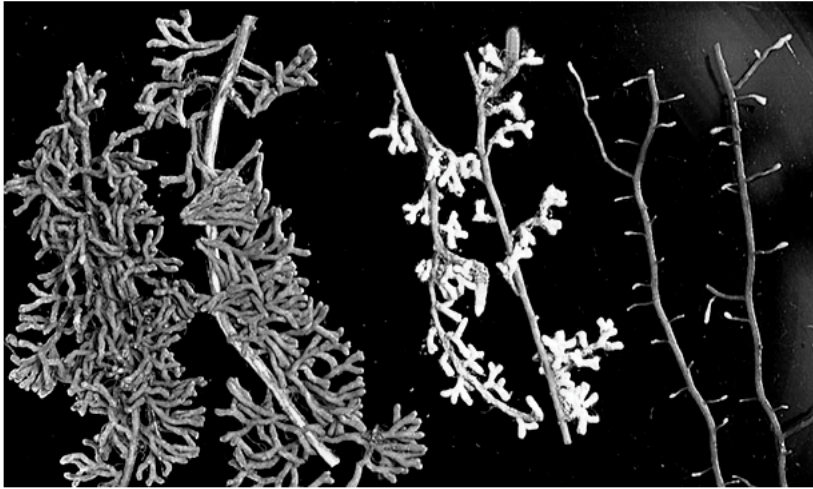
Arbuscular mycorrhiza

Ectomycorrhiza



Root cells of plants (cross-section)

Ectomycorrhizae on Pine Roots

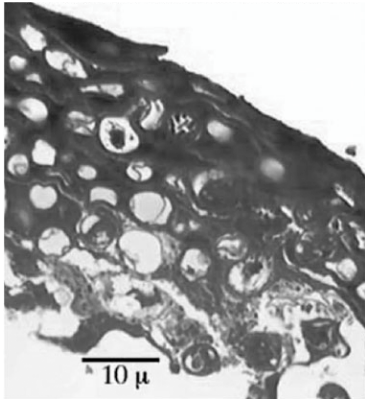


•A range of mutualistic fungal-animal symbioses has been identified.

- ruminants
- leaf-cutter ants
- termites



Chytridiomycosis - emergent infectious disease in amphibians
chytrid *Batrachochytrium dendrobatidis*



Aflatoxins - carcinogenic
compounds produced by
strains of *Aspergillus flavus*
grows on corn, peanuts,
cotton seeds

