Chytridiomycota

- formerly refered to as Phycomycetes
- algal fungi; thought to have evolved from algae via the loss of chloroplast; no longer excepted theory
- chytrids and the rest of Fungi are hypothesized to be more closely related to animals via protozoan ancester

- True Fungi based on:
  - **Chitinous walls**
  - **Flattened mitochondrial cristae**
  - **Lysine synthesis by the alpha aminioadipic acid (AAA) pathway characteristic of all true Fungi and some protists**
    - compare to diaminopimelic acid pathway found in bacteria, plants, and some protists

While in Oomycota:

Lysine synthesis by diaminiopimelic acid pathway (DAP)

Chytridiomycetes

General characteristics

- only flagellated members of the Kingdom Fungi
- chitin cell walls
- flattened mitochondrial cristae
- AAA lysine biosynthesis

Ecology

- aquatic & terrestrial
- saprobes, some parasites of protists, inverts., fungi & plants; a few anaerobic species in the rumen of herbivores

Thallus Types

- Chytridiales, Spizellomycetales and Neocallimasticales
    - Relatively simple thalli, holocarpic or eucarpic with rhizoids or rhizomycelium
- Monoblepharidales
    - Filamentous thalli (mycelium)
- Blastocladiales
    - Stalked thalli with rhizoids

- unicellular, holocarpic - may produce rhizoids that mainly serve to anchor thallus; rhizoids lack nuclei
- filamentous, eucarpic - coenocytic mycelium; septa may form at base of reproductive strucs.
- mono- or polycentric
- endobiotic - living entirely within the cells of their hosts
- epibiotic - producing reprod. organs on the surface of either a living host or dead organic matter with rhizoids or mycelium remaining inside

Flagellated stages of life cycle

- zoospores - asexual reproduction
- planogametes - sexual reproduction
- both zoospores & planogametes possess a single, posterior whiplash flagellum

Asexual reproduction

General characteristics of asexual reproduction in chytrids

- initiates with zoosporangium filled with protoplasm and many nuclei
- protoplasm of zoosporangium is then cleaved into numerous minute section which develop into zoospores
- zoospores are released, swim, encyst, then germinate producing a thallus
- operculate zoosporangia always form a well-defined circular cap, operculum, through which the zoospores emerge
- inoperculate zoosporangia discharge their zoospores through a pore in the wall of the sporangium or discharge tube, formed when the discharge papilla dissolves
- most known species possess inoperculate zoosporangia

Endo-exogenous, endo-epibiontic, mono-polycentric are not phylogenetically conserved

Sexual reproduction

Modes of sexual reproduction

- Planogametic copulation (three forms)
    - isogamous
    - anisogamous
    - nonmotile egg fert. by a motile antherozoid
- Gametangial copulation
    - tranfer of protoplast from one gametangium to another
- Somatogamy
    - fusion between rhizoidal filaments

Major problems in interpreting sex in chytrids

- difficult to distinguish between resting spores and thick-walled resistent sporangia
- biflagellate zoospores may be result of plasmogamy or incomplete cleavage in the zoosporangium

Zoospores

General characteristics

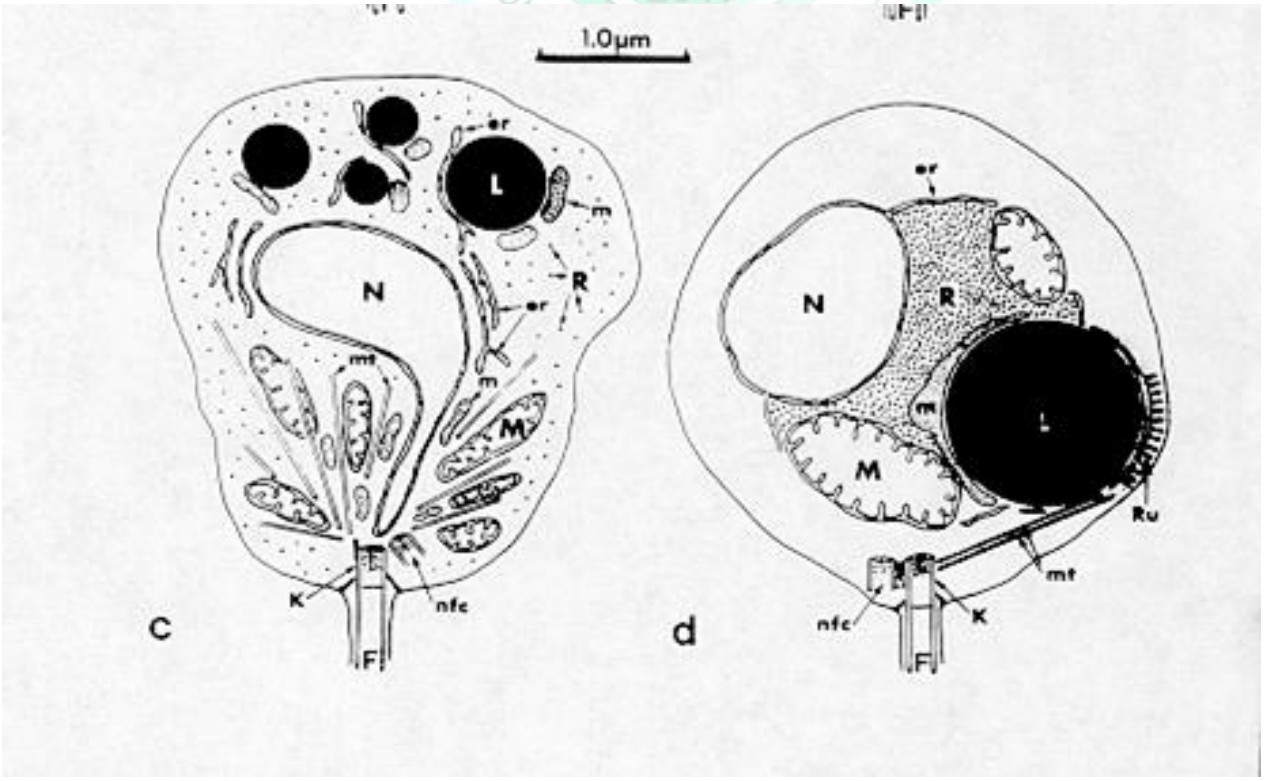
- cornerstone of classification
    - single whiplash flagellum
    - rarely polyflagellate cells
    - usually attached posteriorly but occassionally attached anteriorly or laterally but always directs posteriorly
- organelles
    - mitochondria, microbodies, endoplasmic reticulum and one to many lipid bodies located in specific regions of the zoospore
- some possess microbody-lipid globule complex (MLC)
    - appear to be involved in the utilization of stored lipid during zoospore motility and in the regulation of calcium

Main orders of Chytridiomycota

- **123 genera, 900 species in 5 orders:**
    - **Chytridiales**
    - **Spizellomycetales**
    - **Monoblepharidales**
    - **Neocallimasticales**
    - **Blastocladiales**

Chytridiales

- true mycelium lacking
- Monocentric or polycentric thalli
- rhizoids or rhizomycelium present in some species
- Slender rhizoid tips (< 0.5 micron)
- Inoperculate or operculate; if inoperculate, then single or multipapillate
- Regular-shaped zoospores
- Mostly aquatic
- zoospores
- Chytriomyces hyalinus
    - rhizoidal somatangy; operculate
- Rhizophidium couchii
    - gametangial; inoperculate



Zoospore ultrastructure

Spizellomycetales

- mainly isolated from soil
- zoospores, irregular morphology & undergo ameboid movement while actively swimming

Blastocladiales

Coelomomyces an example

- thought to be the most advanced group
- zoospores, elongated morphology

Monoblepharidales

- oogamous & anisogamous reproduction
- zoospores, somewhat elongate
- nucleus centrally located & apparently unconnected to kinetosome
- flagellar root consists of two parts, striated discs & microtubules

Neocallimastigales

- obligate anaerobes in rumen & hindgut of herbivores
- zoospores, uni- to polyflagellated
- resting spore stage is diploid

Blastocladiales

- Allomyces macrogynus
- alternate generations, anisogamy

Monoblepharidales

- Monoblepharis polymorpha
- nonmotile egg

Order Neocallimasticales

- Also spelled Neocallimastigales
- "Rumen fungi"—first discovered in 1977
- Obligately anaerobic chytrids that live in digestive tract of herbivores (ruminants and hind-gut fermenters
- Some taxa produce polyflagellated zoospores
- Zoospores lack mitochondria

Biology of rumen fungi

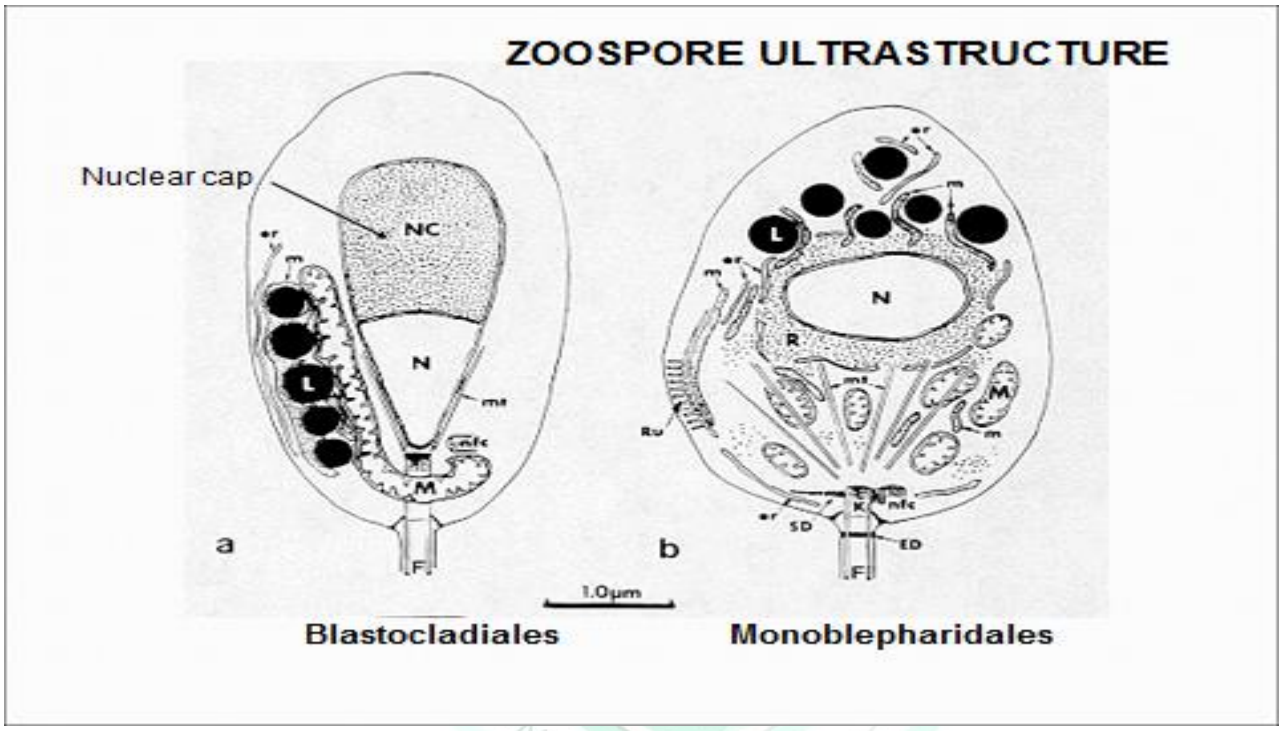
- Zoospores encyst on plant material in rumen and intestine
- Form thallus with well-developed rhizoidal system that penetrates plant material
- Passed from mother to offspring, probably through licking or feces
- No known sexual stage

Phylum Blastocladiomycota

- Zoospores with tightly organized organelles and characterized by 'nuclear cap'
- Most species are saprotrophs in soil, water, mud, plant and animal debris; exceptions:
    - *Coelomomyces*, is an obligate endoparasite of insects
    - *Catenaria* species parasitize small animals

- *Physoderma* species are plant parasites

- Separate gametophytic and sporophytic thalli in several genera, including *Coelomomyces*, *Allomyces* and *Blastocladiella*



Coelomomyces

- Alternating sporophytic and gametophytic stages in mosquito larvae and copepod (fish lice) hosts, respectively
- Wall-less hyphal bodies (‘hyphagens”) formed in coelom of host