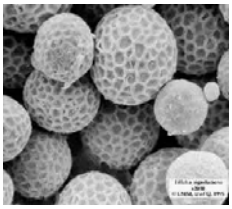
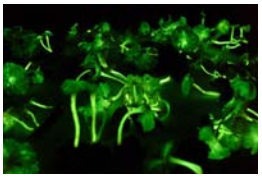
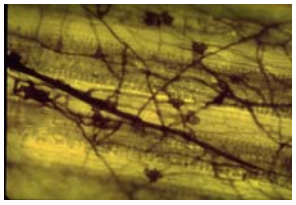




Diversity of Fungi

(Freeman Ch31)


24 February 2009
ECOL 182R UofA
K. E. Bonine

Thanks to Joanna Masel

Upcoming Syllabus (middle third)

24 Feb KB – Fungi Chapter 31
26 Feb KB – Prokaryotes, Protists, Photoautotrophy, Endosymbioses
Chapters 28, 29

3 Mar KB – Plant Diversity Chapter 30
5 Mar KB – Plant Form and Function Chapters 36, 37

10 Mar KB – Plant Function Chapters 38, 40, and 39 (pp. 857-866, 873-882, 887-888)
12 Mar WS - Population Growth and Regulation Chapter 52

17&19 Mar Spring Recess

24 Mar KB – Plant Community Ecology, Disturbance, Succession
Chapters 30, 53
26 Mar KB – Galapagos Case Study Wikelski 2000 and
www.darwinfoundation.org/en/galapagos/marine
www.darwinfoundation.org/en/galapagos/land

31 Mar Part 2. Discussion and Review.
02 Apr **EXAM 2**

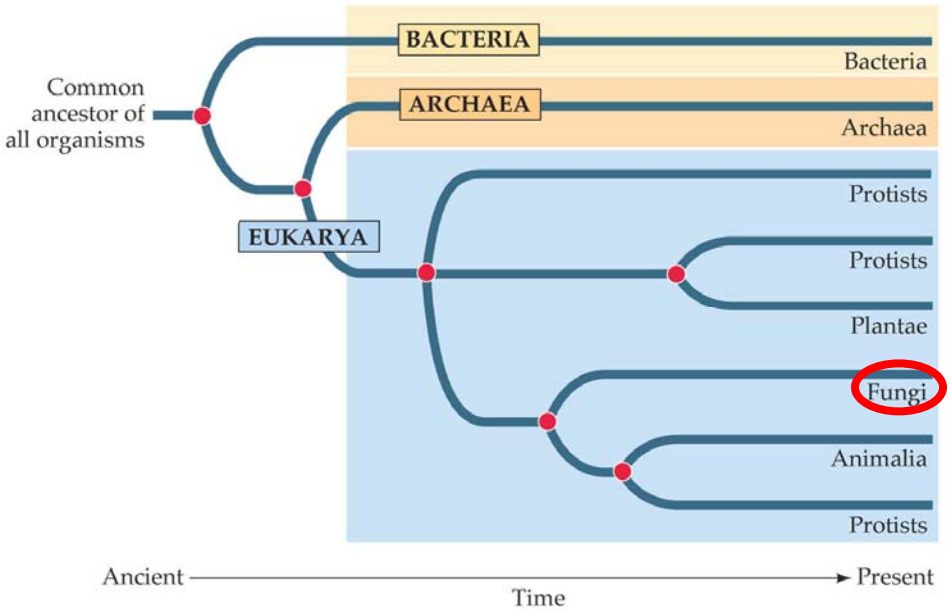
Kevin Bonine
182 Office Hours

10-noon Tuesdays
BSE 113

-also M 1-2 and W 11-noon-
-206 and 437 students have priority-

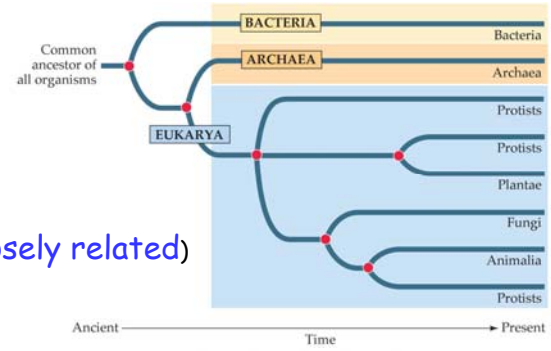
3

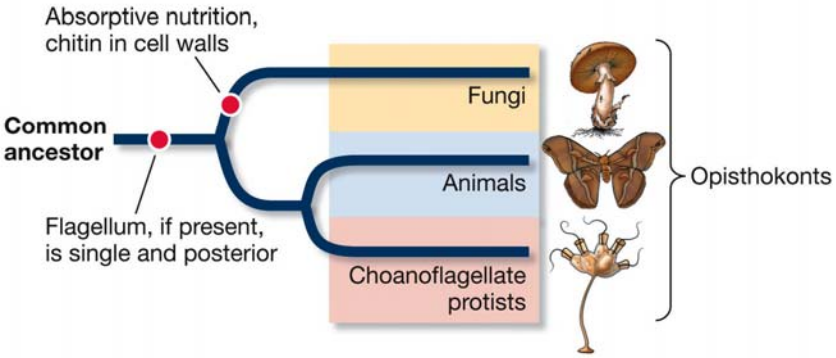
Tree of Life



Opisthokonts

(Fungi and Animals are closely related)





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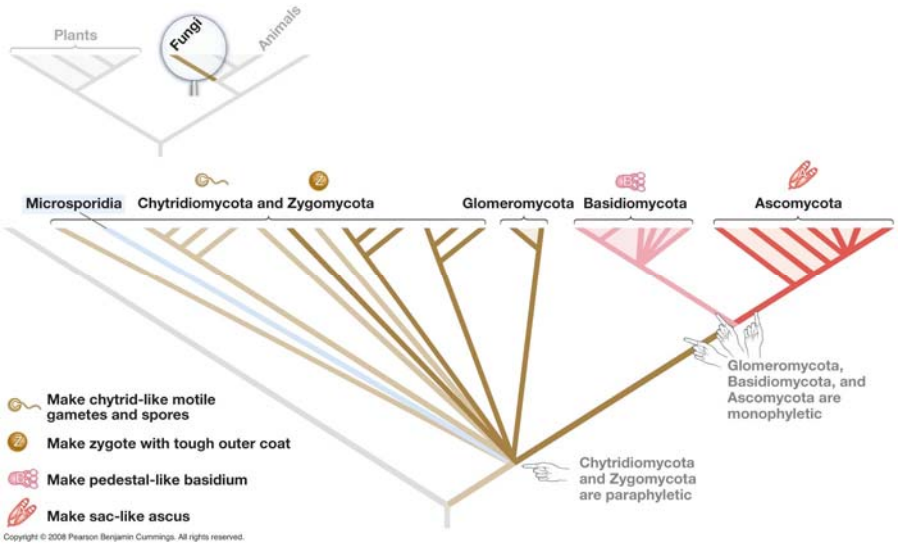
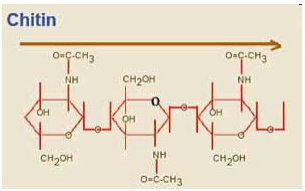


6

Chitin

(tough but flexible nitrogen-containing polysaccharide)

- Production of chitin is a shared derived trait for
  - choanoflagellates



- Evidence that fungi are closer to than

7

How fungi live

- All use absorptive nutrition, secreting digestive enzymes and absorbing the breakdown products
- Most are saprobes (on matter)
  - Earth's main decomposers (with bacteria)
  - principal decomposers of cellulose & lignin
  - nutrient (re)cyclers
- Some are parasites
- A few are mutualists

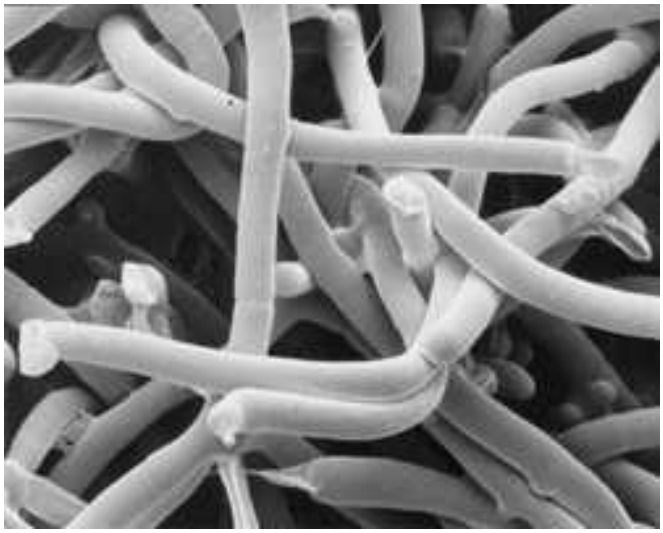
8

Cell structure of multicellular fungi

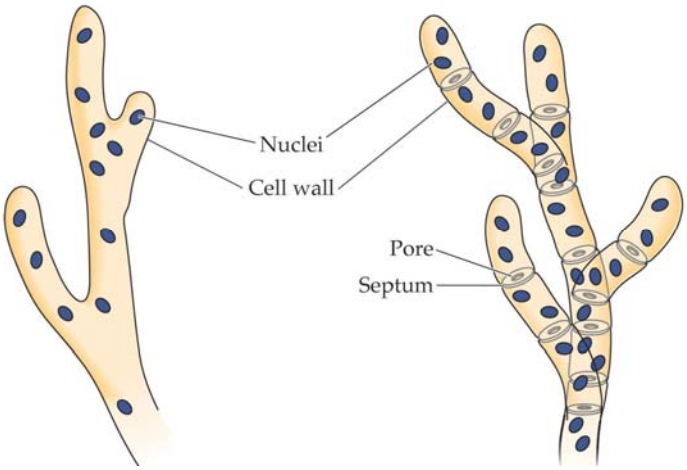
Vegetative body = mycelium (plural mycelia)

Composed of threadlike

(singular hypha)



Incomplete division into cells



coenocytic hypha

septate hypha

Cell-like compartments separated by septa (singular septum)

Free movement of organelles, sometimes even nuclei, and other materials

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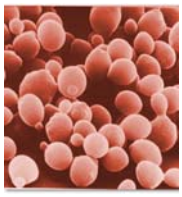
Fungus structure

- Hyphae may
  - disperse to look for nutrients
  - clump together to exploit a food source

are a _____ structure

- Most Unicellular fungi are called _____



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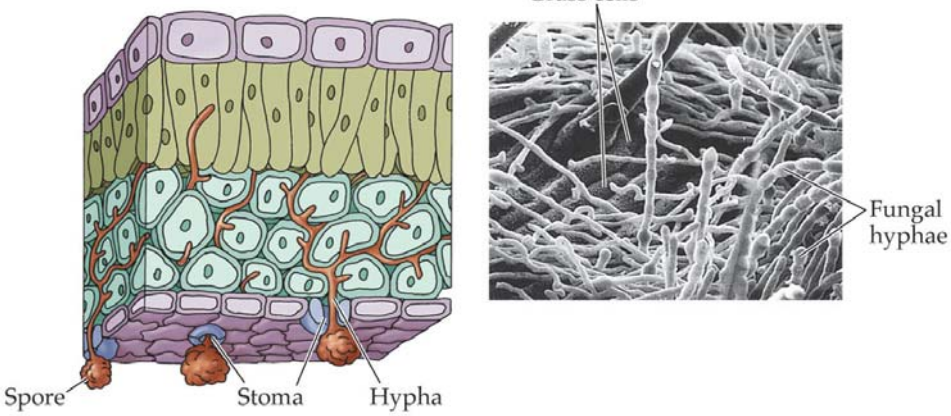
Fungal hyphae attack a leaf



Hyphae give a large surface:volume ratio, which helps with absorptive nutrition

13

Symbiotic fungi

_____ are symbiotic associations of a fungus with a

- unicellular photosynthetic

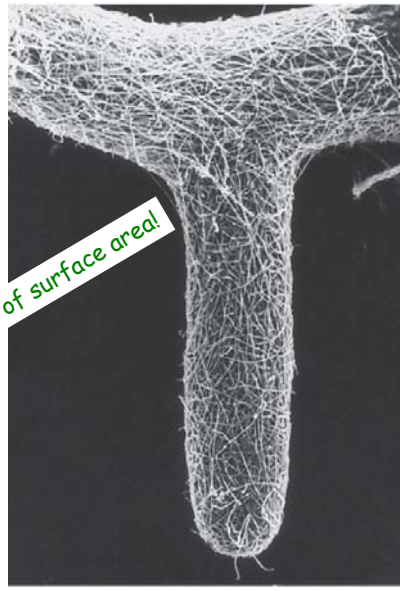
-

- or both

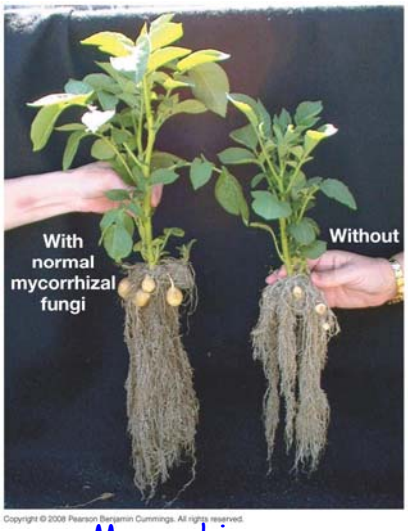
Lichens are important pioneer species

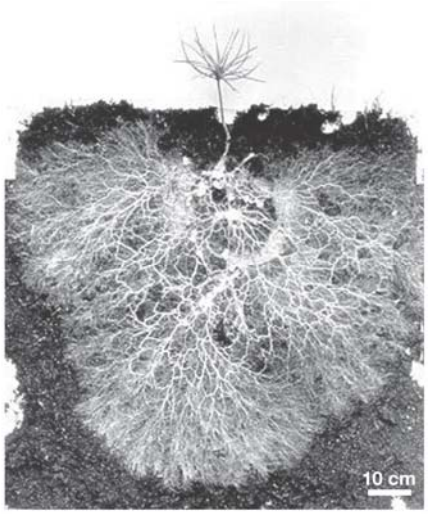
Symbiotic fungi

- Mycorrhizae are associations of and
- The fungus obtains organic compounds, while the plant is provided with water and soil nutrients
- Some plants can't grow without them



Symbiotic fungi



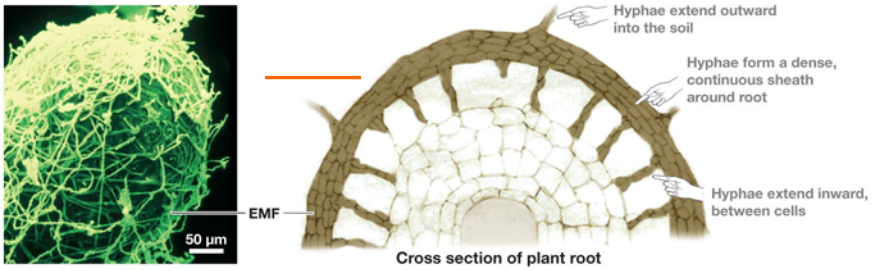


Mycorrhizae = _____ associations of _____ and _____

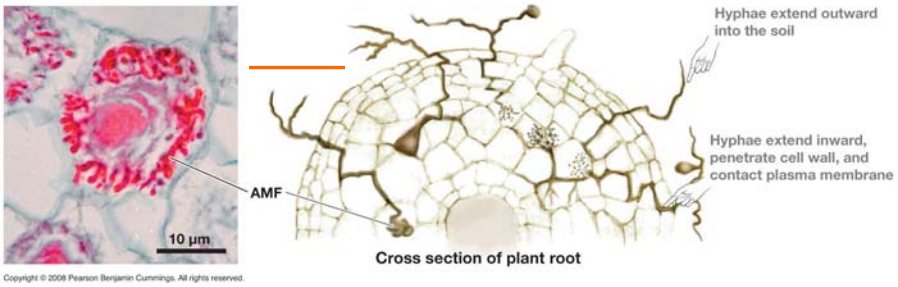
16

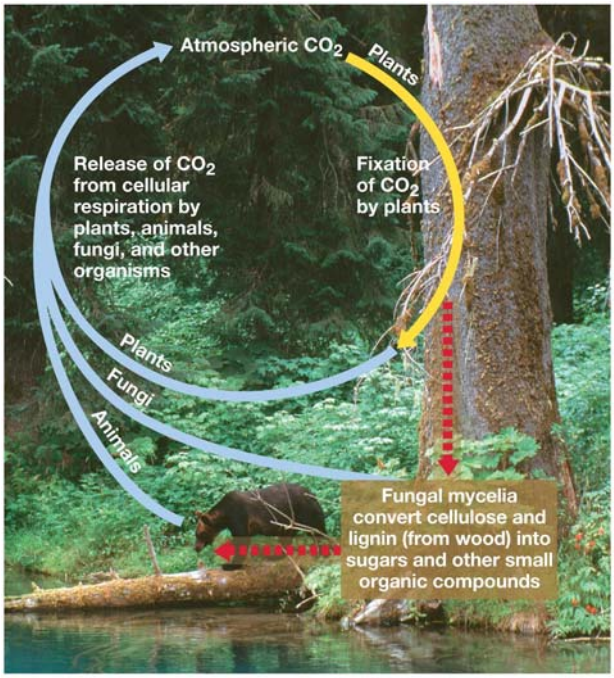
Fungi increase **surface area** for nutrient and water absorption by plant

(a) Ectomycorrhizal fungi (EMF) form sheaths around roots and penetrate between root cells.



(b) Arbuscular mycorrhizal fungi (AMF) contact the plasma membranes of root cells.



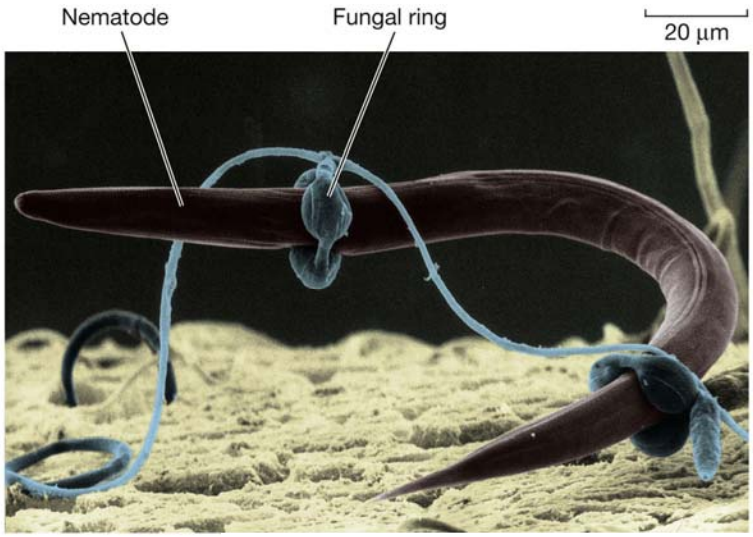


Fungi are very important cyclers of nutrients.

Especially Carbon, Nitrogen, Phosporus.

18

Predatory fungus!



LIFE 8e, Figure 30.6

Fungus capturing a nematode worm

19

Fungal reproduction can be complex

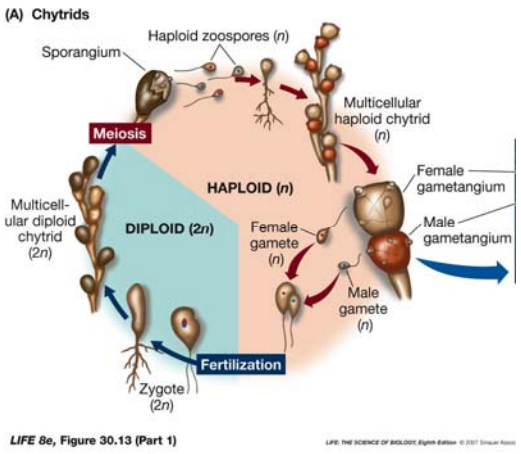
OR

- Life cycles distinguish 4/5 phyla

- When sex has not been observed, provisionally classified as imperfect fungi (aka deuteromycetes): ~ 25,000 species

20

Alternation of Generations



Sexual Reproduction Depicted Here (Meiosis & Fertilization)

Haploid (N)
(~gametes)
↓
Fertilization
↓
Diploid (2N)
↓
Meiosis
↓
Haploid (N)
Etc.

21

Alternation of Generations

Both the haploid and the diploid have forms.

Compare to
Haplontic and Diplontic.

22

Haplontic life cycle

is dominant, multicellular structure

- Often diploid only very briefly as a zygote
- Meiosis produces haploid nuclei again
- Haploid spores divide mitotically to form haploid hyphae

23

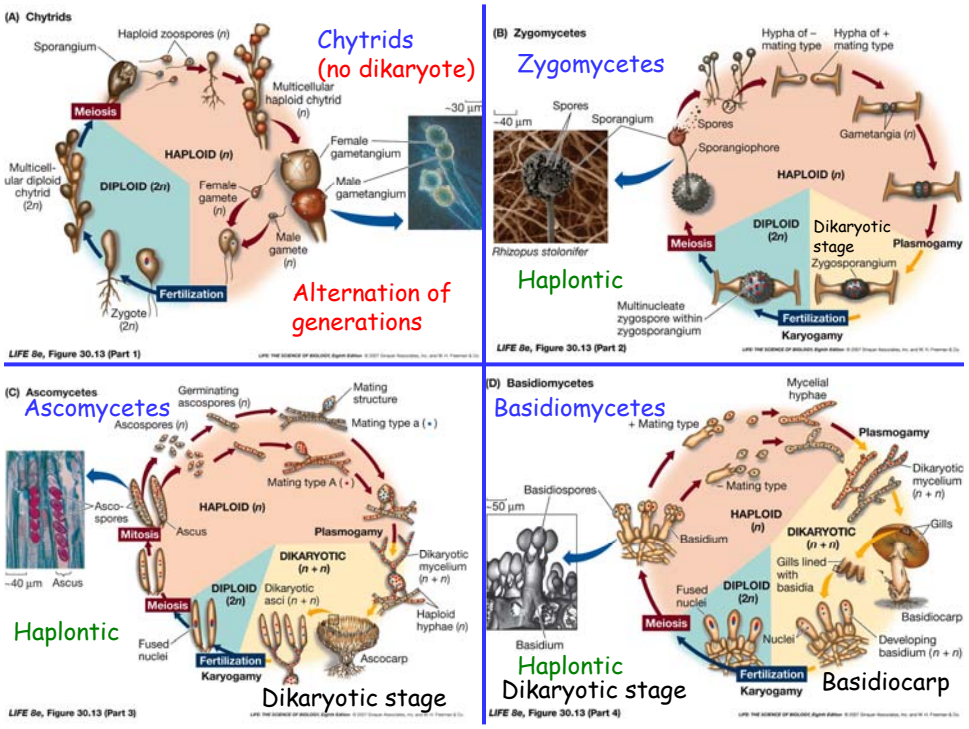
Dikaryotic Lifestage

- Unique to fungi
- Two haploid (n) cells fuse, but not their nuclei

  =

- Plasmogamy (cell fusion)
  followed later by Karyogomy to produce

  Diploid (2n) Zygote

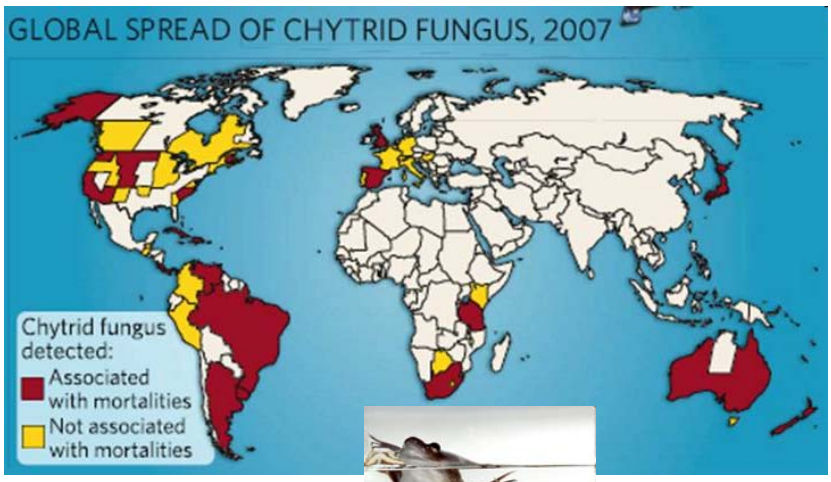


Chytrid Fungi

A chytrid fungus (*Batrachochytrium dendrobatidis; Bd*) has been implicated in the worldwide decline of numerous _____ species.
Frogs infected with this fungus suffer chytridiomycosis, a disease affects amphibian skin and is often fatal. Chytrid zoospores can survive in damp conditions and may be transported between frog populations in muddy clothing and footwear.

- water balance
- respiration
- immune system

26

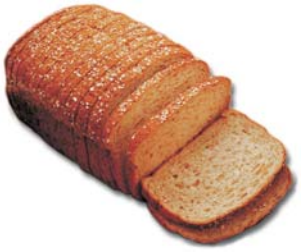


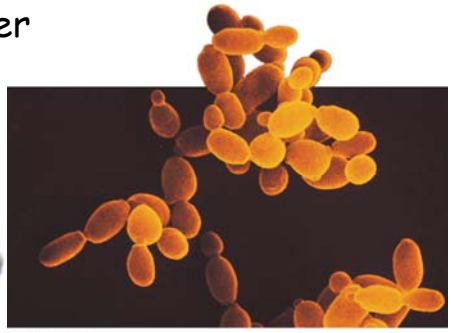
African Clawed Frog?

27

Yeast are fungi

- All five fungal phyla have unicellular species
- Those of all phyla except chytrids are called yeasts
- The yeast *Saccharomyces cerevisiae* makes CO_2 and ethanol during fermentation
- Used for bread and beer

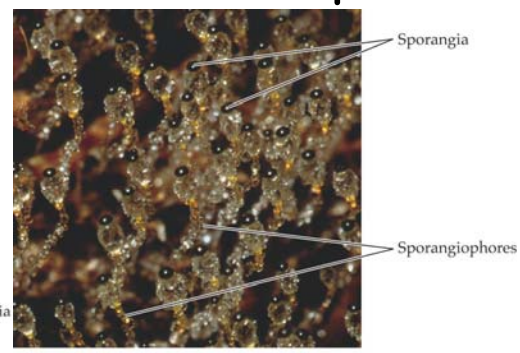




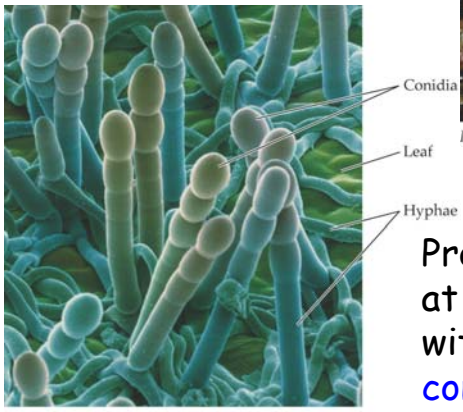
Saccharomyces sp.

Asexual reproduction via spores

Production of haploid spores within sporangia



Pilobolus sp.



Erysiphe sp.

Production of naked spores at the tips of hyphae (not within sporangia) called conidia

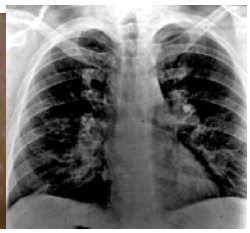
29

Fungal spores are everywhere

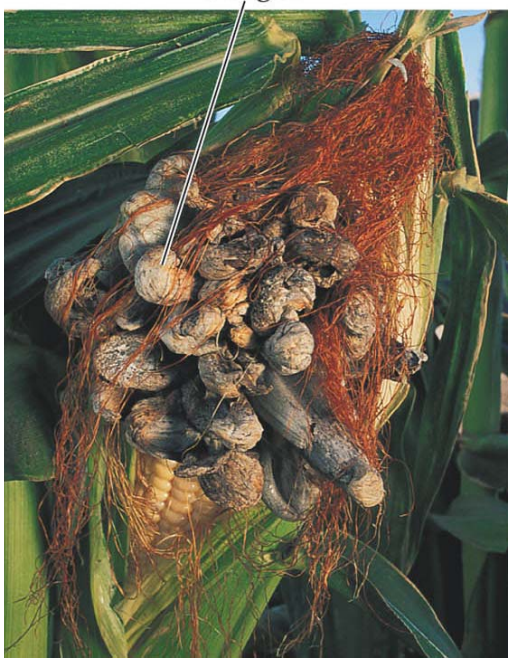
- Every breath we take is full of fungal spores (~10,000/m^3 of air)
- Most humans only succumb to fungal pathogens when immunocompromised

sporotrichosis

ring worm



some pneumonias



Plants are not so lucky

Parasitic fungus *Ustilago maydis* (corn smut)

Fungus (aka mold, mildew, etc.) causes lots of crop damage

- Dutch Elm disease
- Chestnut blight

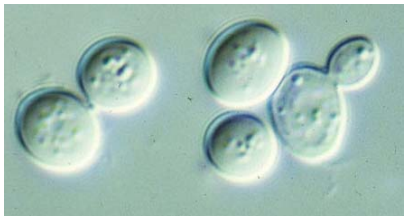
Neither was this ant

Spores of this fungus don't germinate until ingested by an ant

32

Fungal asexual reproduction

- Cell division by unicellular fungi
  _____ (fission)
  _____ (budding)



- Simple breakage of the mycelium

33

Fungal Sexual reproduction

- Some fungi have more than 2 mating types
- Mating types don't look different
- Mating can only occur between different mating types, preventing self-fertilization
- Sexual reproduction when hyphae (or motile cells in chytrids) of different mating types meet and fuse

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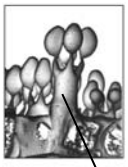
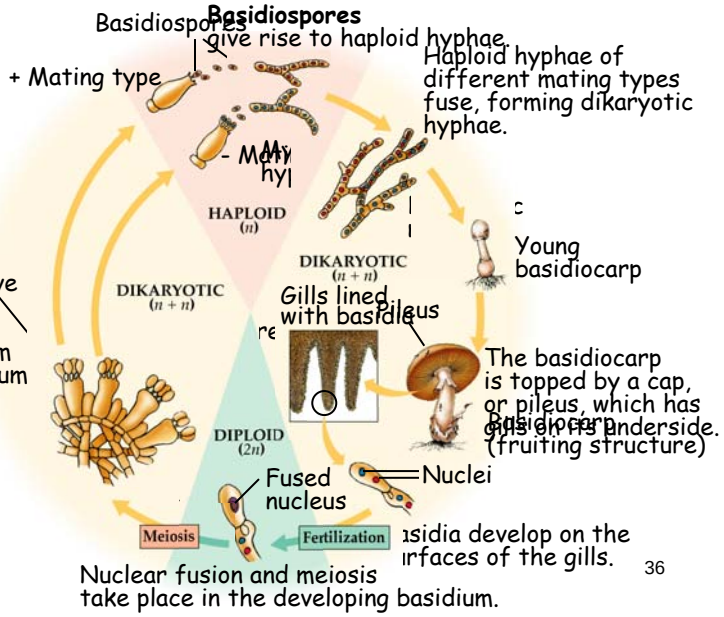
Basidiomycete life cycle



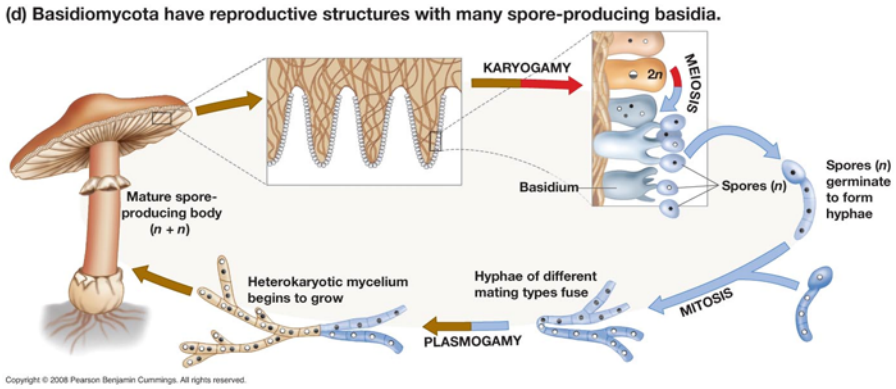
The **basidium** is the characteristic sexual reproductive structure of the basidiomycetes. Basidiospores form *outside* the basidium



Mushrooms

36

Basidiomycete life cycle



Mushrooms

37

Important points about sex and reproduction

- Sex = _____
- Reproduction _____

  _____
- Genetic recombination = any gene exchange: not just sex, also nonreproductive processes such as conjugation
- Dikaryotic individuals include 2 fused individuals, but not fused nuclei
- "Spores" can be sexual or asexual, reproductive or not: normally a small, tough cell with potential to become new organism. Often capable of latency. Can be plant, bacterial, protist or fungal.

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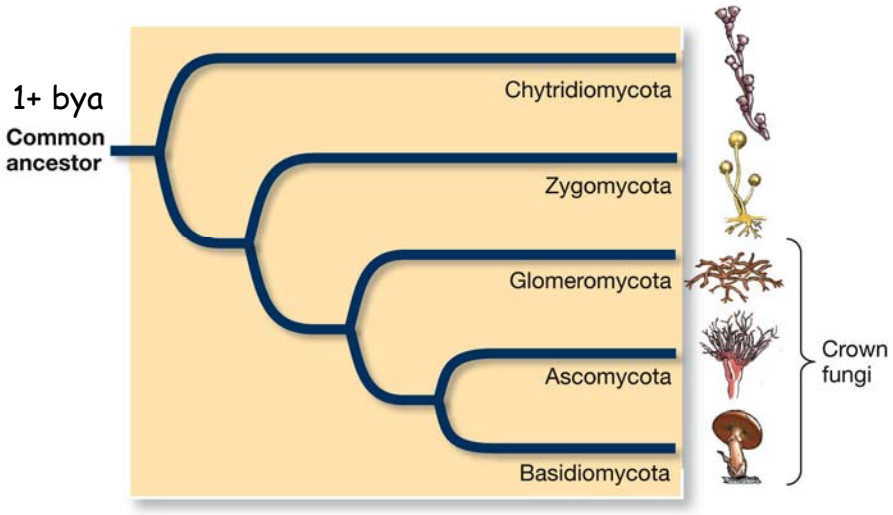
Five Fungi Phyla

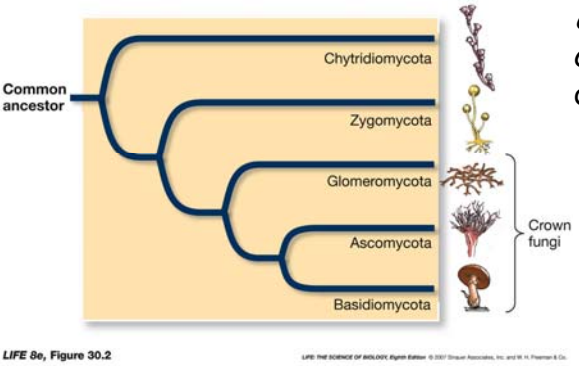


LIFE 8e, Figure 30.2

Chytrids

~Aquatic
Only fungi group with flagella

Includes *Batrachochytrium dendrobatidis* (Bd) causing amphibian die-offs



LIFE 8e, Figure 30.2

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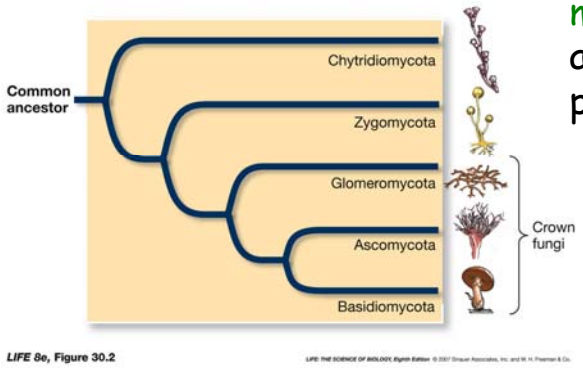
Glomerocytes

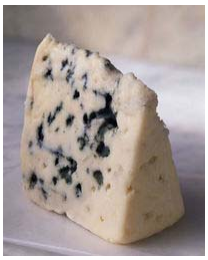


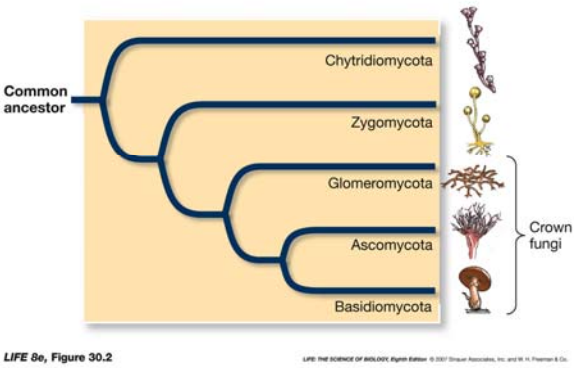
LIFE 8e, Figure 30.2

Important mycorrhizae associations with plants

42

Ascomycetes





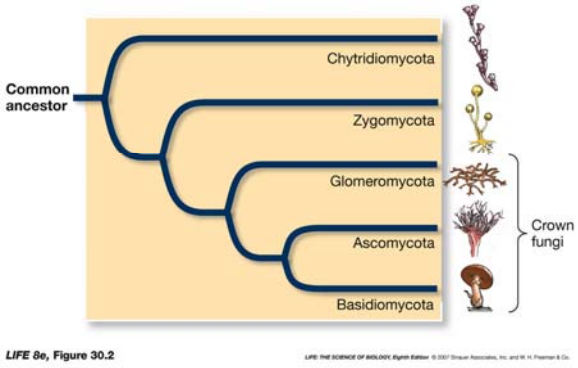
LIFE 8e, Figure 30.2

Includes brewer's and baker's yeast.
Lots of plant parasites.
Molds and Mildew.
Penicillin.
Stinky cheese production.

43

Basidiomycetes

Named after basidiocarp, Which we know as a mushroom



LIFE 8e, Figure 30.2

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