

Week 13: *Coprinopsis*



Reading:

- Read lab manual chapter 13
 - Pages 386, 389-400, 402-406, 410



All About Fungi!

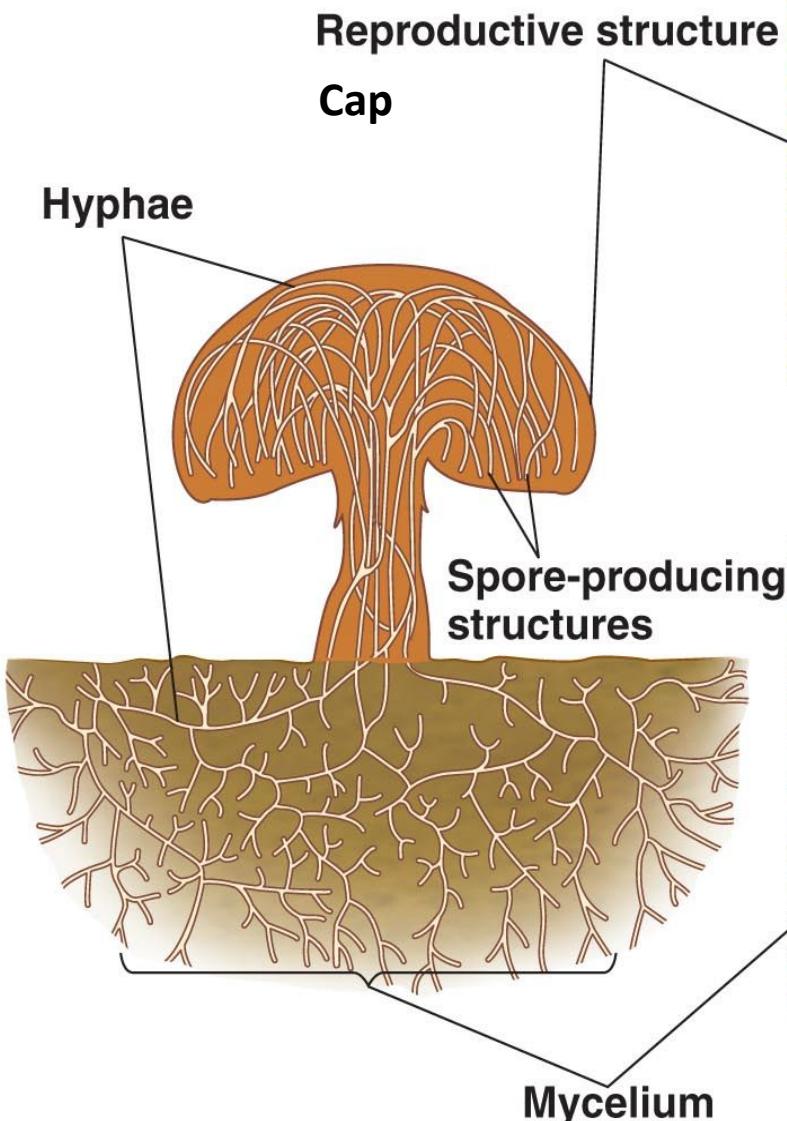


All About Fungi!

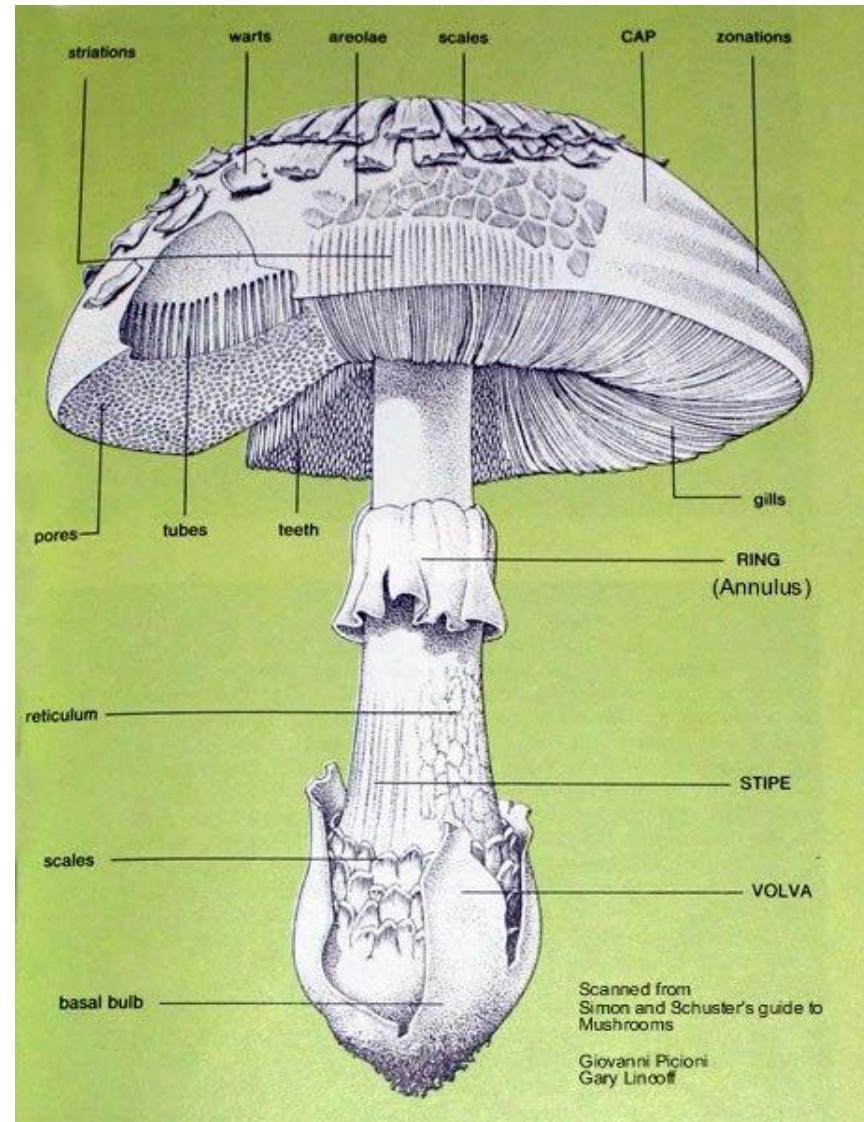
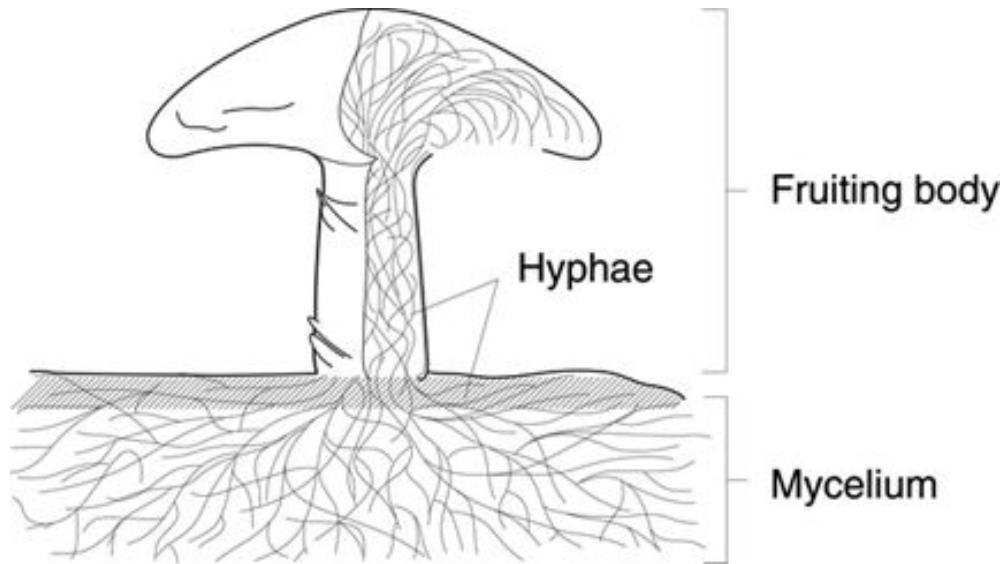
- Lineage Opisthokonta
- Decomposers and parasites
- Mycorrhizal relationships
- Neither plants nor animals
 - Do not photosynthesize (like plants), but do not feed through a mouth (like animals)



Anatomy

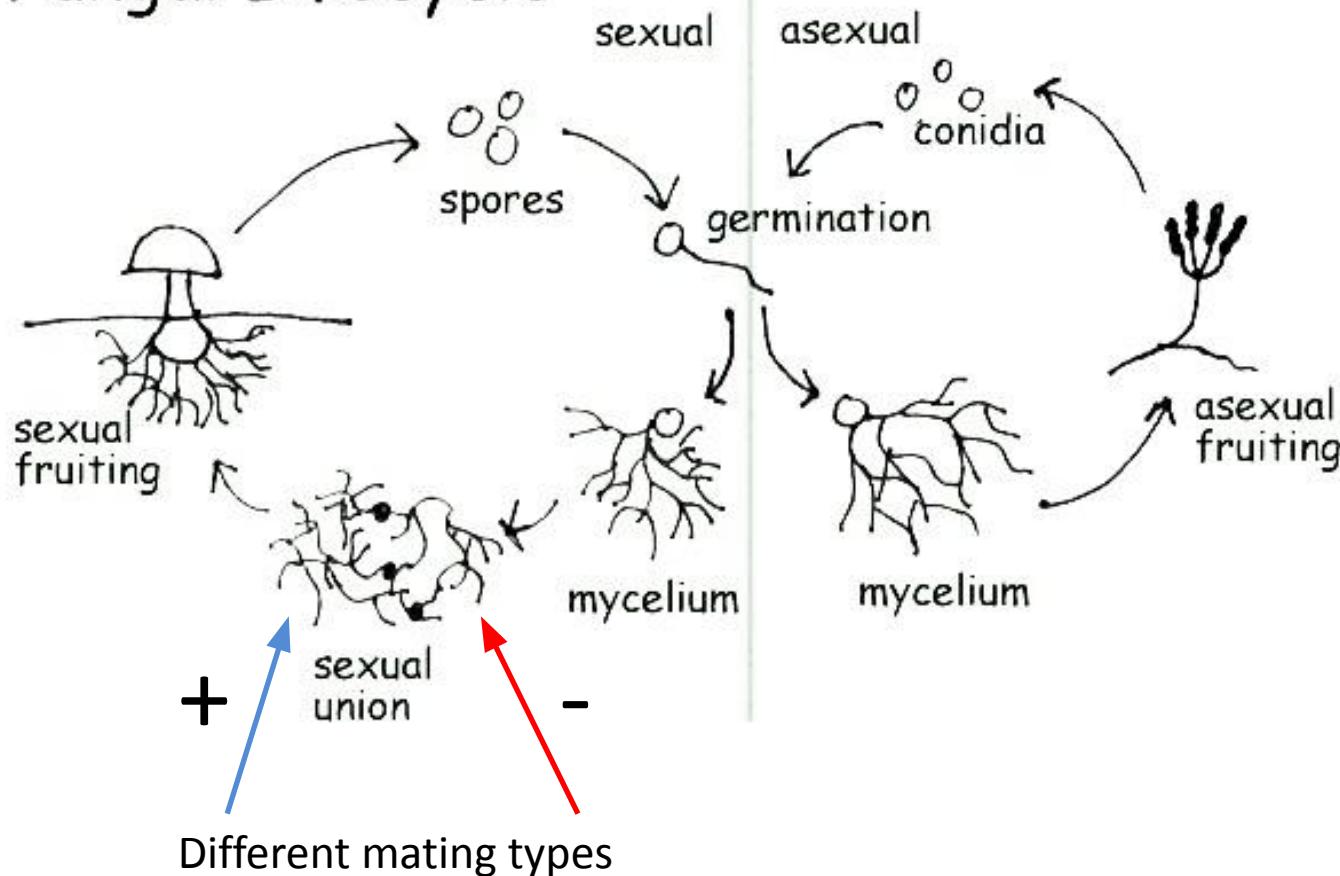


Anatomy



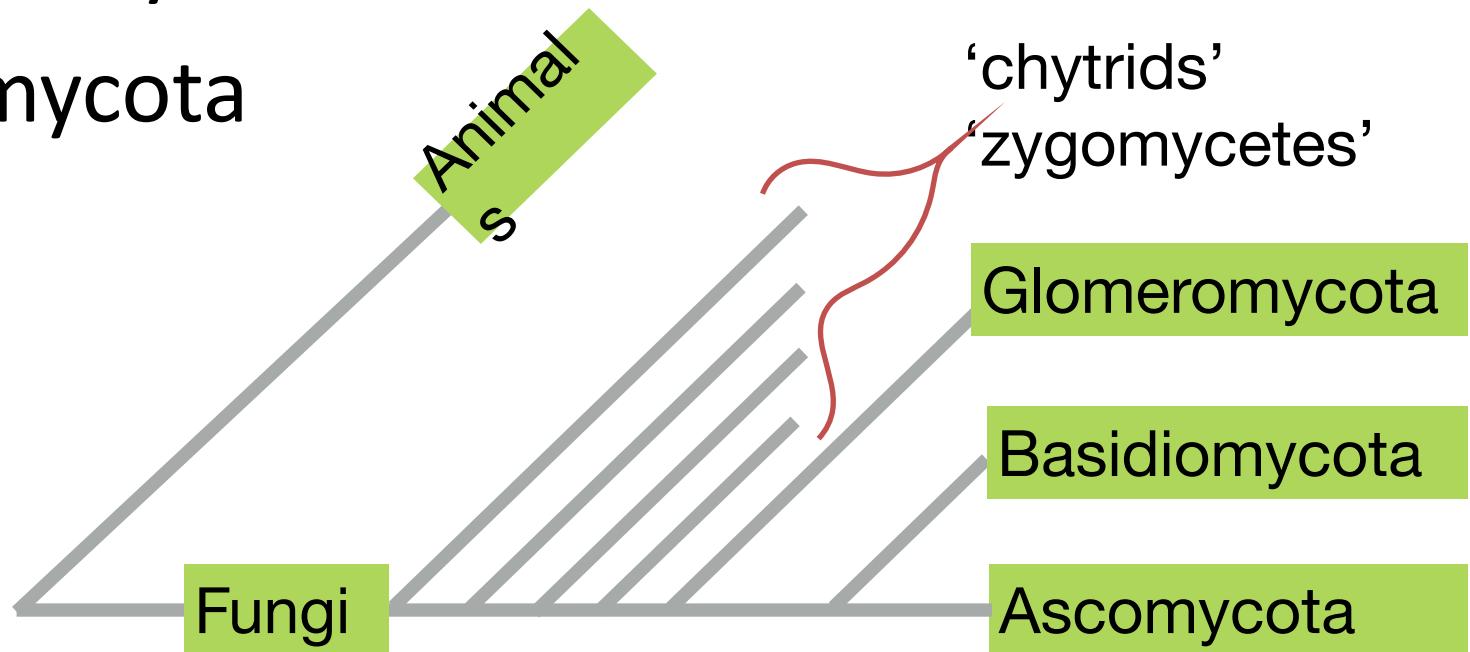
Fungi can reproduce sexually and asexually

Fungal Lifecycle



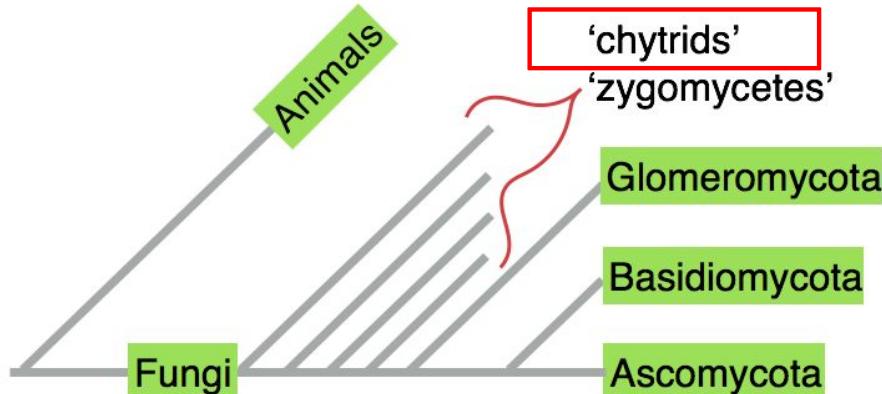
5 Phyla

- ‘Chytridiomycota’
- ‘Zygomycota’
- Glomeromycota
- Basidiomycota
- Ascomycota



Phylum 'Chytridiomycota'

- Parasitic in frogs, other amphibians
- Causes Chytridiomycosis disease
- Common in freshwater and moist soil
- Only fungi with flagella
- Can reproduce sexually or asexually



Batrachochytrium amphibian skin histology
CDC (public domain)

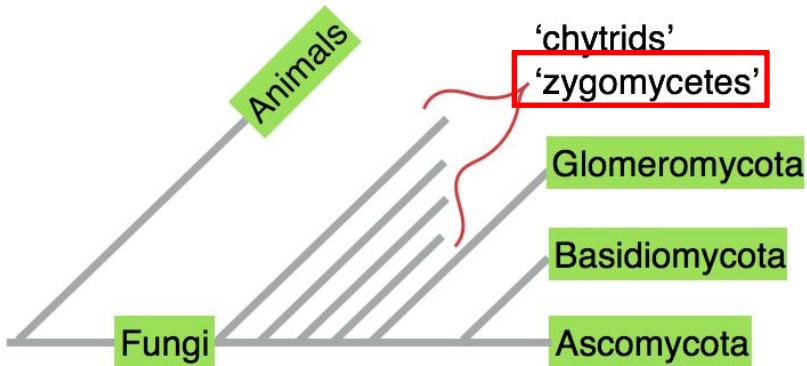
Chytridiomycosis disease

- Caused by the fungus *B. dendrobatidis*
- Affects outer layers of skin
 - Thickens and sloughs off
- Not able to breathe, hydrate, osmoregulate, or thermoregulate
- Major decline of yellow-legged frogs
- Global amphibian decline



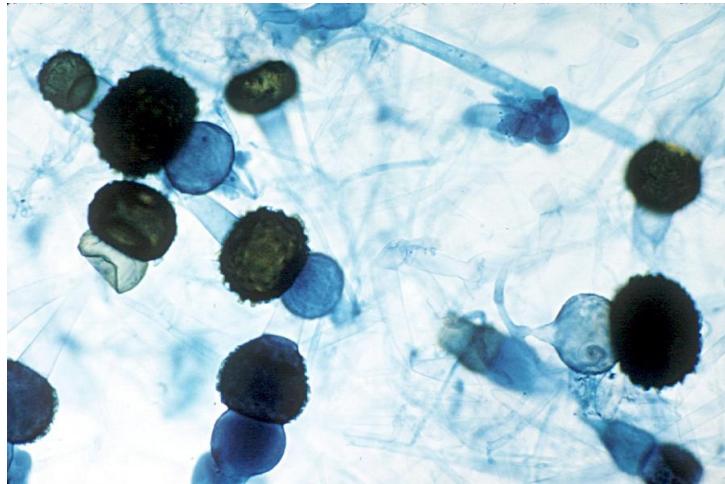
Phylum 'Zygomycota'

- Meiosis occurs in zygospores after hyphae meet and nuclei fuse
- Bread mold: *Rhizopus*
 - Common on organic matter



Phylum ‘Zygomycota’

Specimens



Rhizopus zygospores

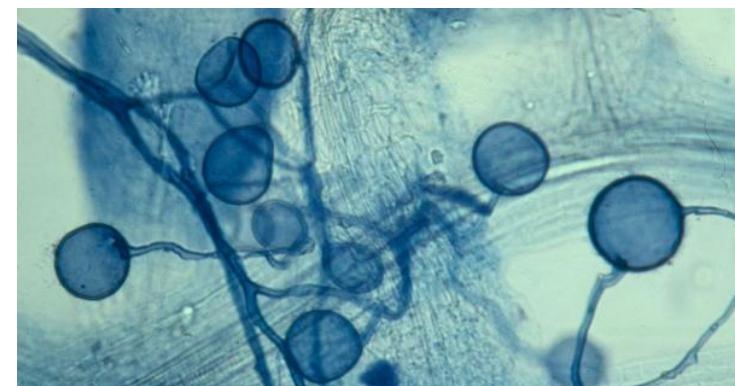
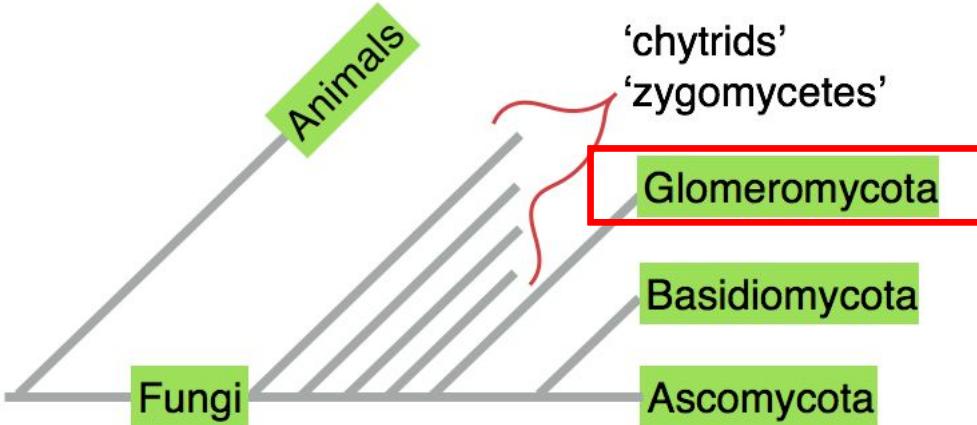
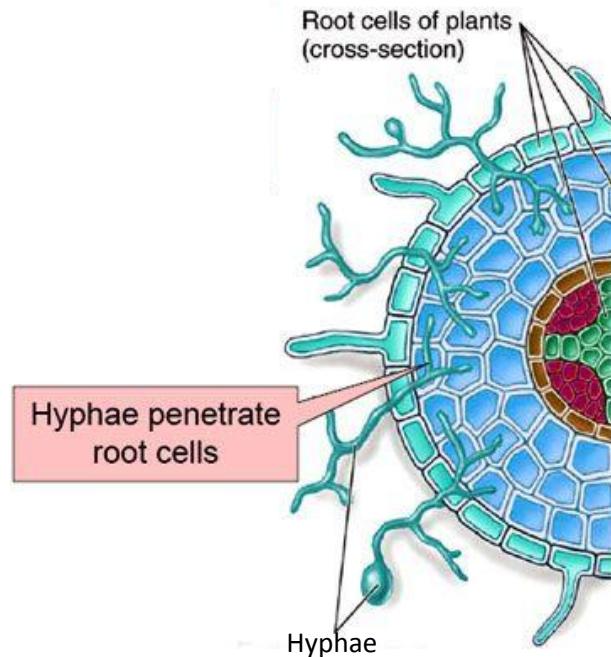


Rhizopus sporangia and mycelium

Phylum Glomeromycota

- All members are obligate endosymbionts with plants
 - **Arbuscular mycorrhizae** – fungi penetrate plant cell walls
- A fungal network called the “Wood Wide Web”

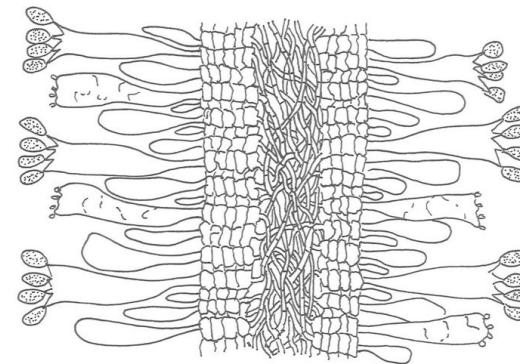
Endomycorrhizae



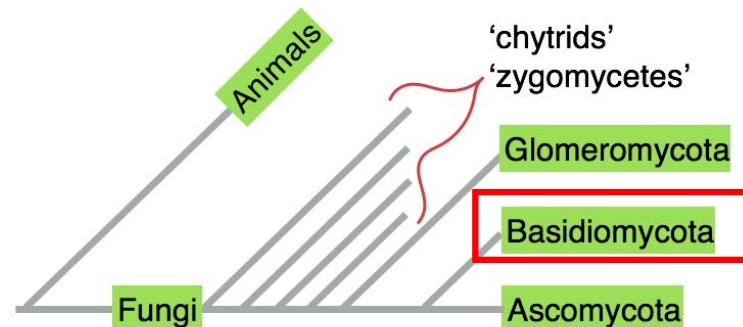
Phylum Basidiomycota

- The “Club Fungi”
- Sexual reproduction by means of basidia and basidiospores
- Complex lifecycle
 - Resembles the alternation of generations of plants
- Highly destructive plant diseases
- Can be **extremely toxic**, but many are edible (portobello, crimini)
- All mushrooms are edible...once. Get it?

NEVER pick and eat wild mushrooms unless they've been identified by an expert!



13.R.8 A gill with basidia and basidiospores. Drawing J. Dole



Phylum Basidiomycota

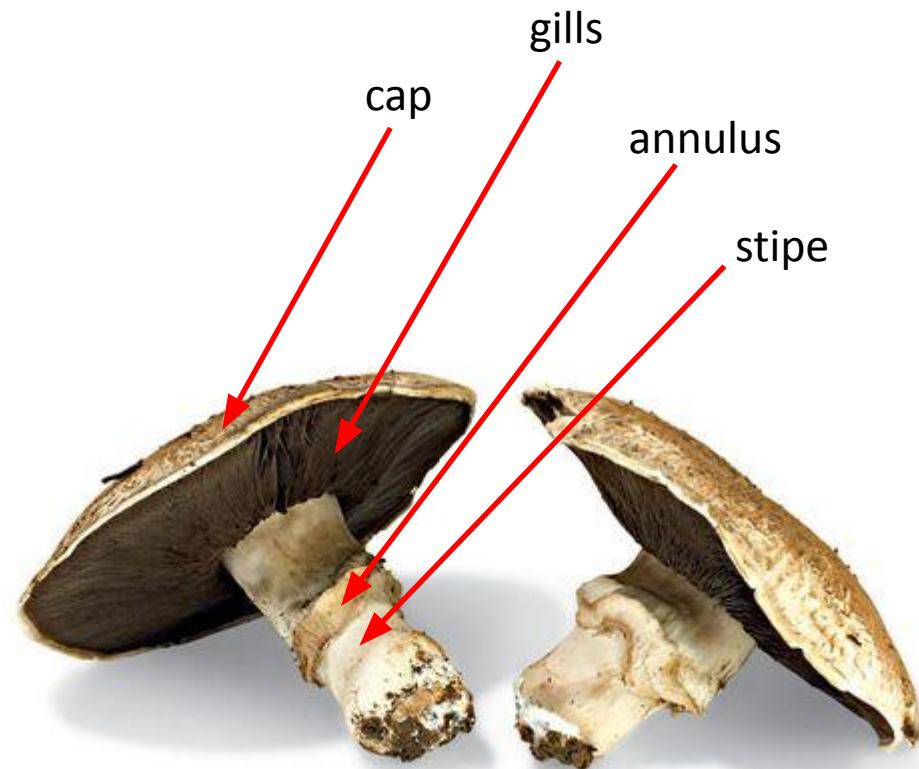
Specimens



Crimini mushrooms



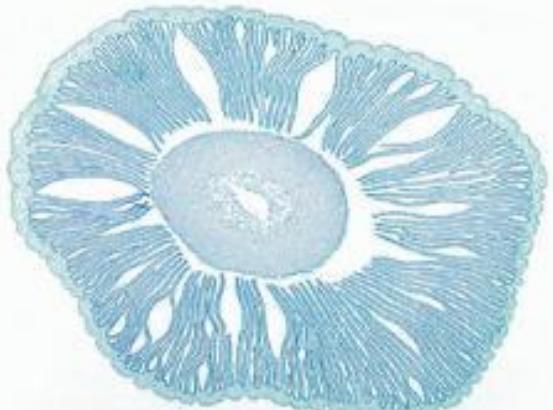
Portobello mushrooms



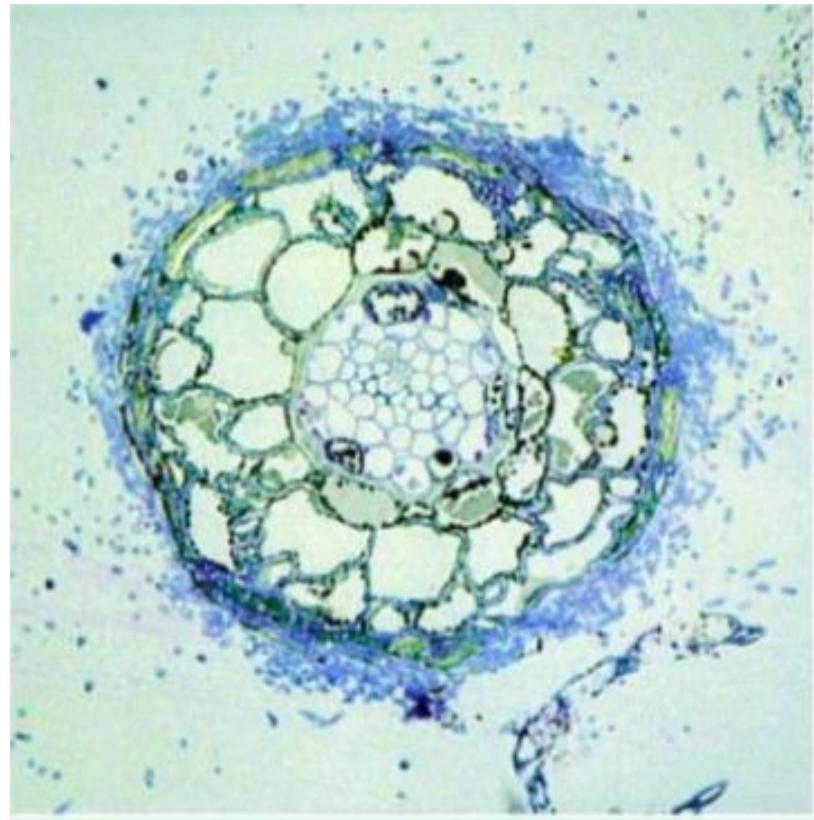
Phylum Basidiomycota

Specimens

Coprinopsis gills cross section



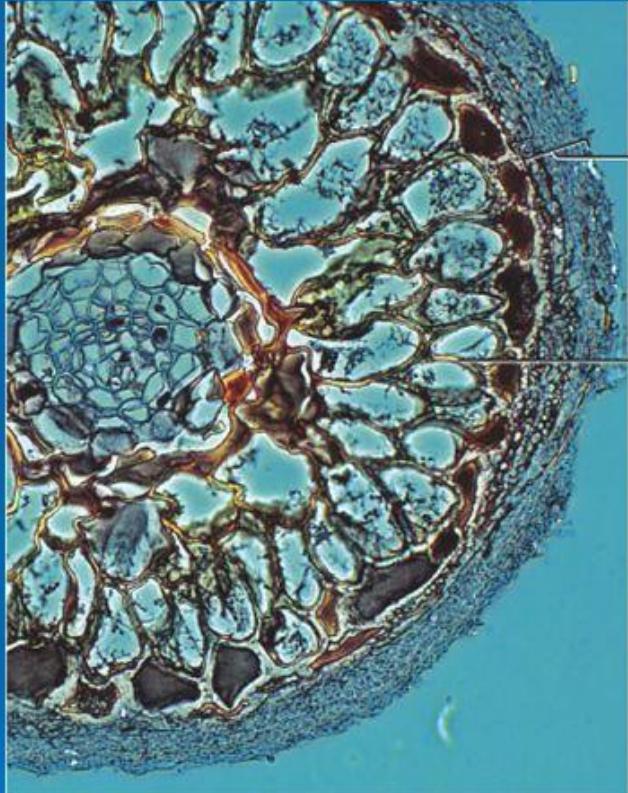
Ectomycorrhizae surrounding pine root-cross section



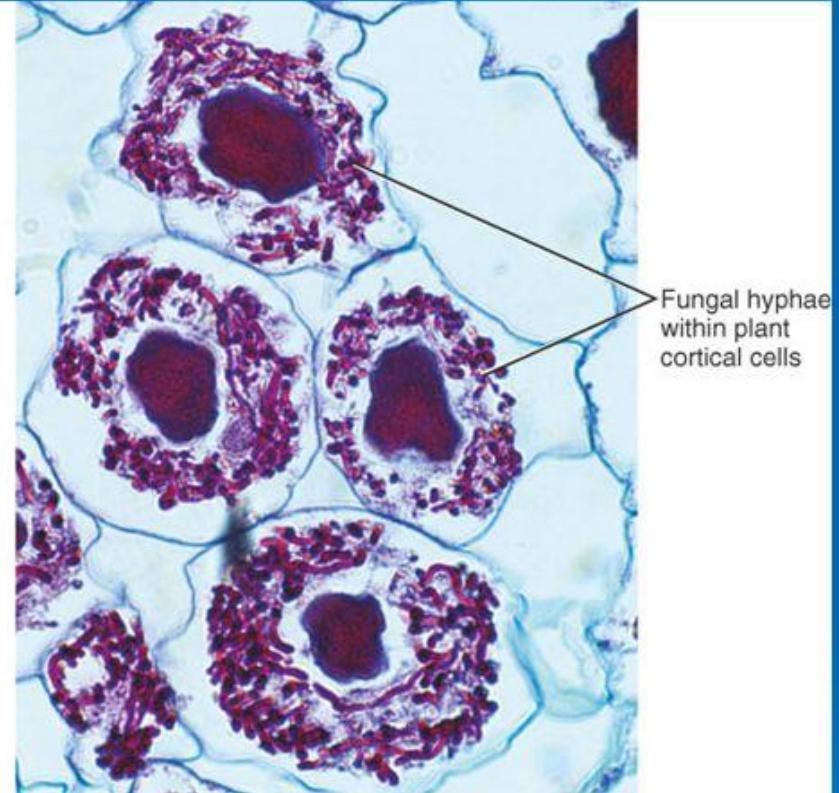
Phylum Basidiomycota

Specimens

Mycorrhizae



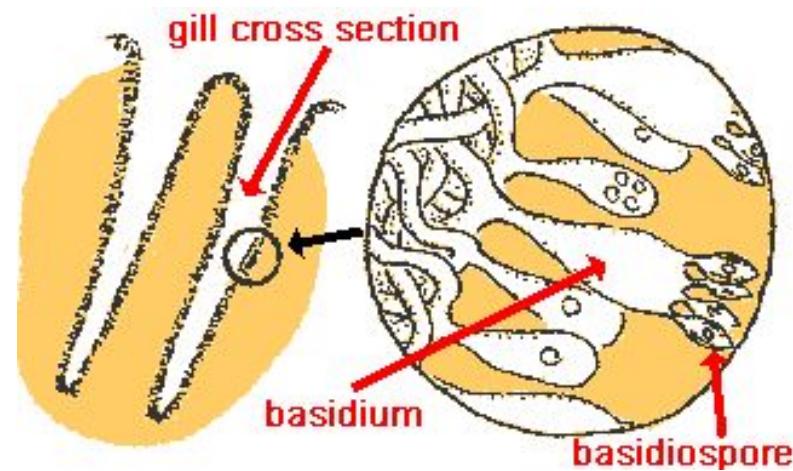
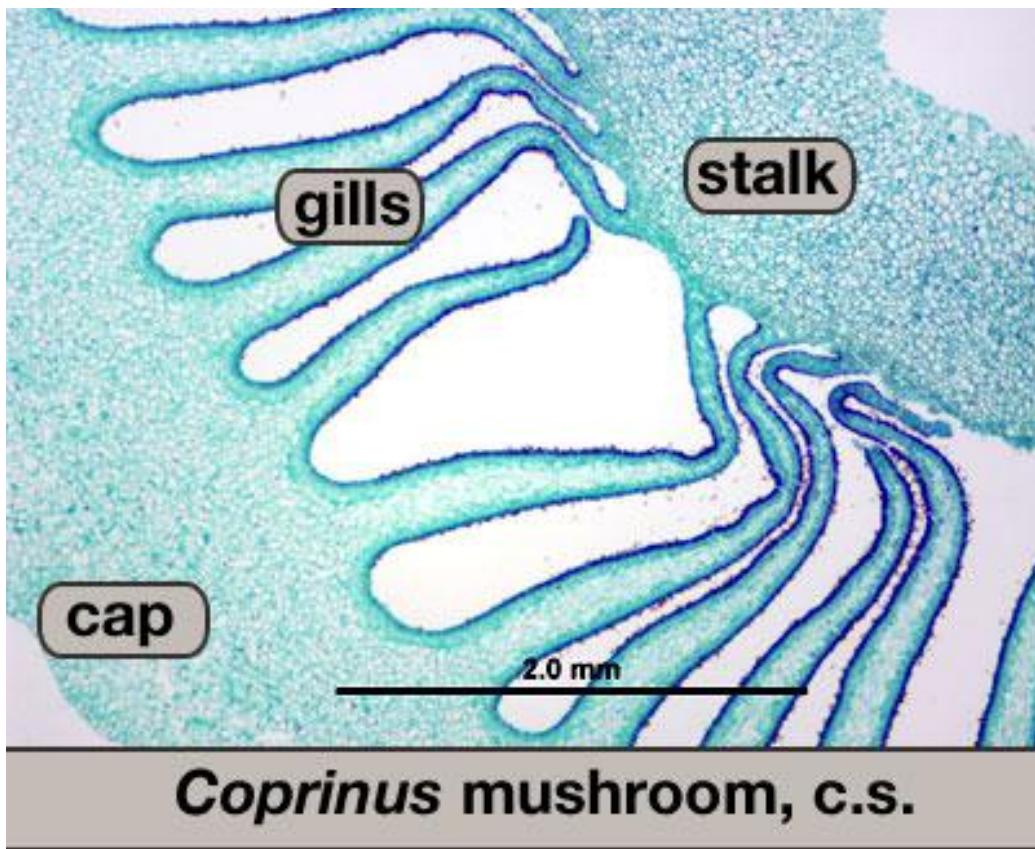
(a) Cross section of root showing ectomycorrhizae, fungal associations that form a sheath around the root. The fungal hyphae penetrate the root between cortical cells but do not enter the cells.

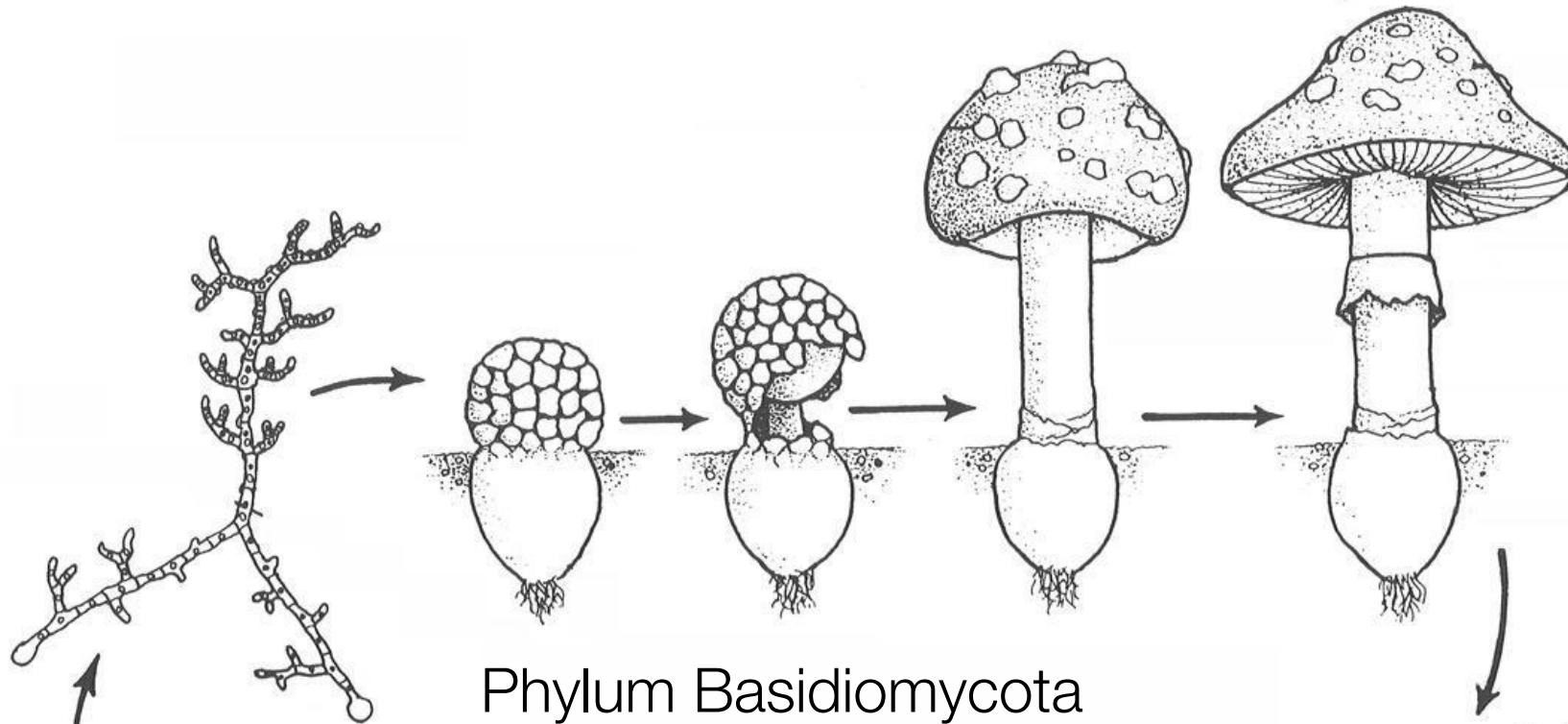


(b) Cells of a root cortex showing endomycorrhizae, fungal associations in which the fungal hyphae penetrate root cells of the cortex to aid in delivering and receiving nutrients. Endomycorrhizae colonize roots of most vascular plant species.

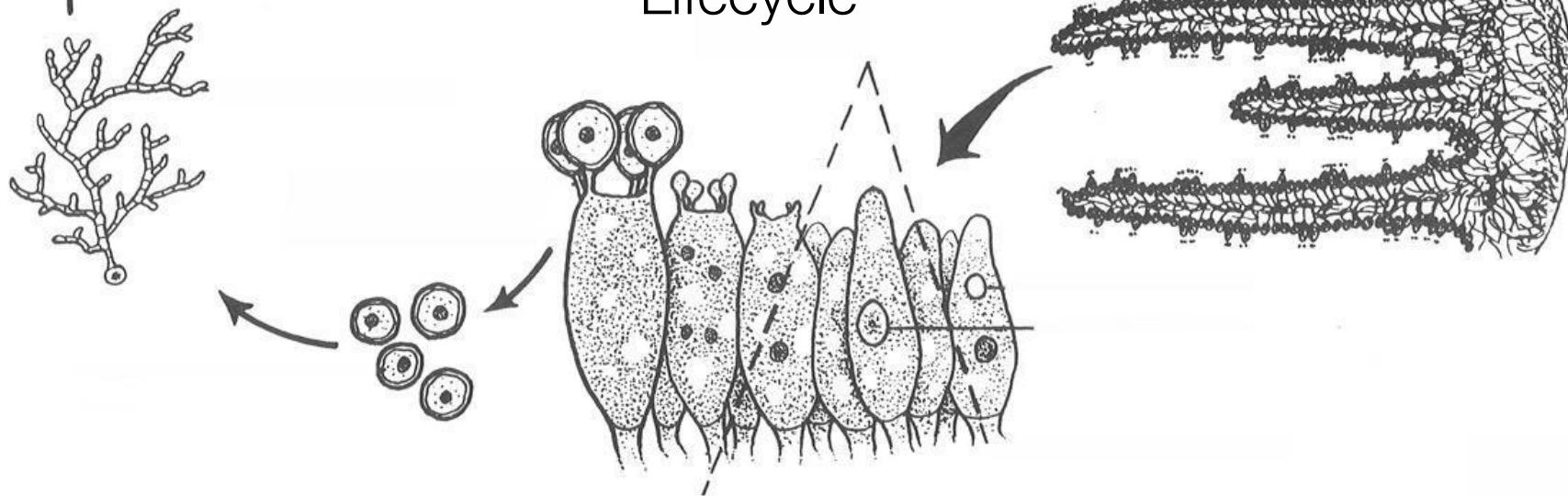
Phylum Basidiomycota

Specimens

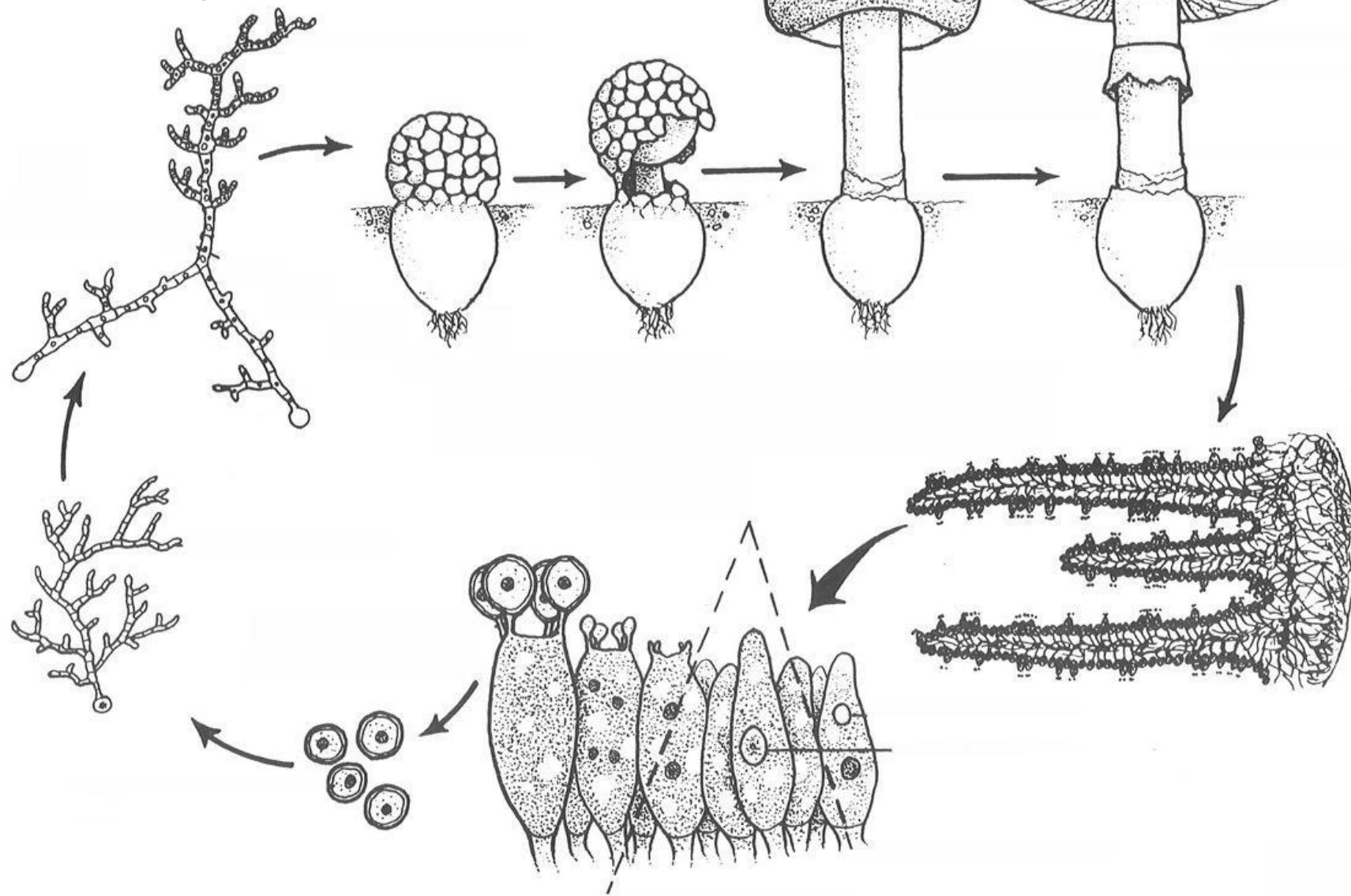




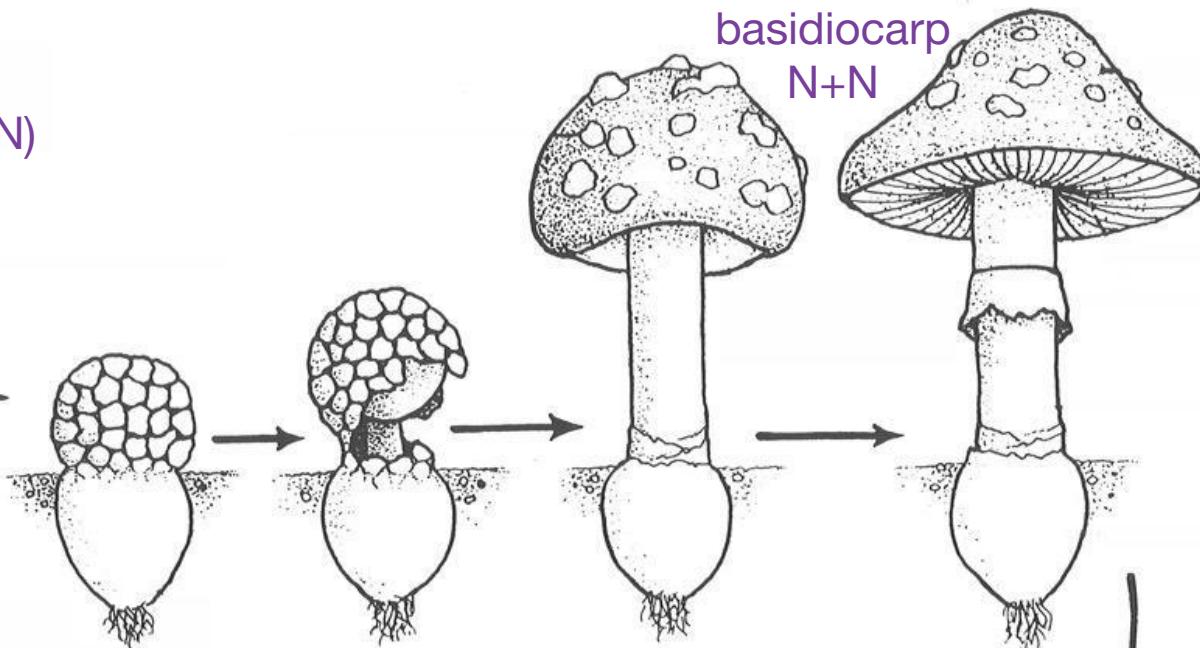
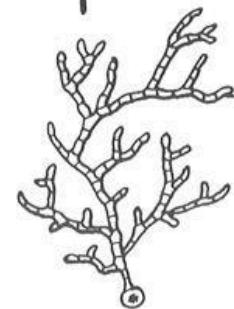
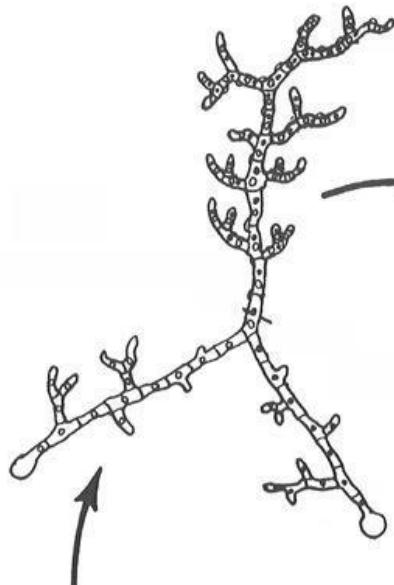
Phylum Basidiomycota Lifecycle



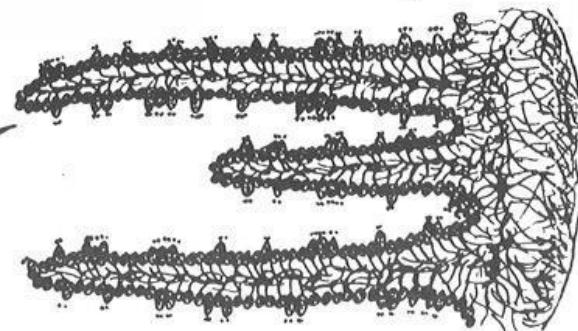
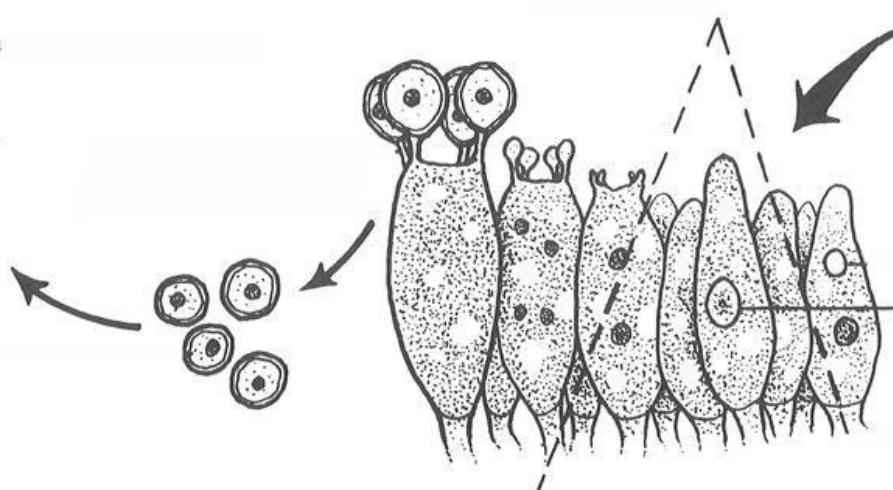
dikaryotic (N+N)
mycelium

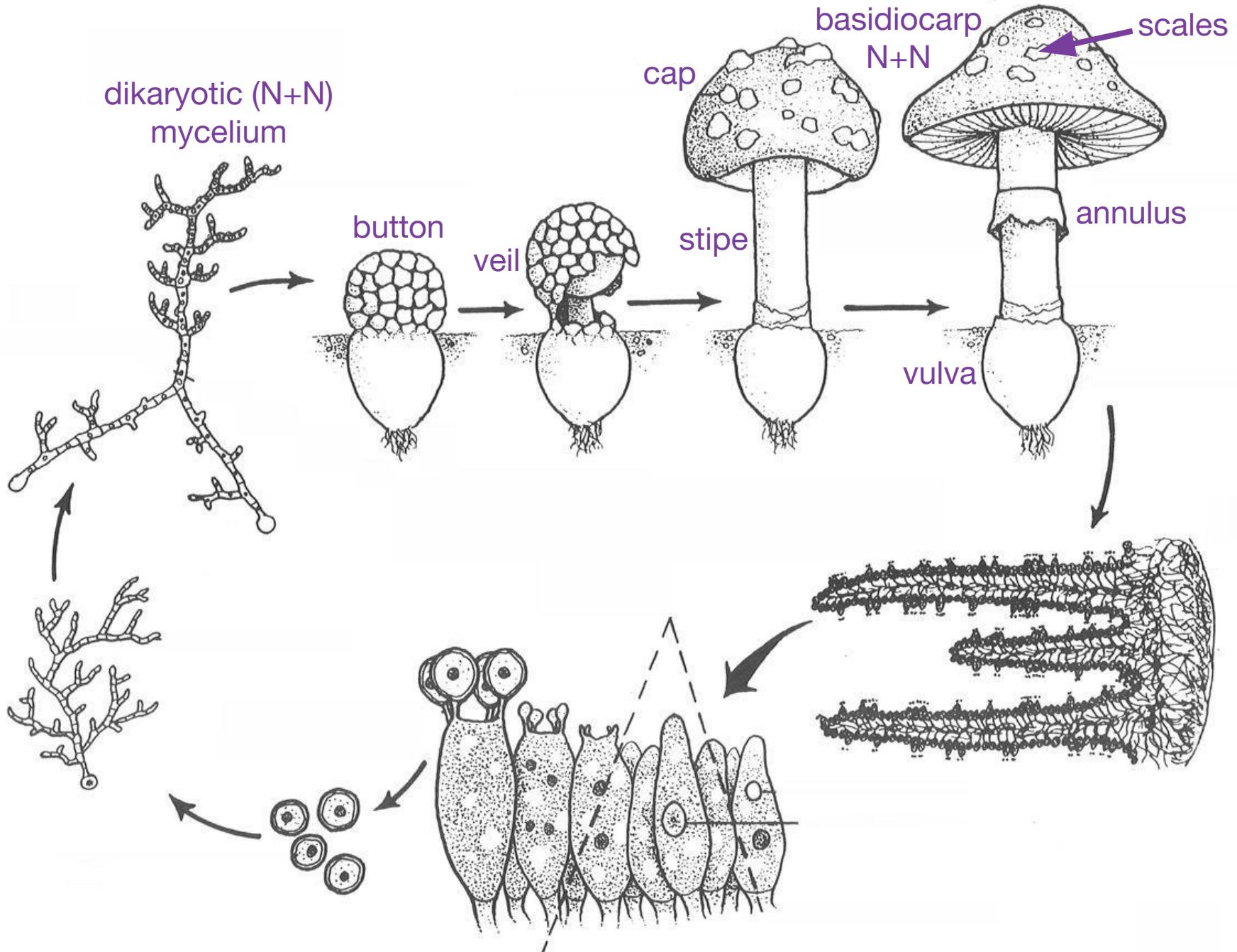


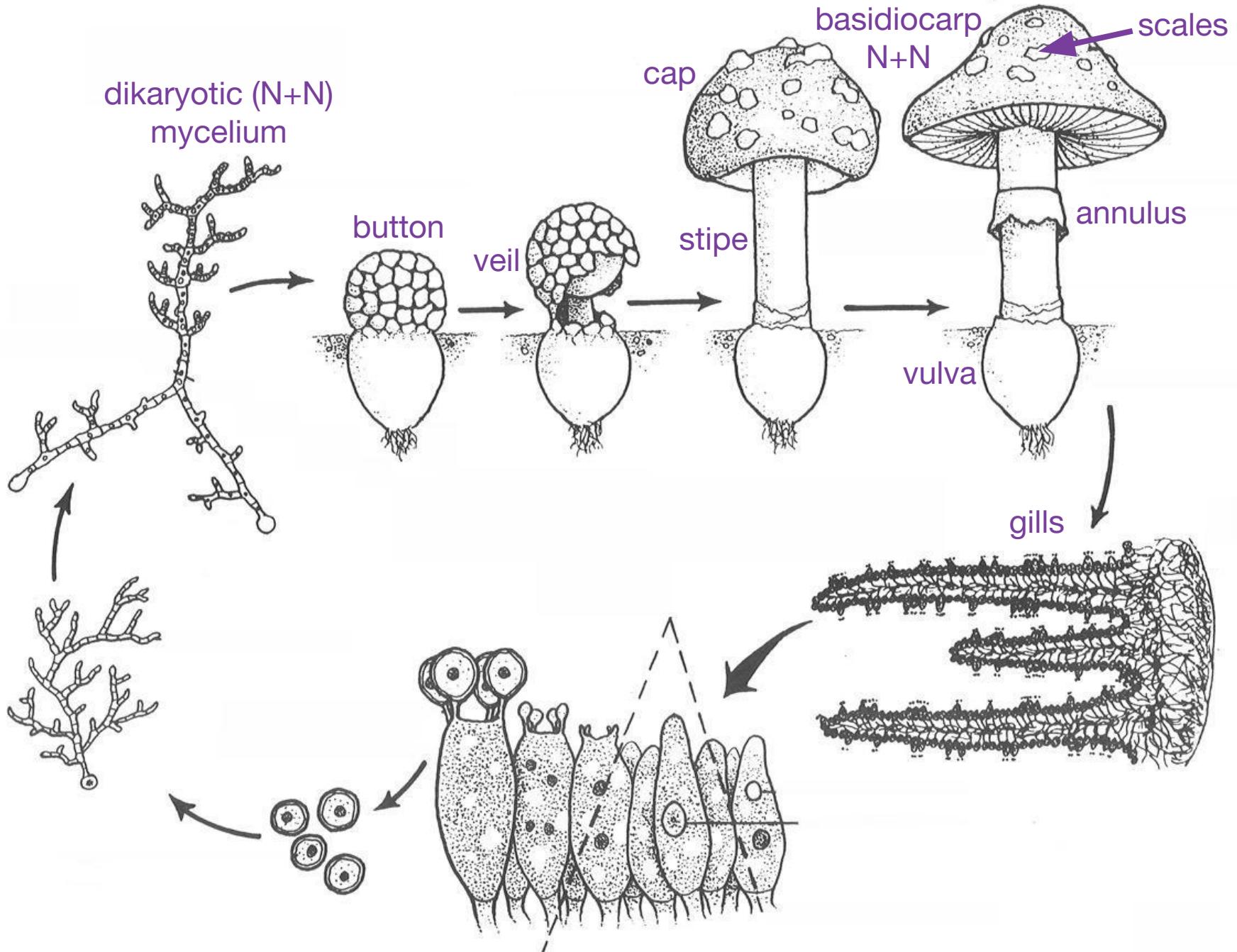
dikaryotic (N+N)
mycelium



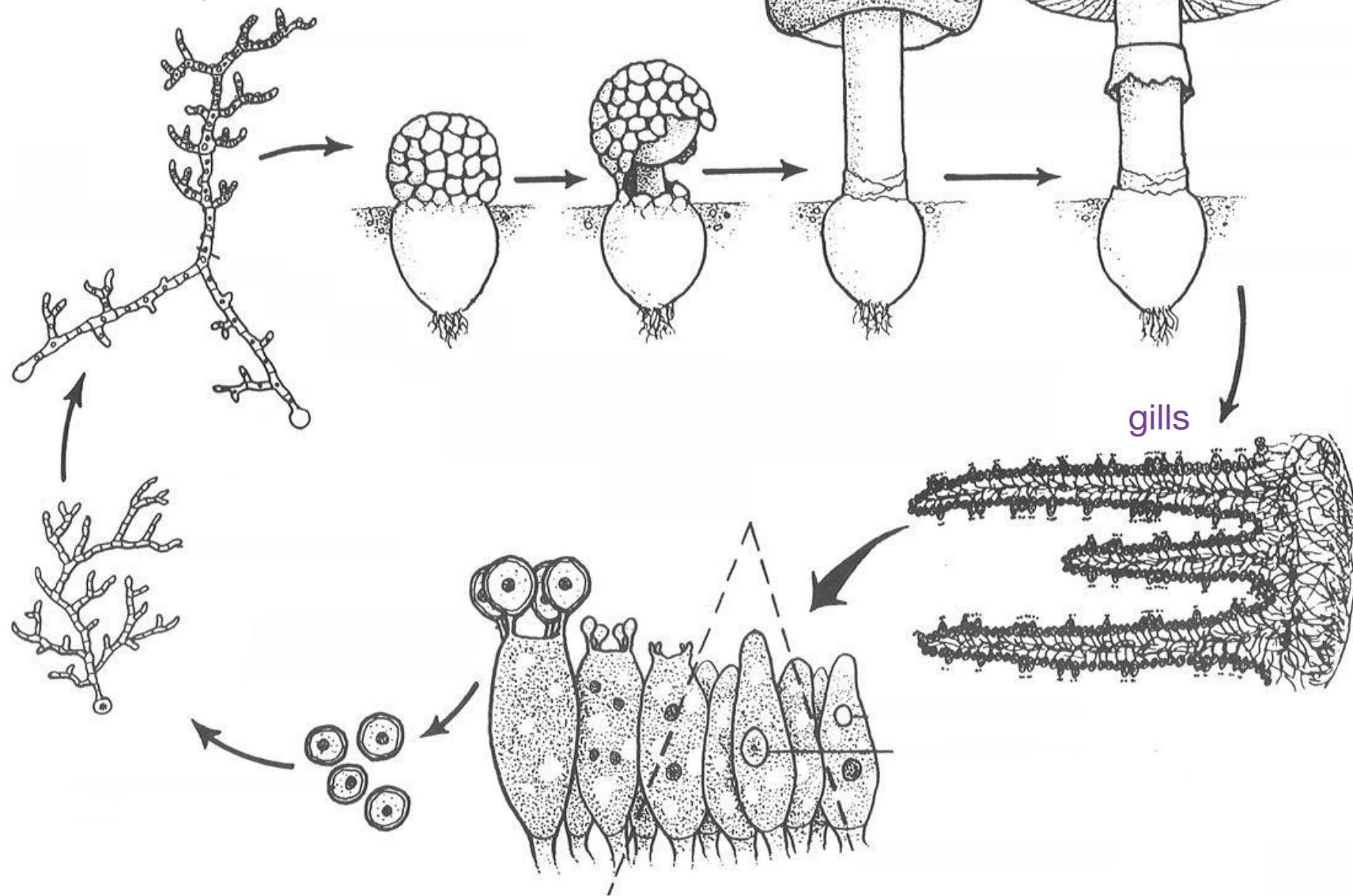
basidiocarp
N+N



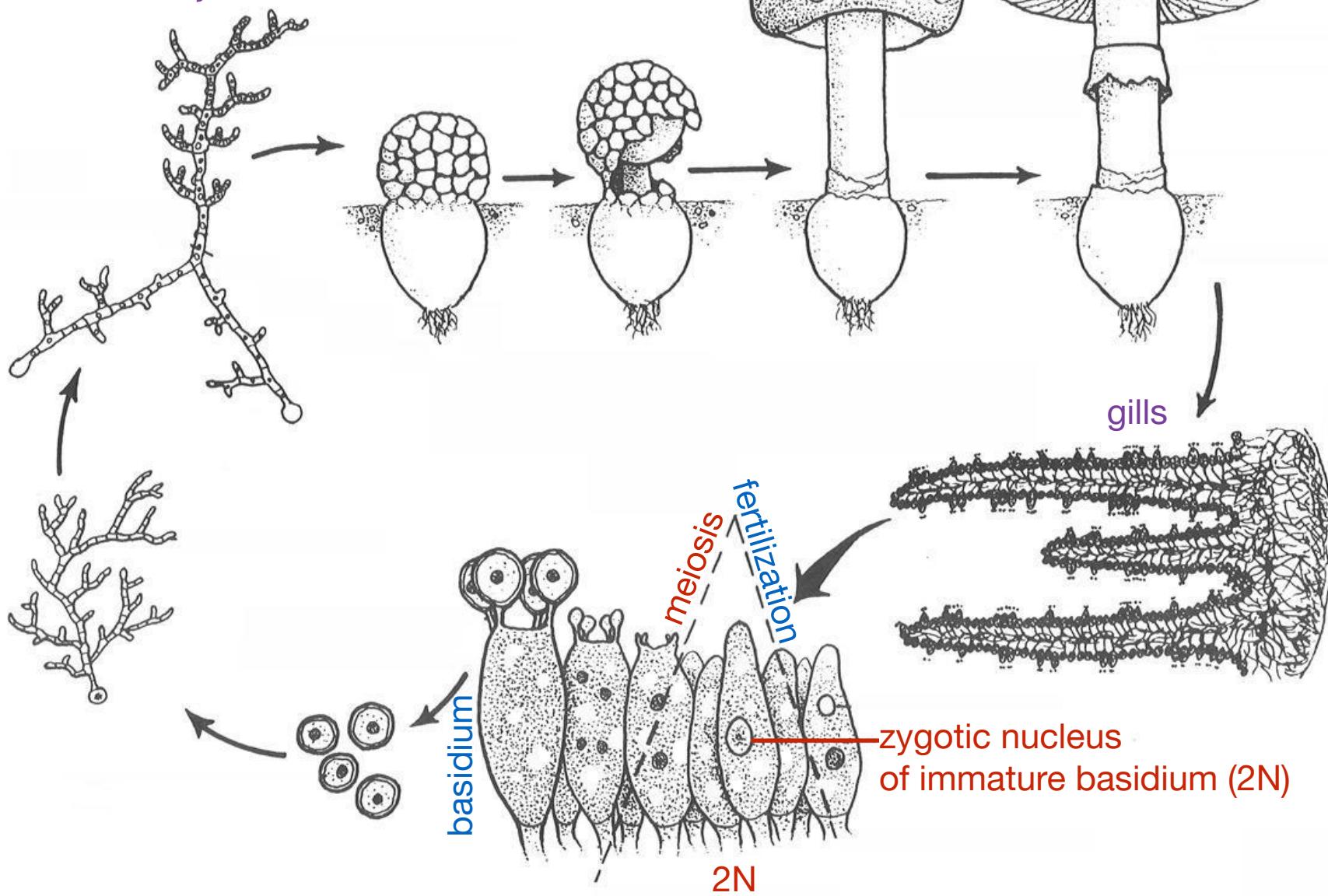




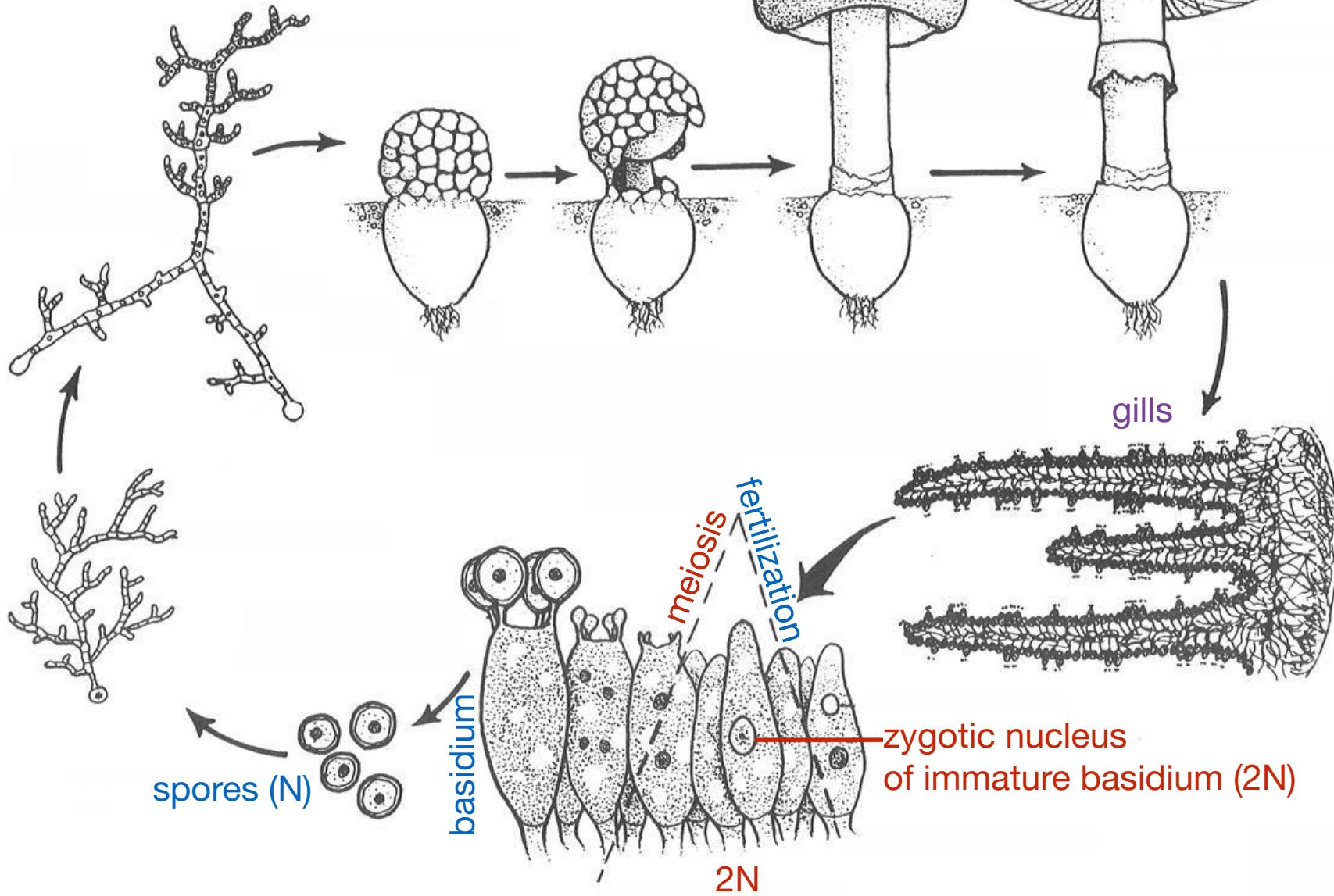
dikaryotic (N+N)
mycelium



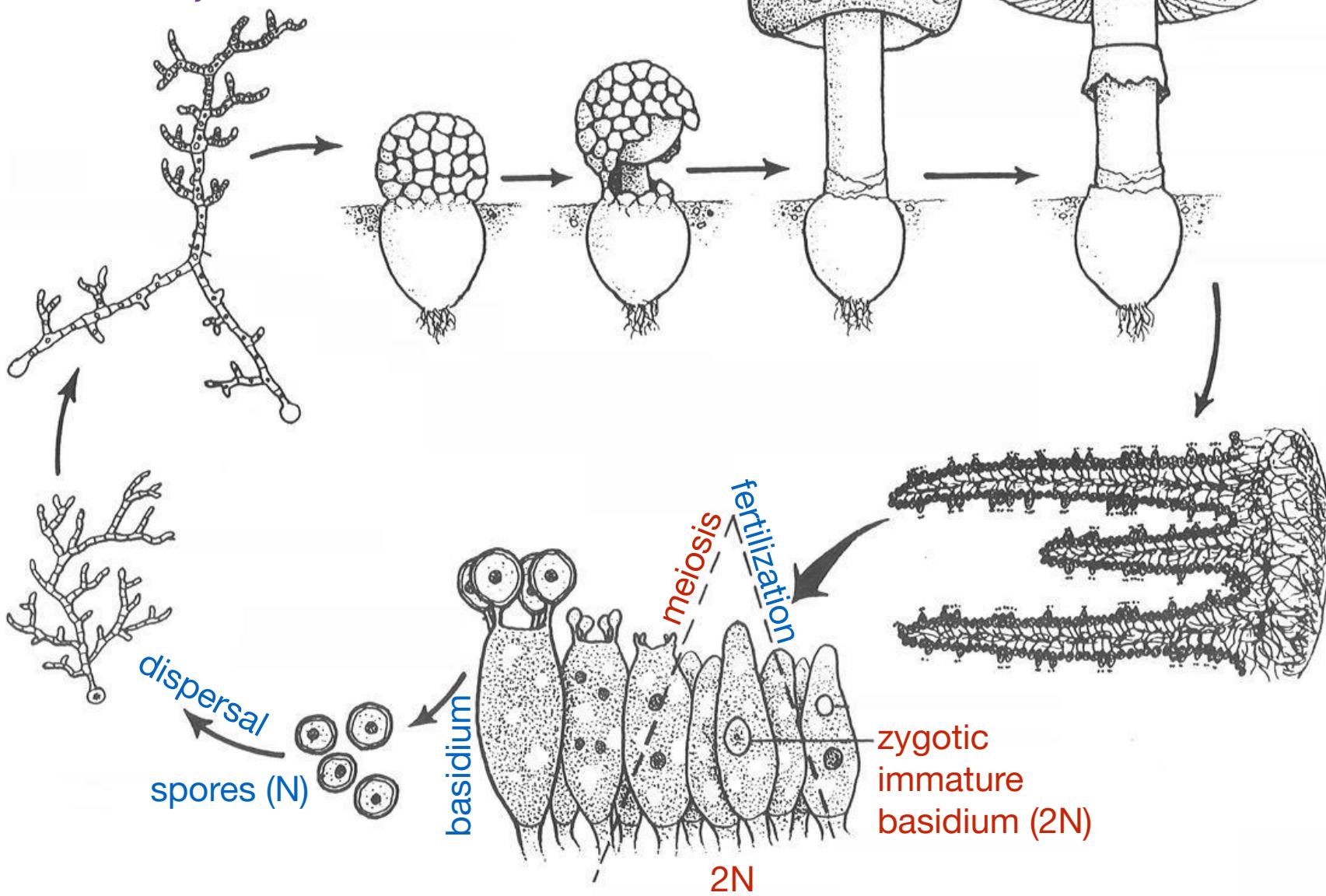
dikaryotic ($N+N$)
mycelium



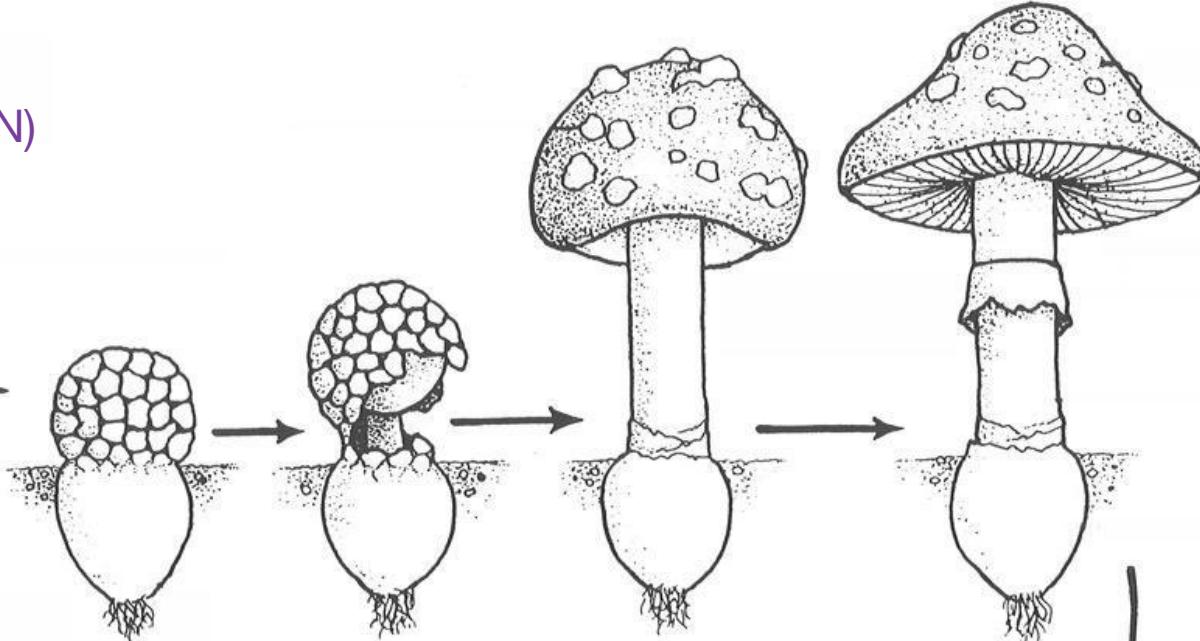
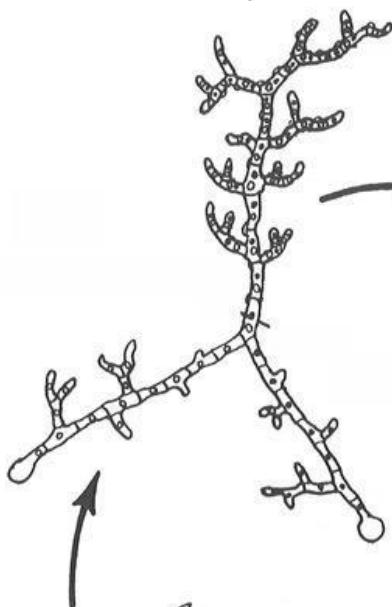
dikaryotic ($N+N$)
mycelium



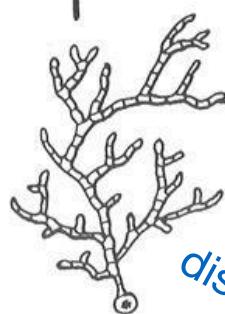
dikaryotic ($N+N$)
mycelium



dikaryotic ($N+N$)
mycelium

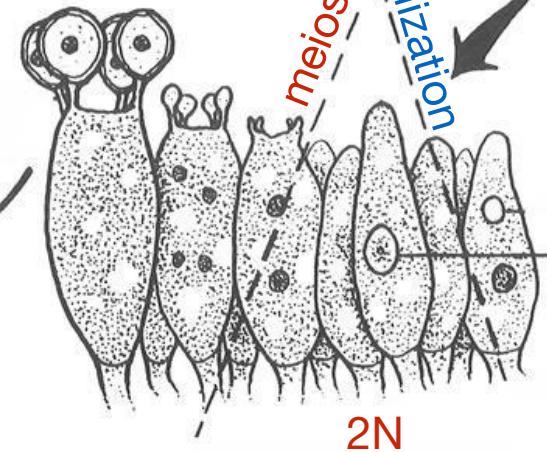


haploid (N)
mycelium

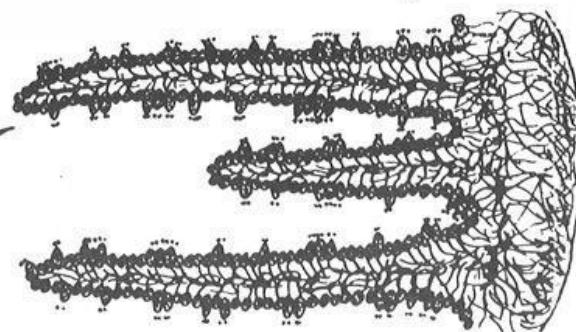


dispersal

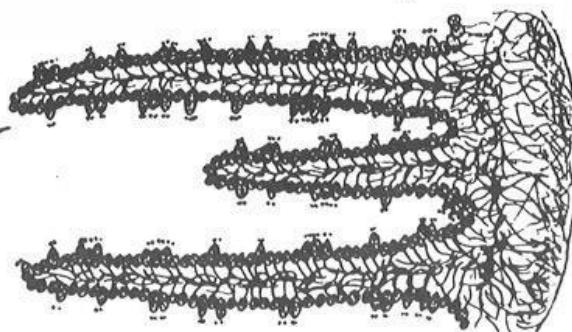
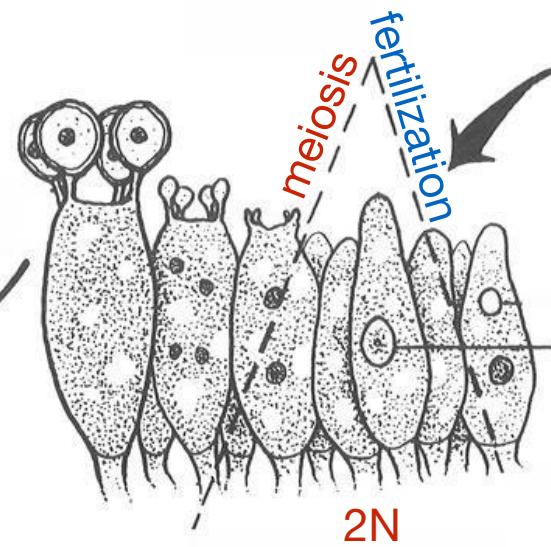
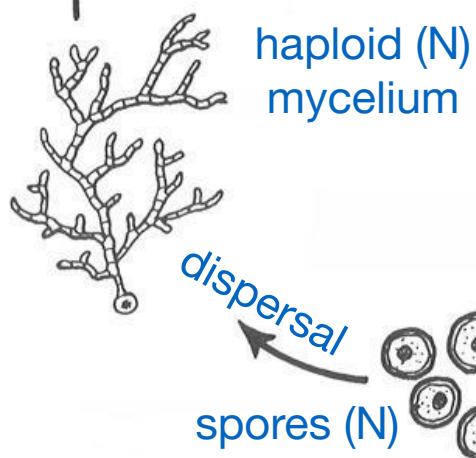
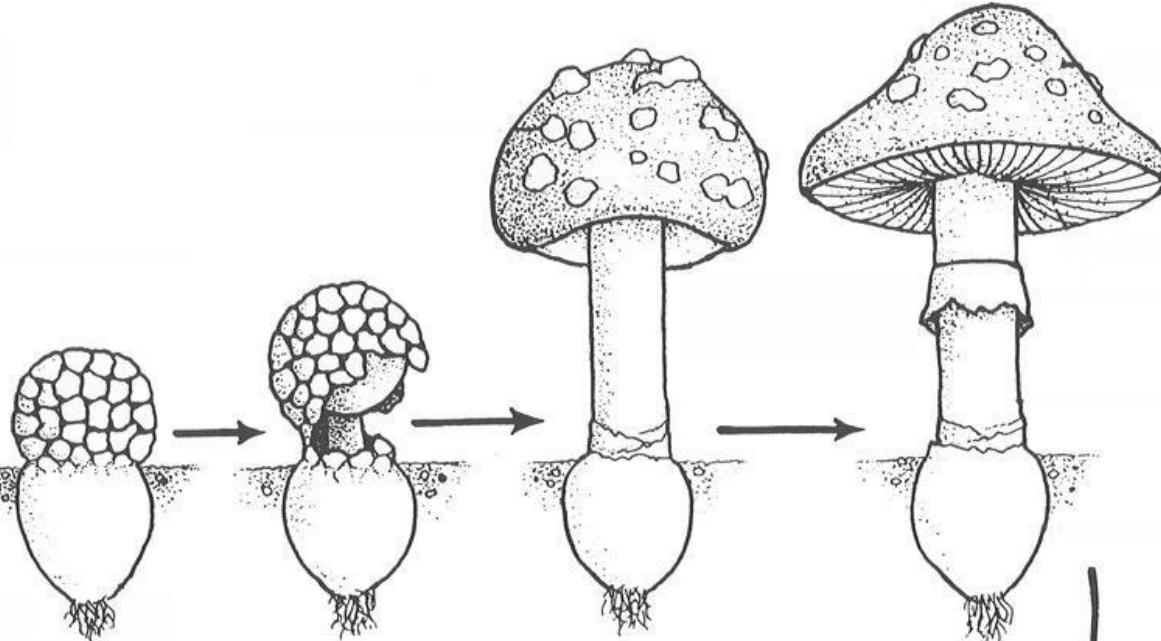
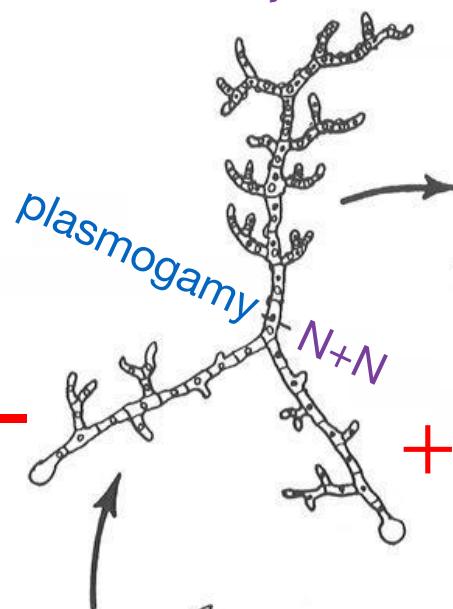
spores (N)

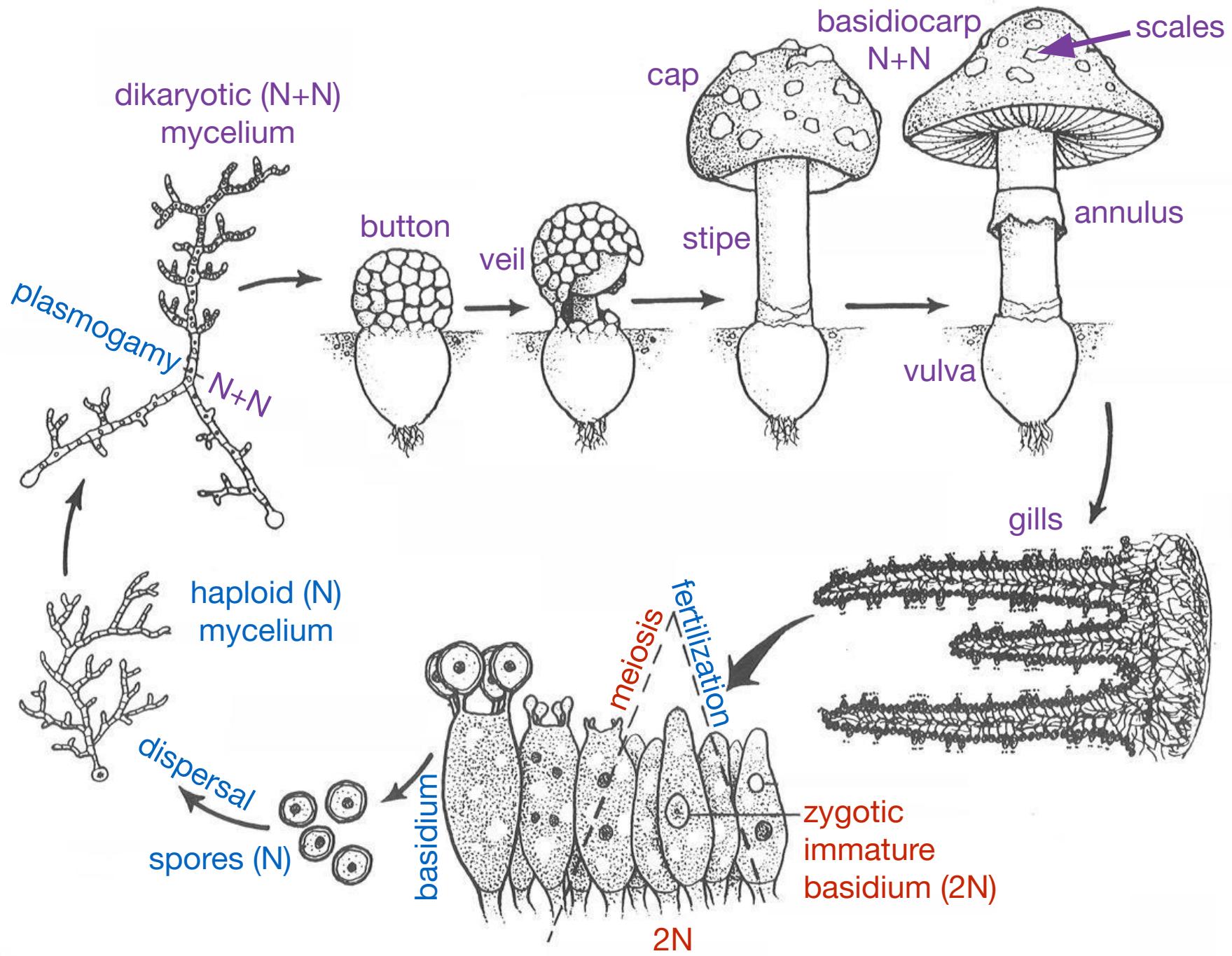


2N



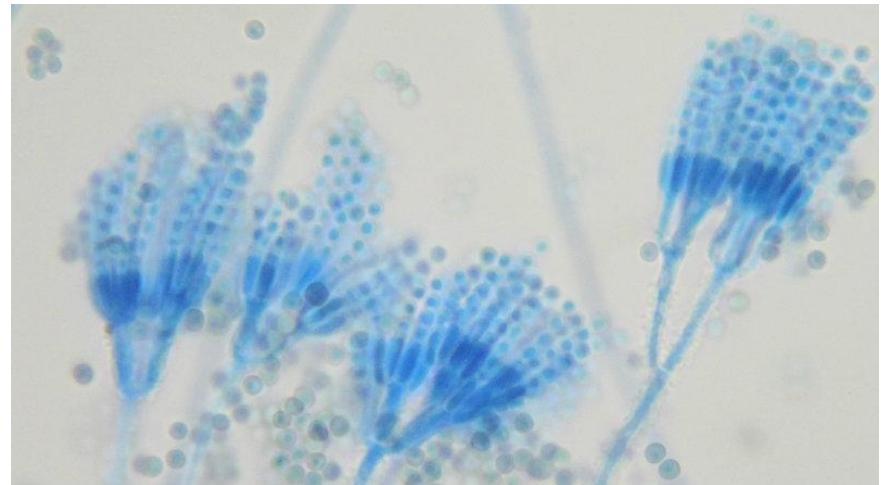
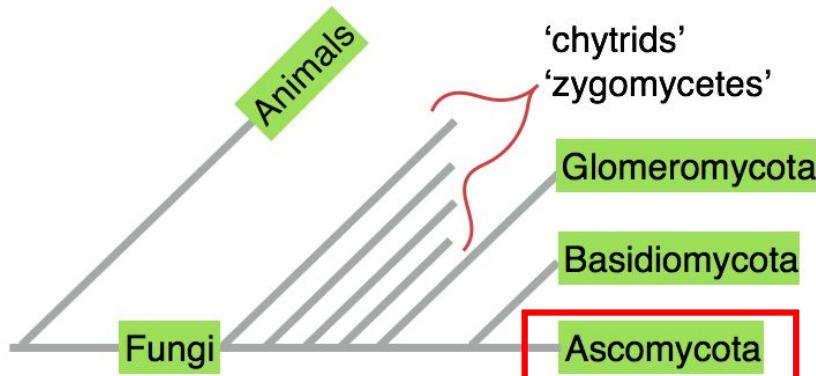
dikaryotic ($N+N$)
mycelium





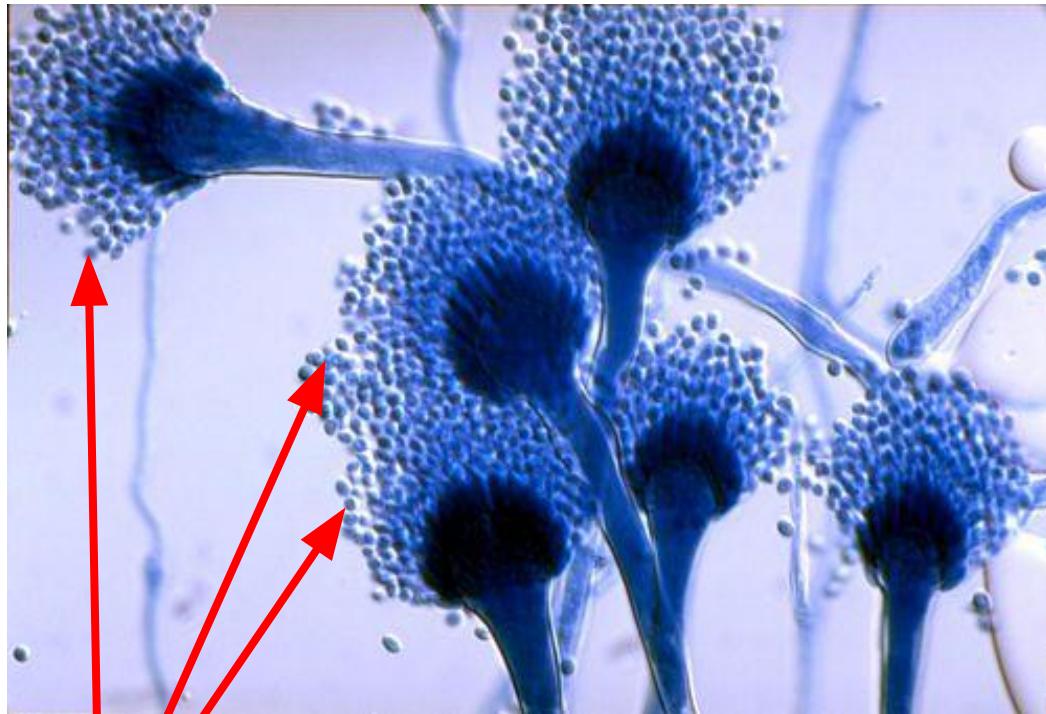
Phylum Ascomycota

- The sac fungi
- Most are colonial
- Some are unicellular
- Sexual reproduction through ascospores
- Asexual spores: Conidia
- Ex. *Penicillium*, *Aspergillus*, *Sarcoscypha*

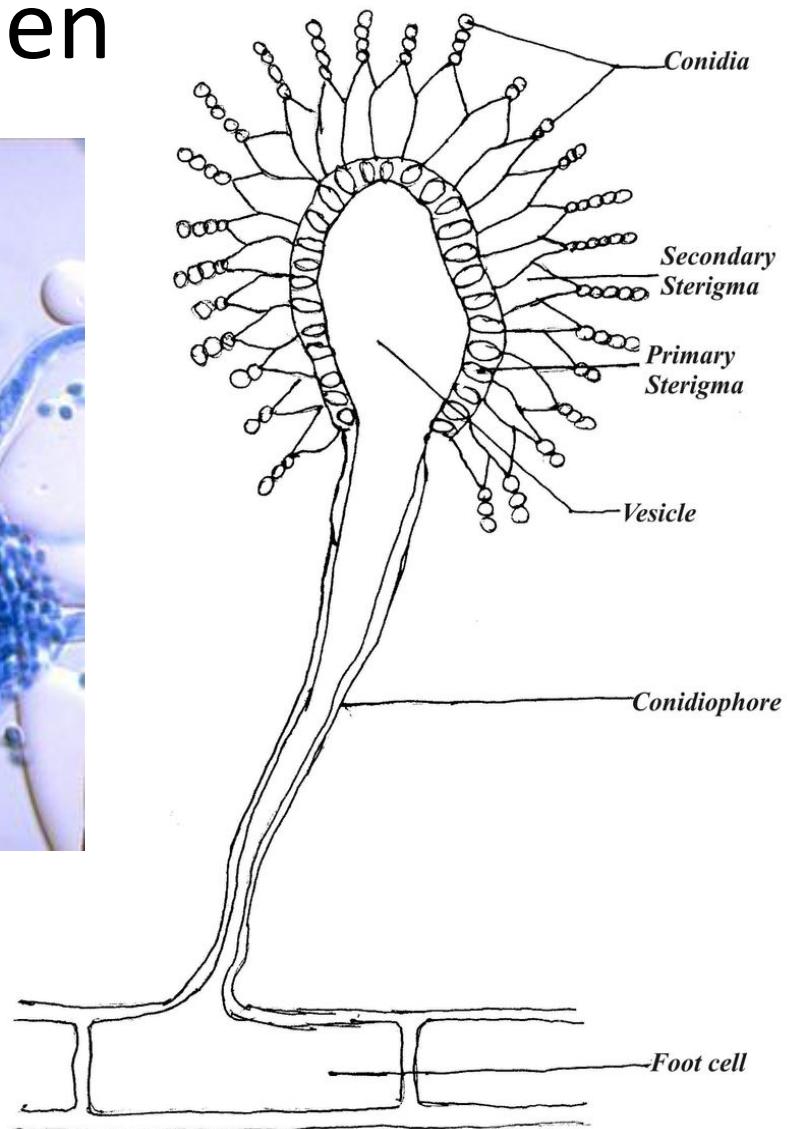


Phylum Ascomycota

Specimen



Aspergillus
Conidia-spores



M = X 40

Zombie bugs

Ophiocordyceps unilateralis parasitizes formicine ants, invading host tissue and controlling the host's nervous system in order to reproduce, ultimately killing the host

How to make a zombie ant



1. INFECTION

A foraging carpenter ant walks through an area of the rainforest floor infested with microscopic spores dropped by a mature fungus. The spore excretes an enzyme that eats through the ant's exterior shell.



2. DEATH GRIP

After two days, the ant leaves its tree colony and climbs down to a spot where humidity and temperature are optimal for the fungus to grow. The ant crawls onto a stem or the underside of a leaf and bites into its main middle vein so it won't fall. Then it dies.



3. FUNGAL GROWTH

The fungus consumes the ant's internal organs, using its shell as a protective casing. The fungus' main stem, called a stroma, erupts from the back of the ant's head and bites into its main middle vein so it won't fall. Then it dies.



4. "KILLING ZONE"

The mature fungus releases spores from its stroma. The spores fall to the ground, creating a 10-square-feet "killing zone," which will attack new ants.

EMERGENT 150 FEET

CANOPY 100 FEET

ANT COLONY 80 FEET

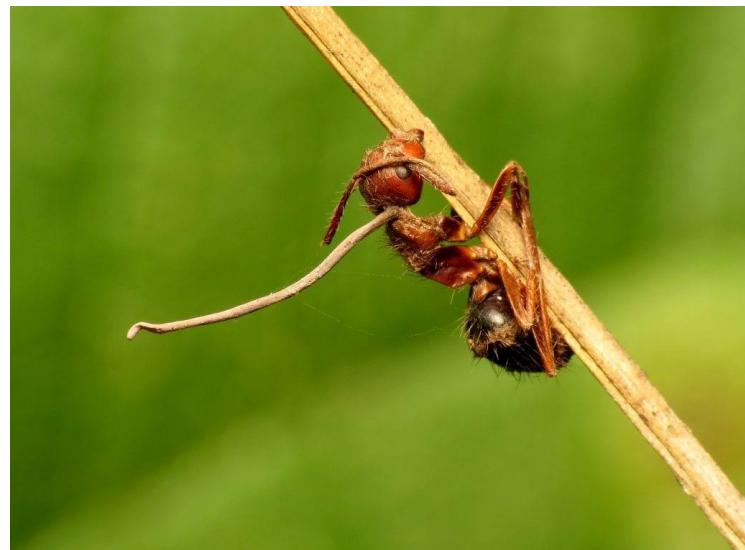
UNDERSTORY 50 FEET

SHRUB 5 FEET

FUNGAL ZONE 1 FOOT

FOREST FLOOR 0 FEET

Source: David P. Hughes,
Harvard University
LISA MERKLIN | DISPATCH



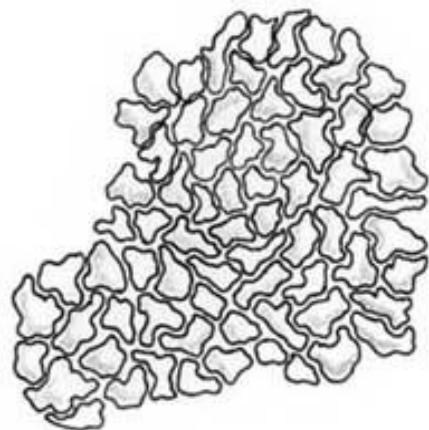
Lichens

- Made of a symbiotic relationship between algae/cyanobacteria and two fungi
- Asexual reproduction through fragmentation
- Biological indicator of air quality

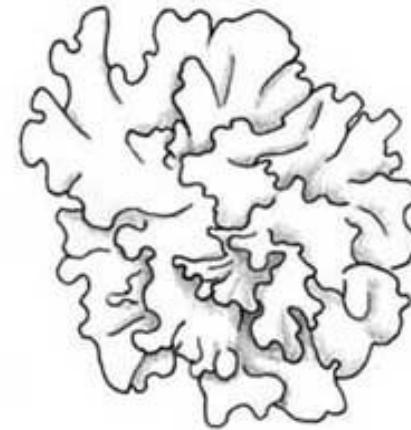


Lichens

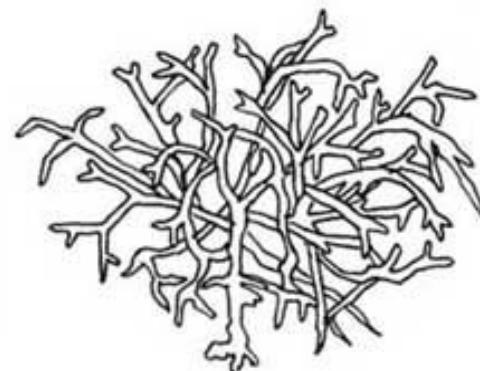
3 morphologies



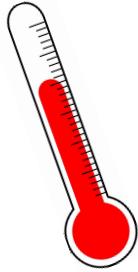
crustose



foliose



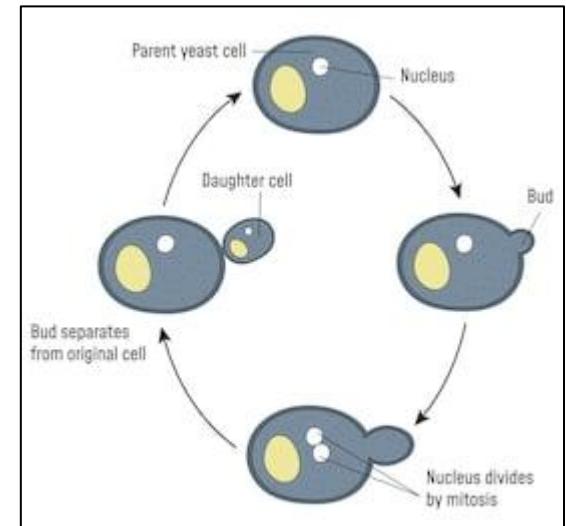
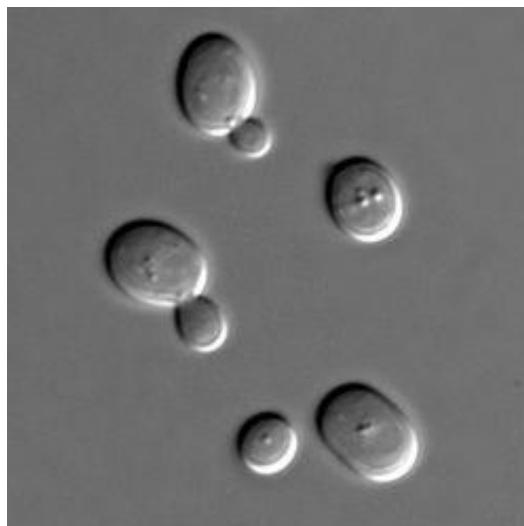
fruticose



Yeast experiment!

How does temperature affect reproduction of yeast cells?

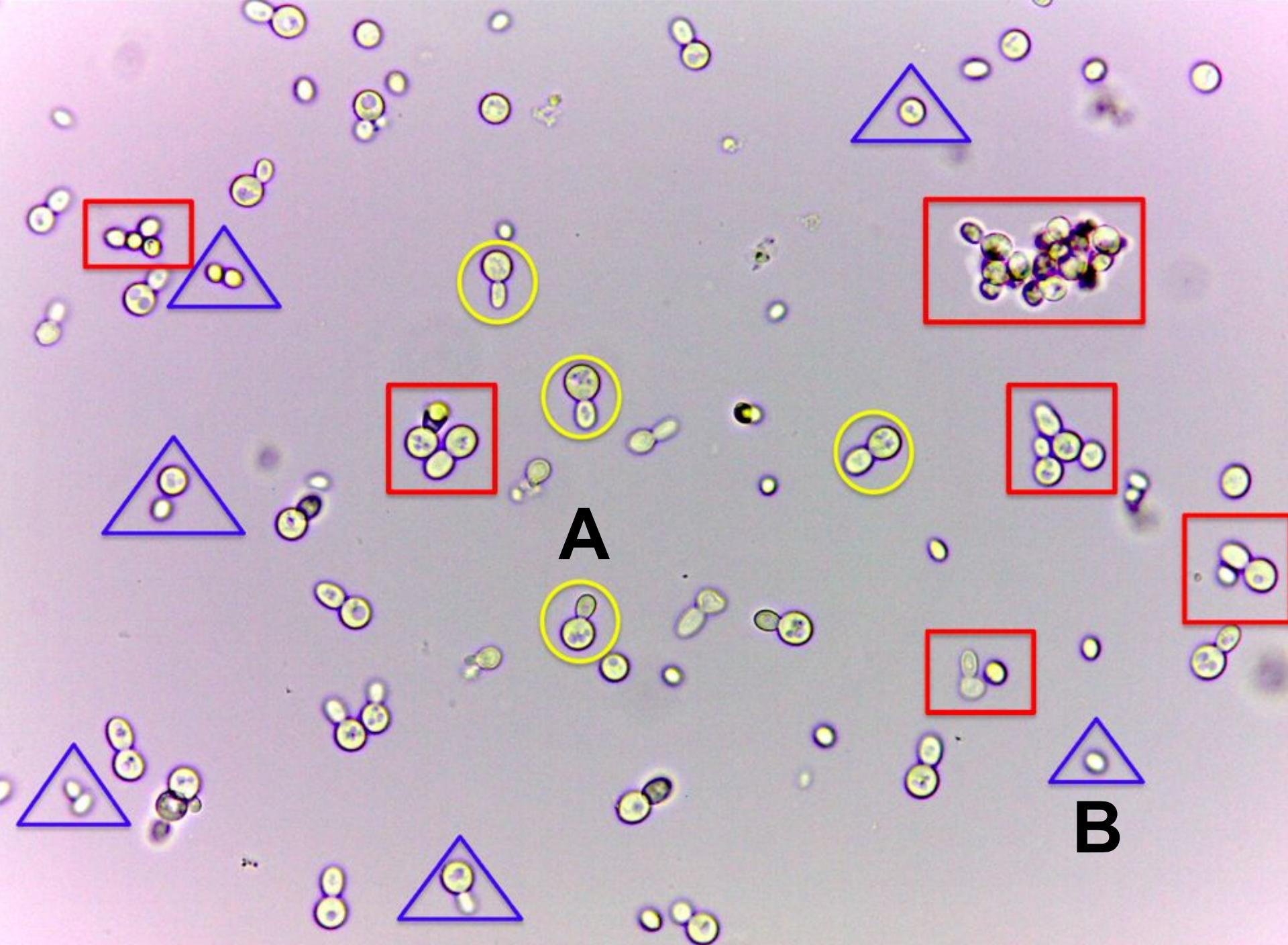
Yeast reproduction: budding



Yeast Experiment

At what temperature does yeast bud best?

- Before starting the lab report, watch the “Yeast budding experiment with Robyn” video on Canvas
- Before you look at the data, what are your hypotheses?
 - “I predict yeast will bud the most at ___°C”
- Data and instructions are on Canvas
- Calculate the percentage of budding
 - Ratio of budding cells to single cells
 - Ex: 10 budding cells out of 100 total cells = $10/100 = 10\%$ budding
- To compare the three treatments, graph the means and associated error bars. Look at assignment details on Canvas for further instruction.



A

B

Specimen List

- ‘Zygomycota’
 - *Rhizopus*
 - Zygospore
- Phylum Basidiomycota
 - Mushroom anatomy
 - *Coprinopsis* cross section
 - Ectomycorrhizae
- Phylum Ascomycota
 - *Aspergillus* conidia
- Lichen morphology: Crustose, foliose, fruiticose



Thanks for watching!

