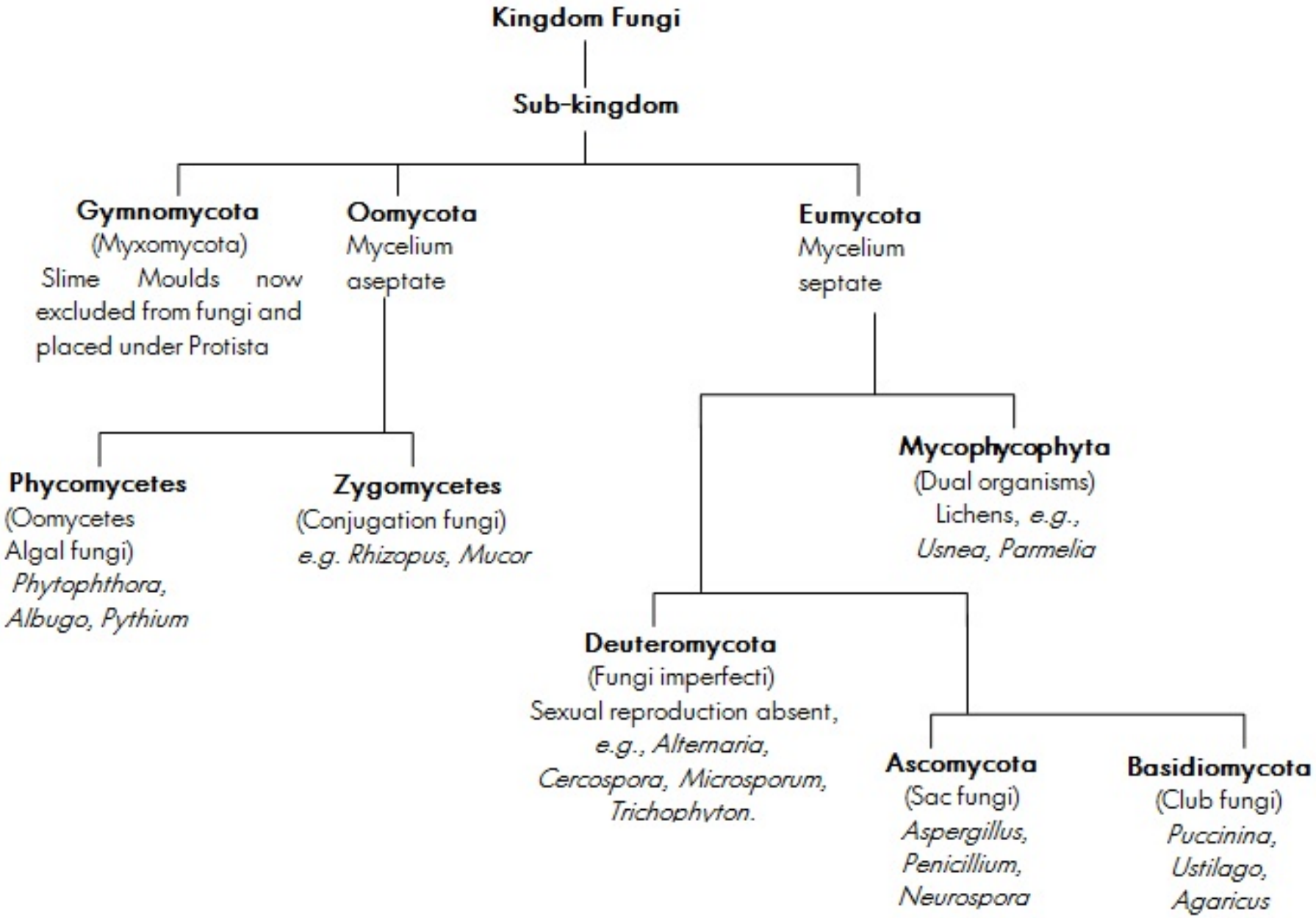
# Lezione 43
# Fungi

## Chytridiomycetes
## Zygomycetes
## Basidiomycetes

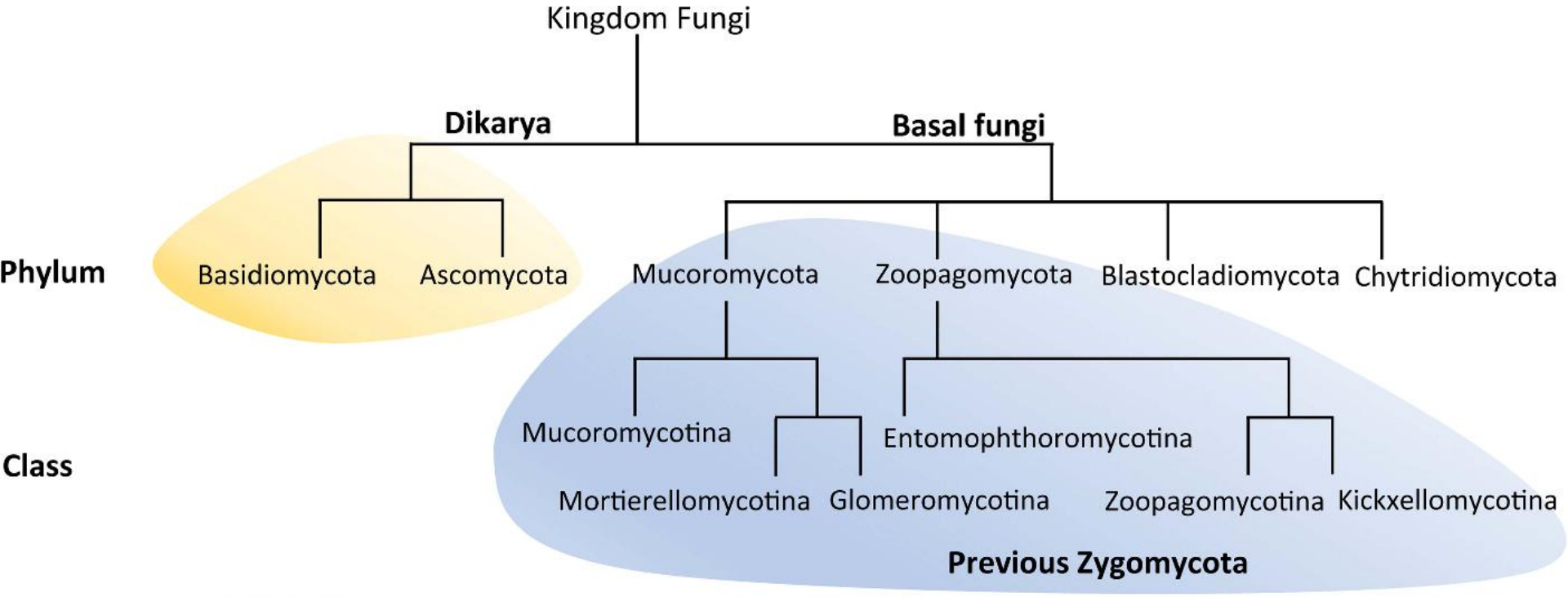
A few years ago….



The **Kingdom FUNGI**:
Systematic organization based on genome sequencing into **6 phyla** (James et al., 2020):

**Ascomycota, Basidiomycota** (Dikarya)

**Zygomycota, Glomeromycota, Blastocladiomycota, Chytridiomycota**



# Organization of „Fungi“

- ***Unikonta (inkl. Opisthokonta)***

  **Fungi = Eumyceten** (chitin)

  ≤100.000 described species

  **Cryptomycota**
  **Microsporidia**
  **Chytridiomycota**
  **Zygomycota**
  **Glomeromycota (AMF)**
  **Ascomycota**
  **Basidiomycota**

- ***Chromalveolata (inkl. Chromista = Straminipila)***

  **Oomyceten = Peronosporomycetes** (cellolosa)

  ~1000 described species

  **Oomycota**

- **Myxomycota (Protista)**

# **Fungi** („Chitin fungi“)

- **Chytridiomycota**
  - Holokarpic to eukarpic, planospores (= Zoospores)
- **Zygomycota**
- **Glomeromycota**
- **Ascomycota**
- **Basidiomycota**

*"filamentous fungi"*

# **Fungi** („Chitin fungi“)

- **Chytridiomycota**
  - holokarp bis eukarp, Planosporen (= Zoosporen)
- **Zygomycota**
- **Glomeromycota**
- **Ascomycota**
- **Basidiomycota**

**Dikarya, Eumycetes**
*"filamentous fungi"*

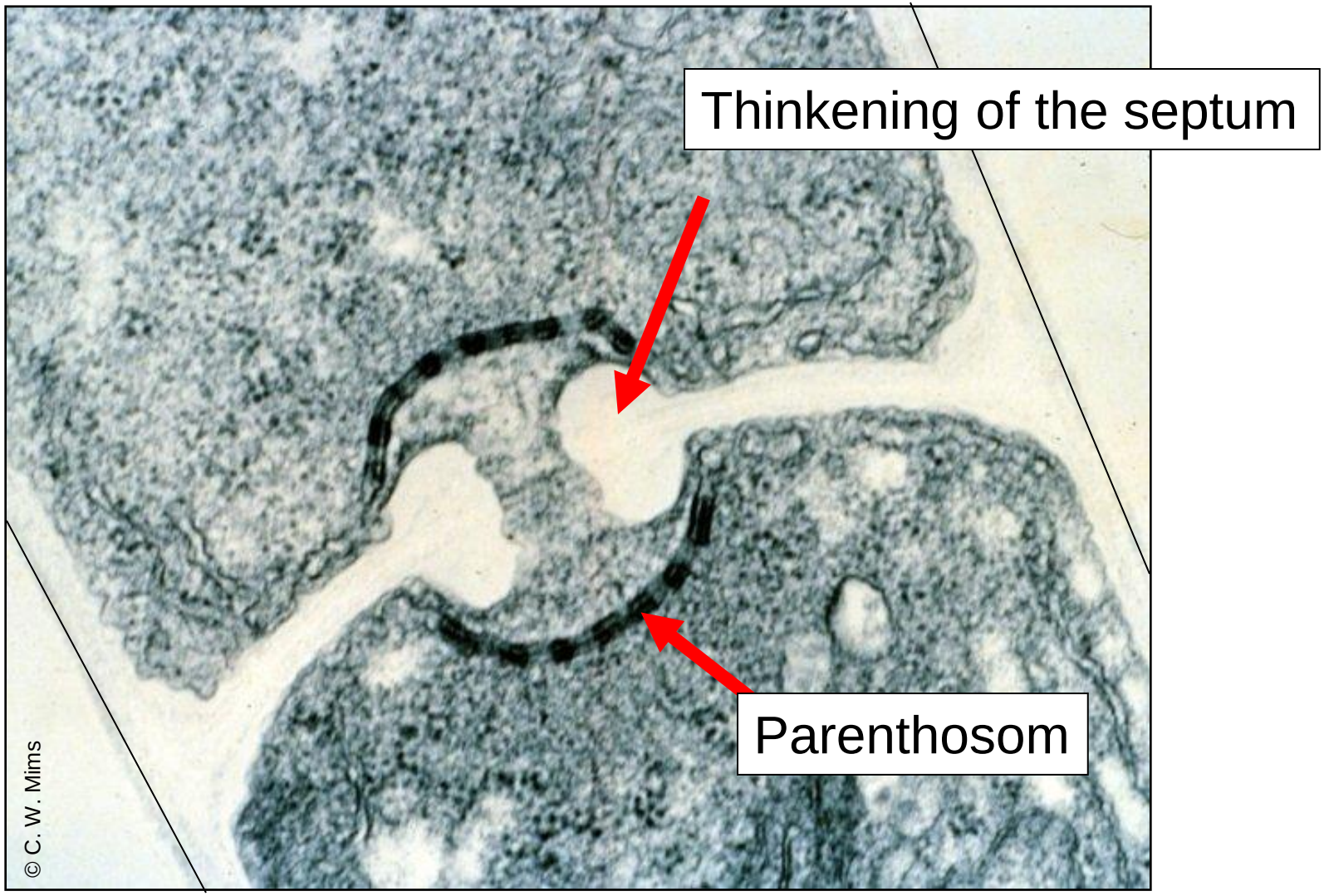
# Fungi: phylum Basidiomycota

# Fungi: Basidiomycota

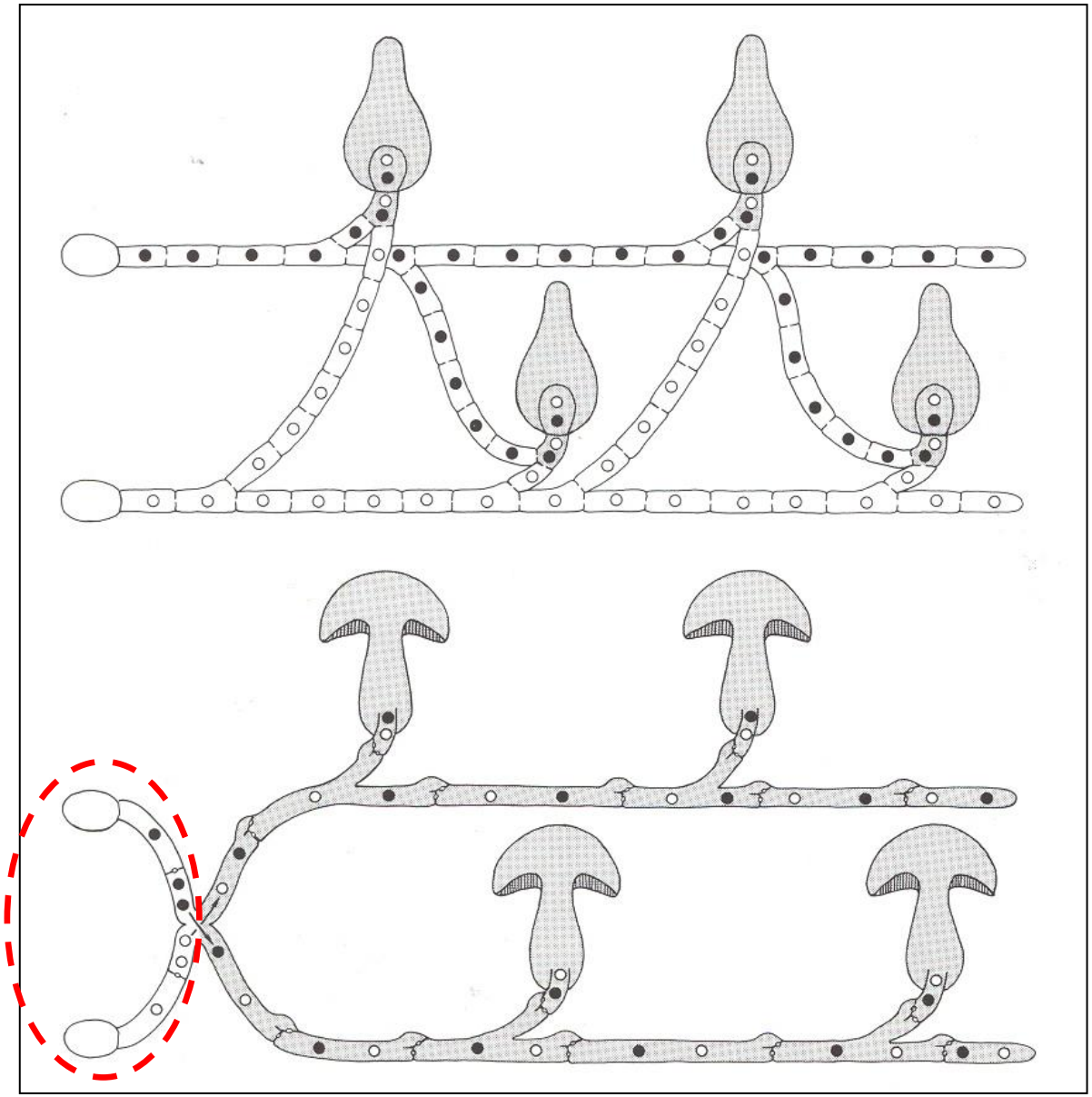
- **Agaricomycotina:**
  mushrooms and jelly fungi, Hefen
- **Ustilaginomycotina:**
  smut fungi, yeasts
- **Pucciniomycotina** (= Urediniomycetes):
  rust fungi, yeast, jelly fungi,




# Basidiomycota, Agaricomycotina: doliporus



# comparison Ascomycota - Basidiomycota



Gametangiogamie:

**1 x P! > D! > K! > M!**

**> 1 (small) fruitbody**

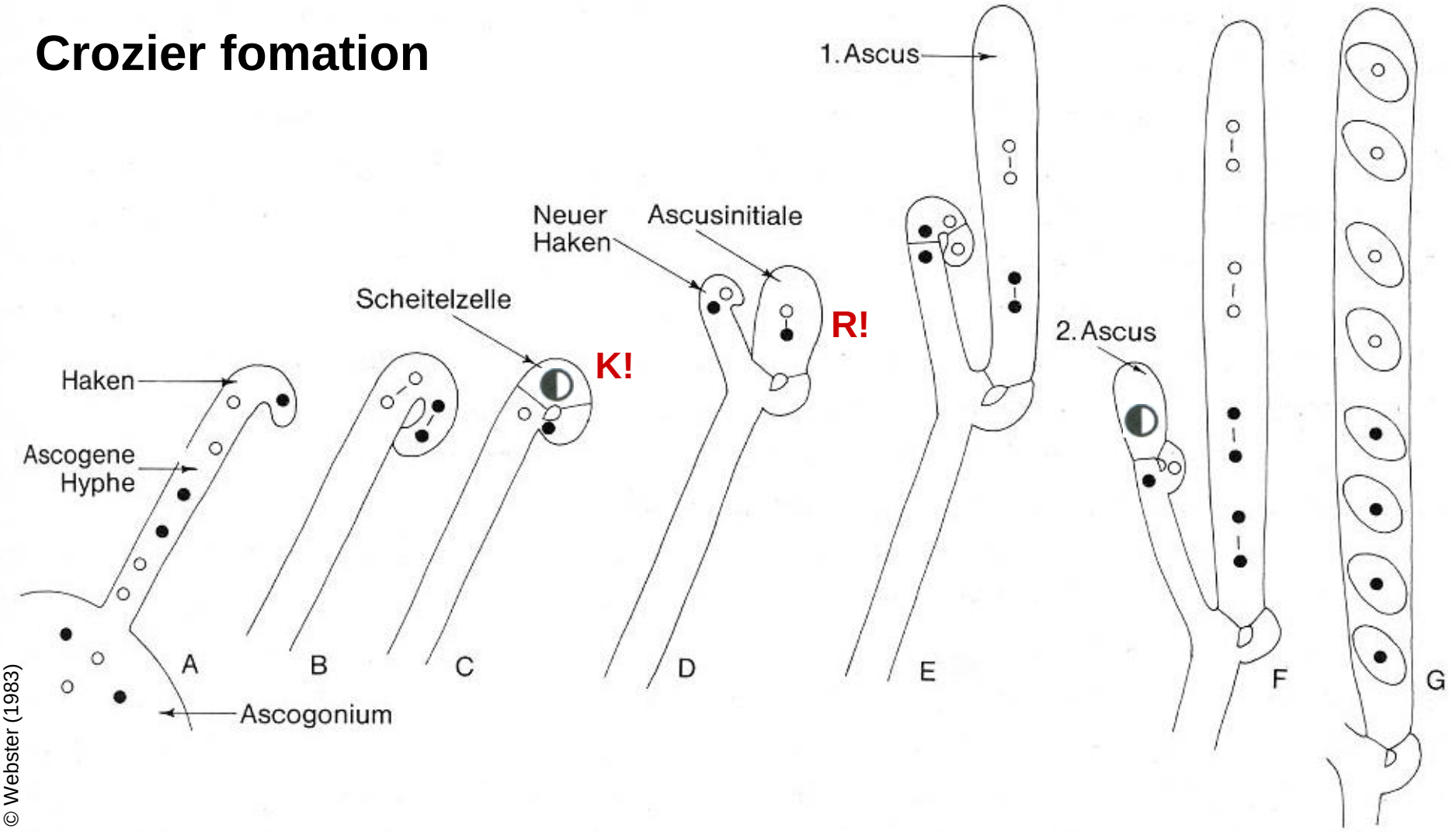
Somatogamie:

**1 x P! > D!**

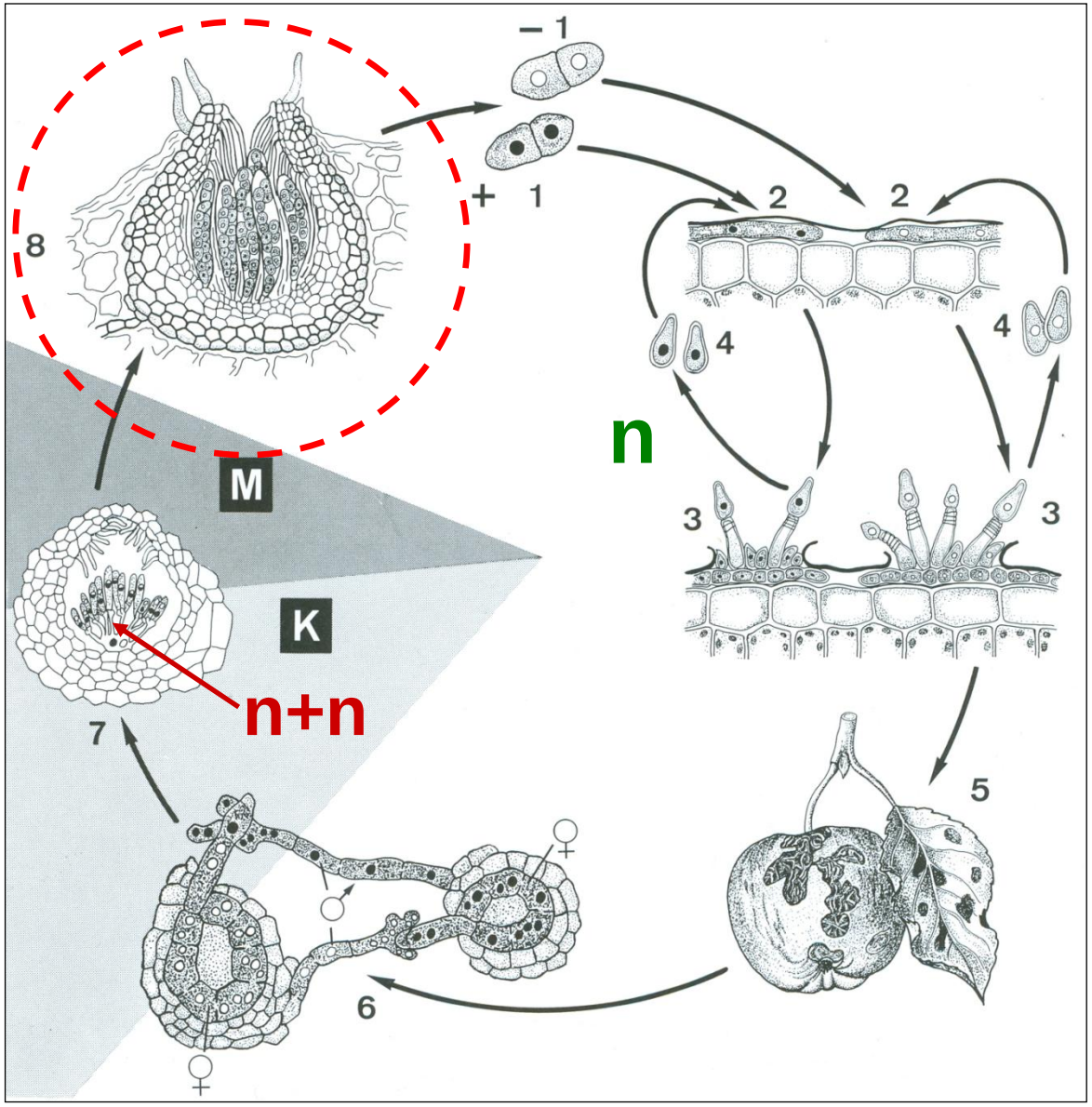
**> ∞ (big) fruitbody**

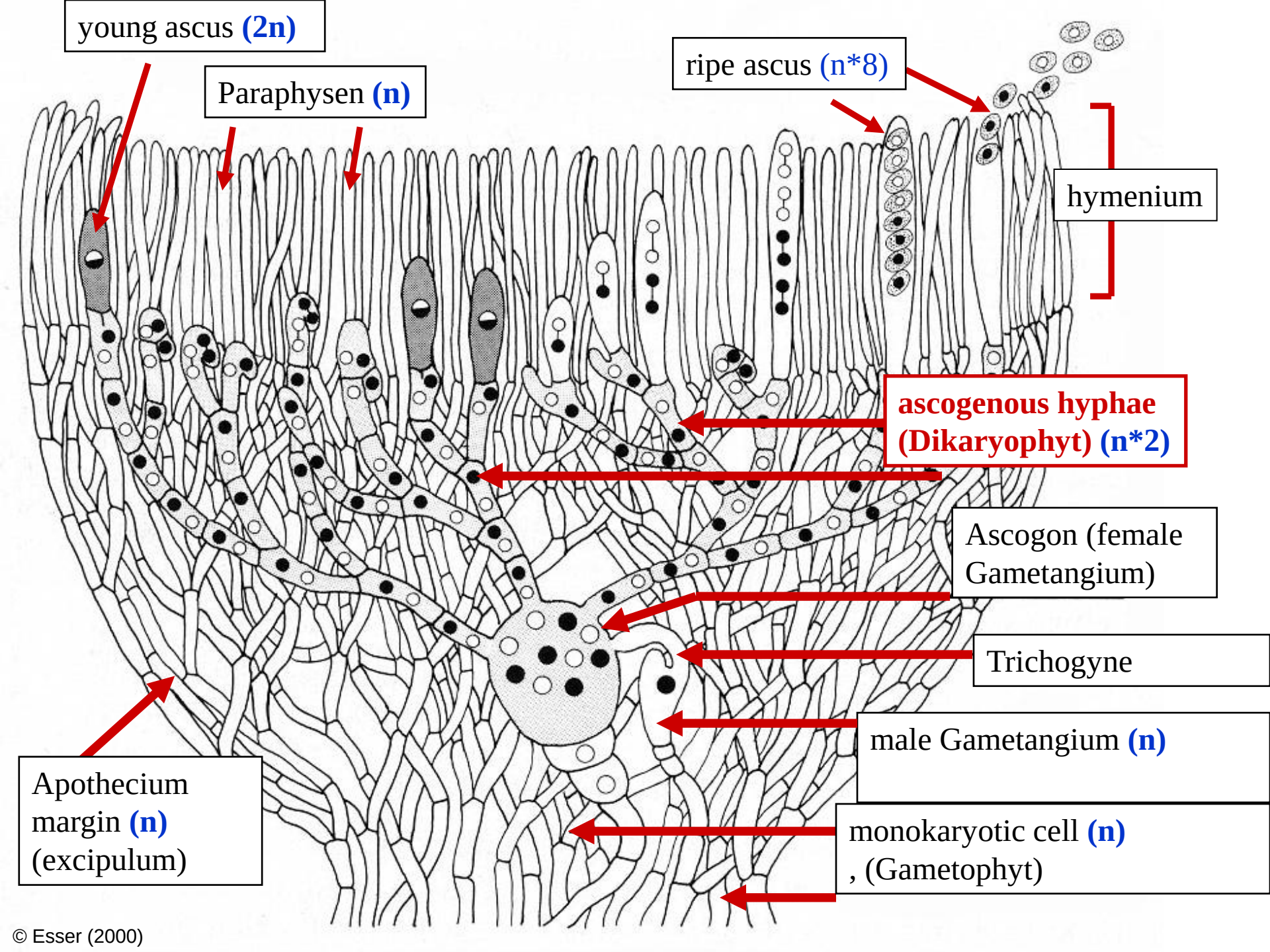
# **ASCOMYCOTA, Pezizomycotina:** dikaryotic generation of ascogenous hyphae

## Crozier fomation



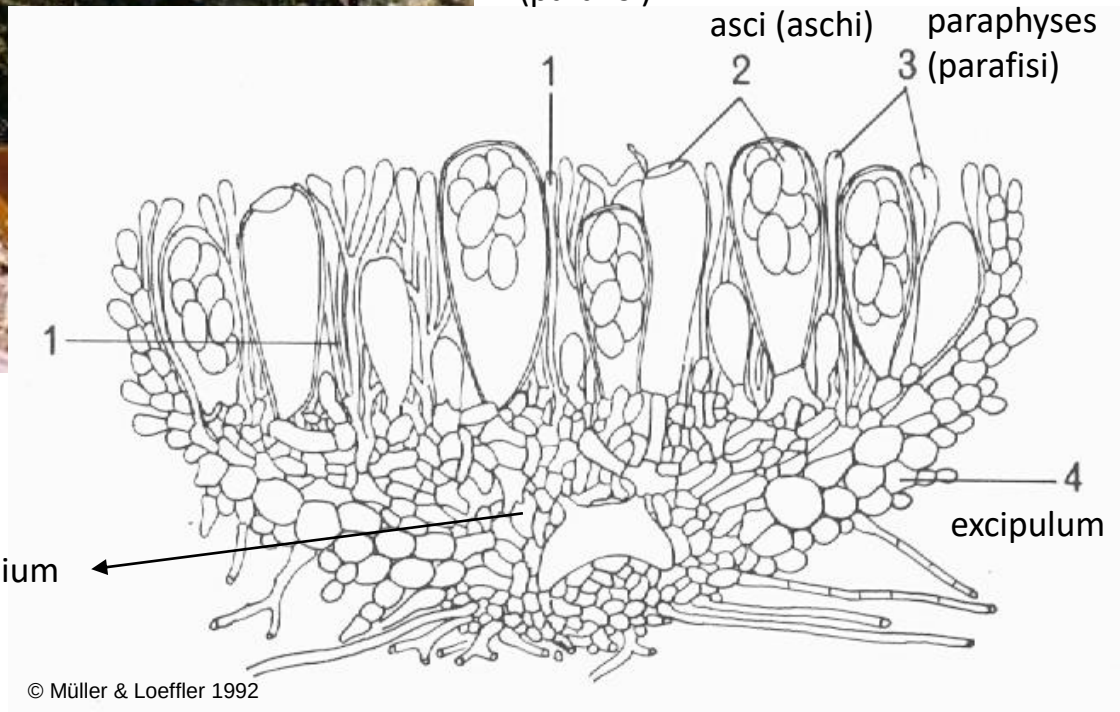
# Ascomycota, Pezizomycotina: ascocarps



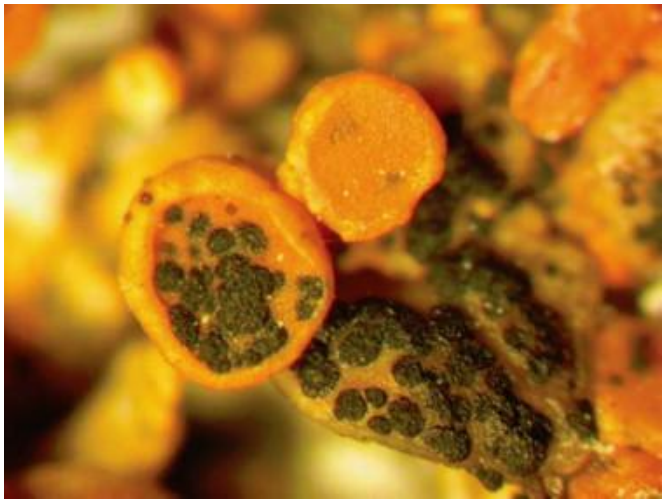

young ascus (2n)
Paraphysen (n)
ripe ascus (n*8)
hymenium
ascogenous hyphae (Dikaryophyt) (n*2)
Ascogon (female Gametangium)
Trichogyne
male Gametangium (n)
monokaryotic cell (n) , (Gametophyt)
Apothecium margin (n) (excipulum)

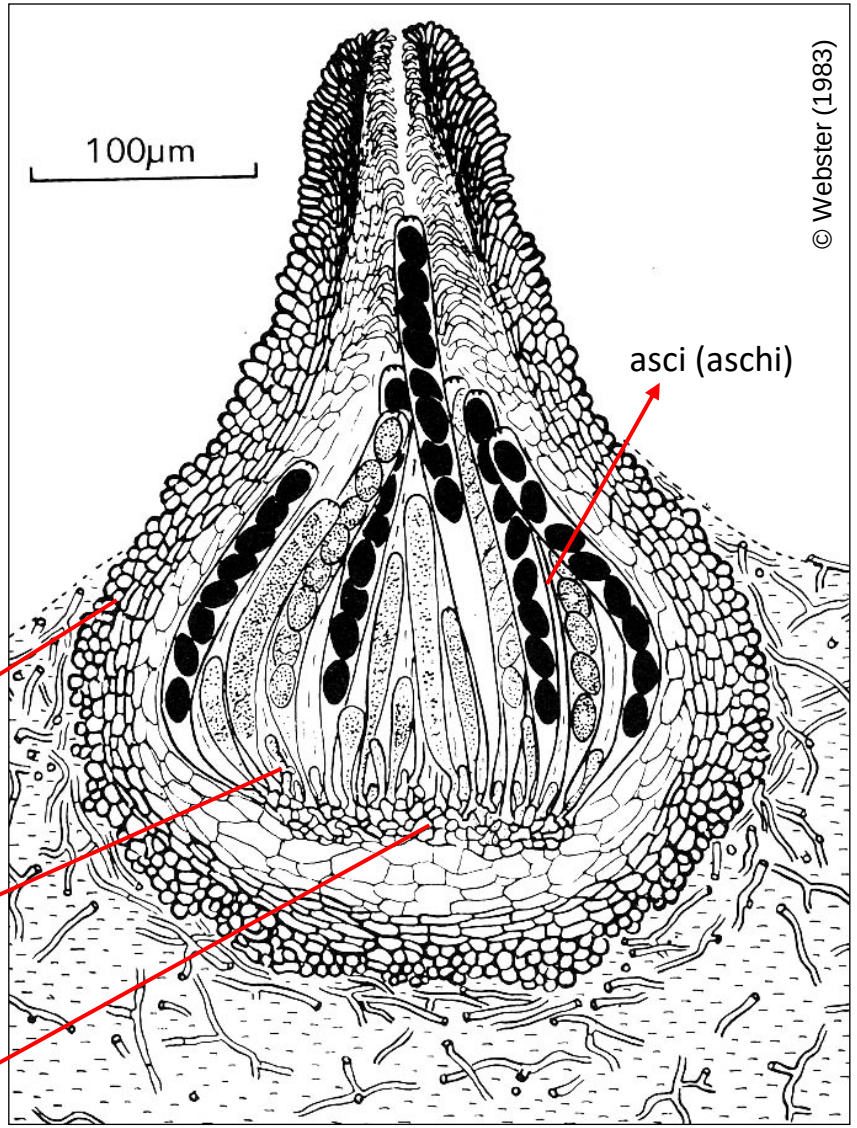
# **ASCOMYCOTA, Pezizomycotina:** Apothecium


paraphyses
(parafisi)

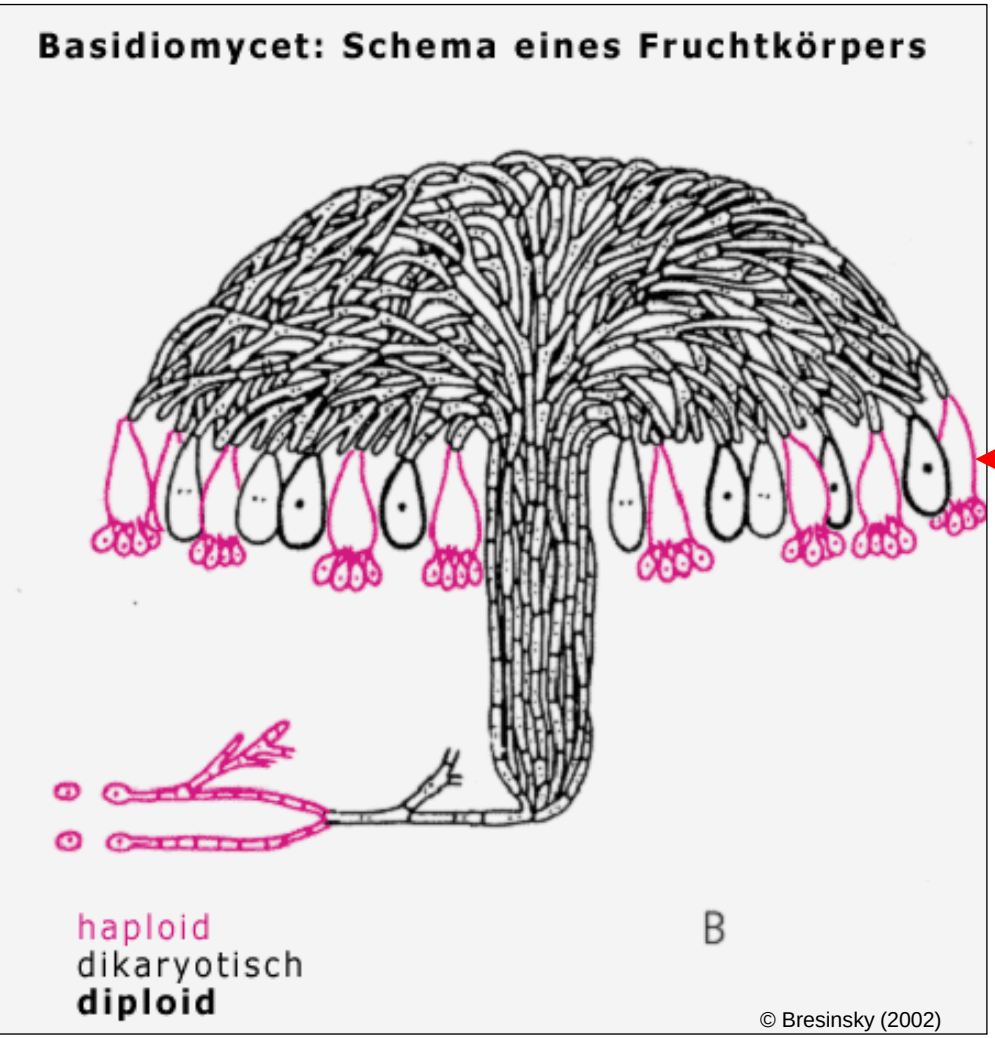


# **ASCOMYCOTA, Pezizomycotina:** Perithecium

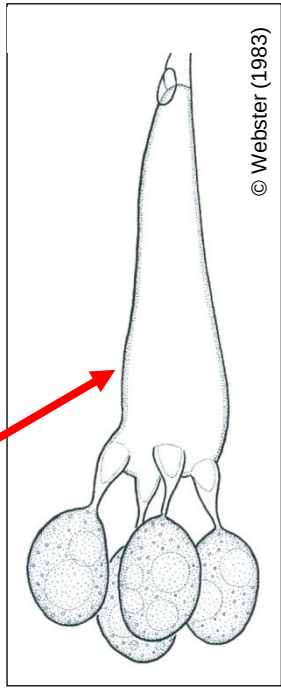


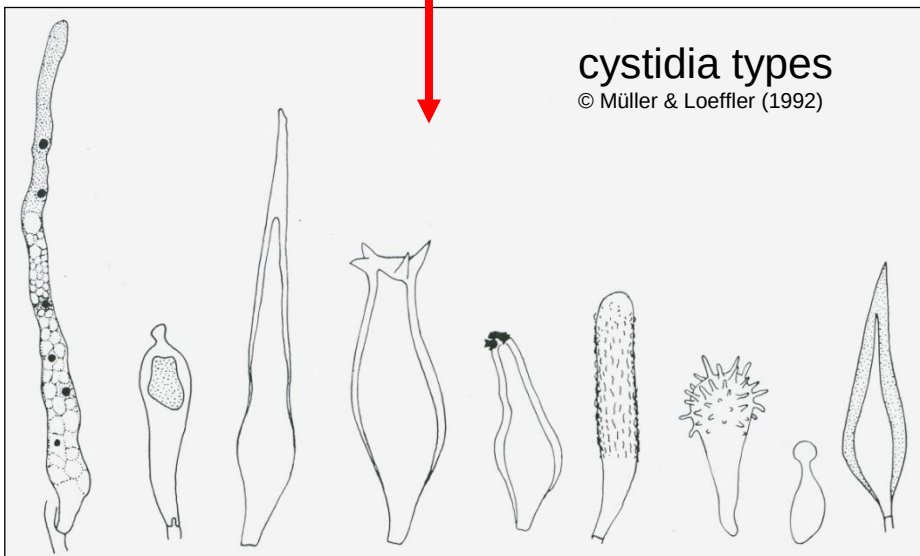


# BASIDIOMYCOTA, Agaricomycotina

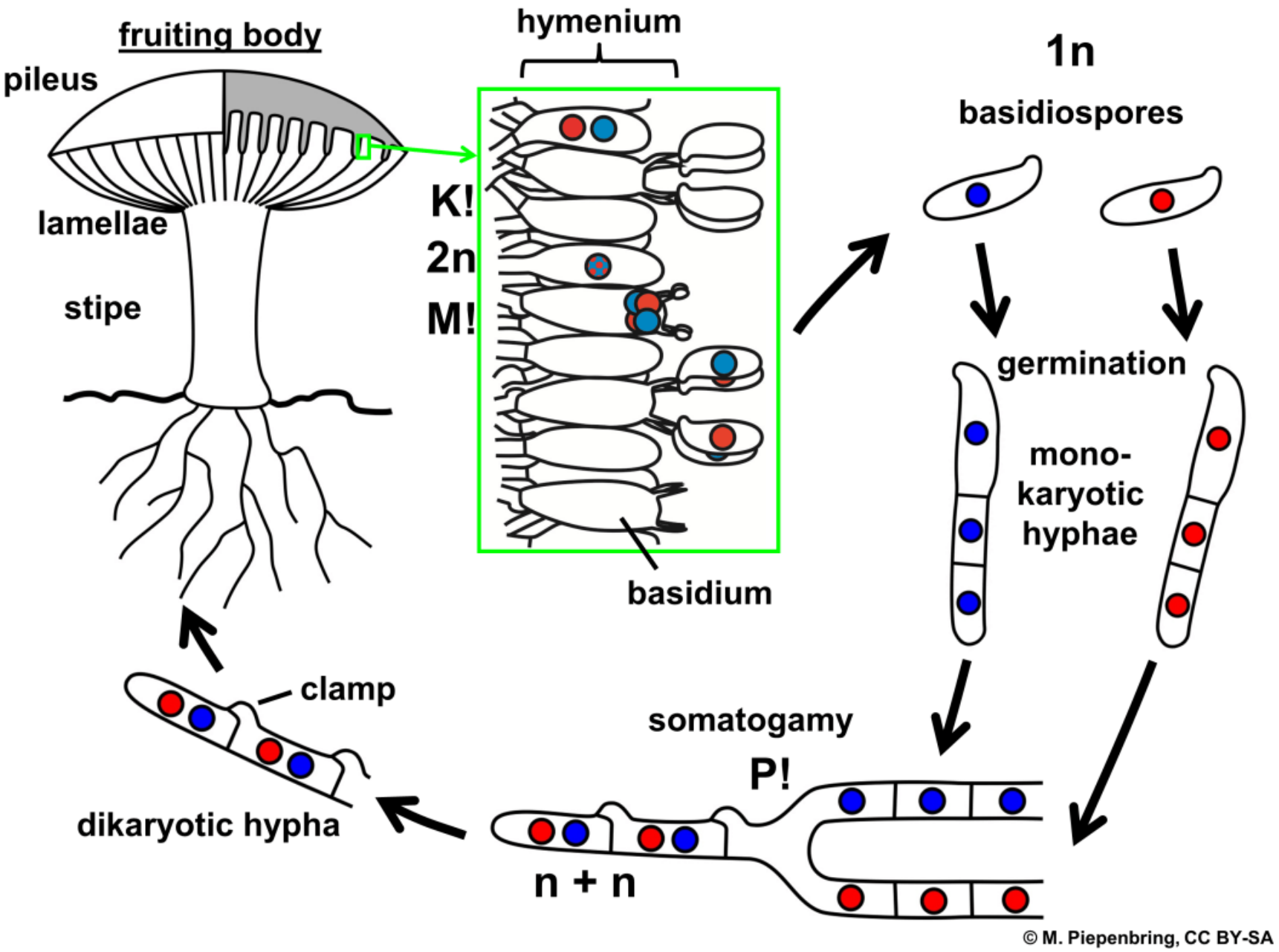



Hymenium with **basidia** and sterile **cystidia**

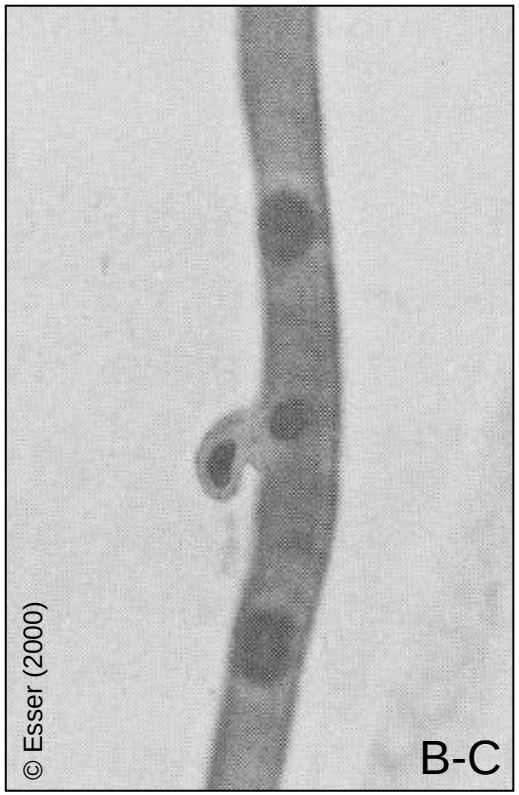


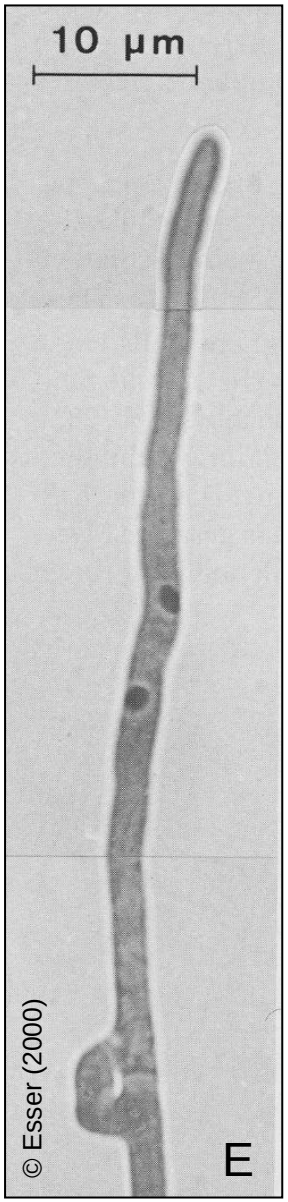



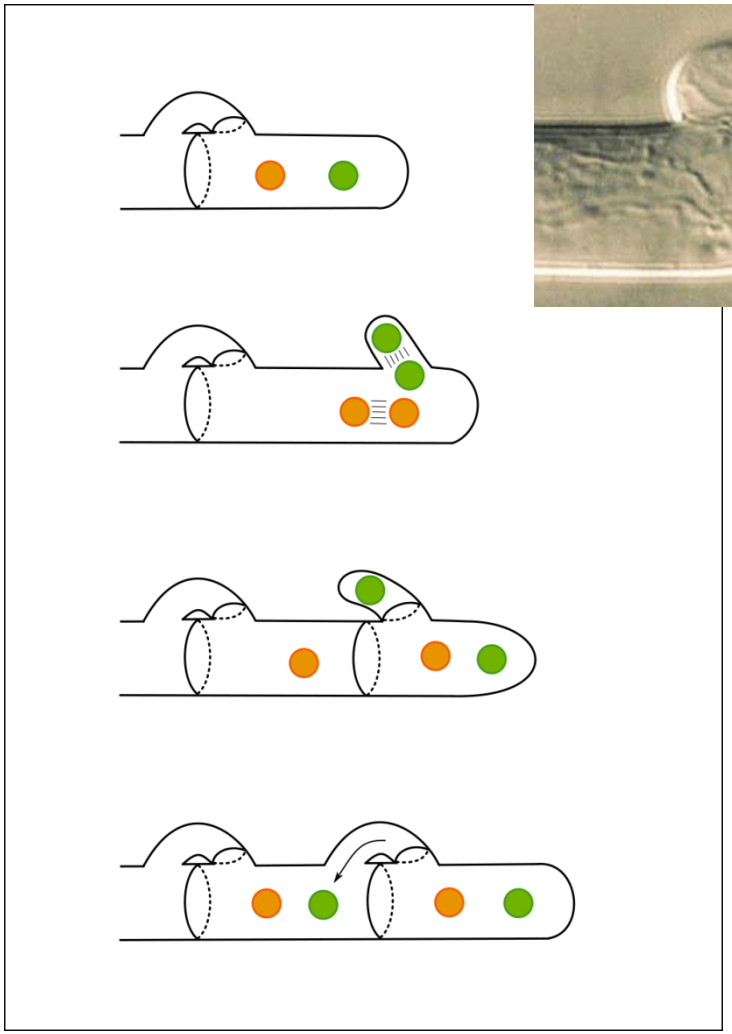
**BASIDIOMYCOTA, Agaromycotina**: dikaryotic generation of ascogenous hyphae

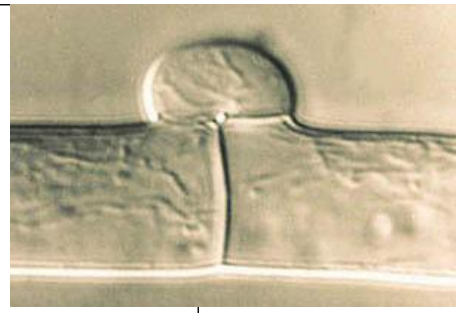


# **BASIDIOMYCOTA, Agaricomycotina**: **clump** formation (Dikaryon)

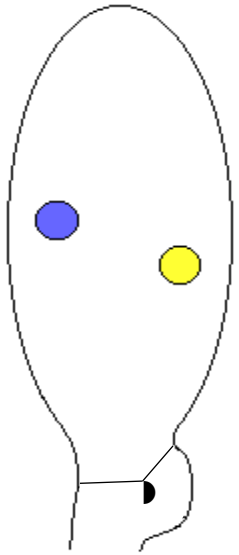


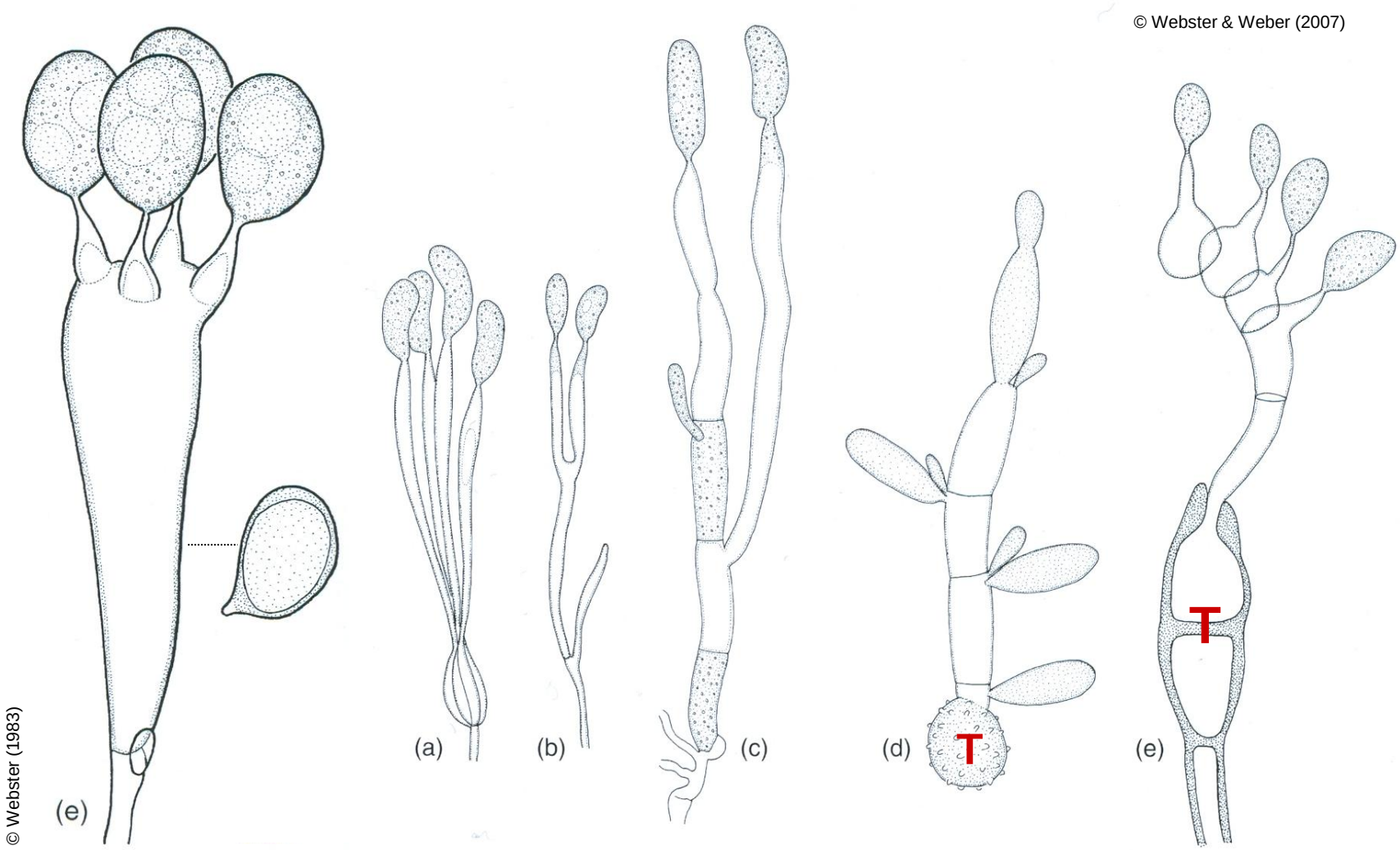





# **BASIDIOMYCOTA, Agaricomycotina**: development of a holobasidium



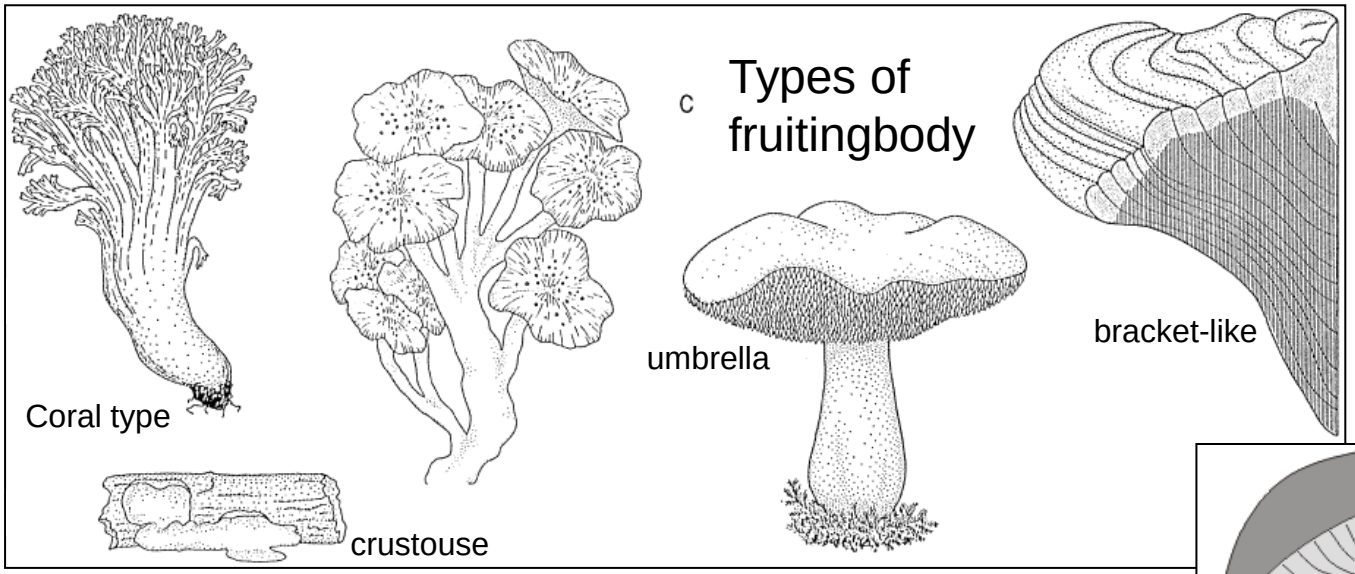
# Typic holobasidia and and example of other types of basidia




Type Holobasidium
(Agaricomycotina)
meiosporangium

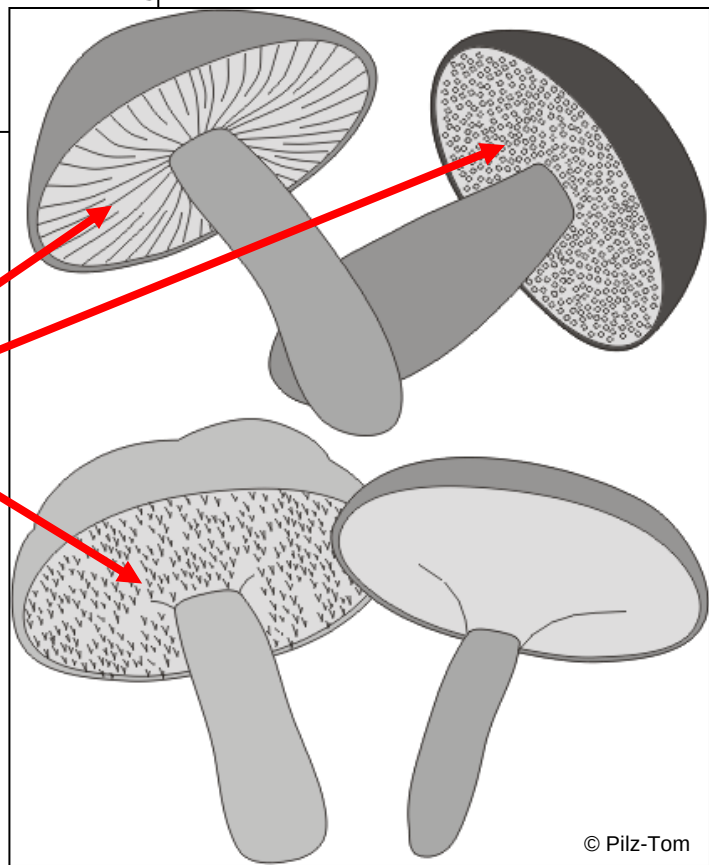
**T** = Teleutospore
(Teliospore, Probasidium)

# **BASIDIOMYCOTA, Agaricomycotina**: hymenophor and types of carpophre

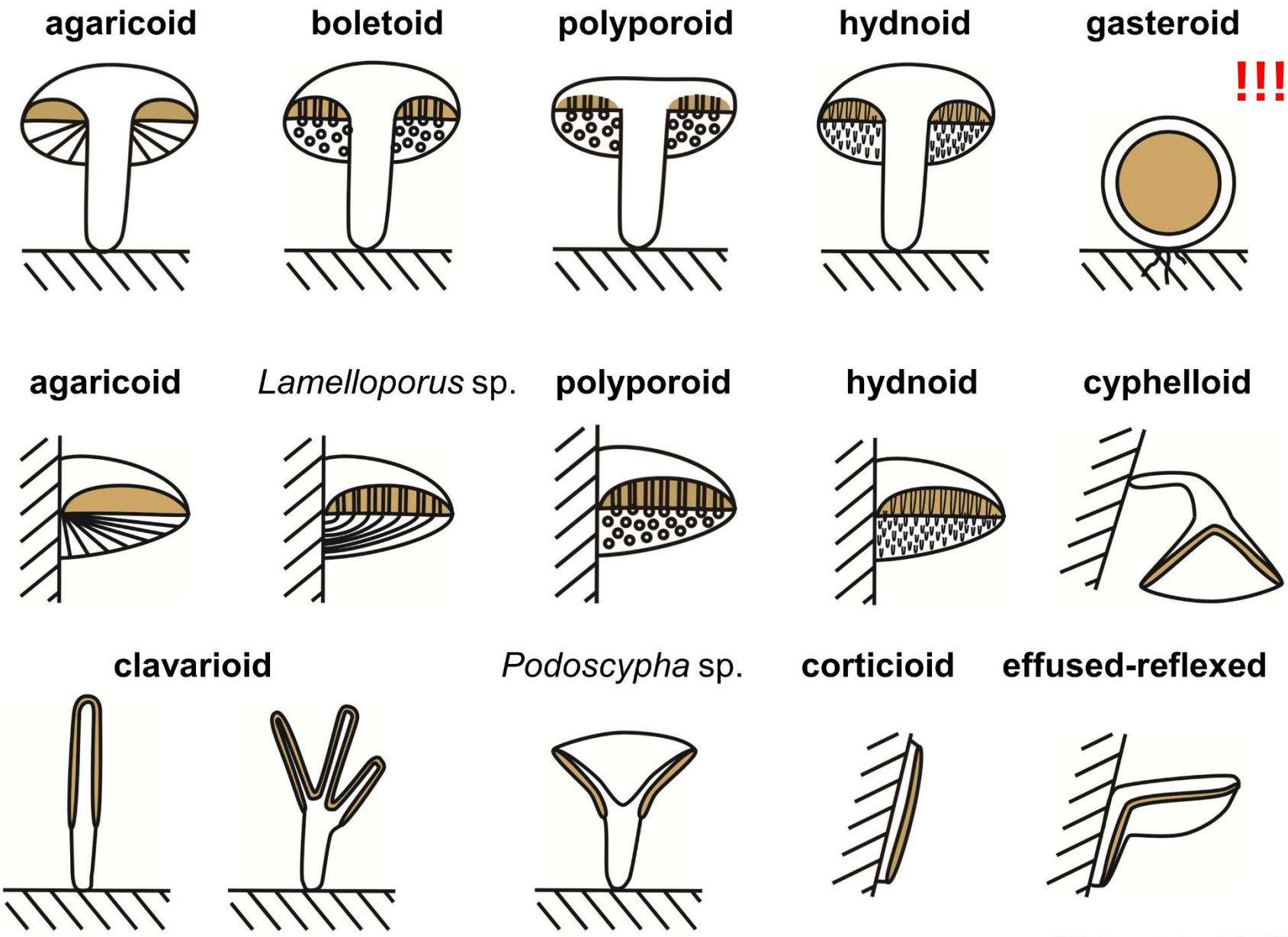





Surface enlargement of the **hymenophore** to enhance spore production: lamelle (+ pseudolamellae), pores/tubes, needles.

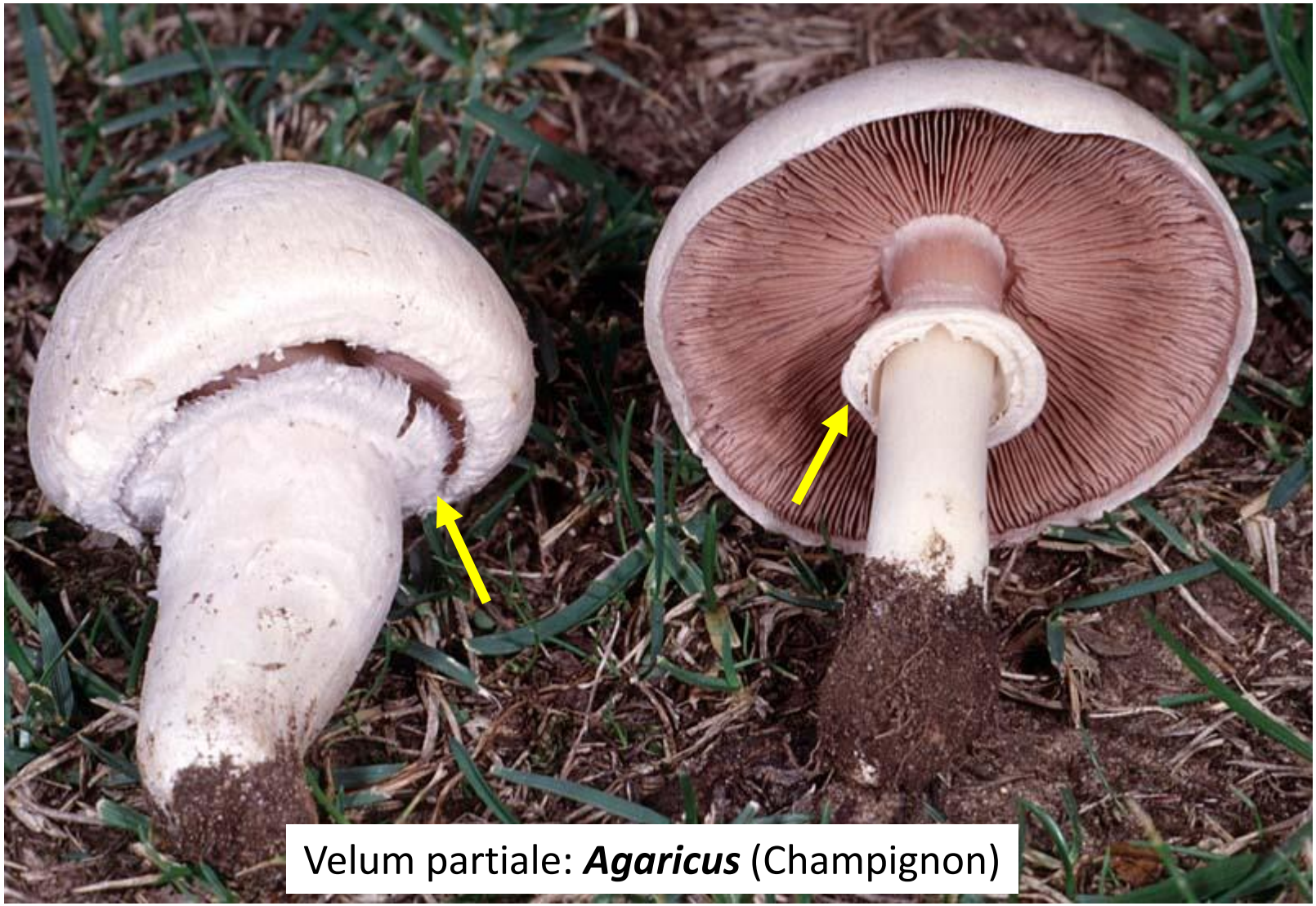


# **BASIDIOMYCOTA, Agaricomycotina**: hymenophor and types of fruitbodies



# Agaricomycotina: simple, crust-forming fruitbody

# Agaricomycotina: carpophore with velum (**velum parziale**)

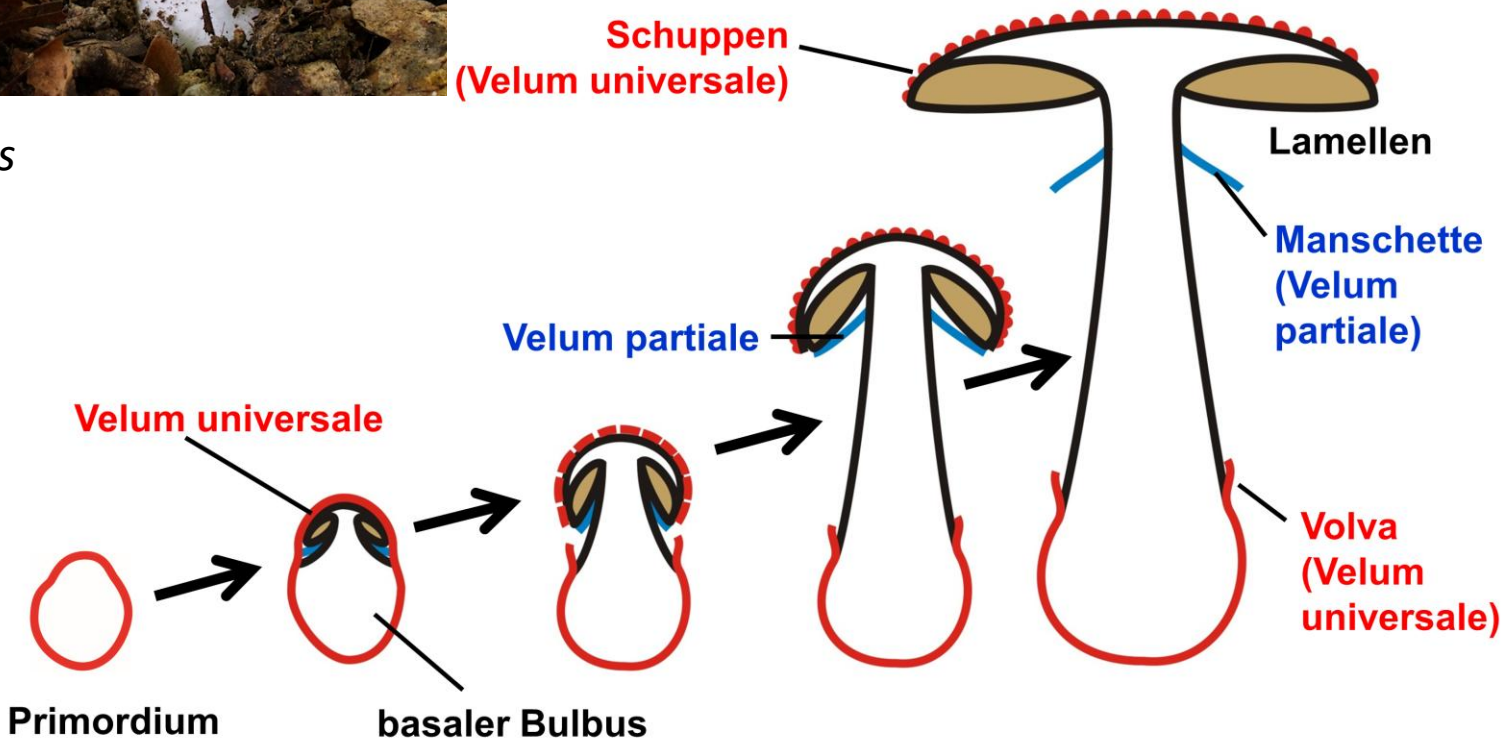


Velum partiale: ***Agaricus*** (Champignon)

*Amanita phalloides*

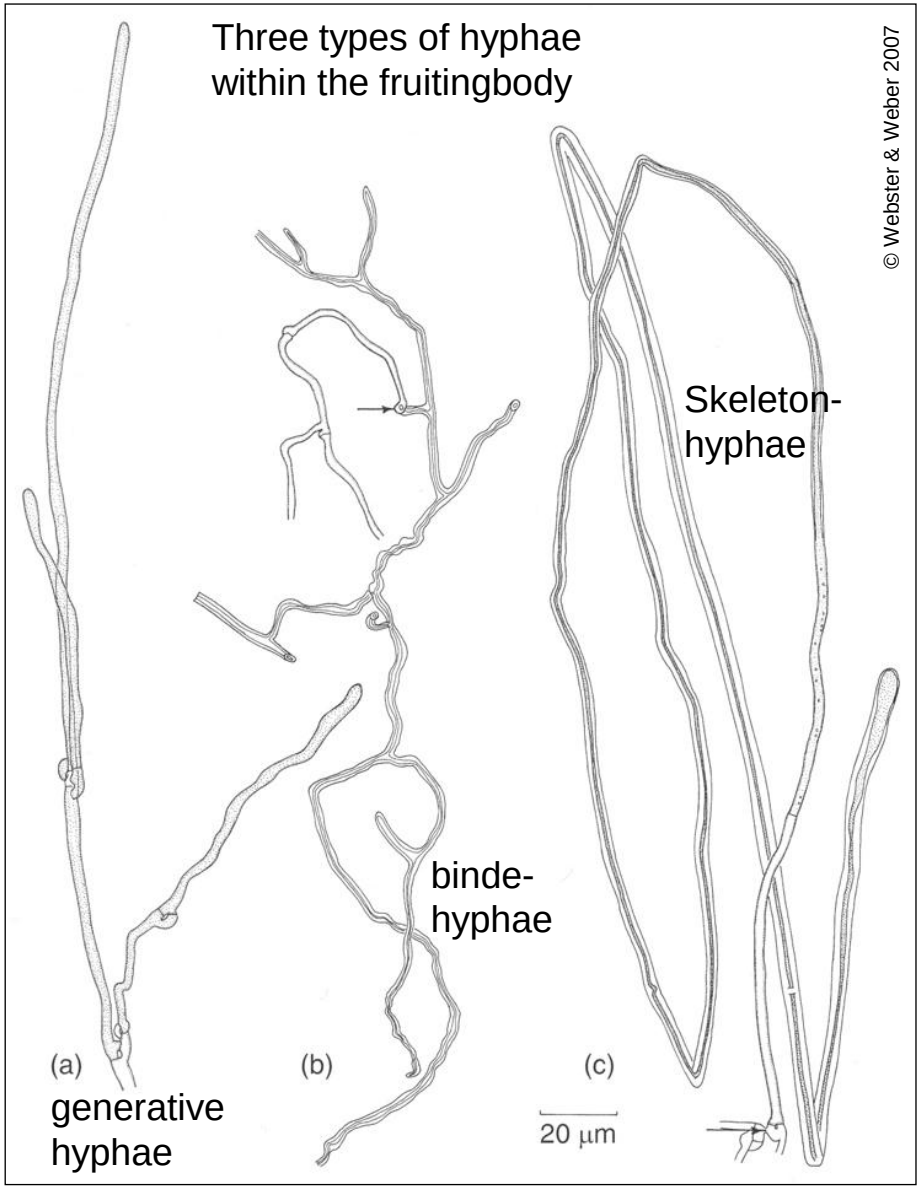
resto del velo universale

**volva** (velo universale)

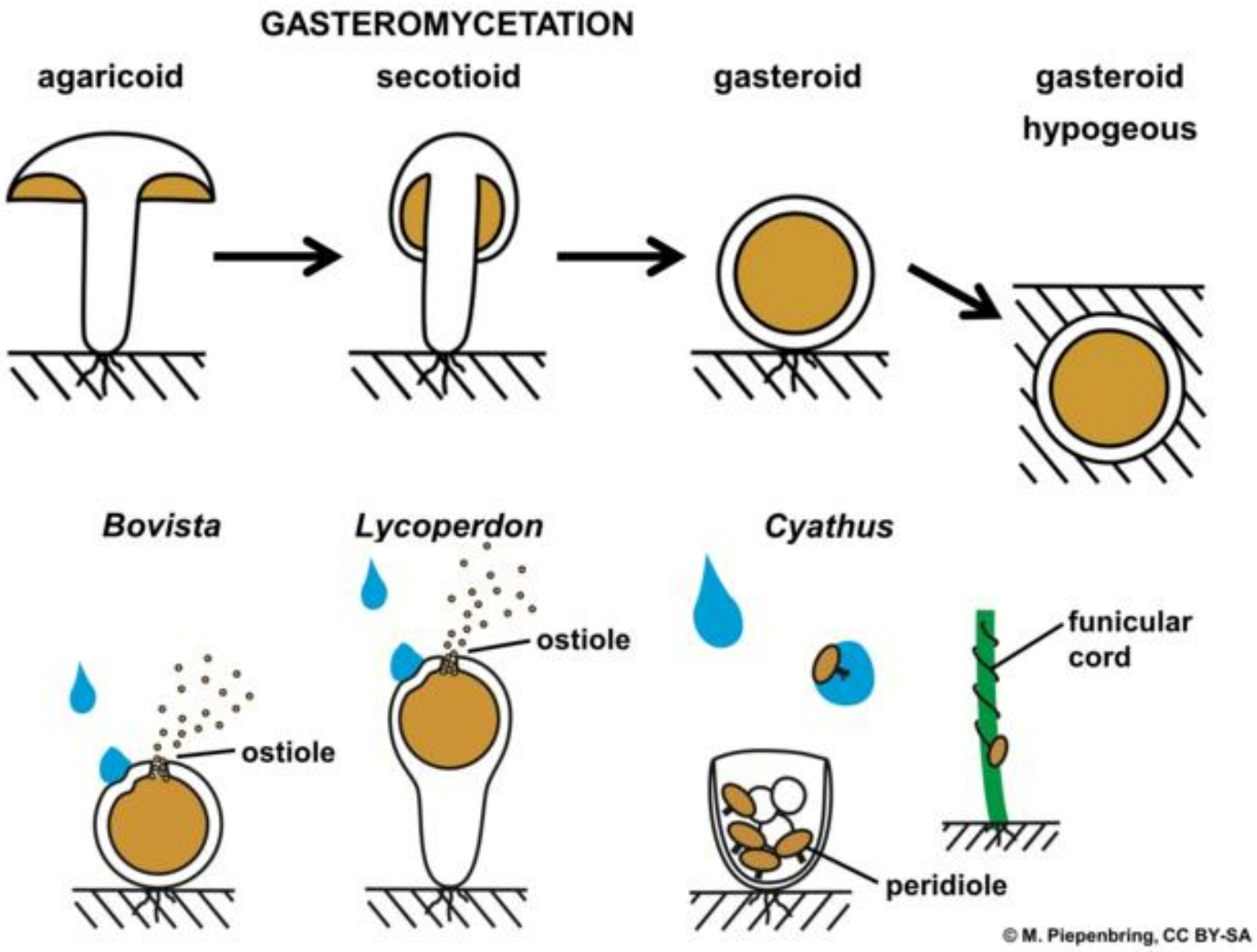


# Agaricomycotina: „tree-sponges"

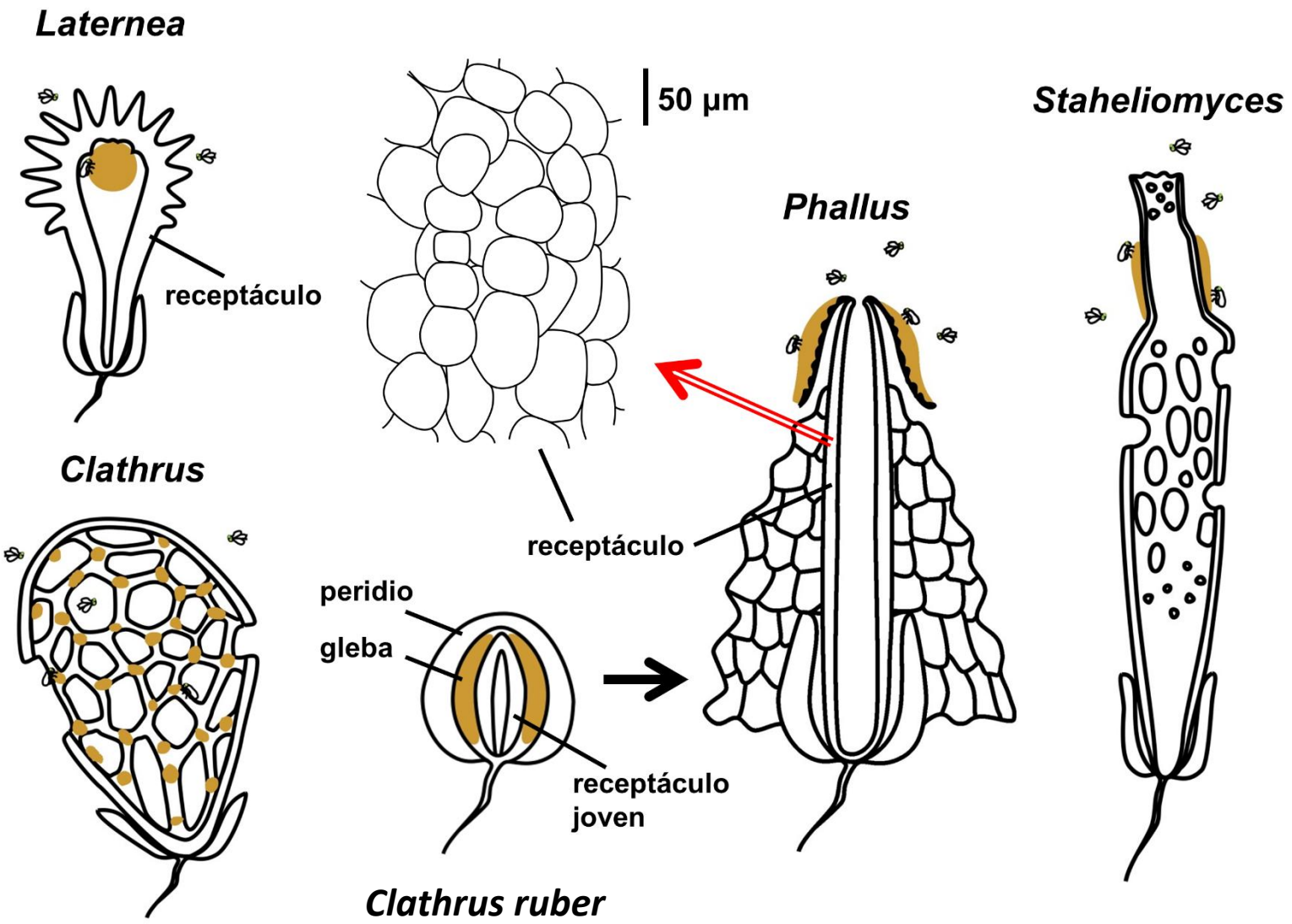




# Agaricomycotina: Gasteromycetes



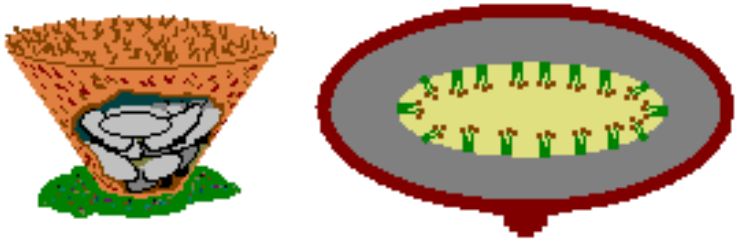
# Agaricomycotina: Gasteromycetes



# Agaricomycotina: Gasteromycetes

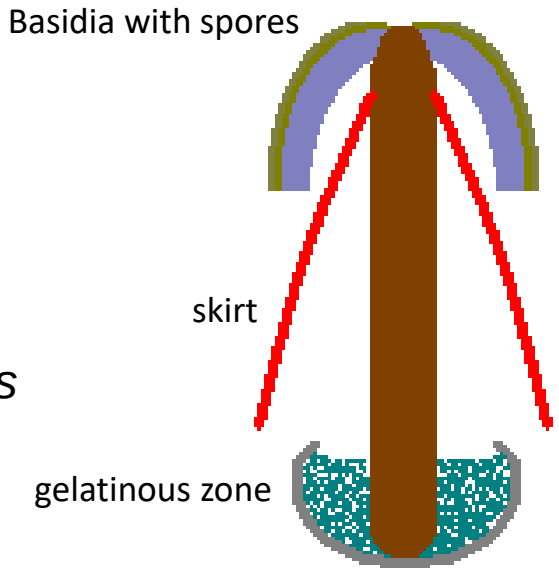

*Geastrum saccatum*


- Polyphyletic group of Basiodiomycota
- Basidia with basidiospores develope inside the fruitng bodies and are later passively dispersed (insects, e.g. flies).



*Cyathus novae-zealandiae*

*Dyctiophora indusiata,*
*syn. Phallus indusiatus*

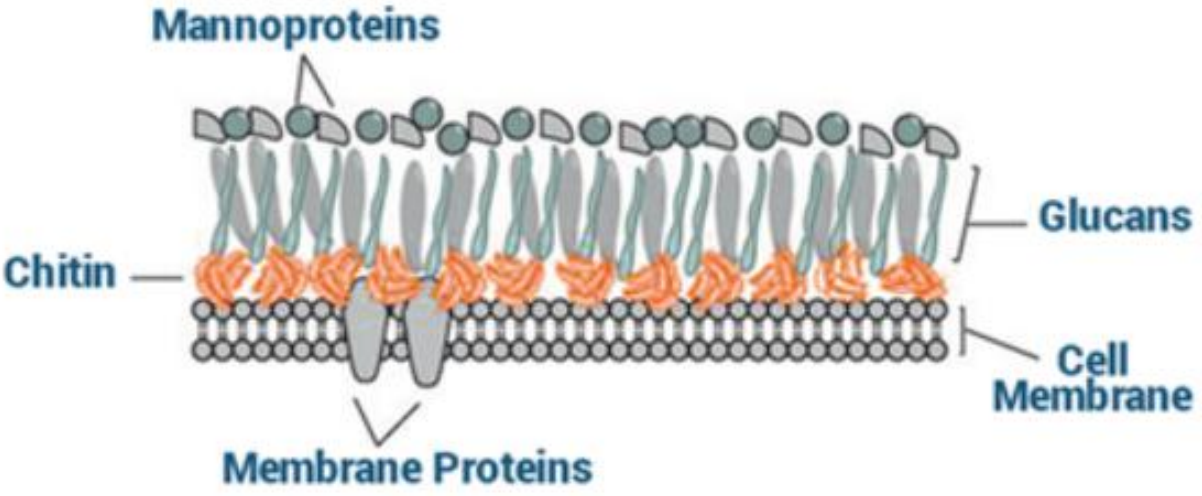


# **Fungi** („Chitin fungi“)

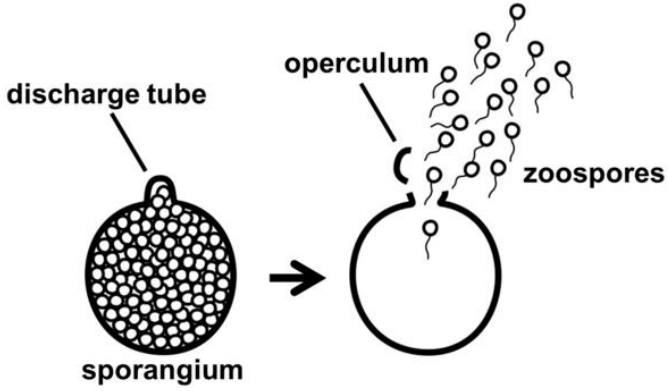
- **Chytridiomycota**
  - holokarp bis eukarp, Planosporen (= Zoosporen)
- **Zygomycota**
- **Glomeromycota**

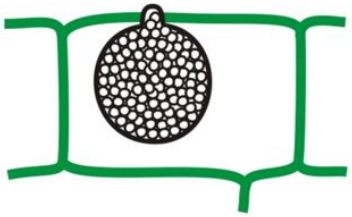
**Basal, not septate, chitin Fungi**

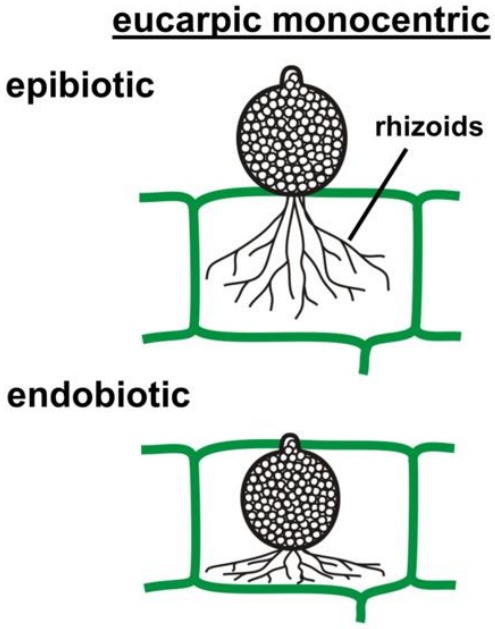
- **Ascomycota**
- **Basidiomycota**

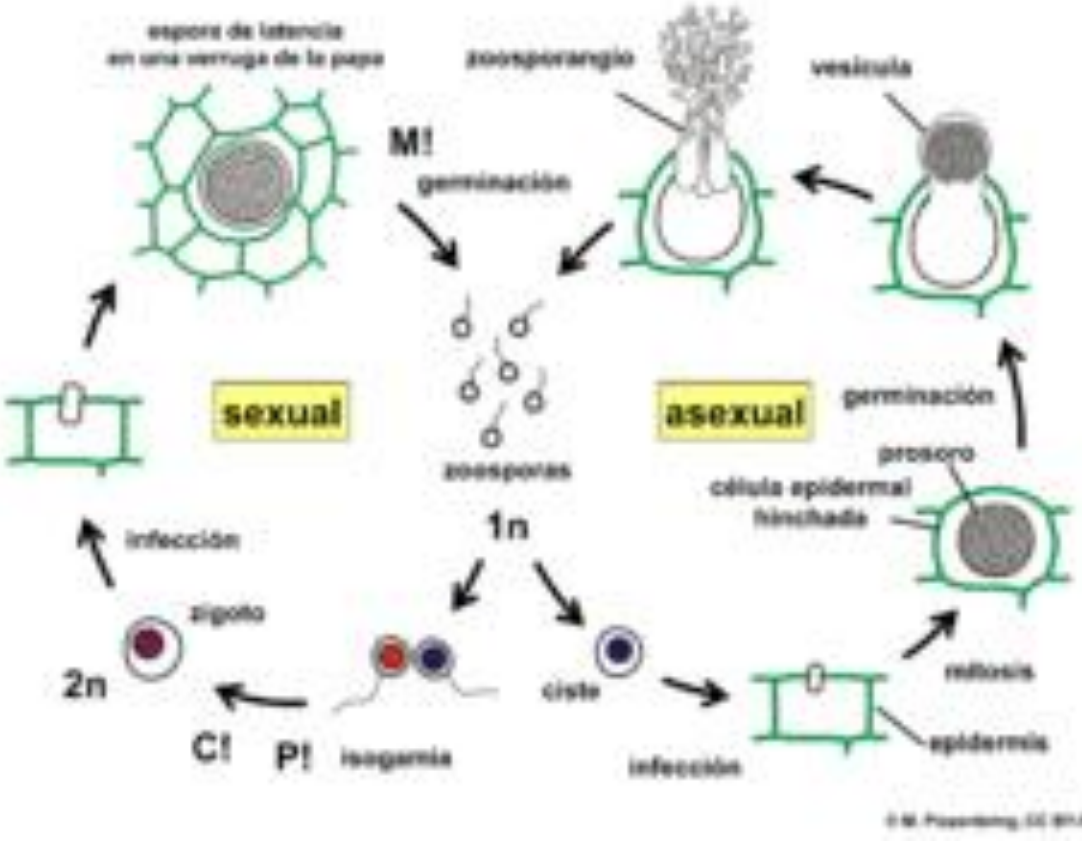


# Chytridiomycota

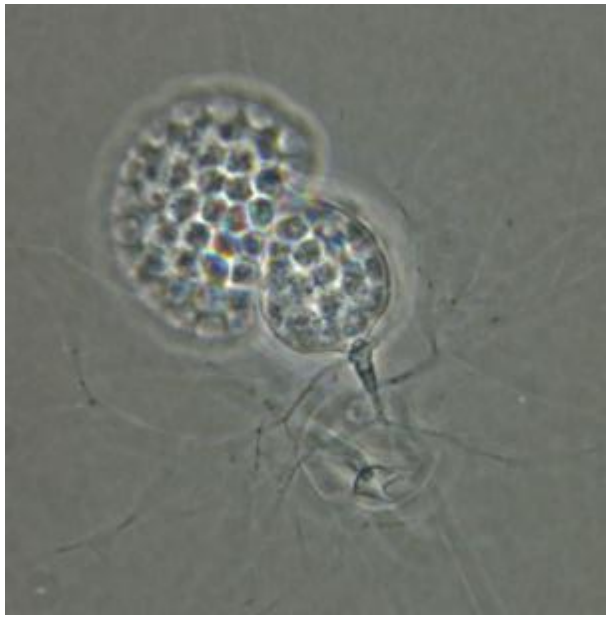


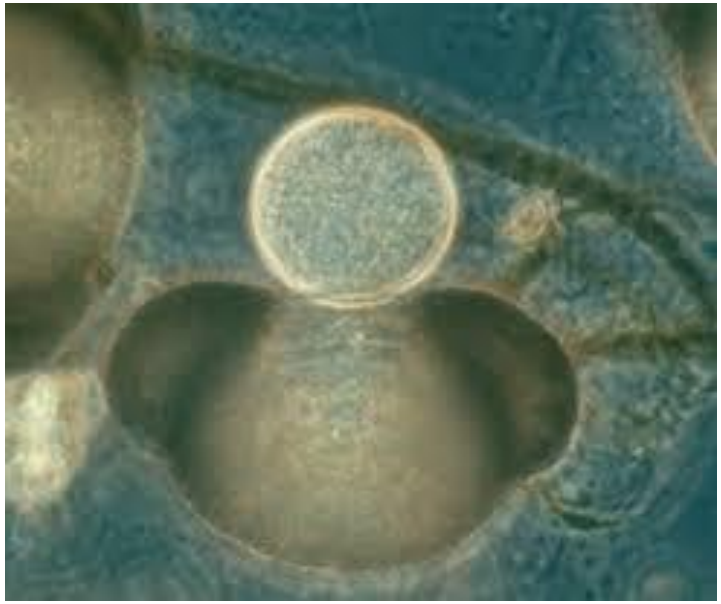



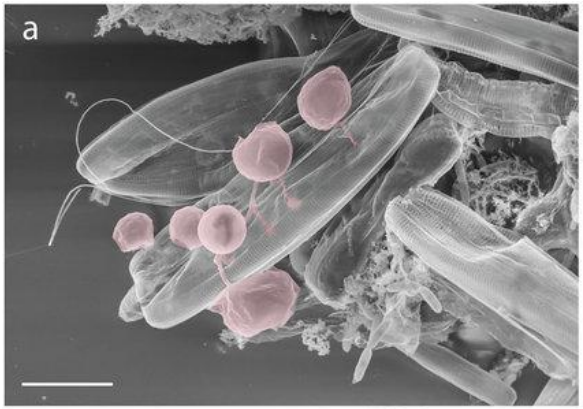



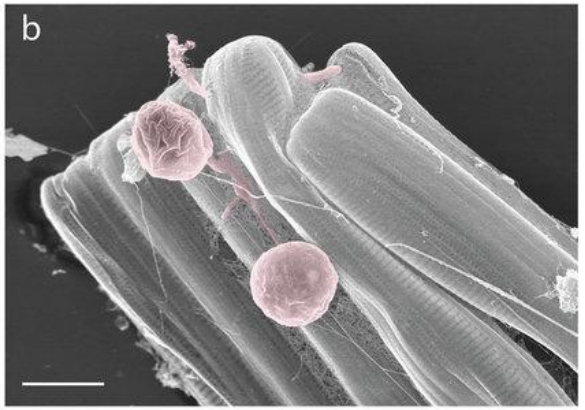



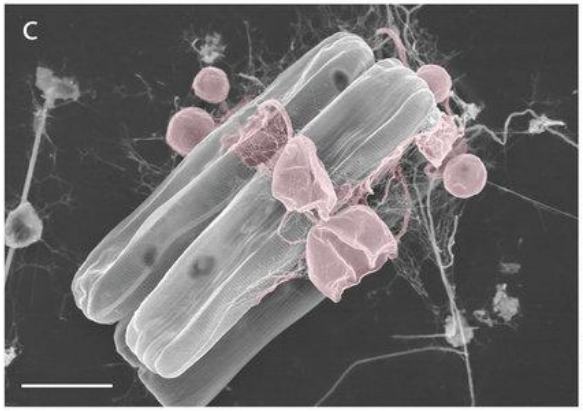
# Chytridiomycota

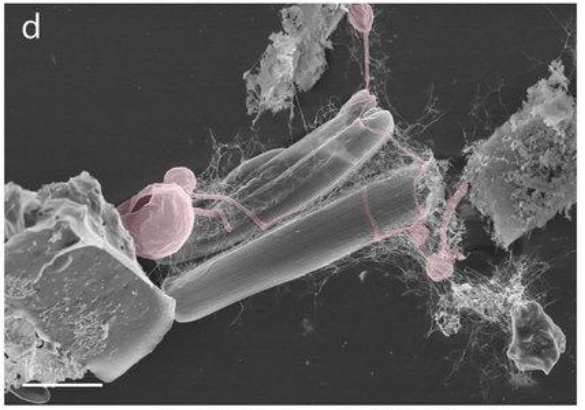


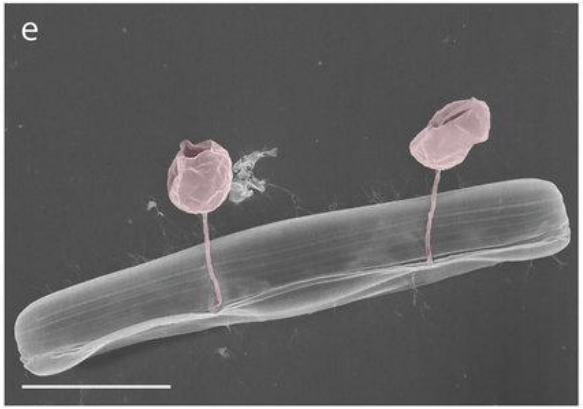


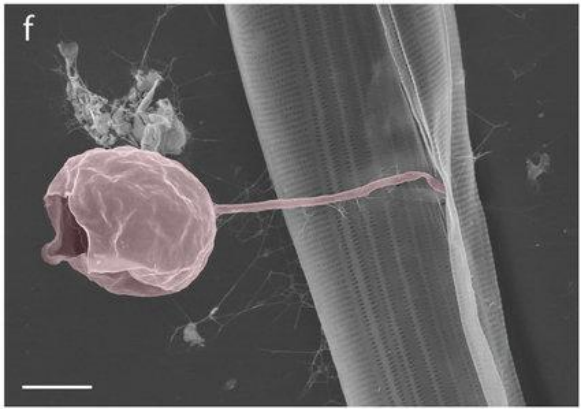


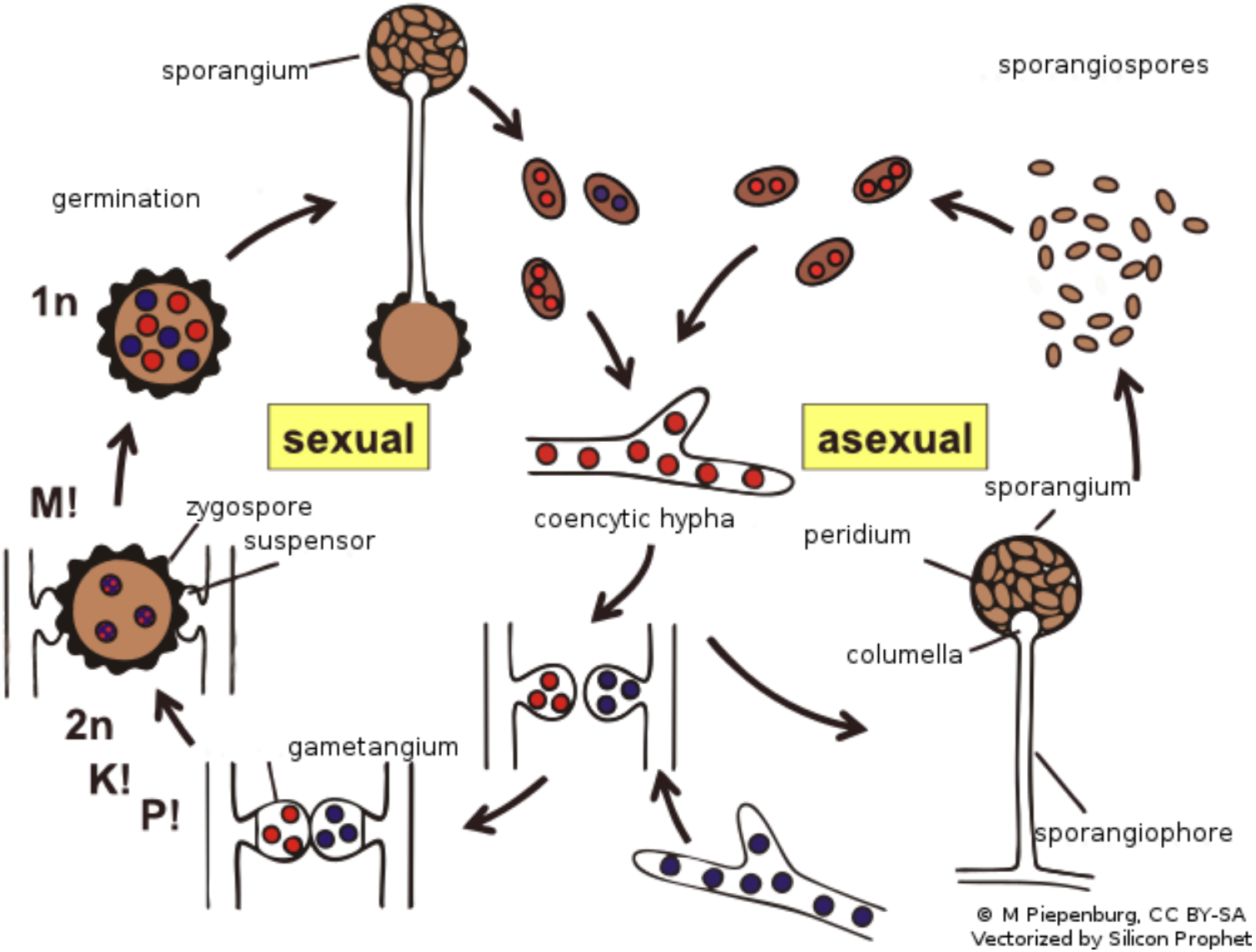



# Zygomycota


sporangium
sporangiospores
germination
1n
sexual
asexual
M!
zygospore
suspensor
coencytic hypha
sporangium
peridium
columella
2n
K!
P!
gametangium
sporangiophore
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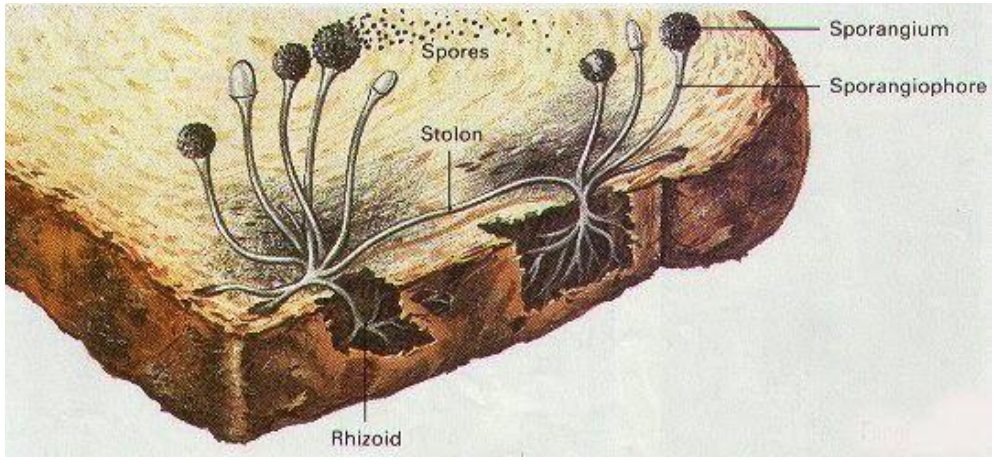
Vectorized by Silicon Prophet

# Zygomycota




*Rhizopus stolonifer*

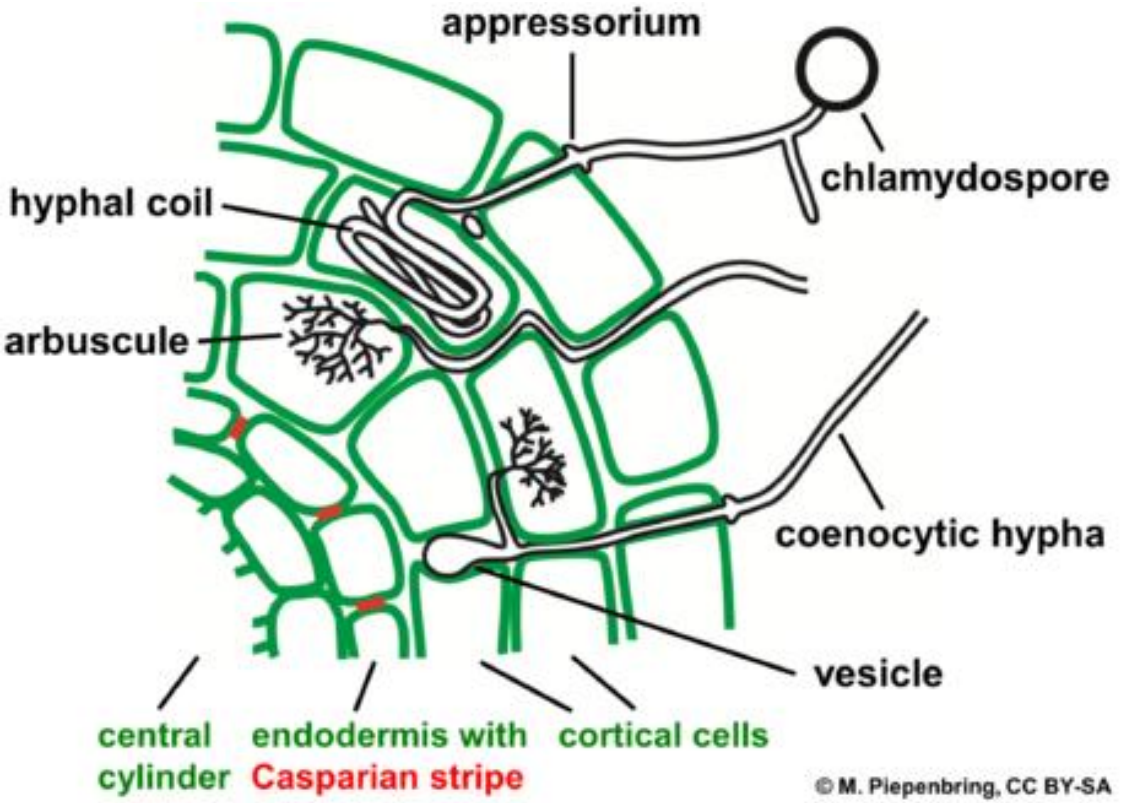
(a)

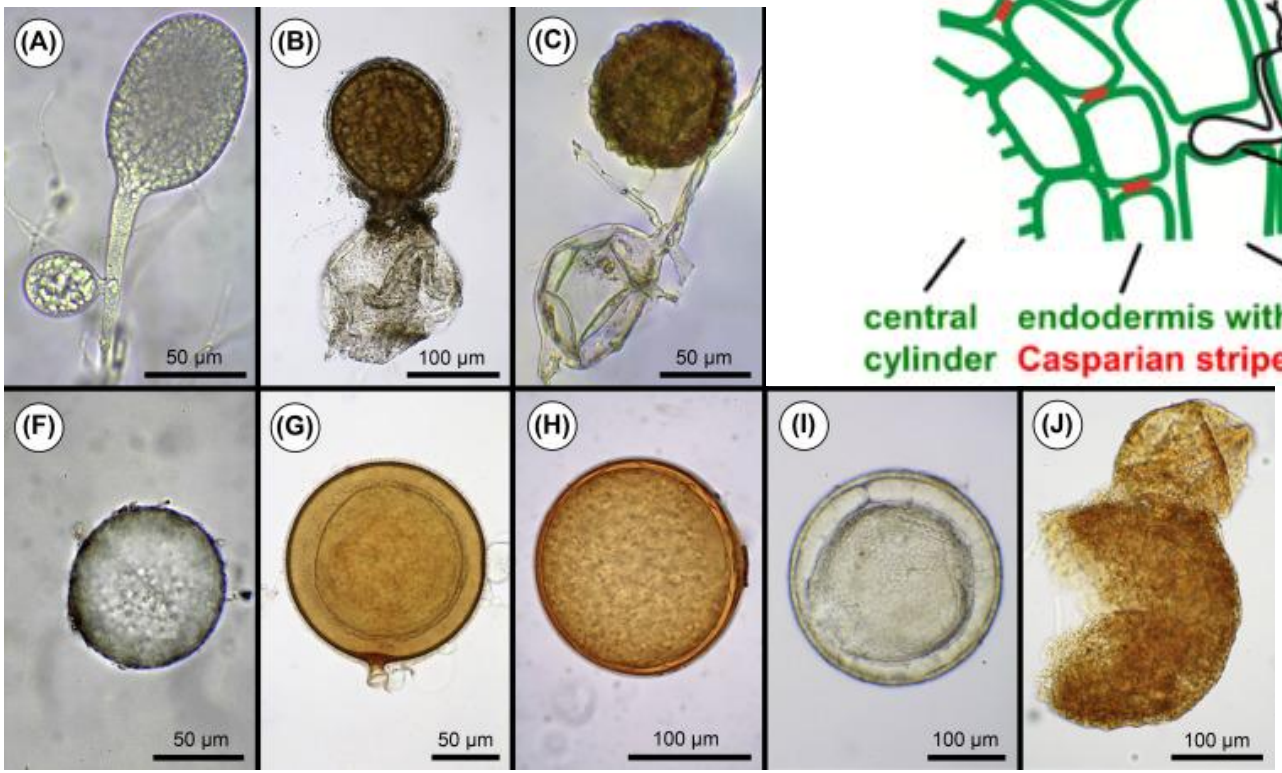
(b)

*Pilobolus crystallinus*

# Glomeromycota

- associate with plant roots also with high secificity to their host plant
- form arbuscular mycorriza (**AMF**)




***Geosiphon pyriformis*** does not form AM, instead it forms an endocytobiotic association with ***Nostoc*** cyanobacteria