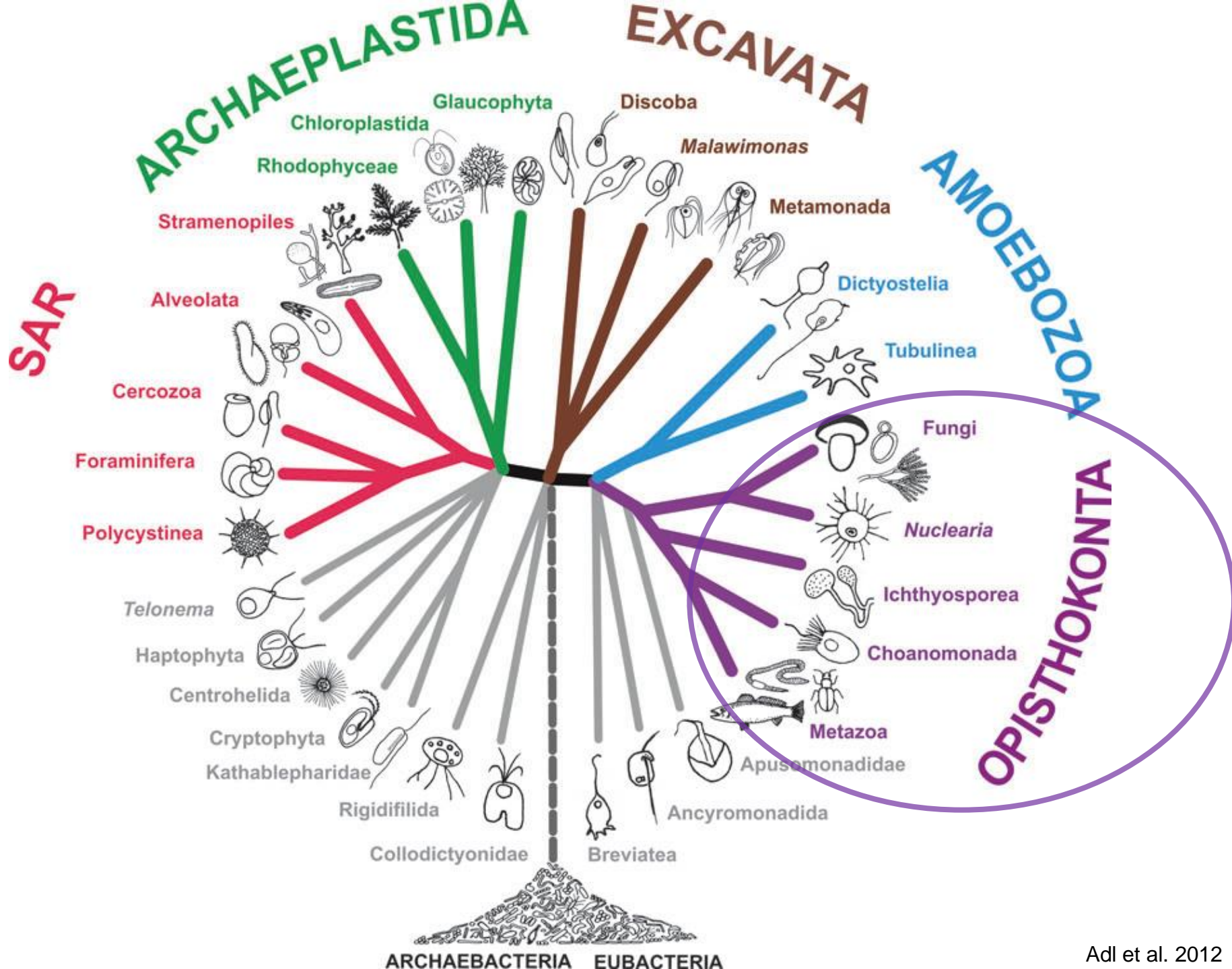
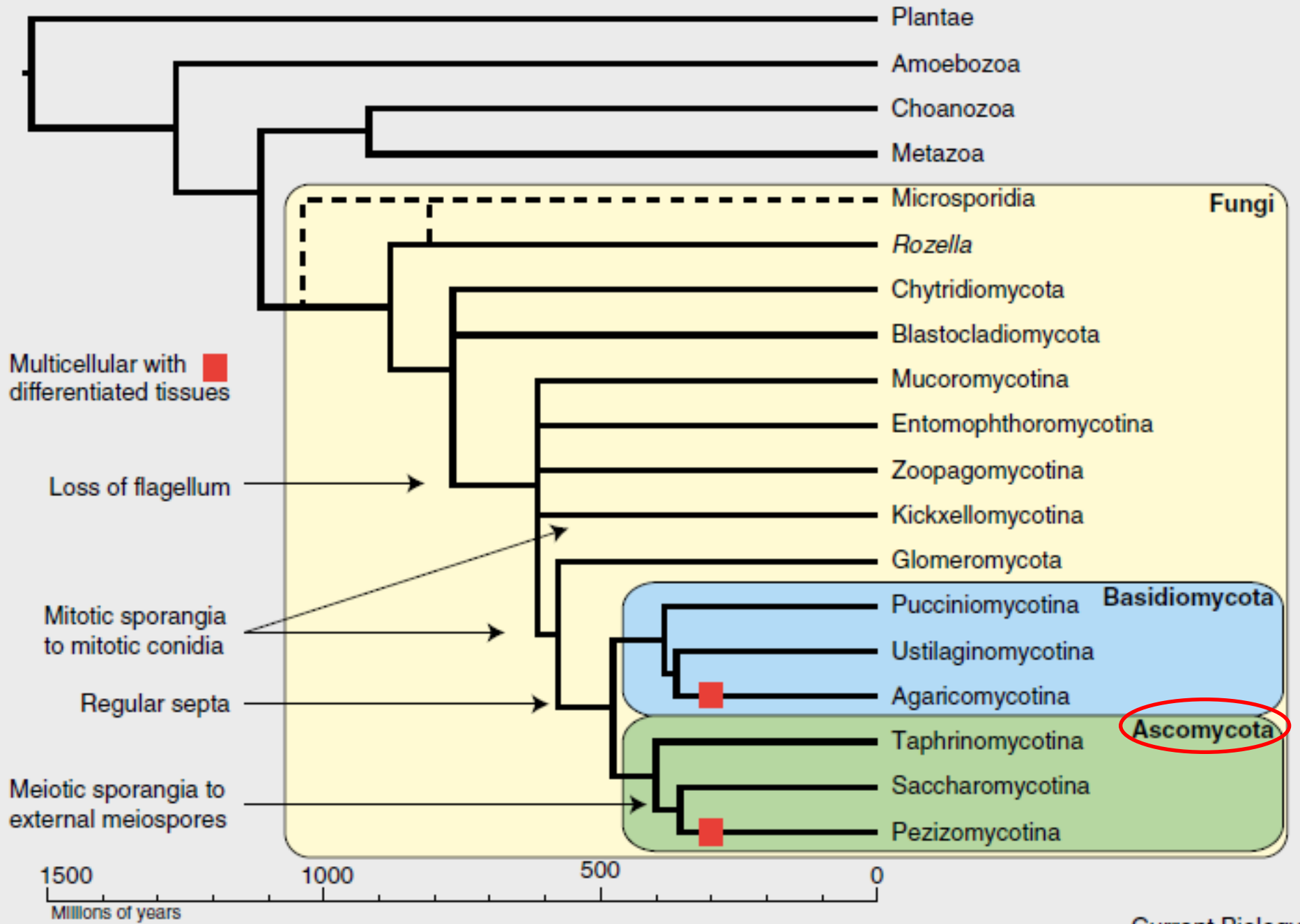


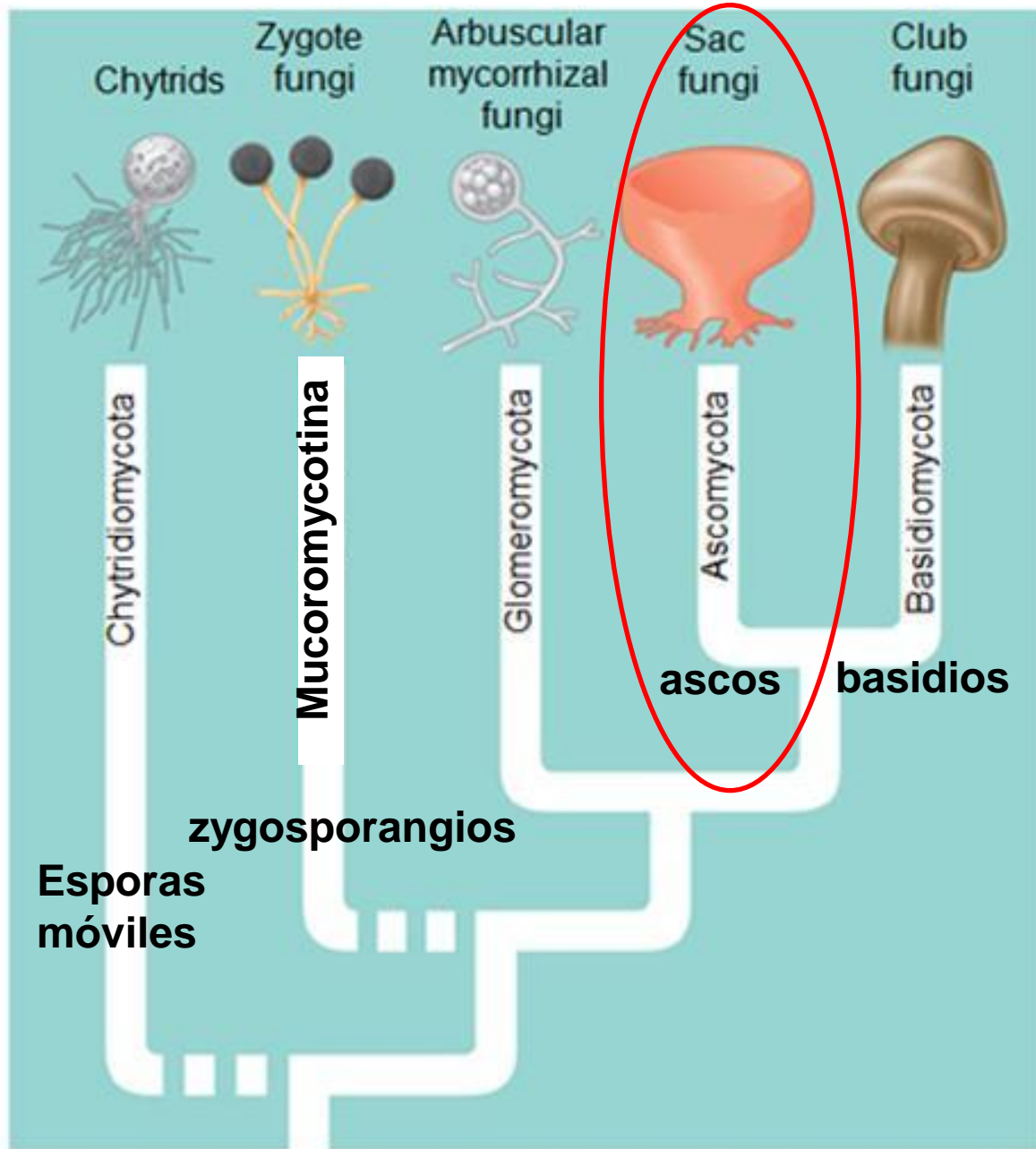


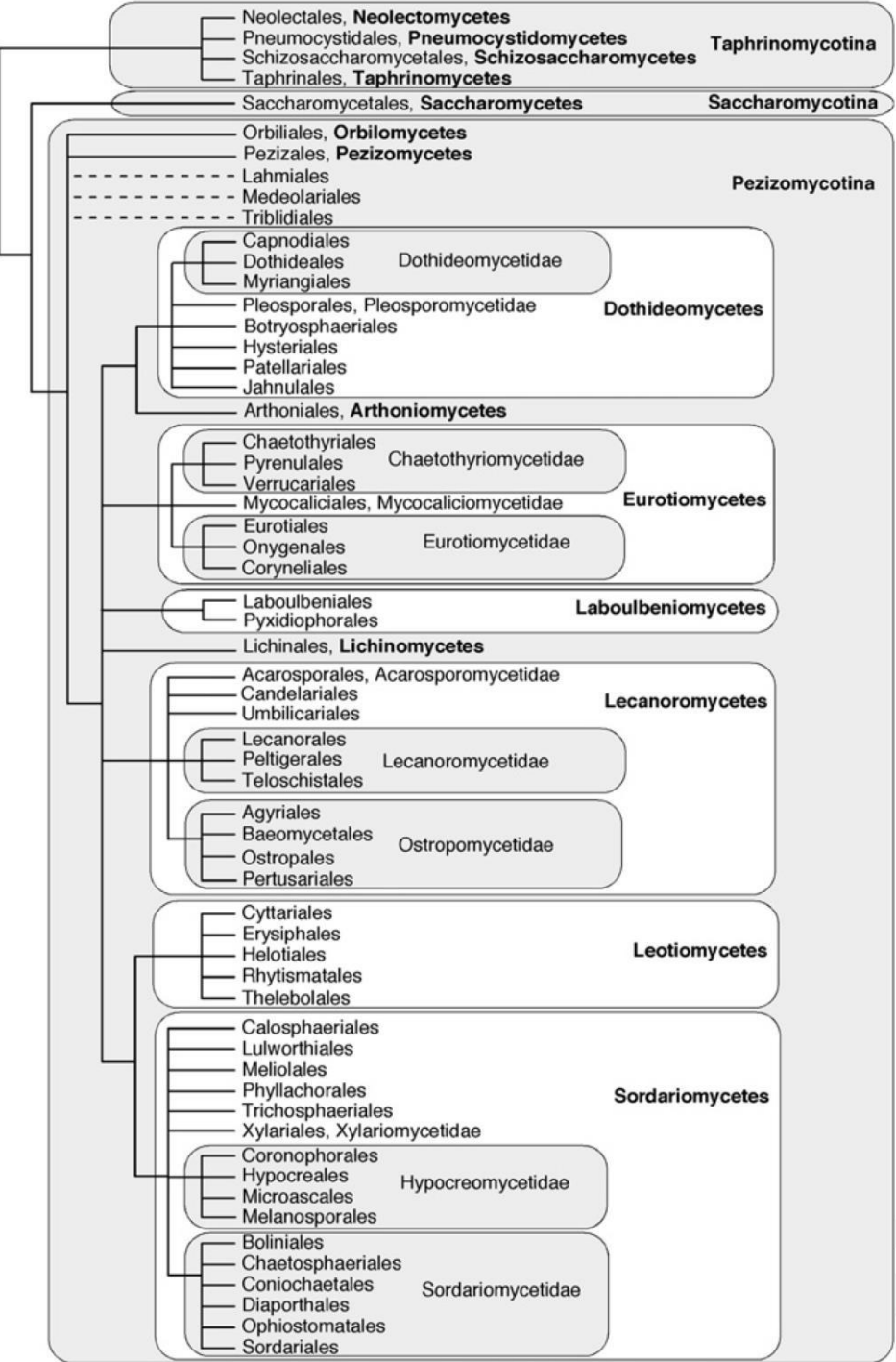
Ascomycota











Subphylum TAPHRINOMYCOTINA

Subphylum SACCHAROMYCOTINA

Subphylum PEZIZOMYCOTINA

Class ORBILIOMYCETES

Class PEZIZOMYCETES

Class DOTHIDEOMYCETES

Class ARTHONIOMYCETES

Class EUROTOMYCETES

Class LABOULBENIOMYCETES

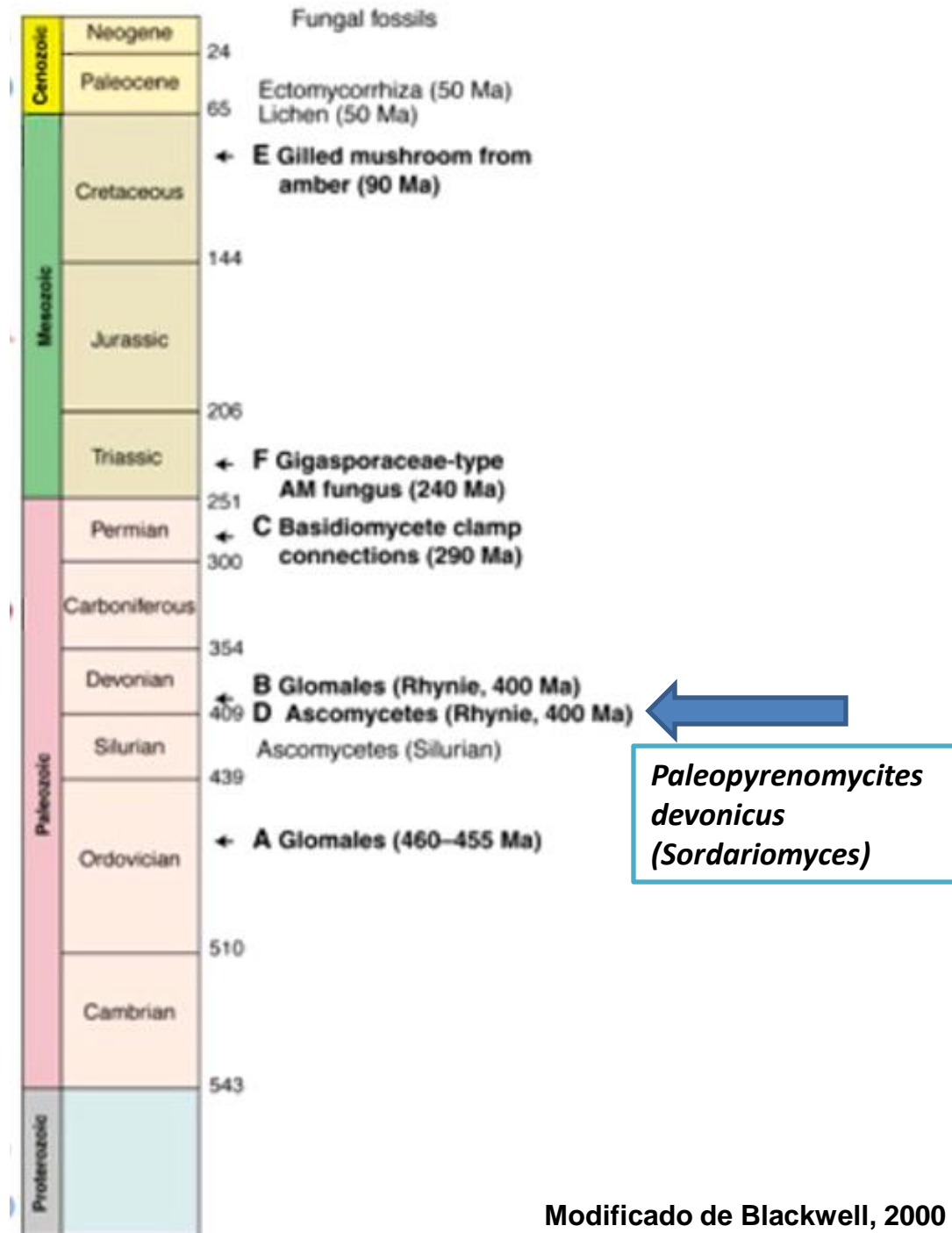
Class LICHINOMYCETES

Class LECANOROMYCETES

Class LEOTIOMYCETES

Class SORDARIOMYCETES

Registros Fósiles



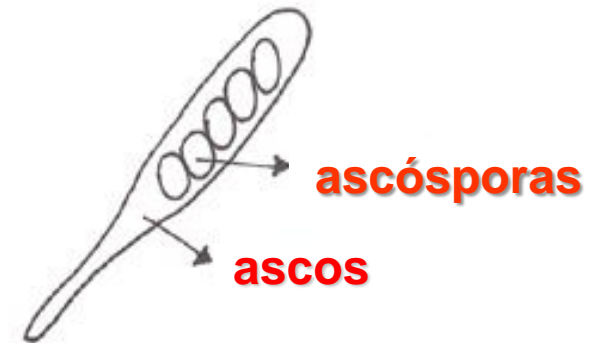
Características generales

Ascomycota

Aprox.
65.000 spp.

> 40% Lichenes

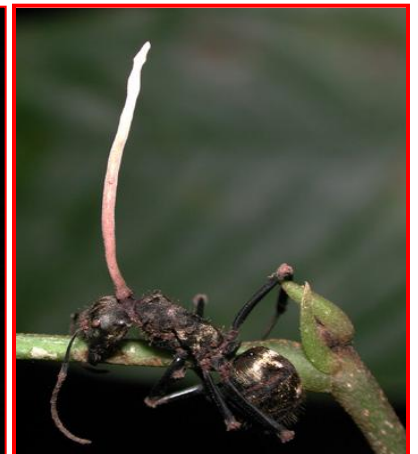
Característica del grupo: **Producción de esporas sexuales en un saco (esporangio) llamado asco.**



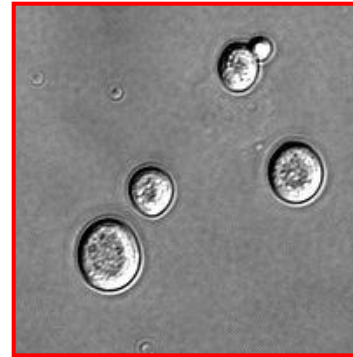
Características generales

Ascomycota

- Nutrición: saprófitos, parásitos, patógenos de plantas y animales, simbióticos \longrightarrow líquenes (con algas) y micorrizas (con raíces de plantas).



Unicelulares o Pluricelulares

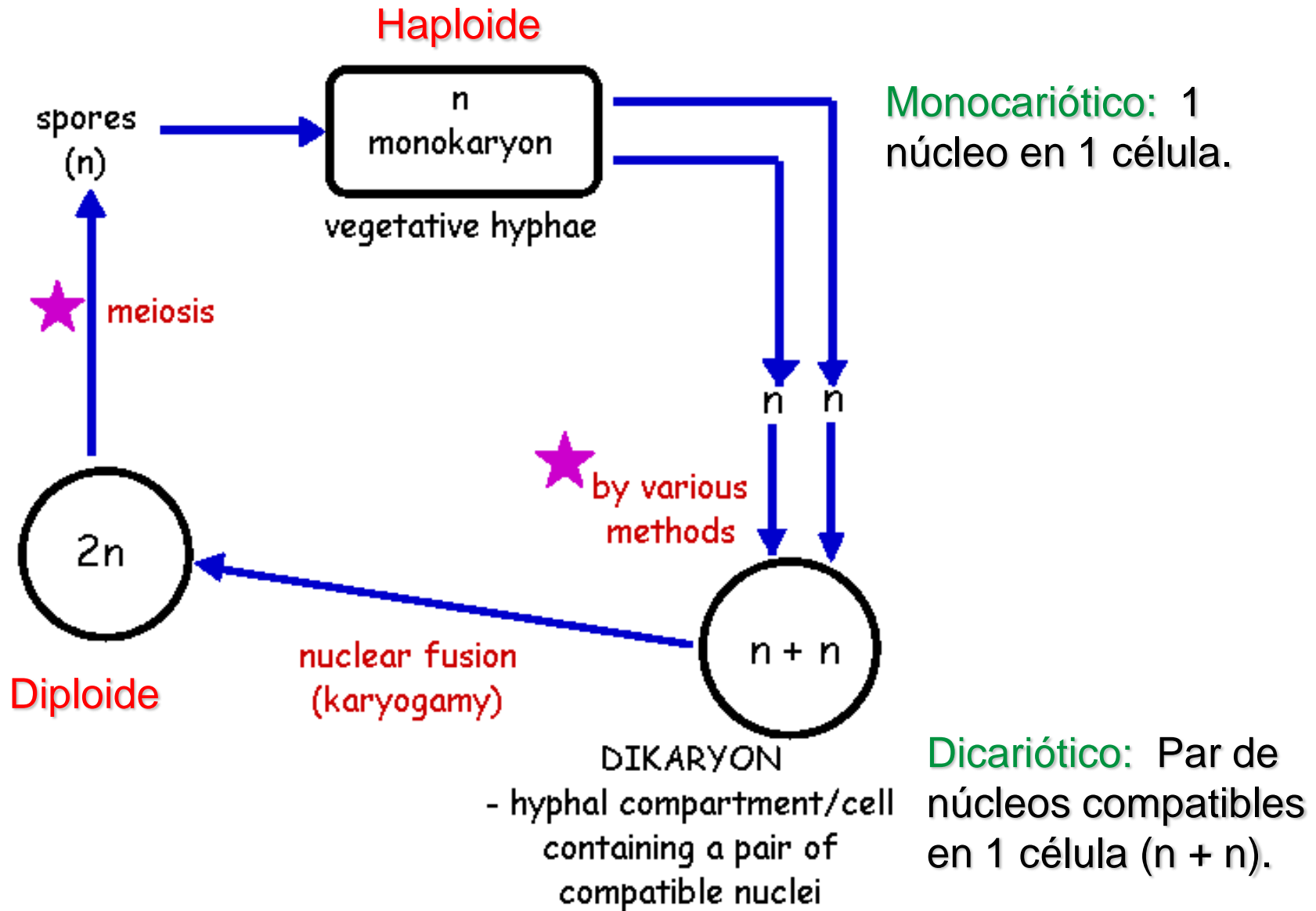


Micelio

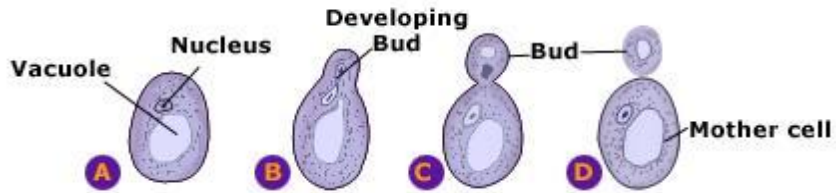
- paredes con quitina, celulosa, mananos y glucanos
- hifas septadas con poros,
- con 1 o 2 núcleos



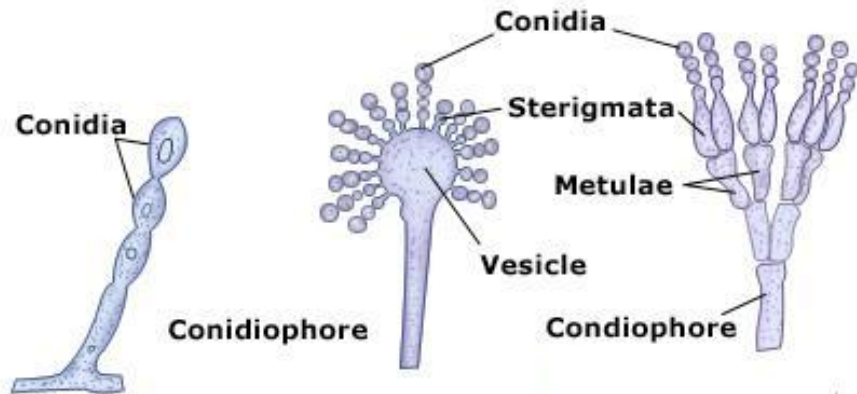
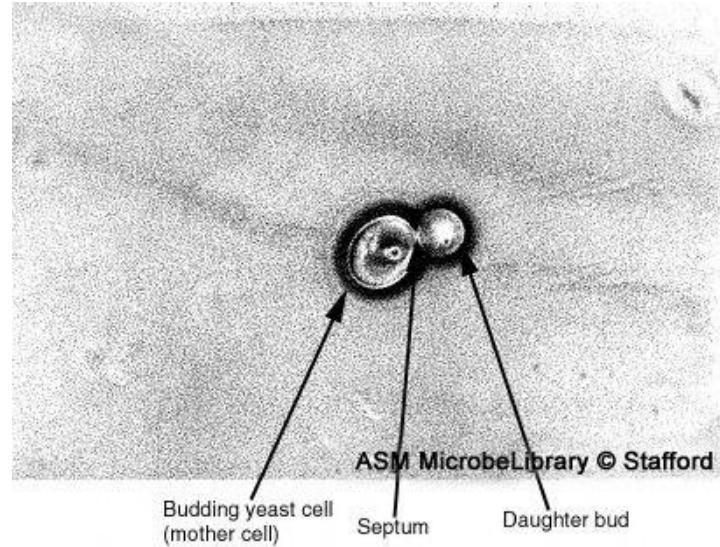
Micelio



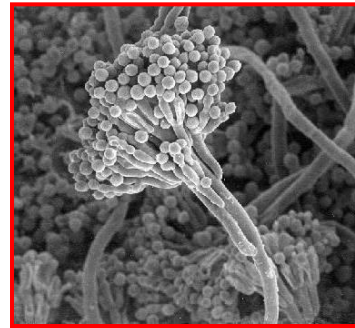
Reproducción asexual



Gemación



Conidios



Reproducción sexual

Gametangiogamia

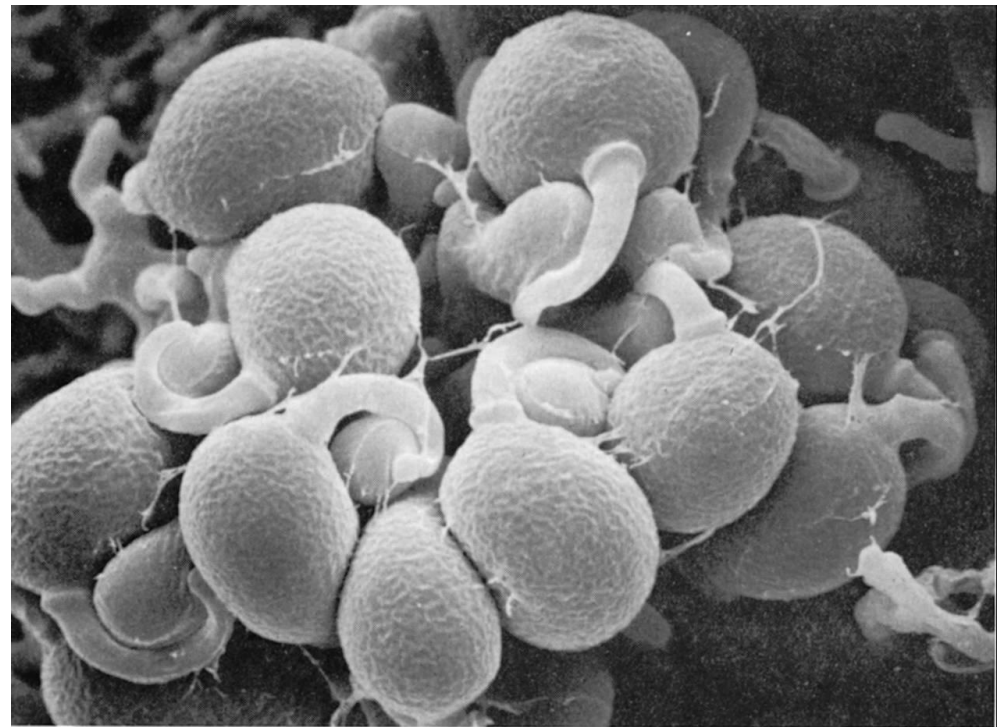
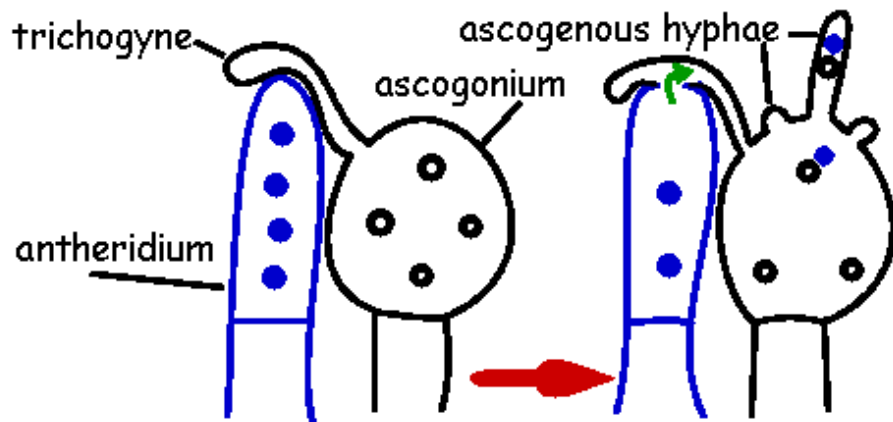
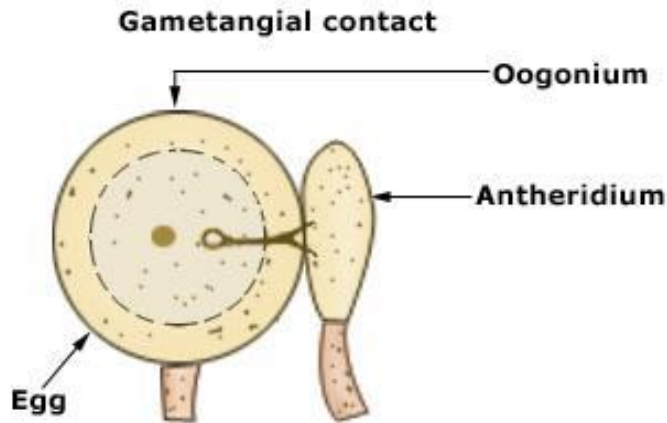
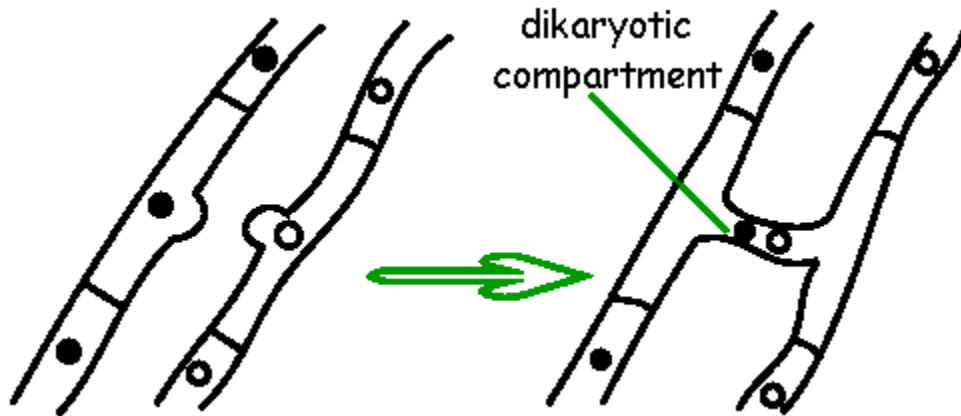


Figure 5-4 Scanning electron micrograph of the gametangia of *Pyronema domesticum*. The ascogonia are the balloonlike structures, and each is producing a tubular trichogyne that is in contact with a club-shaped antheridium. $\times 1000$. [Courtesy K. L. O'Donnell.]

Somatogamia



Ascóspora (N) (+) (A)

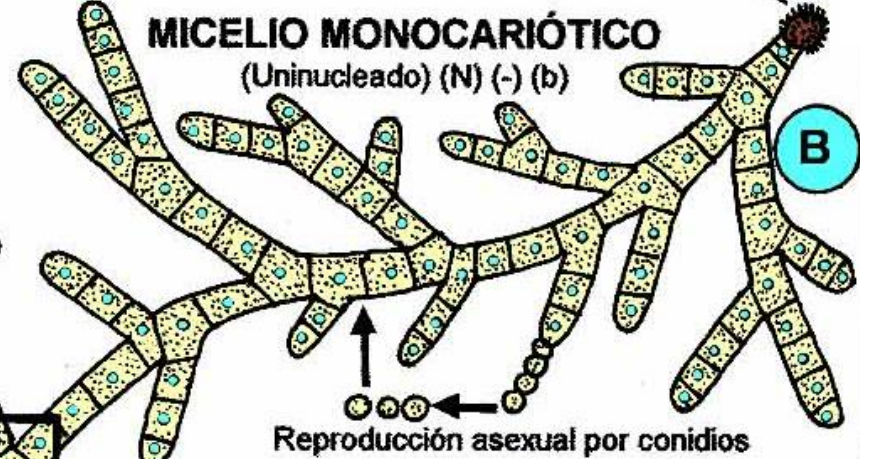
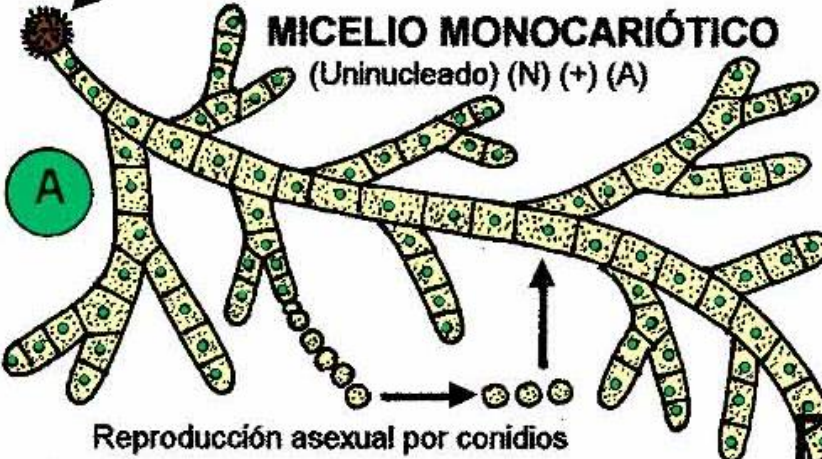


Germinación de la ascóspora

Ascóspora (N) (-) (a)

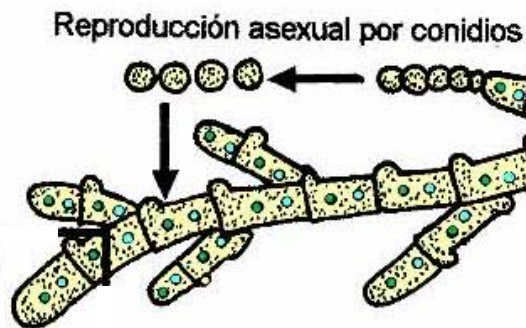


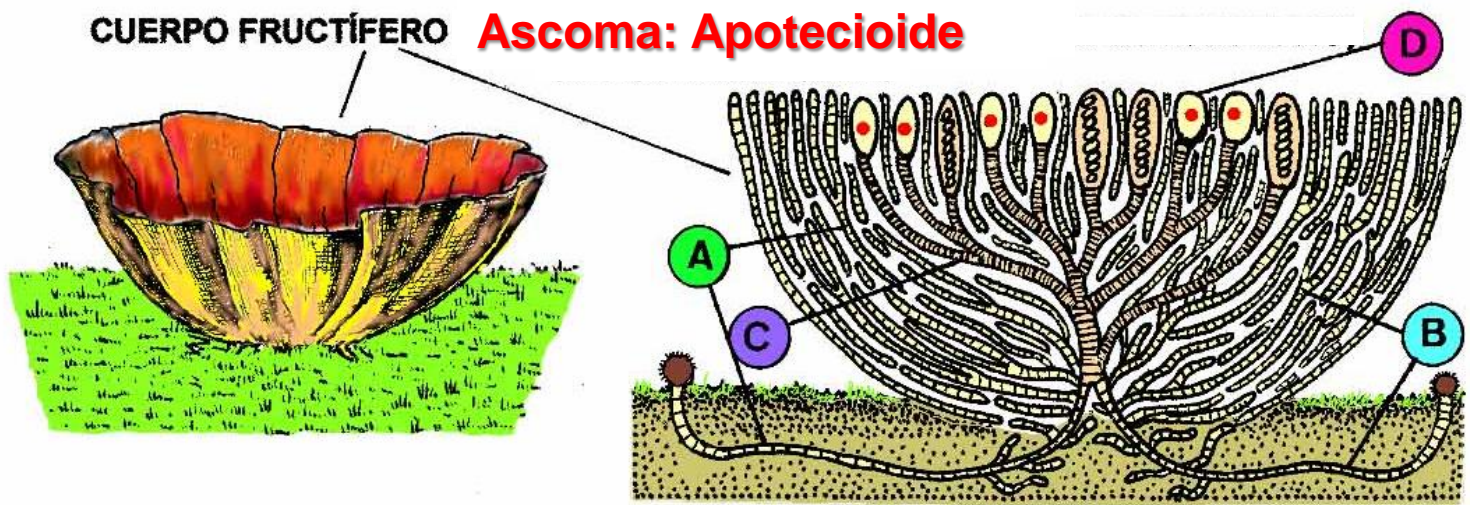
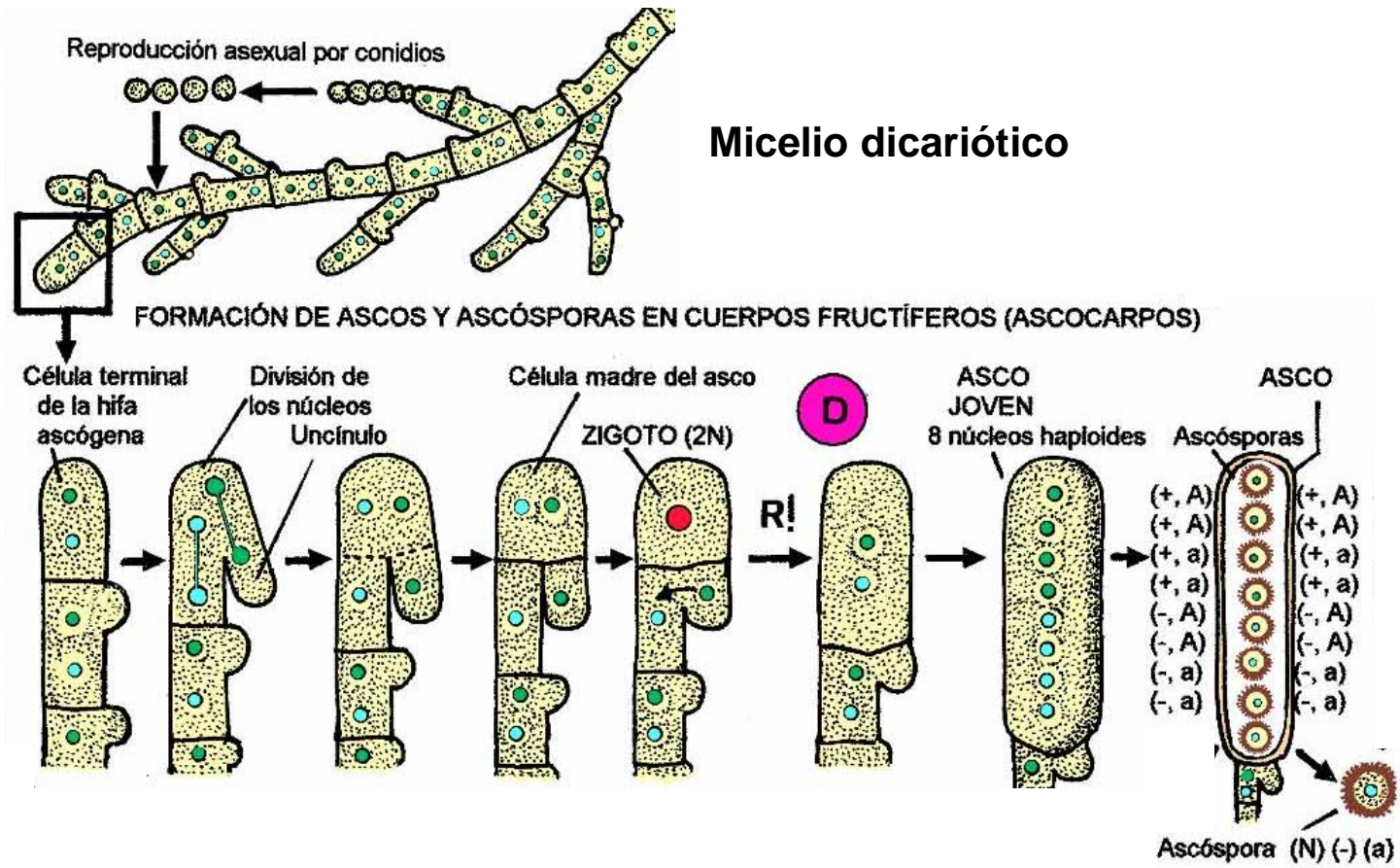
Germinación de la ascóspora



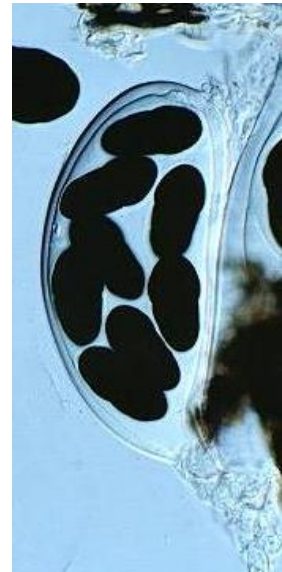
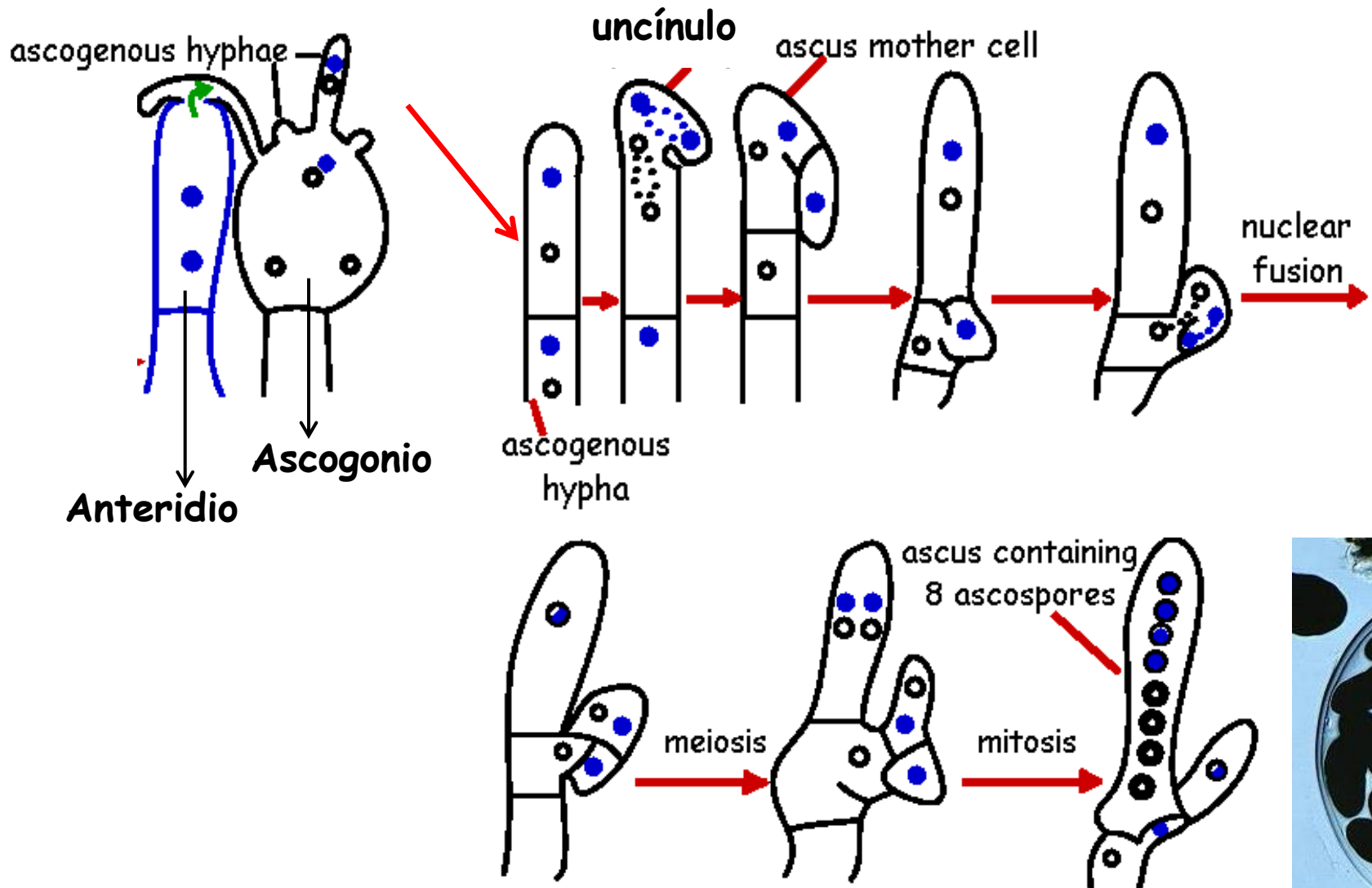
REPRODUCCIÓN SEXUAL
(Somatogamia)

MICELIO DICARIÓTICO
(Hifas ascógenas) (N + N) (A, b)





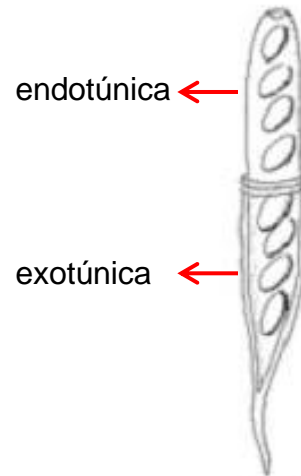
Formación de las Ascósporas



Tipos de Ascos



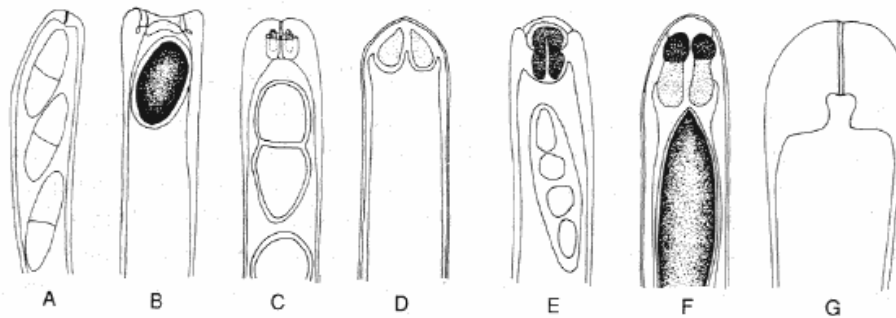
asca prototunicada



asca bitunicada



asca unitunicada con poro operculado

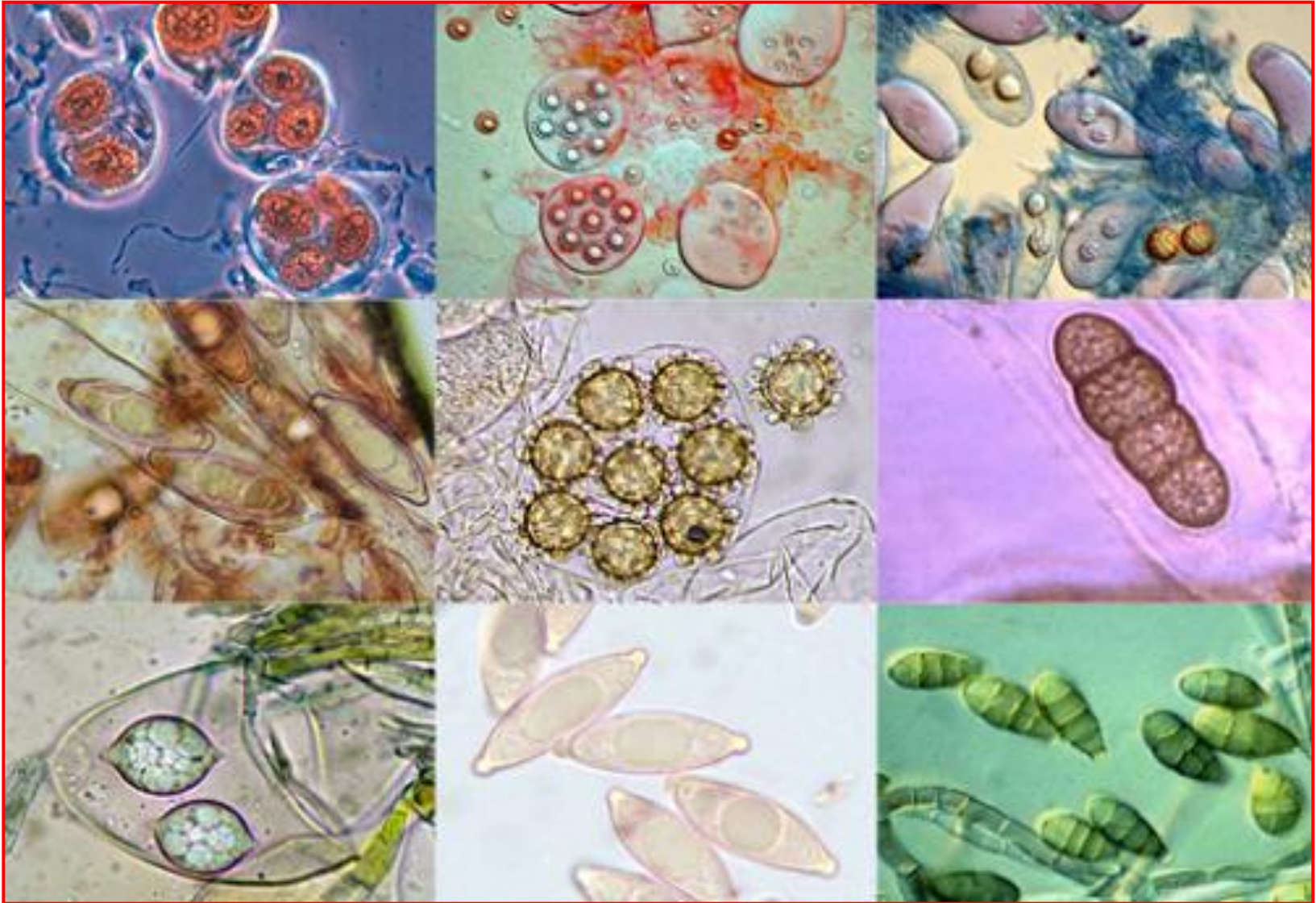


Unitunicate-inoperculate asci. A: *Nectria* (Hypocreales); B: *Sordaria* (Sordariales); C: *Melanconis* (Diaporthales); D: *Claviceps* (Clavicipitales); E: *Microglossum* (amyloid ring, Leotiales); F: *Rosellinia* (amyloid ring, Sphaeri-ales); G: *Lecanora* (Lecanorales).



Clasificación en base al tipo de asco

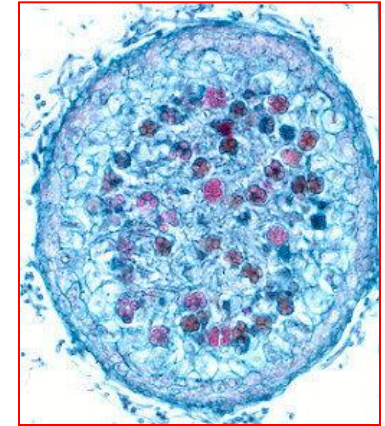
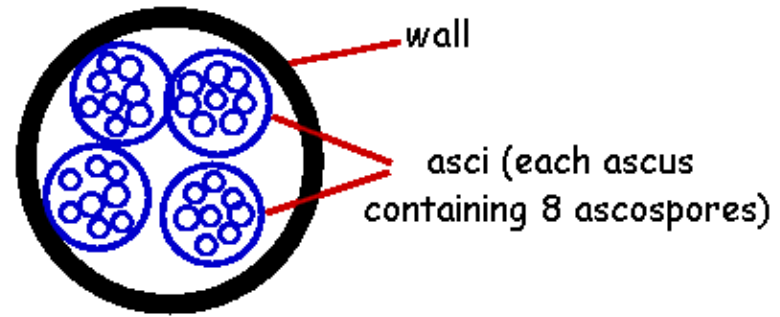
Esporas



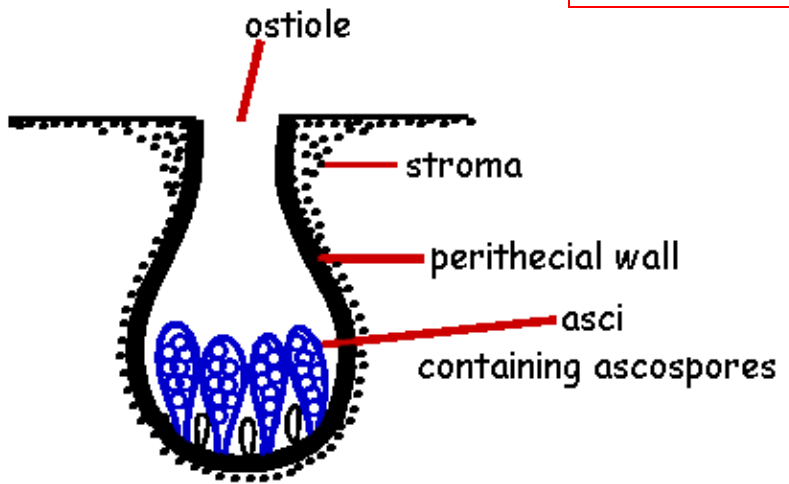
Clasificación en base al tipo de espora

Tipos de Ascomas

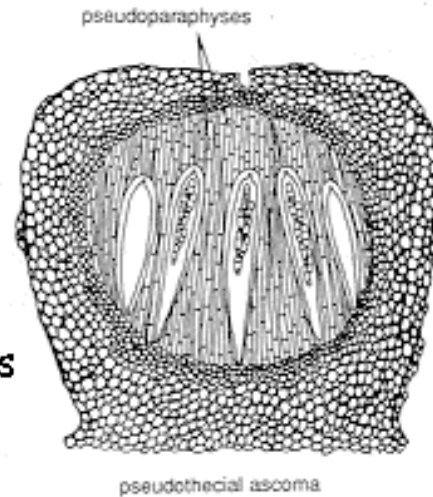
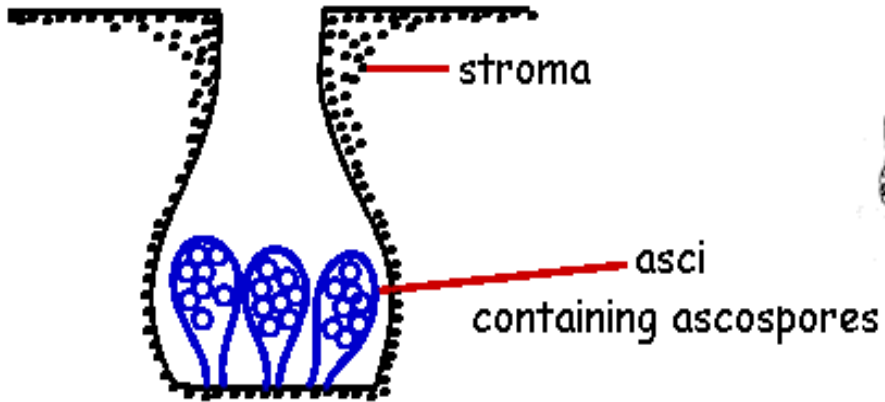
Cleistotedioides



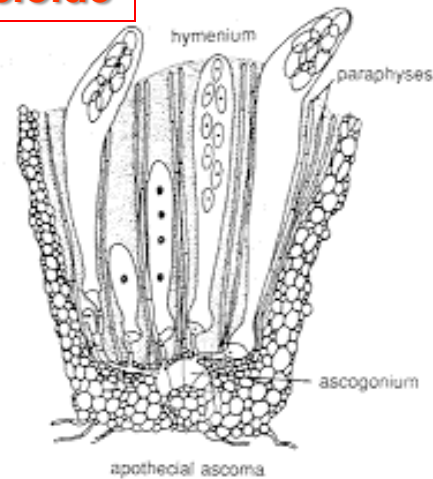
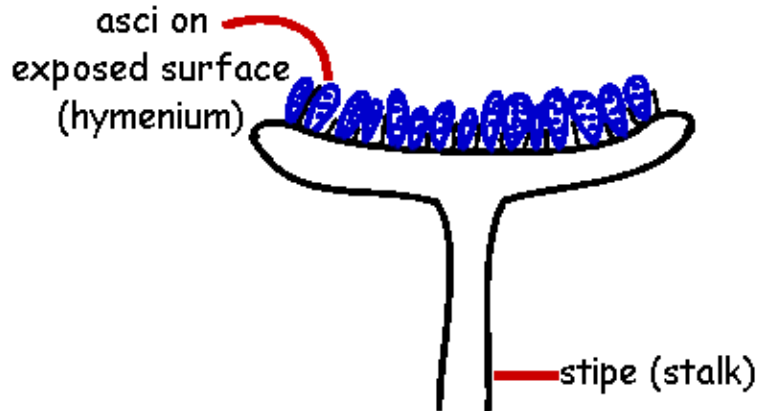
Peritecioides



Ascostroma

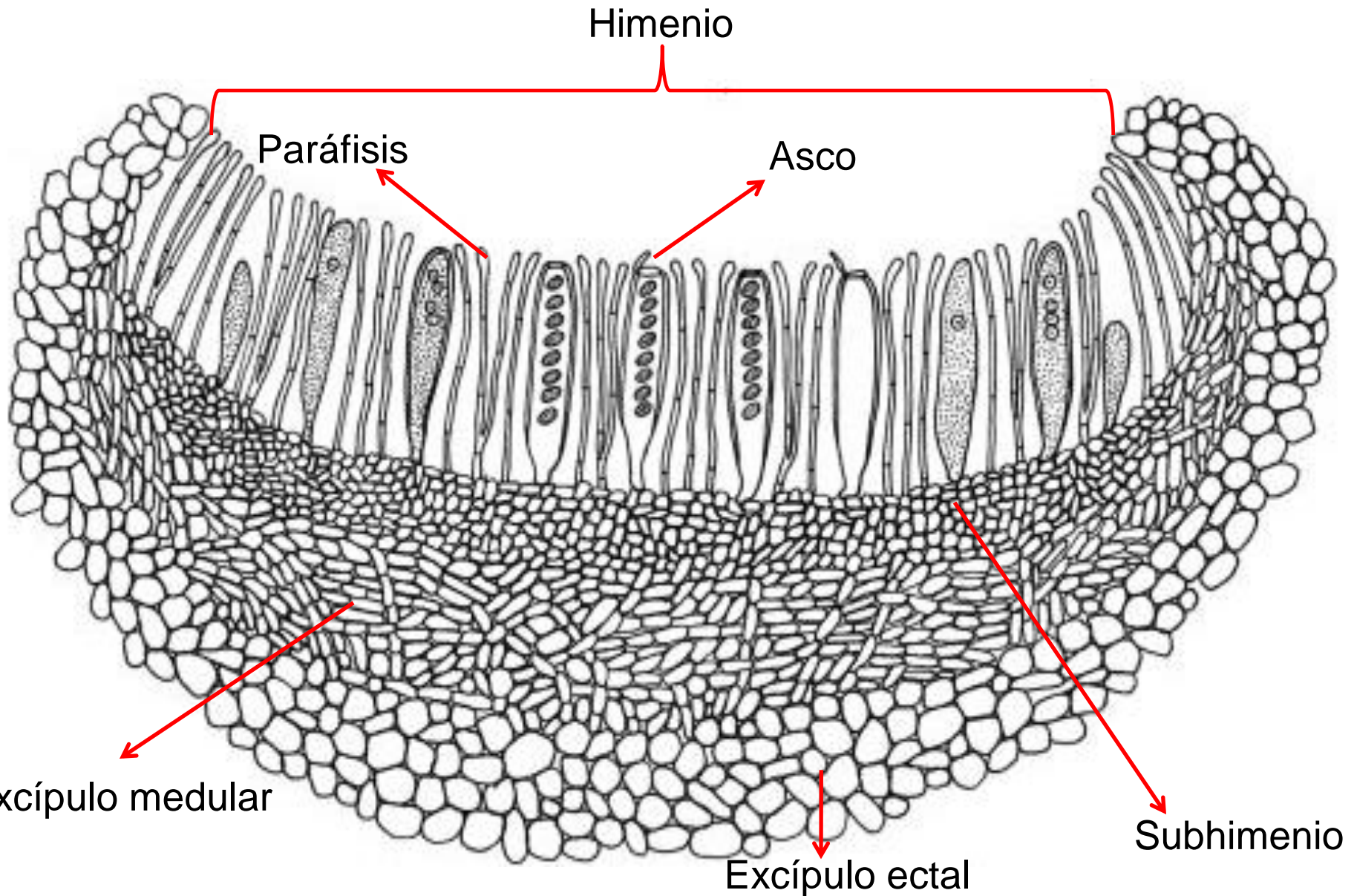


Apotecioide



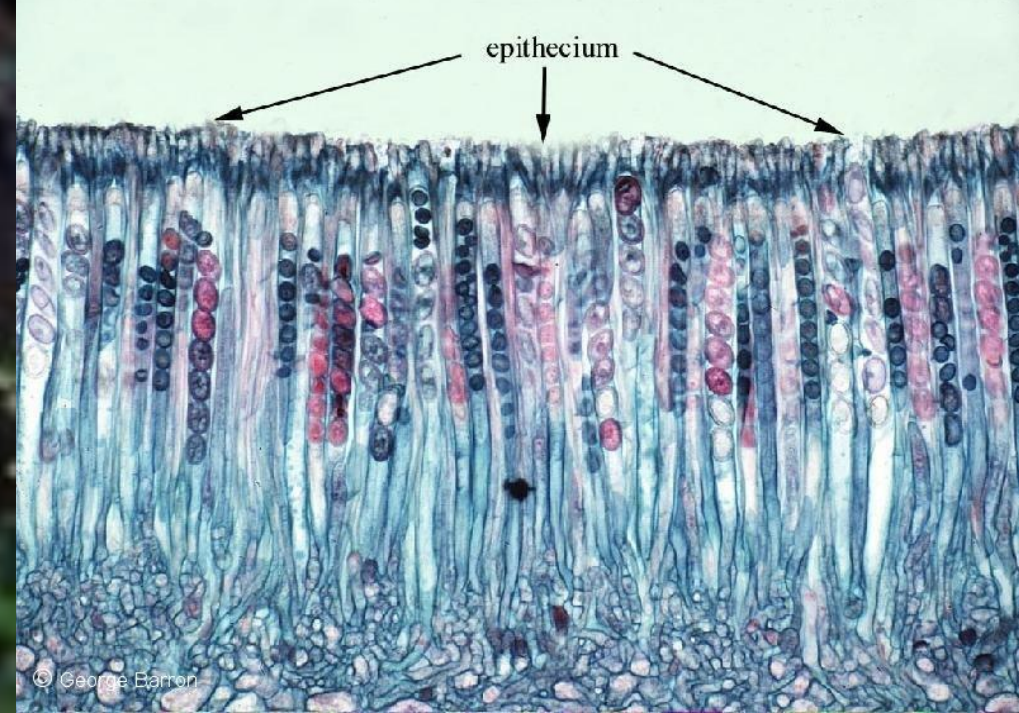
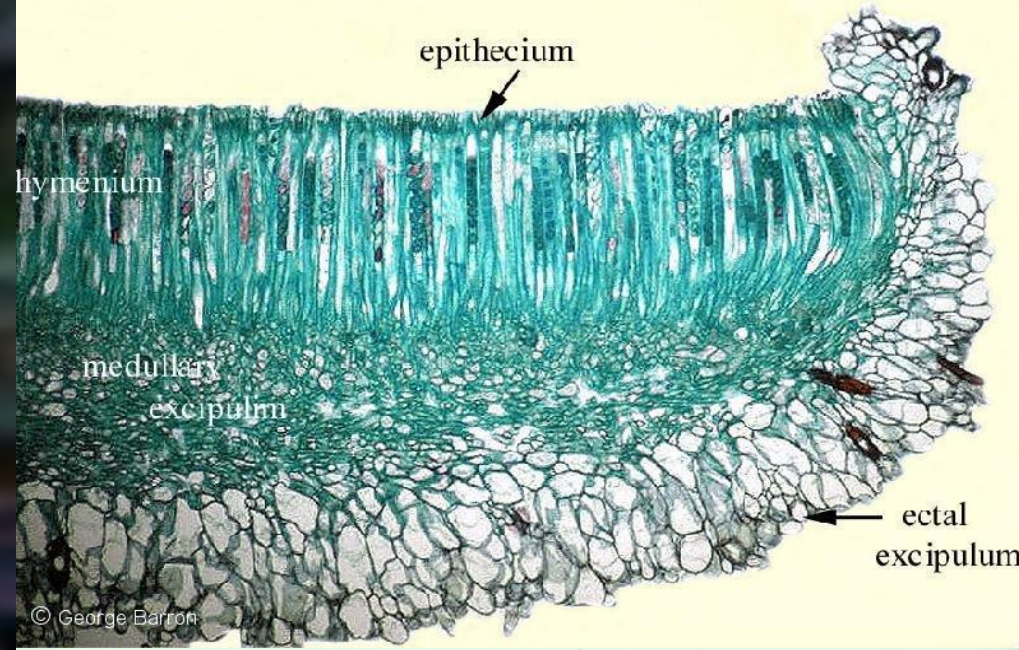
Clasificación en base al tipo de ascoma

Qué encontramos por dentro?





Section Through Apothecium of *Peziza*



TIPOS DE TEJIDOS

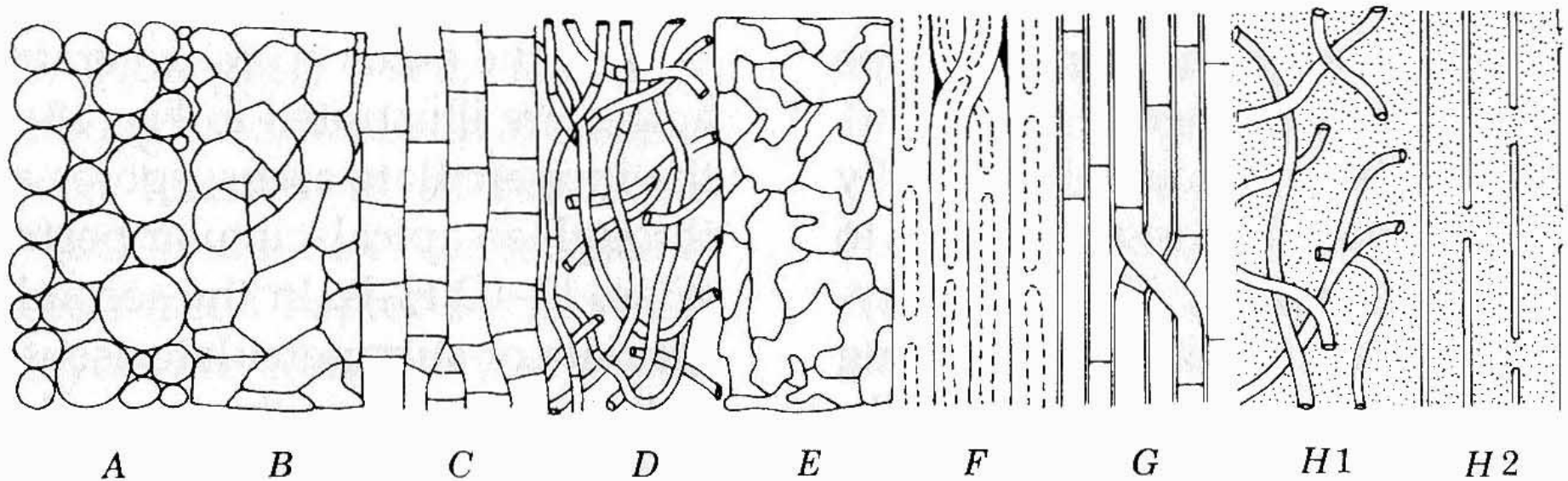


Figure 13-3 Tissue types (cross-sectional view) in apothecia or in stroma or sclerotia from which apothecium arises. (A) *Textura globulosa*. (B) *Textura angularis*. (C) *Textura prismatica*. (D) *Textura intricata*. (E) *Textura epidermoidea*. (F) *Textura oblita*. (G) *Textura porrecta*. (H1) *Textura intricata* widely spaced and immersed in gel. (H2) Gelatinized tissue, appearing to have widely spaced, parallel, thin-walled hyphae immersed in gel, but probably arising from gelatinization of thick walls of earlier *textura oblita*. [Redrawn by R. W. Scheetz from Korf (1973). By permission of Academic Press.]

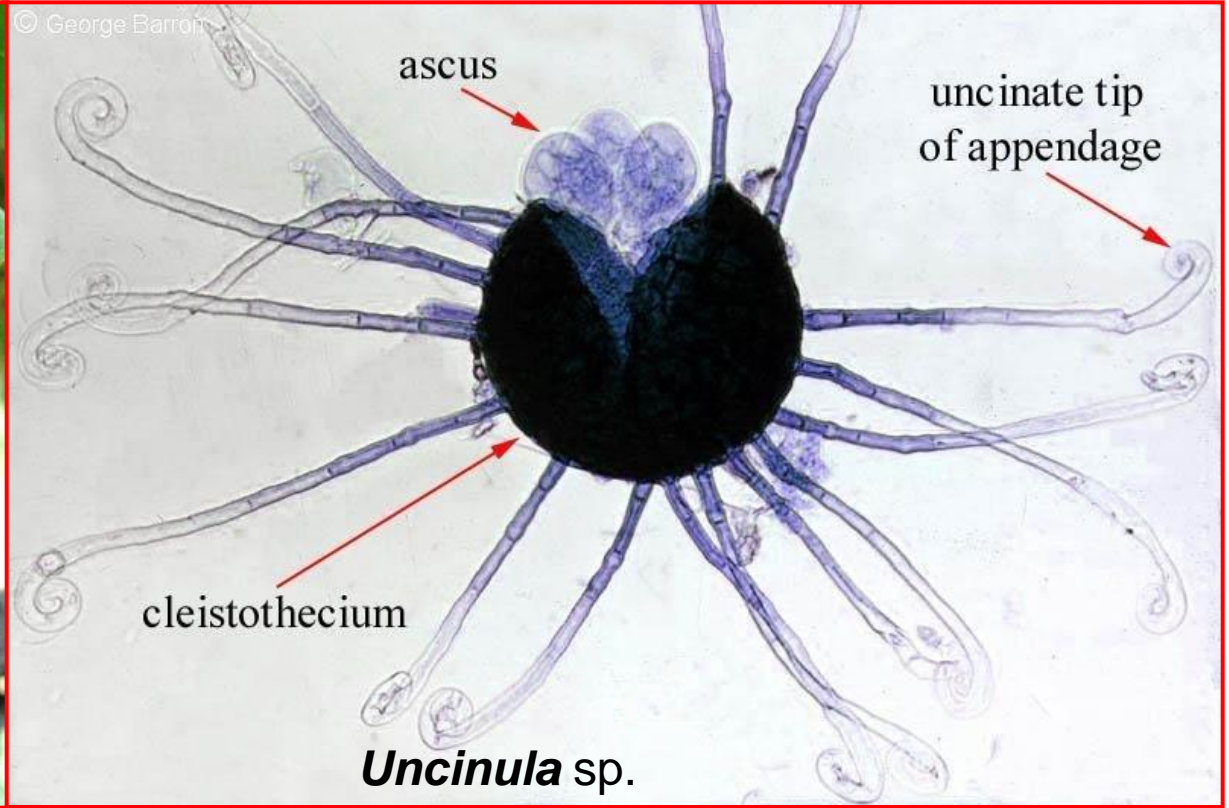
Importancia y Ecología

Saprófitos



Hypocreodendron (anamorfo)
Discoxylaria myrmecophila
Cultivado por hormigas del género *Atta*

Parásitos

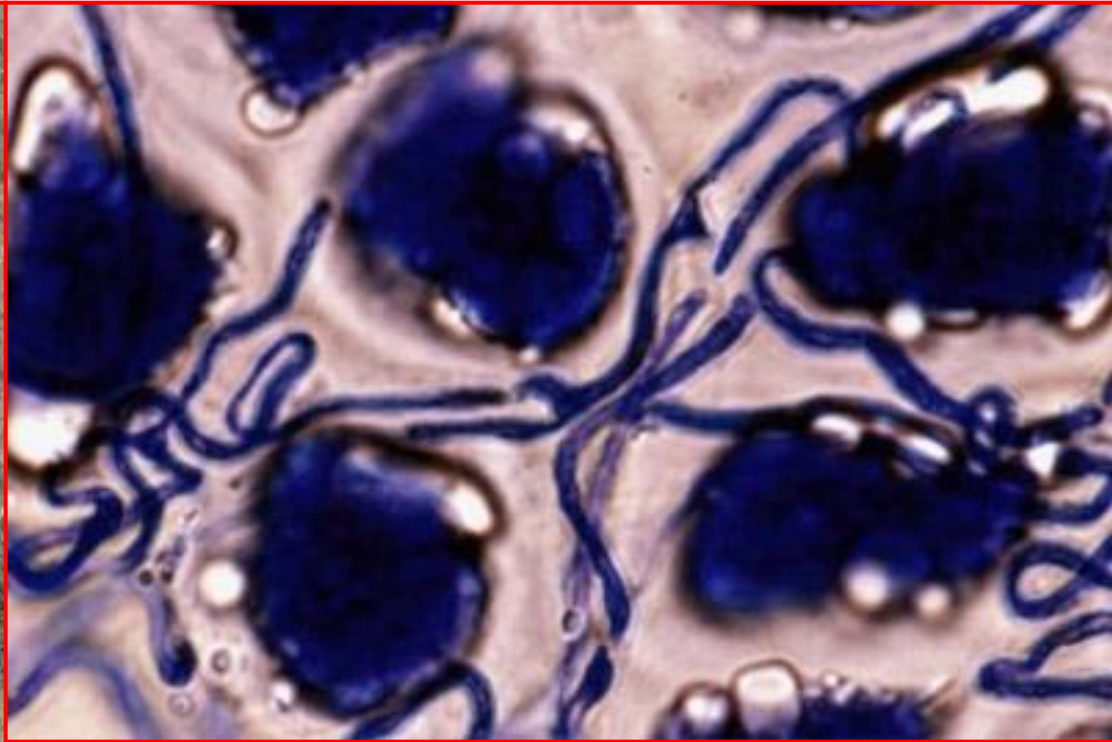


Parásitos de hongos



Cordyceps capitata parasitando ***Elaphomyces* sp.**

Endófitos



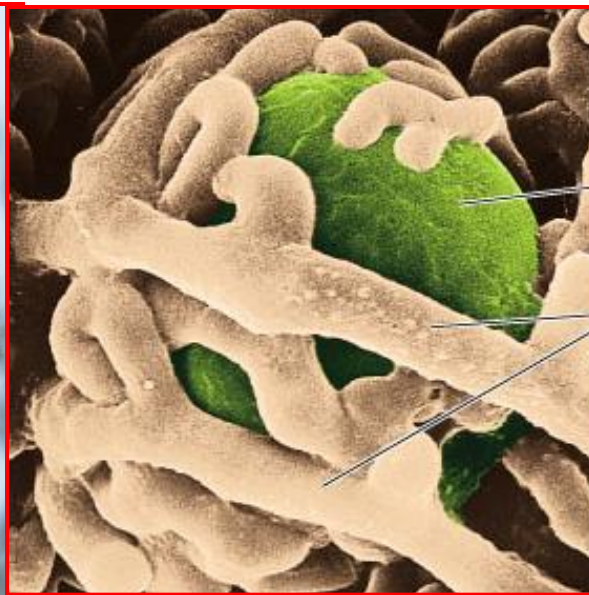
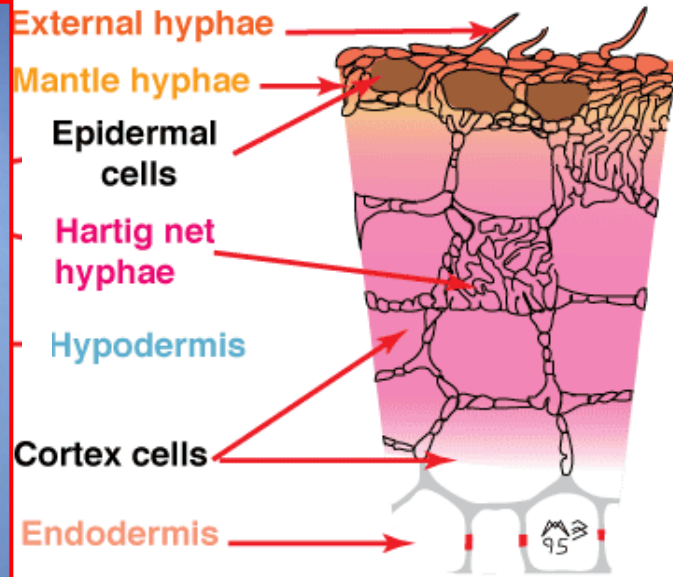
Hifas de un endófito (*Epichloë* sp.) en la capa de aleurona de cariopses de *Festuca hyeronimi*

Comestibles

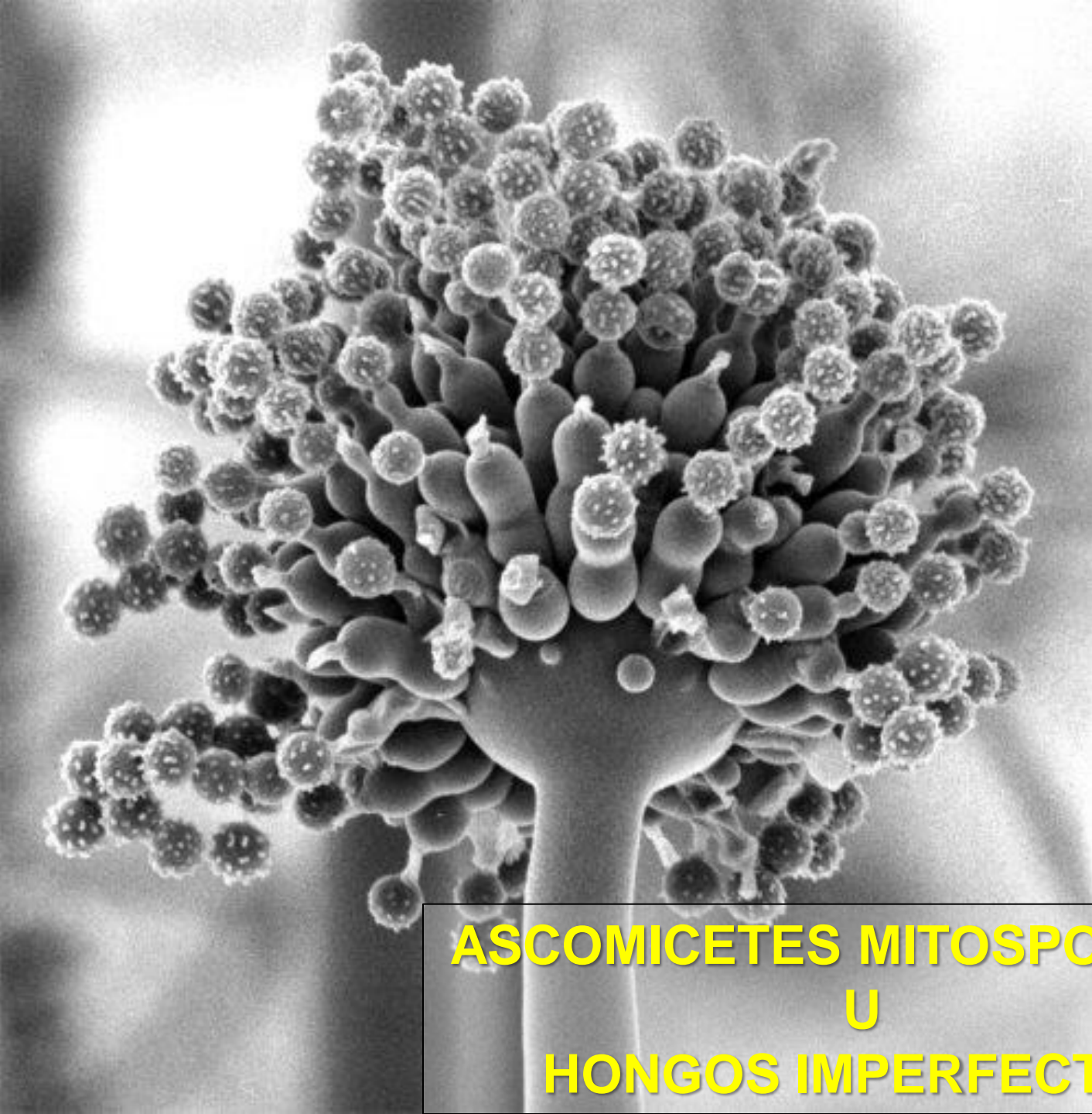


Simbióticos

Ectomicorrizas



Lichenes



ASCOMICETES MITOSPORICOS
U
HONGOS IMPERFECTOS

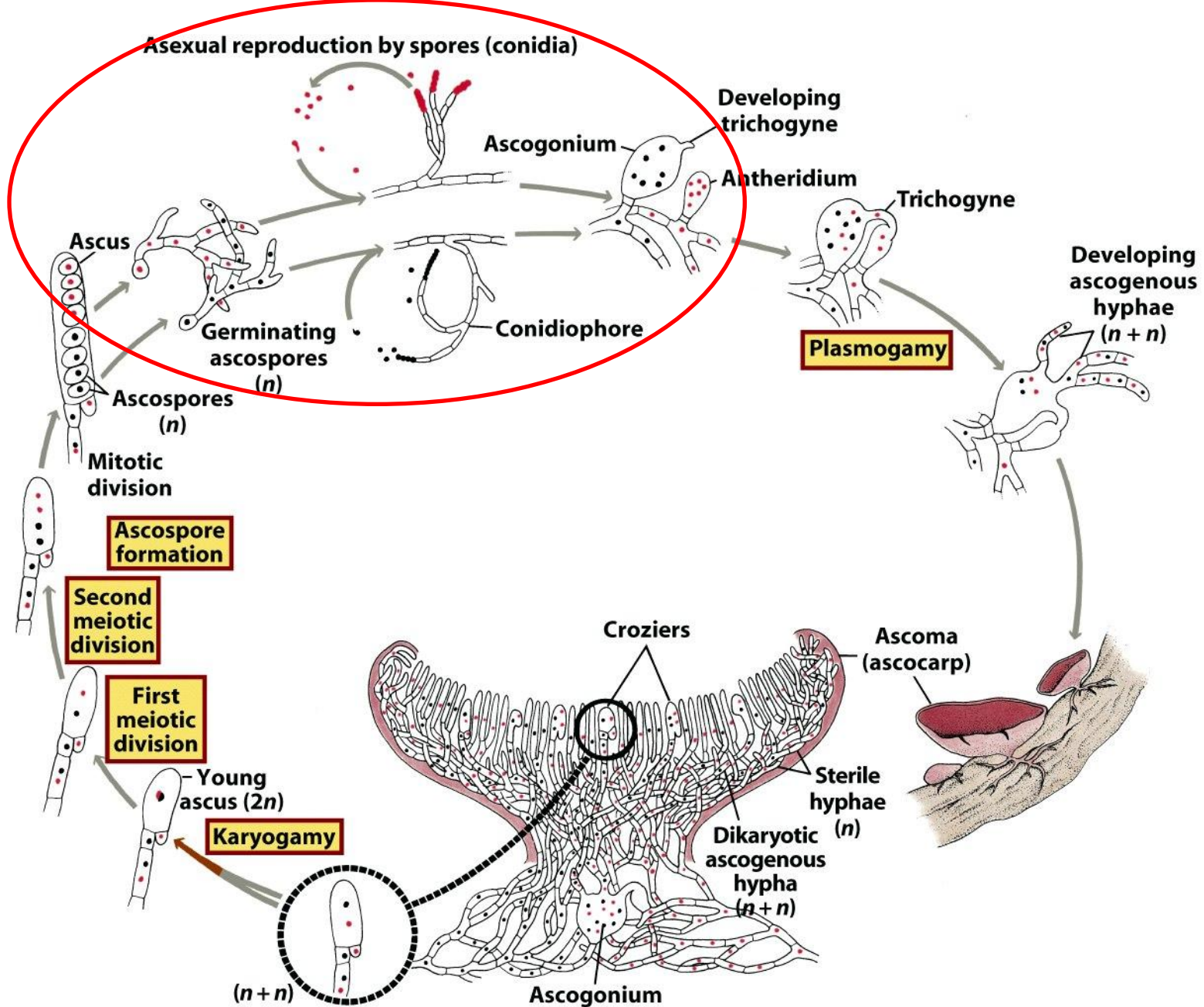


Figure 14-14
Biology of Plants, Seventh Edition
 © 2005 W. H. Freeman and Company

Hongos Mitospóricos

Algunos
Ascomycota
(30.000 spp.)

Esporas
asexuales
Mitósporas

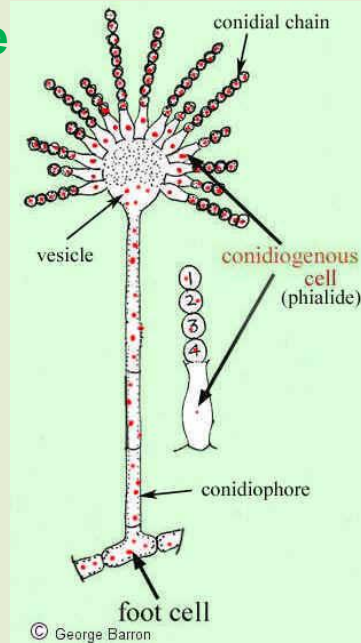
Fase Anamorfa

~~Holomorfo = Anamorfo + Teleomorfo~~

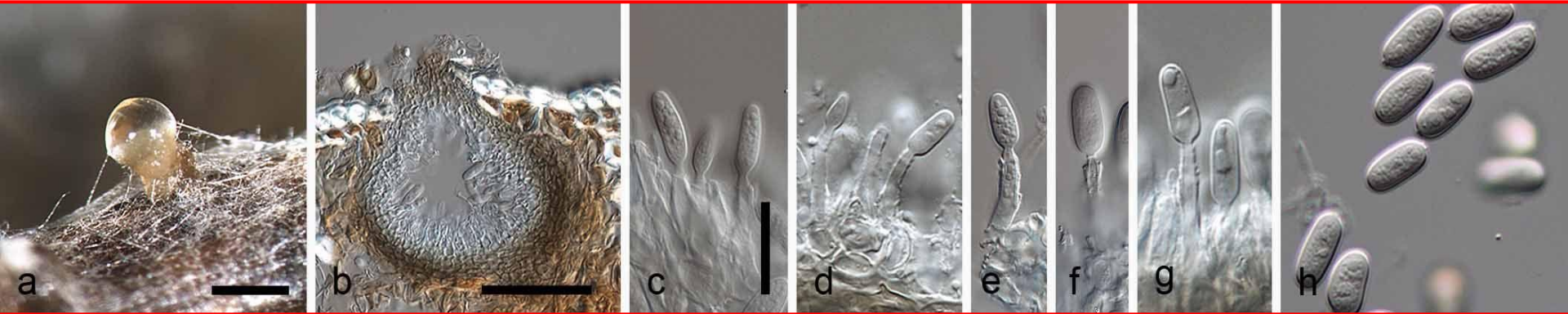
ausente

Clasificación anamórfica

- Mitósporas o tipos de conidios (esporas de diseminación)
- Células conidiógenas (a partir del cual se desarrolla el conidio)
- Conidióforos (hifa sobre las que nacen los conidios)
- Conidiomata (conidióforos agregados)
- Conidiogénesis (desarrollo de conidios)
- Datos moleculares



Clasificación anamórfica



Conidiomata

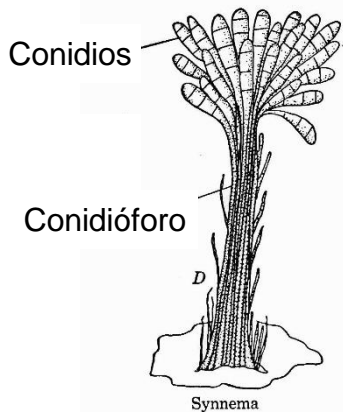
C/T de conidiomata

Conidios pegados a la célula conidiógena

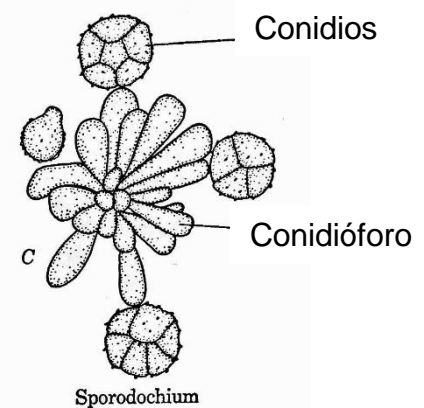
Conidios

Conidiomata o conidioma (conidióforos agrupados)

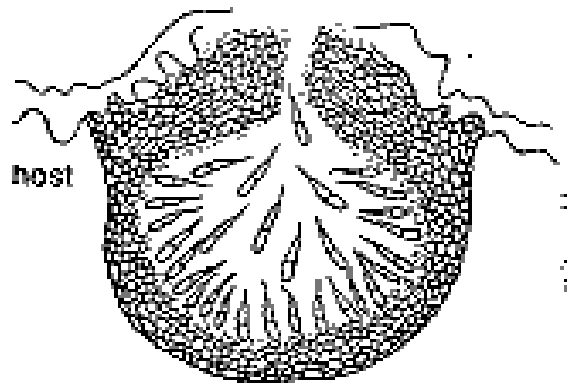
Coremia o Synnemata



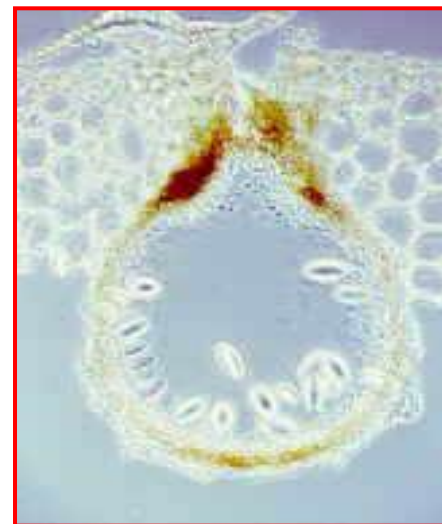
Esporodocio



Picnidio

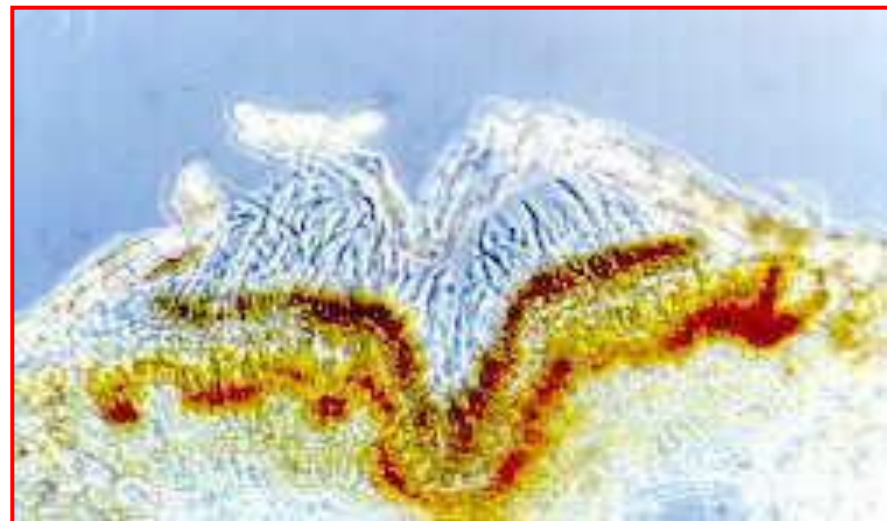
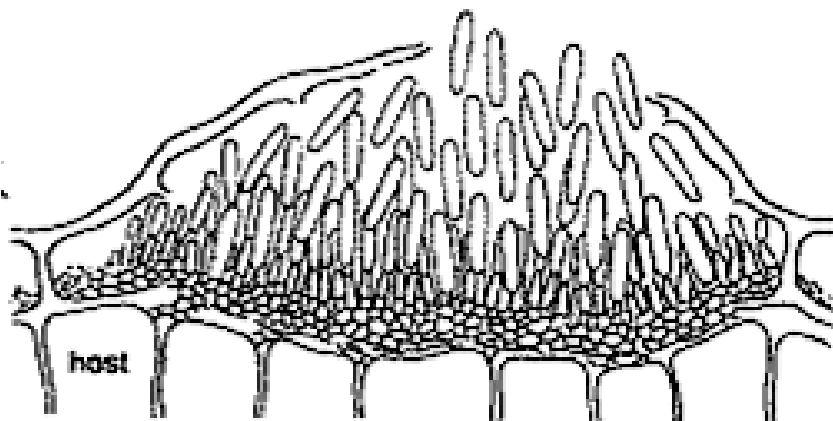


superficie



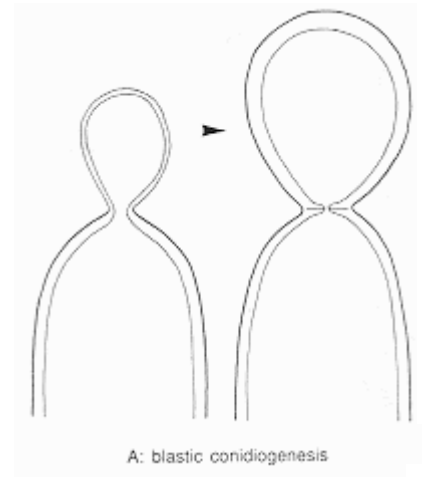
C/L

Acérvulo (conidioma cubierto)

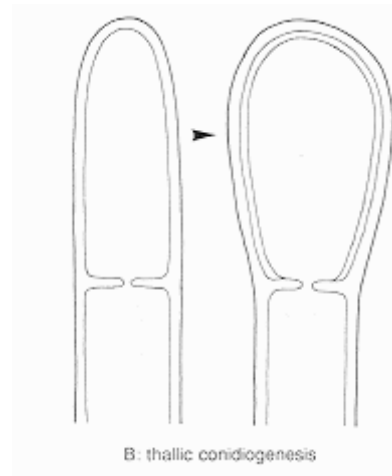


Conidiogénesis

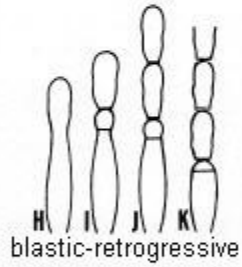
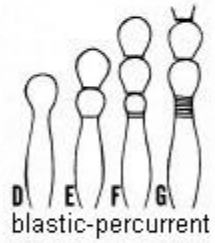
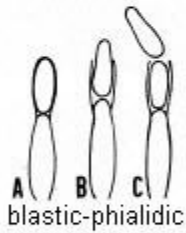
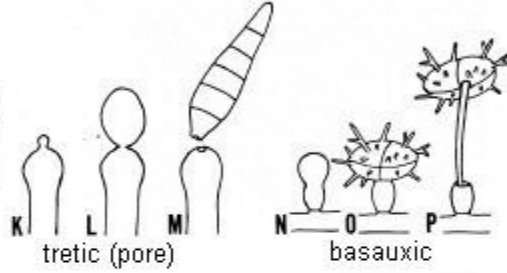
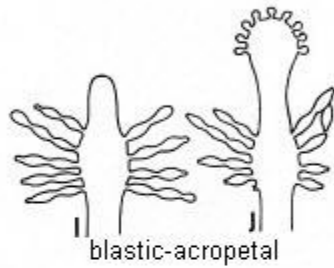
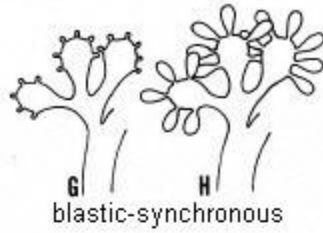
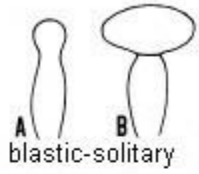
Blástica (hinchazón): el conidio es reconocible antes de que se corte por la pared.



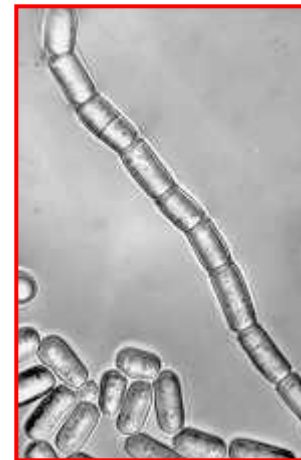
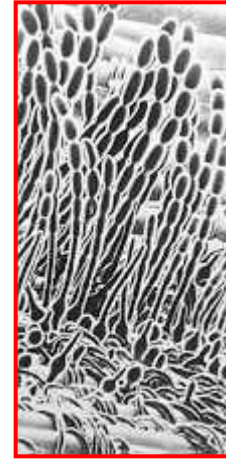
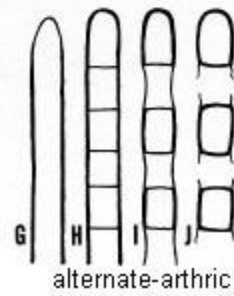
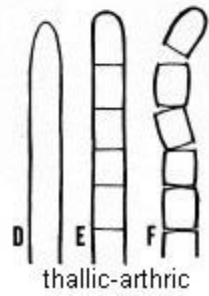
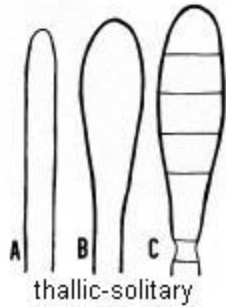
Tálica (fragmentación): la pared se desarrolla antes que comience la diferenciación del conidio



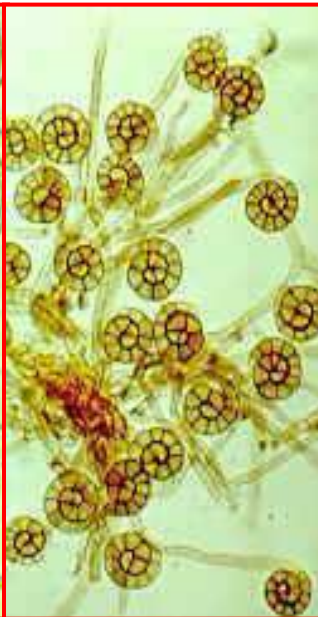
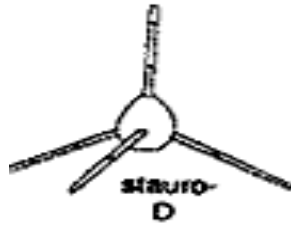
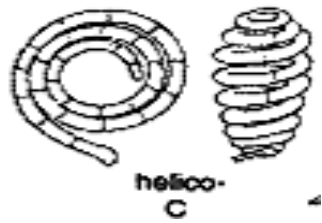
BLASTIC



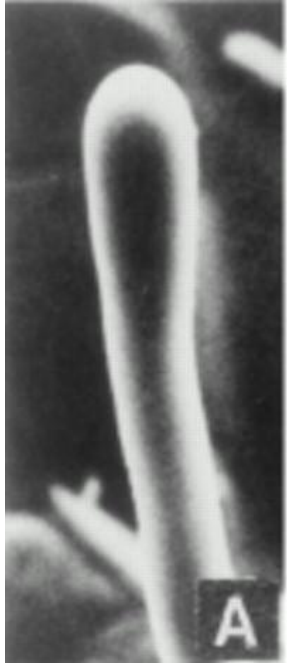
THALLIC



Morfología de los conidios



Cambios morfológicos durante la formación de un conidióforo



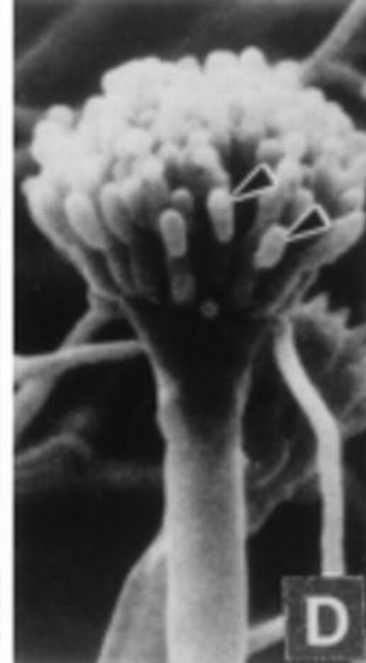
Conidióforo



Vesícula



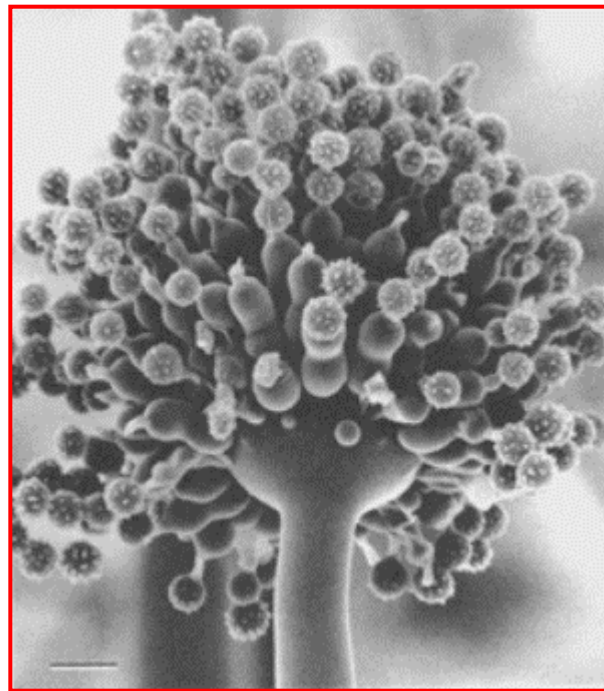
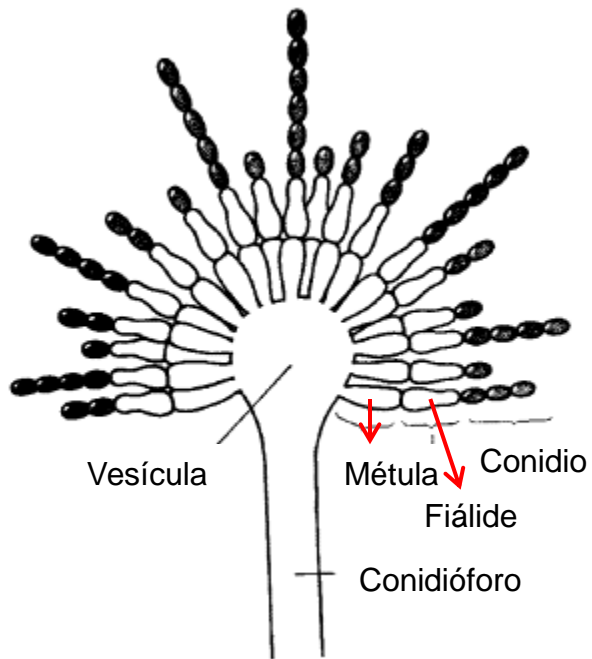
Métula



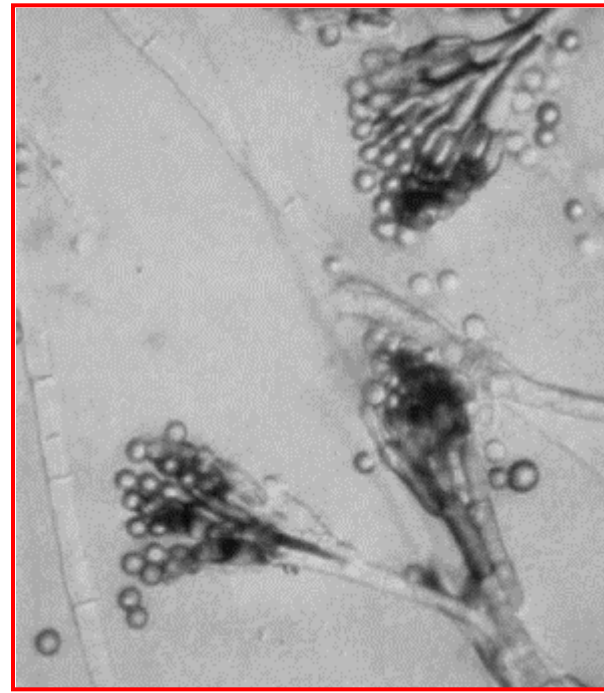
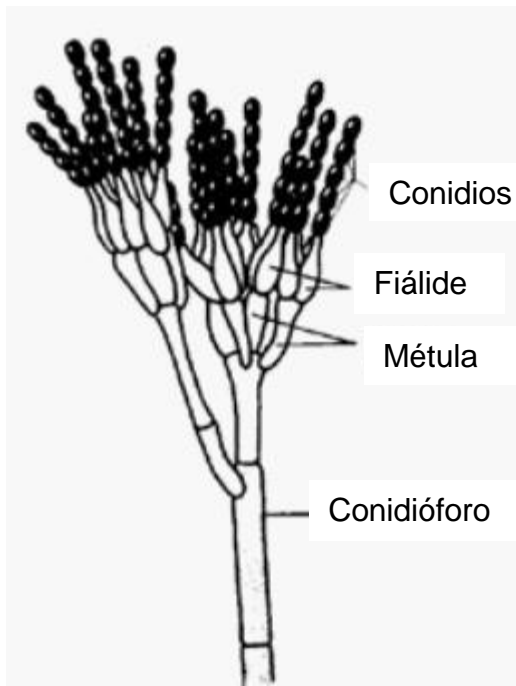
Fiálides



Conidios



Aspergillus



Penicillium

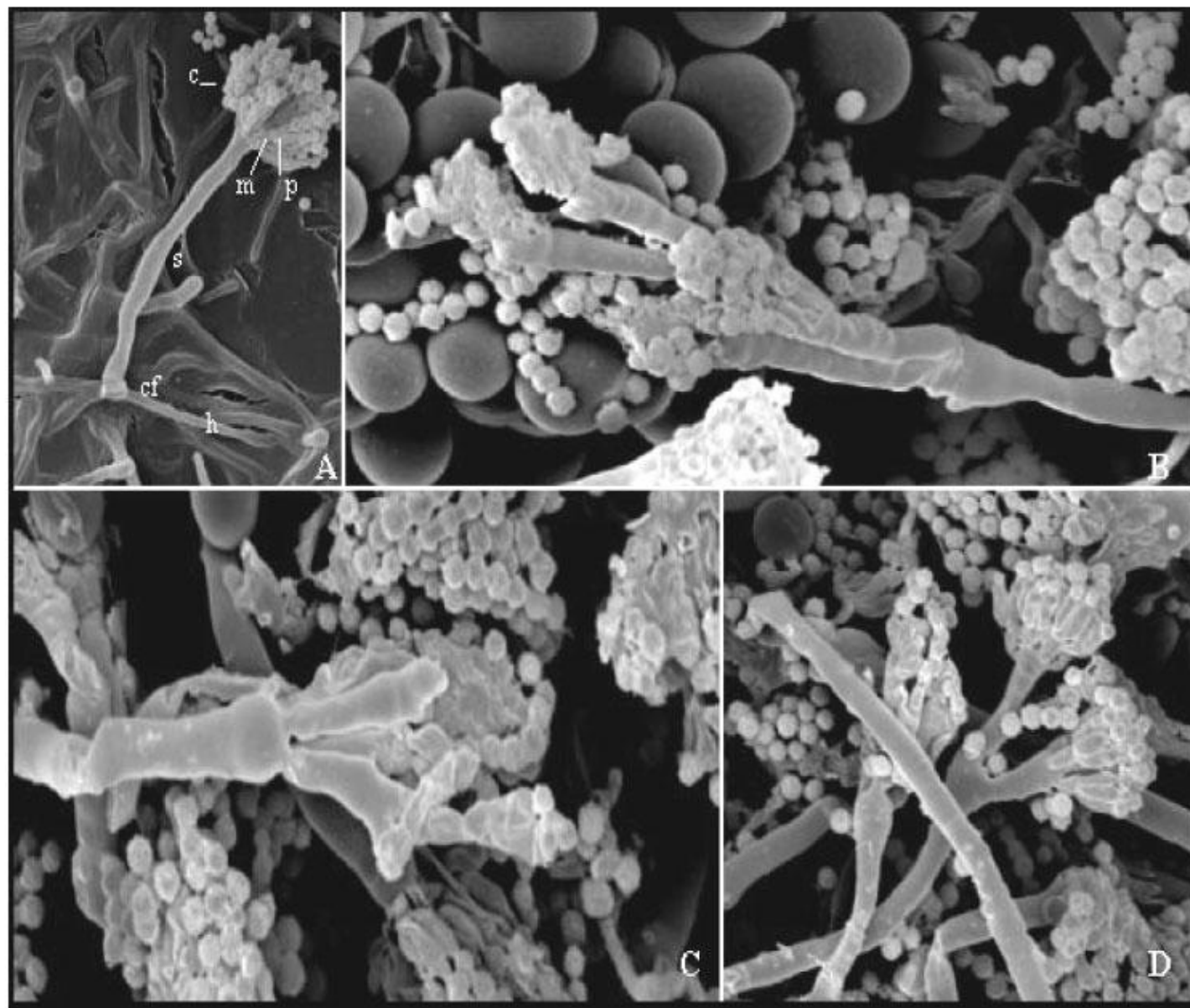


Figure 2. SEM showing conidia (c), metulae (m), phialides (p), stalk (s), foot-cell (cf) and hyphae (h) of wild-type (A) and V103 (B, C and D) strains of *A. nidulans*. In B and C, metulae and phialides were long, indistinct and showed secondary conidiophores. In D, Conidiophore stalks ramify. Colonies were grown at 37 °C in Agar Complete Medium for 48 hours . Magnification from A to D: 2500×, 3030×, 3420× and 3490×, respectively.

Importancia

Micosis humana



Farmacéutica

Drogas para combatir enfermedades bacterianas:

Penicillium sp. → penicilina

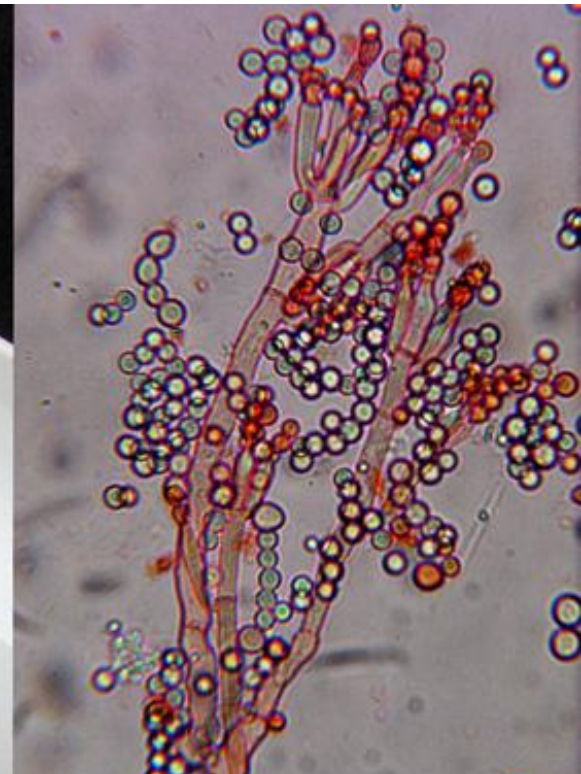
Tolypocladium niveum: fuente de la droga inmunosupresiva (**ciclosporina**)

Alimentos

Agentes saborizantes para quesos

Convierten la proteína de soja → salsa de soja

Penicillium roquefortii



Enfermedades en las plantas

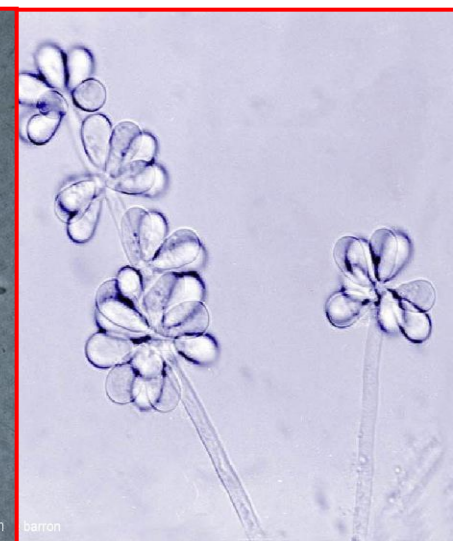
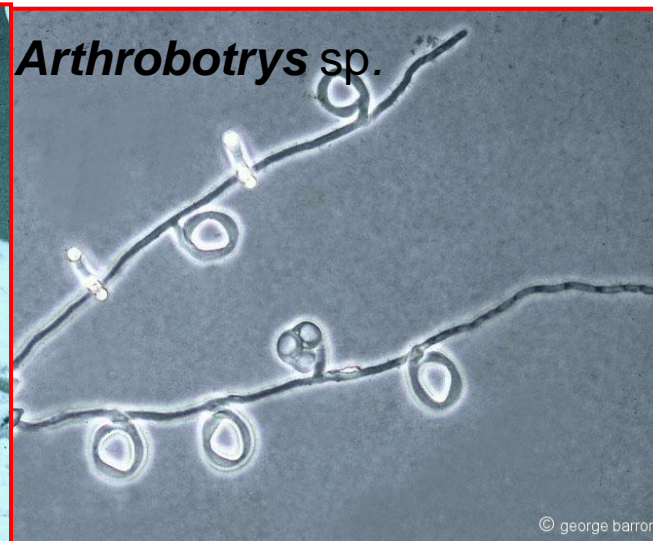
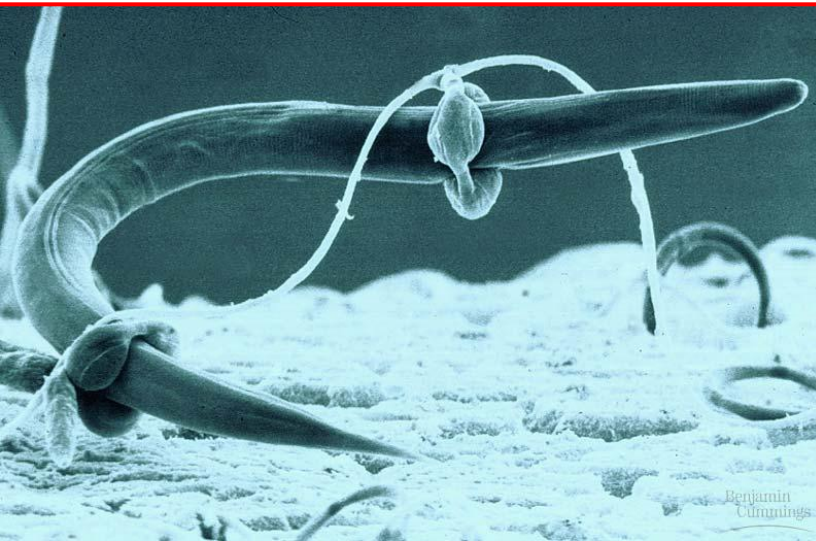
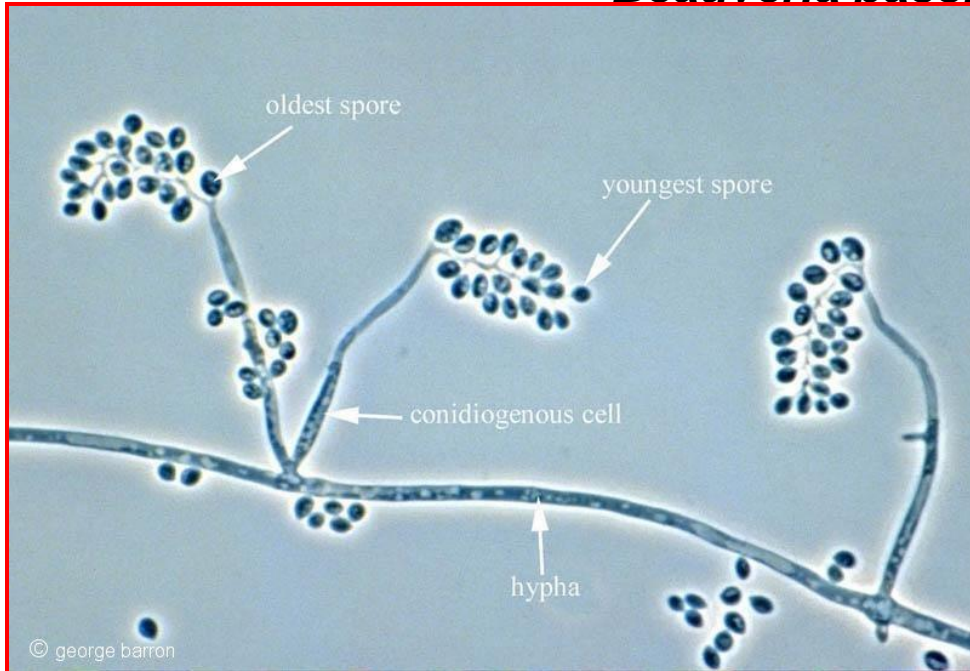


Alternaria alternata



Parásitos de animales

Beauveria bassiana



Phylum Ascomycota particularidades



- Neolectales, **Neolectomycetes**
- Pneumocystidales, **Pneumocystidomycetes**
- Schizosaccharomycetales, **Schizosaccharomycetes**
- Taphrinales, **Taphrinomycetes**

Taphrinomycotina

- Saccharomycetales, **Saccharomycetes**

Saccharomycotina

Subphylum TAPHRINOMYCOTINA

Subphylum SACCHAROMYCOTINA

- Ordiinales, **Ordiomycetes**
- Pezizales, **Pezizomycetes**
- Lahmiales
- Medeolariales
- Triblidiales

Pezizomycotina

- Capnodiales
- Dothideales
- Myriangiales

Dothideomycetidae

Dothideomycetes

- Pleosporales, Pleosporomycetidae
- Botryosphaerales
- Hysteriales
- Patellariales
- Jahnulales

- Arthoniales, **Arthoniomycetes**
- Chaetothyriales
- Pyrenulales
- Verrucariales
- Mycocaliciales, Mycocaliciomycetidae

Chaetothyriomycetidae

Eurotiomycetes

- Eurotiales
- Onygenales
- Coryneliales

Eurotiomycetidae

- Laboulbeniales
- Pyxidiphorales

Laboulbeniomycetes

- Lichinales, **Lichinomycetes**
- Acarosporales, Acarosporomycetidae
- Candelariales
- Umbilicariales

Lecanoromycetes

- Lecanorales
- Peltigerales
- Teloschistales

Lecanoromycetidae

- Agryiales
- Baeomycetales
- Ostropales
- Pertusariales

Ostropomycetidae

- Cyttariales
- Erysiphales
- Helotiales
- Rhizmatiales
- Thelebolales

Leotiomycetes

- Calosphaerales
- Lulworthiales
- Meliolales
- Phyllachorales
- Trichosphaerales
- Xylariales, Xylariomycetidae

Sordariomycetes

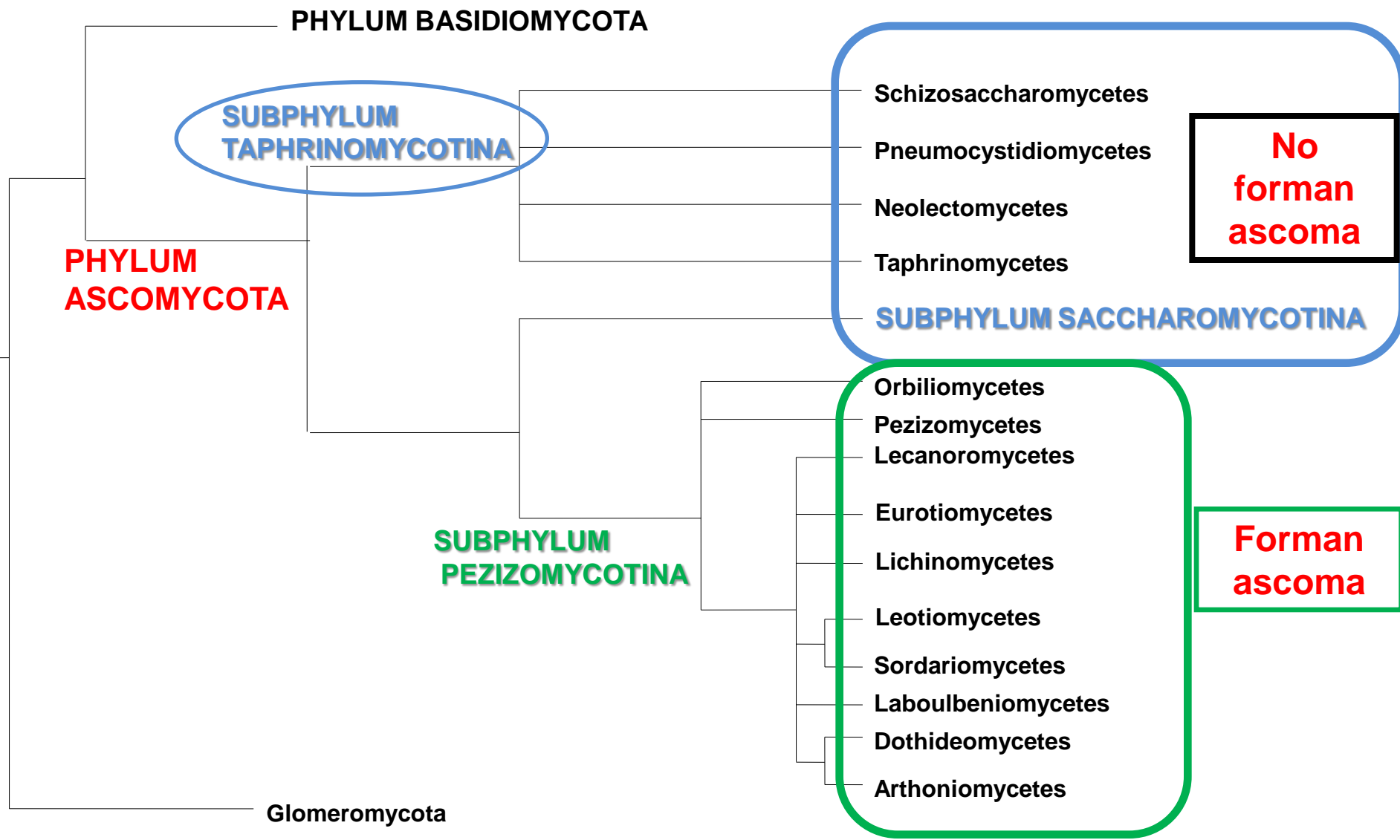
- Coronophorales
- Hypocreales
- Microascales
- Melanosporales

Hypocreomycetidae

- Boliales
- Chaetosphaerales
- Coniochaetales
- Diaporthales
- Ophiostomatales
- Sordariales

Sordariomycetidae

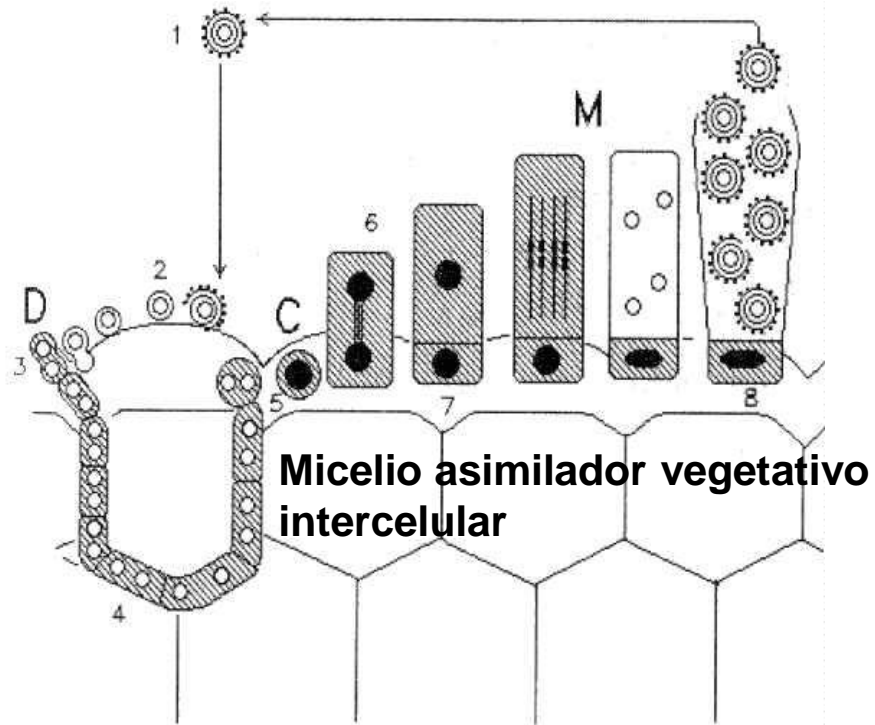
Subphylum PEZIZOMYCOTINA



SUBPHYLUM TAPHRINOMYCOTINA

Taphrinomycetes

- Patógenos de plantas
- Causa enrulamiento de hojas (duraznero).
- No ascoma. Micelio verdadero.



Taphrina deformans



Taphrina entomospora infectando *Nothofagus pumilio*

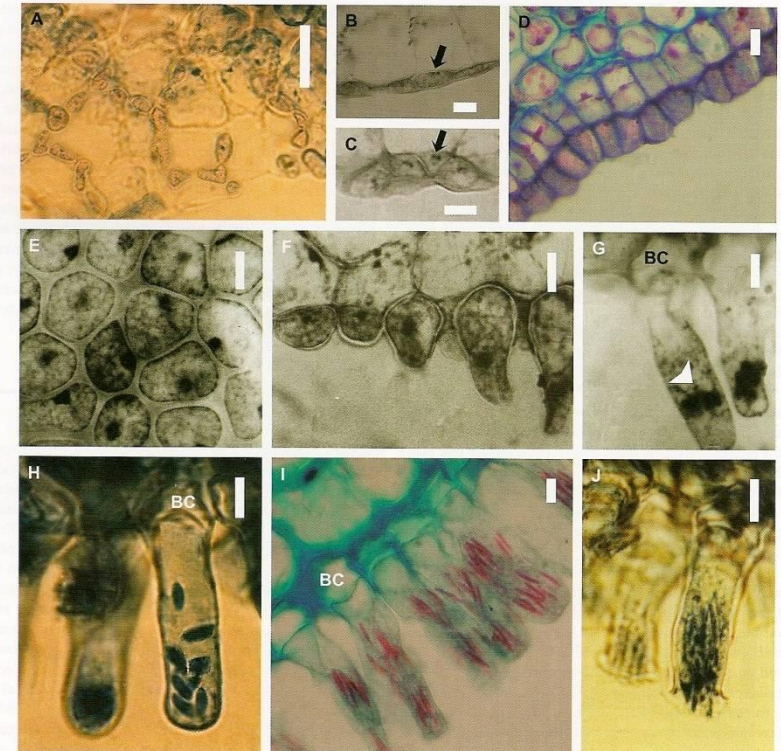
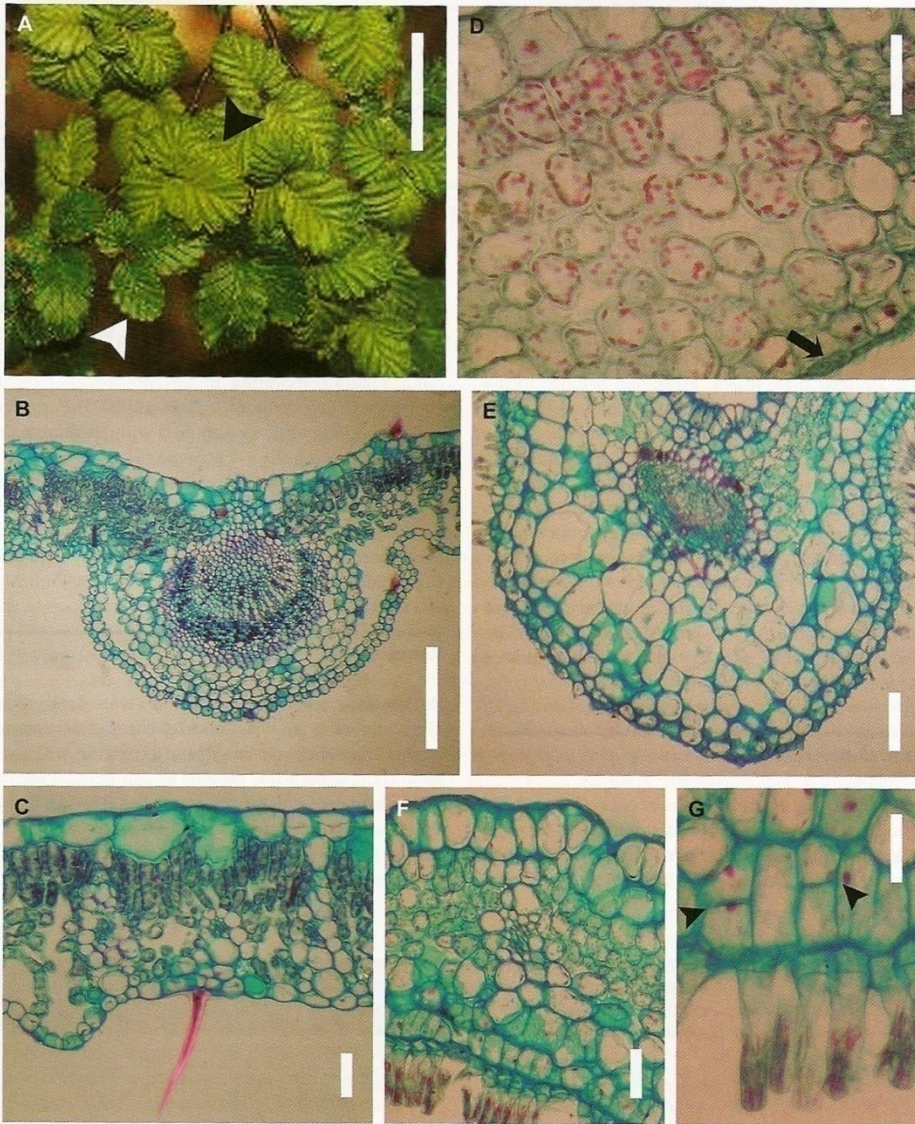
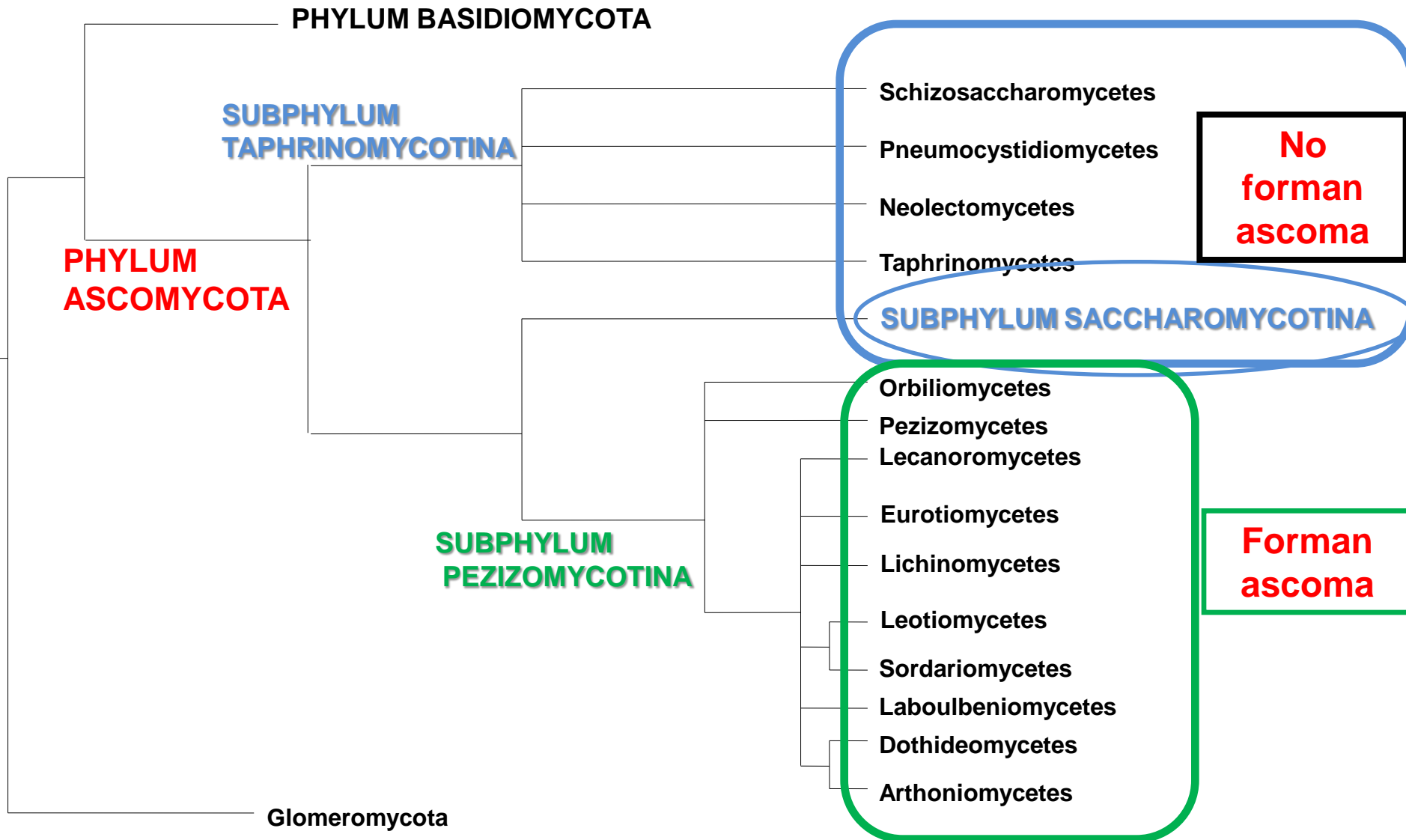


Fig 2 – Microscopic details of *Taphrina entomospora*. (A) Paradermal section of an infected leaf of *Nothofagus pumilio* showing the vegetative mycelium of *T. entomospora*. Bar = 25 μ m. (B–C) Transverse sections of infected leaves. Notice the dikaryotic condition of the individual cells from the vegetative mycelium (arrows). Bars = 15 μ m. (D) Continuous layer of young ascogenous cells (abaxial side of leaf). Bar = 25 μ m. (E) Paradermal section of ascogenous cells, each with one large nucleus. (F) Elongating ascogenous cells. (G) First division of the nucleus (arrowhead) in a fully developed ascus. (H) Primary ascospores. (I) Mature ascospores inside asci. (J) Liberation of ascospores through simple rupture of asci tips. Bar = (E–J) 10 μ m. (H,I) Trypan blue, (B–C, E–G) Heidenhain's haematoxylin, (D,I) safranin-fast green.

Fig 1 – Macroscopic and microscopic features of healthy and infected leaves of *Nothofagus pumilio*. (A) Healthy (white arrowhead) and infected (black arrowhead) leaves. Bar = 5 cm. (B–C) Transverse sections through healthy leaves with the typical dorsiventral layered structure. Bars: (B) = 250 μ m, (C) = 50 μ m. (D) An infected bud in first stages of infection by *Taphrina entomospora*. Arrow points to the subcuticular mycelium. Bar = 50 μ m. (E–F) Transverse sections of leaves in advanced stages of infection. Notice the lack of intercellular spaces in the mesophyll. Bars: (E) = 100 μ m, (F) = 50 μ m. (G) Abaxial epidermis of an infected leaf showing periclinal divisions (arrows). Bar = 50 μ m. (B–G) Safranin-fast green.



SUBPHYLUM SACCHAROMYCOTINA

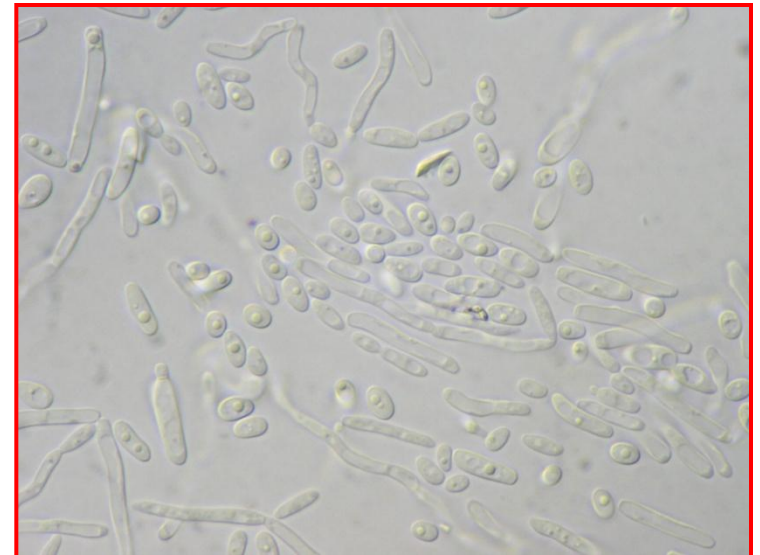
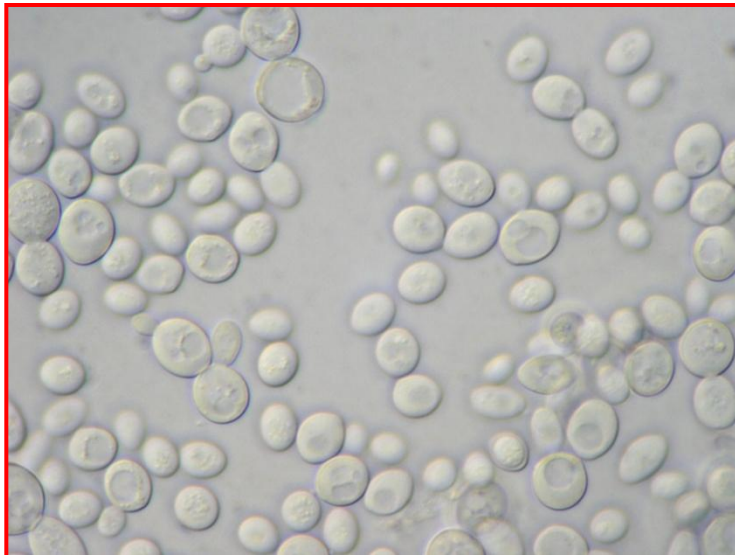
No producen ascoma ni hifa ascógena. Ascospores prototunicados.

Pared celular de mananos, β -glucanos junto a pocas cantidades de quitina.

Incluye a las levaduras unicelulares que se reproducen por gemación.

Algunas especies producen un **Pseudomicelio** (células adheridas después de la gemación).

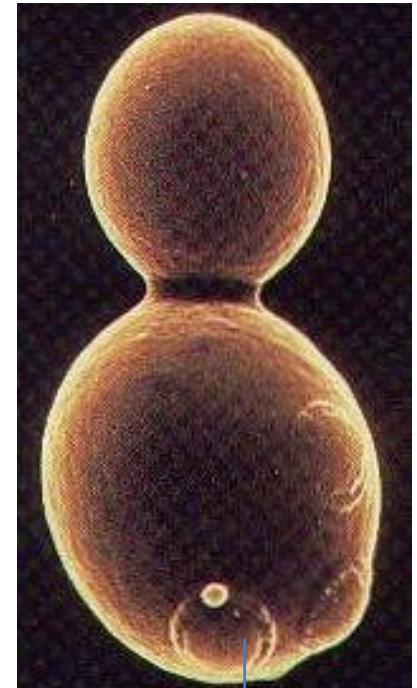
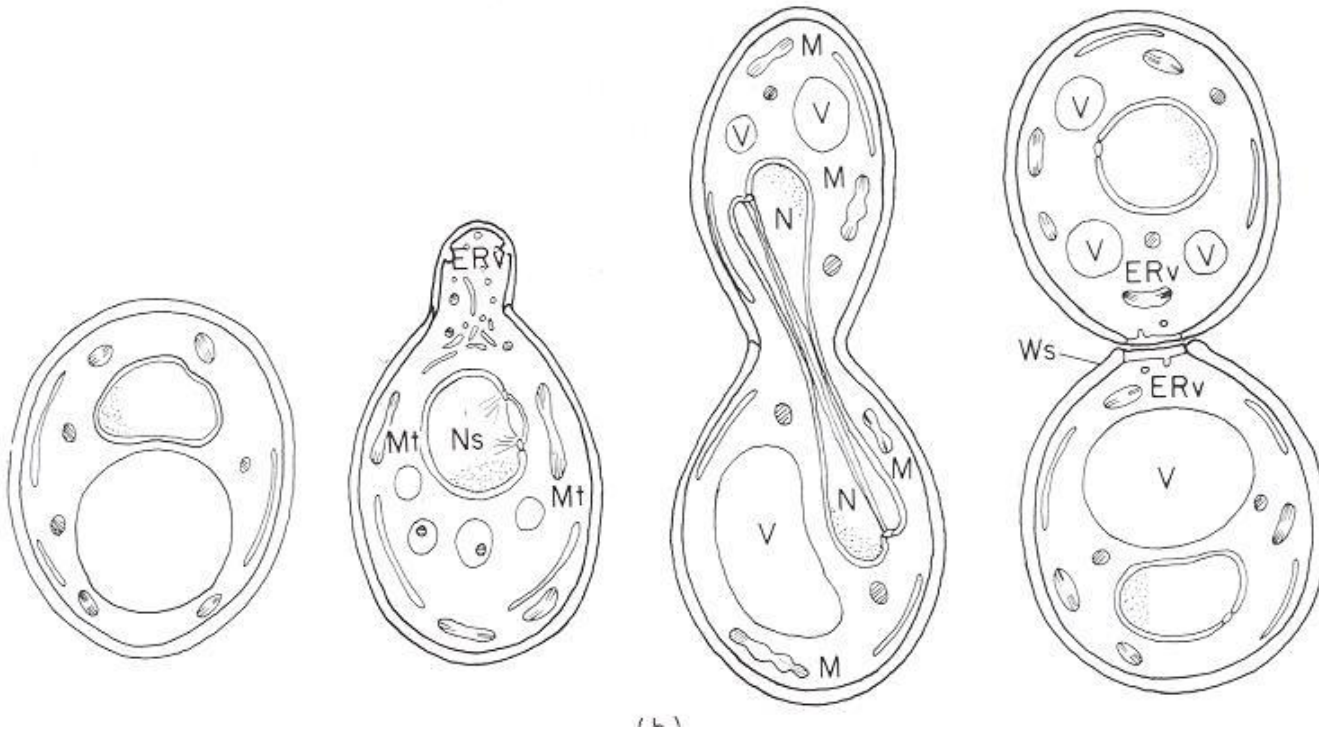
Otras especies forman **verdadero micelio** (crecimiento apical).



Gemación

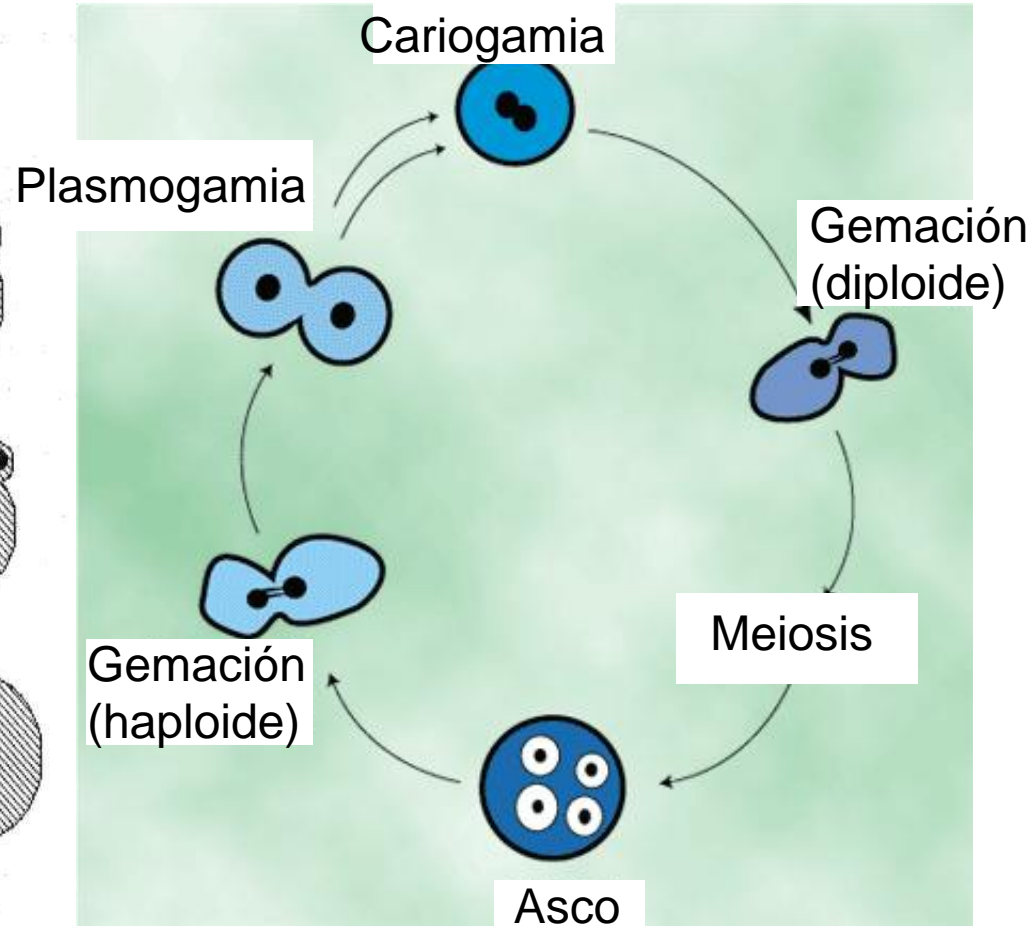
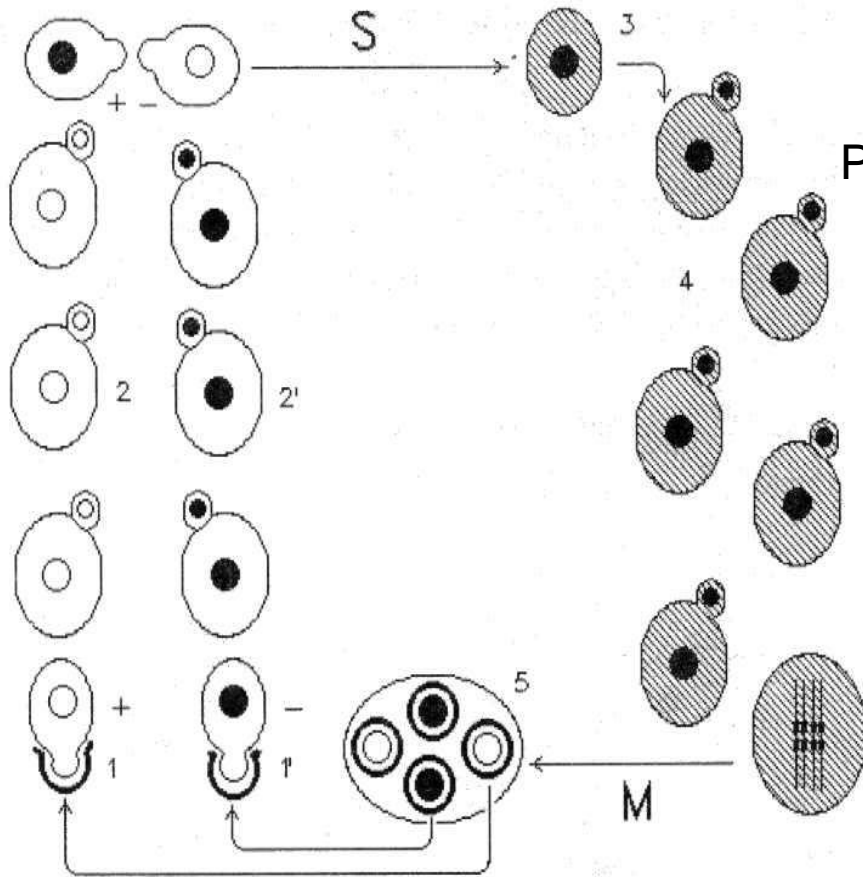
Reproducción asexual– división celular en formas unicelulares.

Gemación – la célula hija crece hasta que se separa de la madre.



**Cicatrices de
la gemación**

Saccharomyces cerevisiae



**Organismo haplodiploide diplobionte
(alternancia de generaciones)**

Ascosporas prototunicadas

Importancia

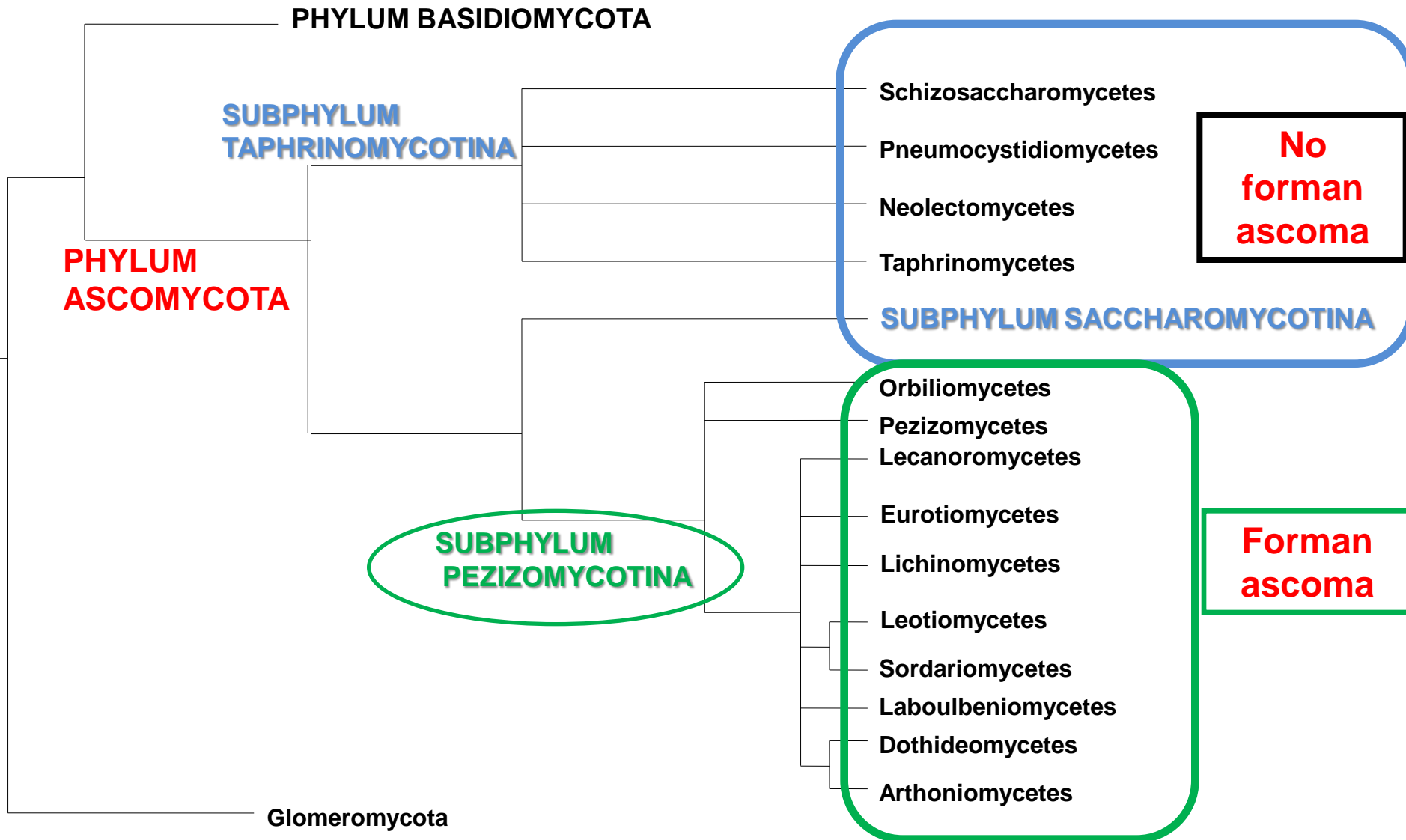
Elaboración de la cerveza (10^{11} litros/año) y vino (10^{10} litros/año)

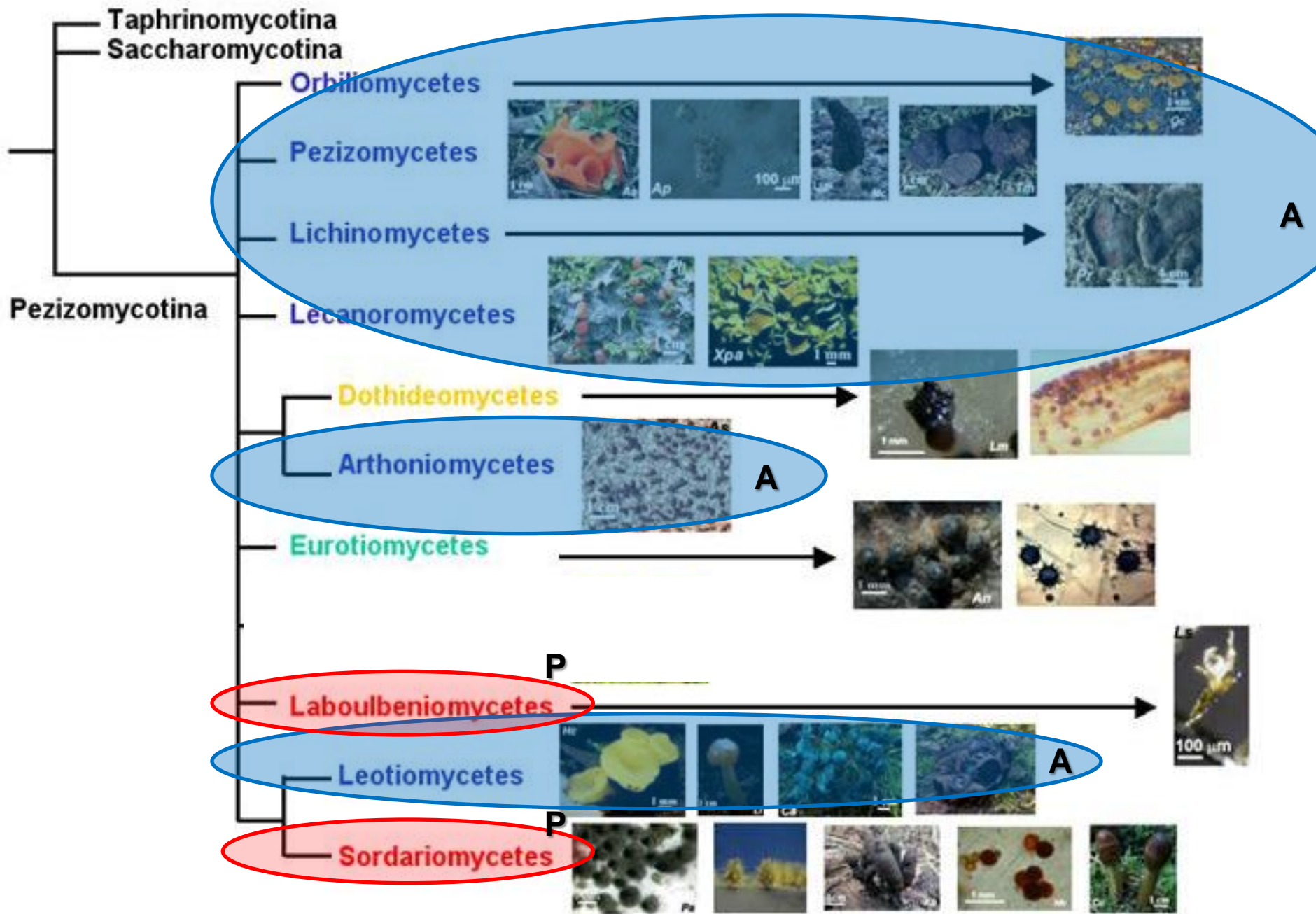
La producción de alimentos (pan, $1,5 \times 10^6$ toneladas/año de células de *S. cerevisiae* en el mundo)

Producción de vitaminas (Riboflavina, *Eremothecium*) y proteínas recombinantes (enzimas, antígenos, insulina)

Control biológico (contra *Penicillium* spp. sobre fruta)

Patógenos para los animales (humanos – *Candida albicans* –flora normal).





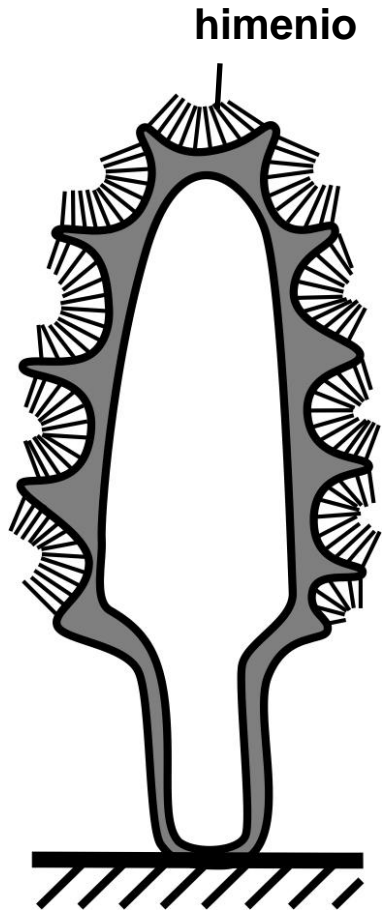
Clase Pezizomycetes

Saprófitos

Ascomas estipitados



Morchella esculenta



Morchella



George Barron

Helvella crispa

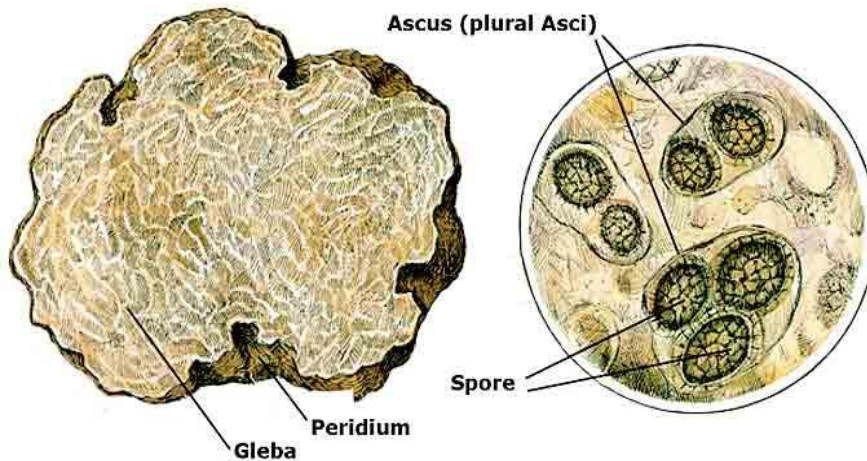
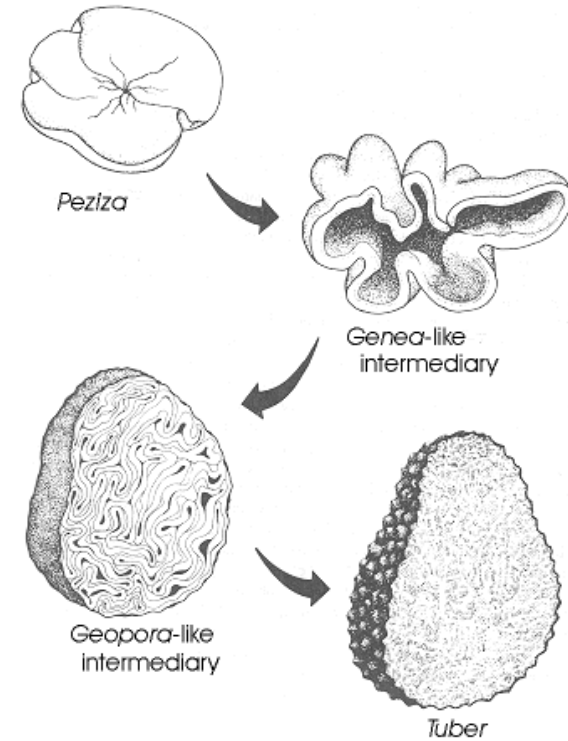


Gyromitra infula

↳ **Giromitrina (veneno)**



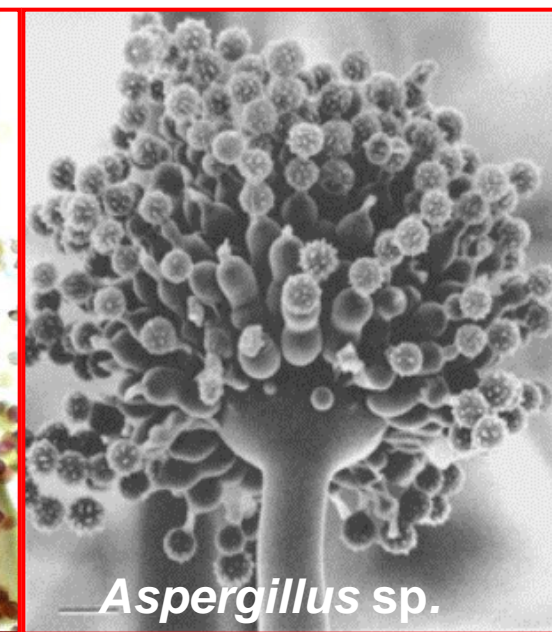
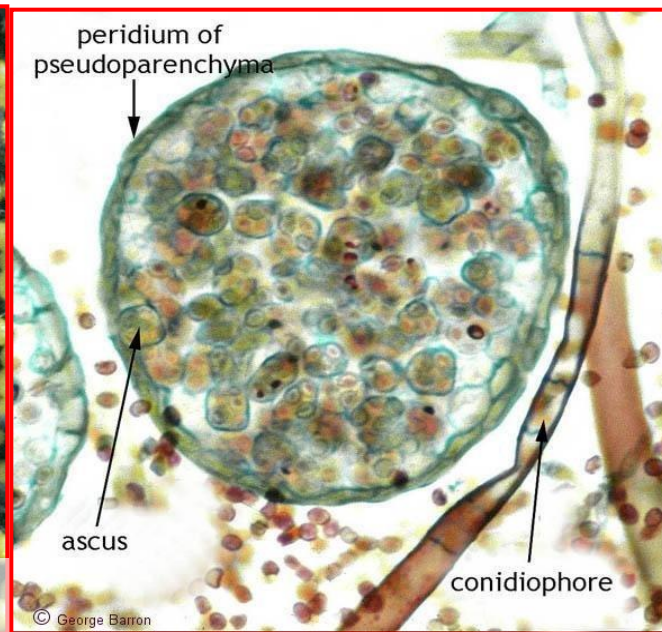
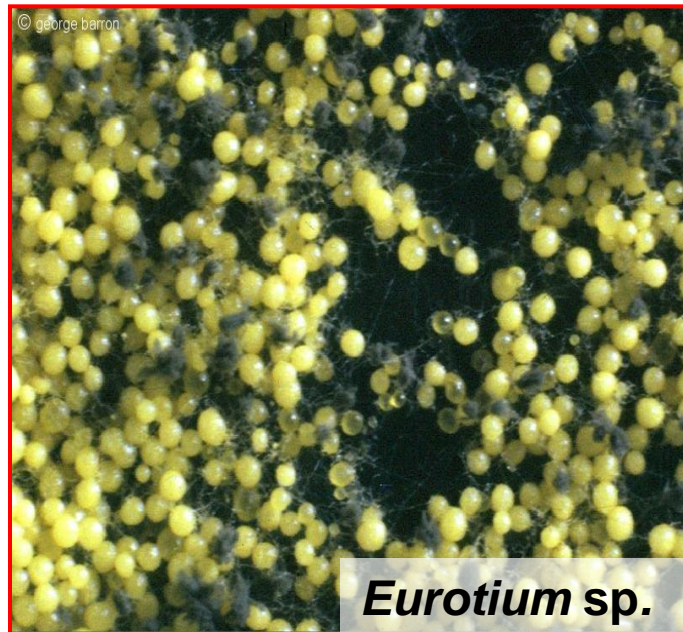
Micorrícicos



- Hipógeos, ascósporas dispersadas por animales.
- Ascoma apotecioide modificado
- Ascus con descarga pasiva
- Ectomicorrícicos (*Quercus* spp.)

Clase Eurotiomycetes

Saprófitos, degradadores (celulosa, proteínas -patógenos de animales-, productores de antibióticos).



Clase Leotiomycetes

- Parásitos de plantas

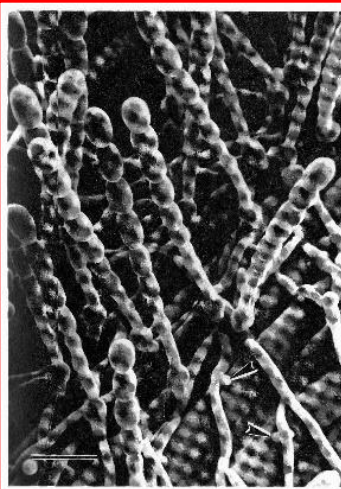
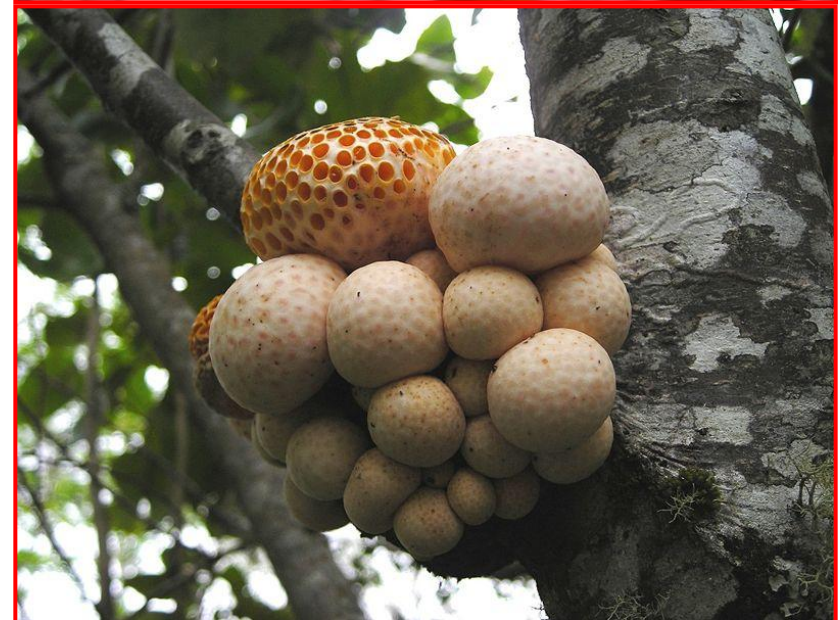


Figure 15-7 SEM showing chains of conidia of *Blumeria graminis* produced on host leaf. Note swollen base cell of each conidial chain. Simple appressoria (arrowheads) attach conidial hyphae to leaf. Bar = 40 μm . (Photograph courtesy C. Girasoli and R. Guggenheim, SEM Laboratory, University of Basel, in cooperation with SANDOZ AGRO AG, Basel, Switzerland.)
Alexopoulos et al; 1996



Cyttaria darwinii



Clase Sordariomycetes

Ord. Xylariales

Oscuros, de aspecto de cuero, o madera quemada.

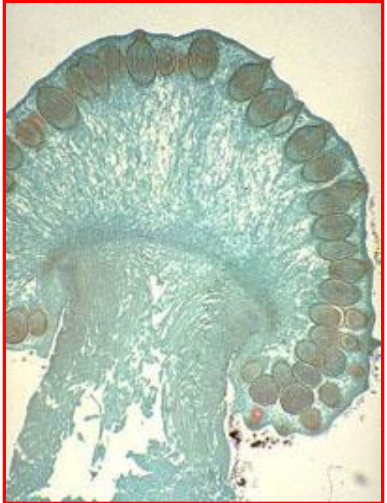
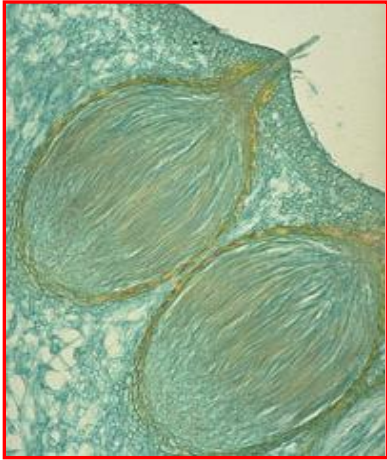
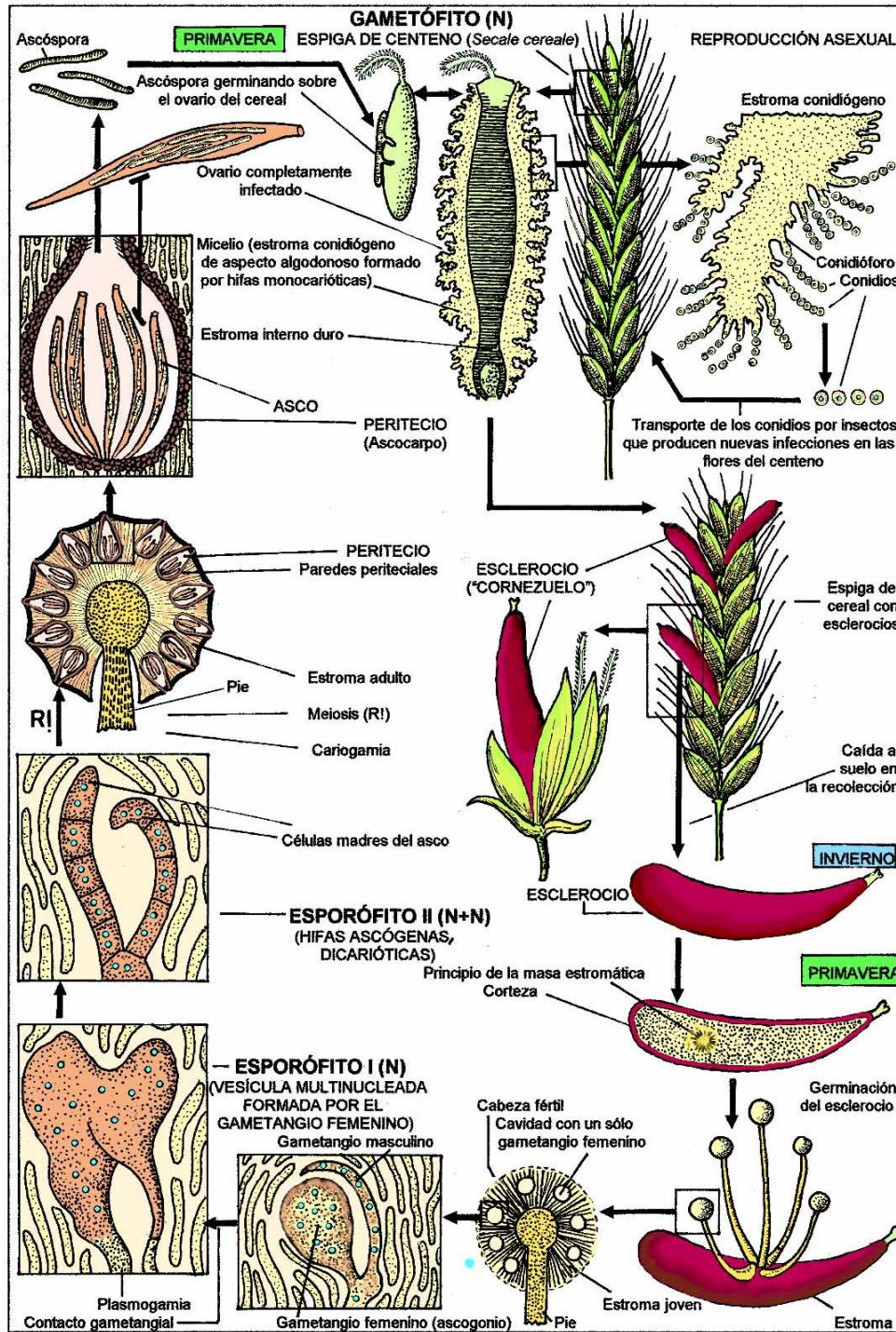
Descomponedores de la madera, endófitos, patógenos de plantas.



Xylaria sp.

Ord. Clavicipitales

“Cornezuelo del centeno”



Cordyceps sp.

Parásitos de larvas de insectos y hongos hipógeos.

El estroma que emerge del hospedante. **Peritecioides** embutidos en la región apical.

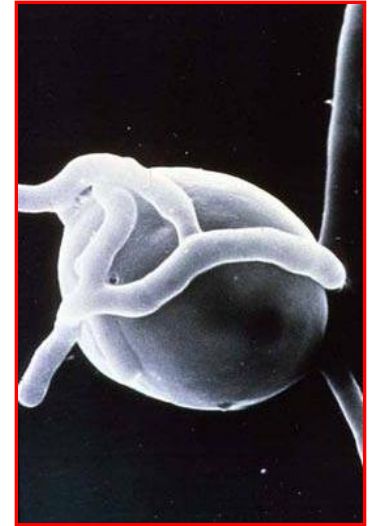
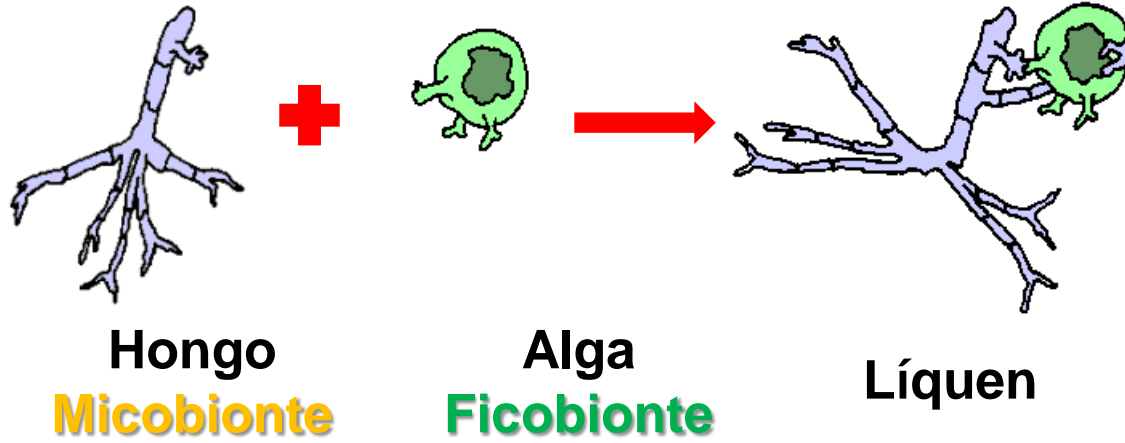
Cordyceps militaris → propiedades medicinales (usado en Asia).



Lichenes



Lichenes



13.500 spp. hongos liq.
100spp. ficobiontes

Micobionte

ASCOMYCOTA (98%)
(apotecioide o peritecioide)



ASCOLÍQUENES

BASIDIOMYCOTA (20 spp.)



BASIDIOLÍQUENES

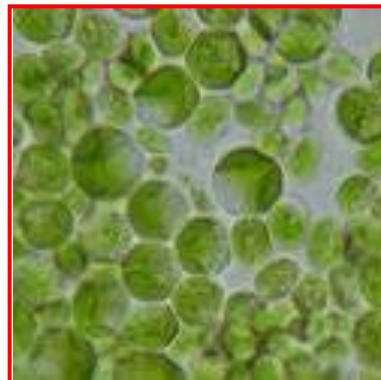
Ficobionte

CIANOBACTERIAS (10%)



Nostoc sp.

CLOROFITAS (85%)

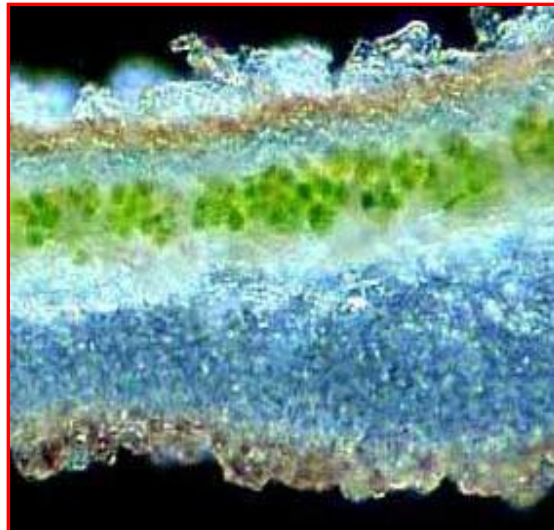
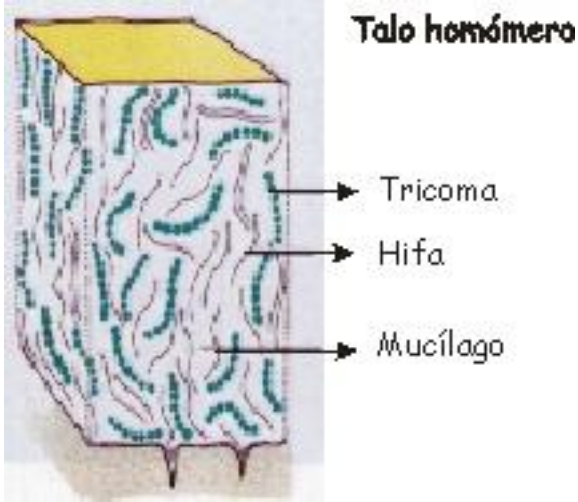


Trebouxia sp.

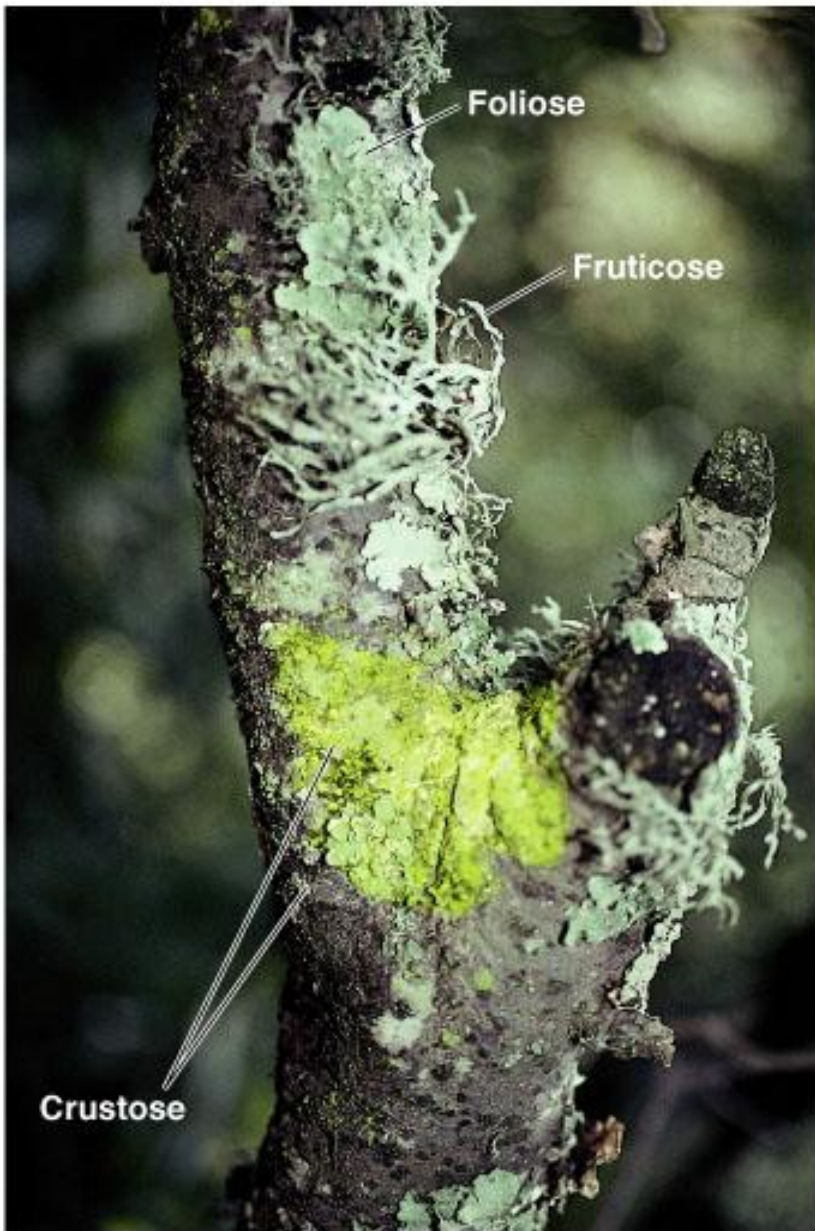


Trentepohlia sp.

Talos Liquénicos

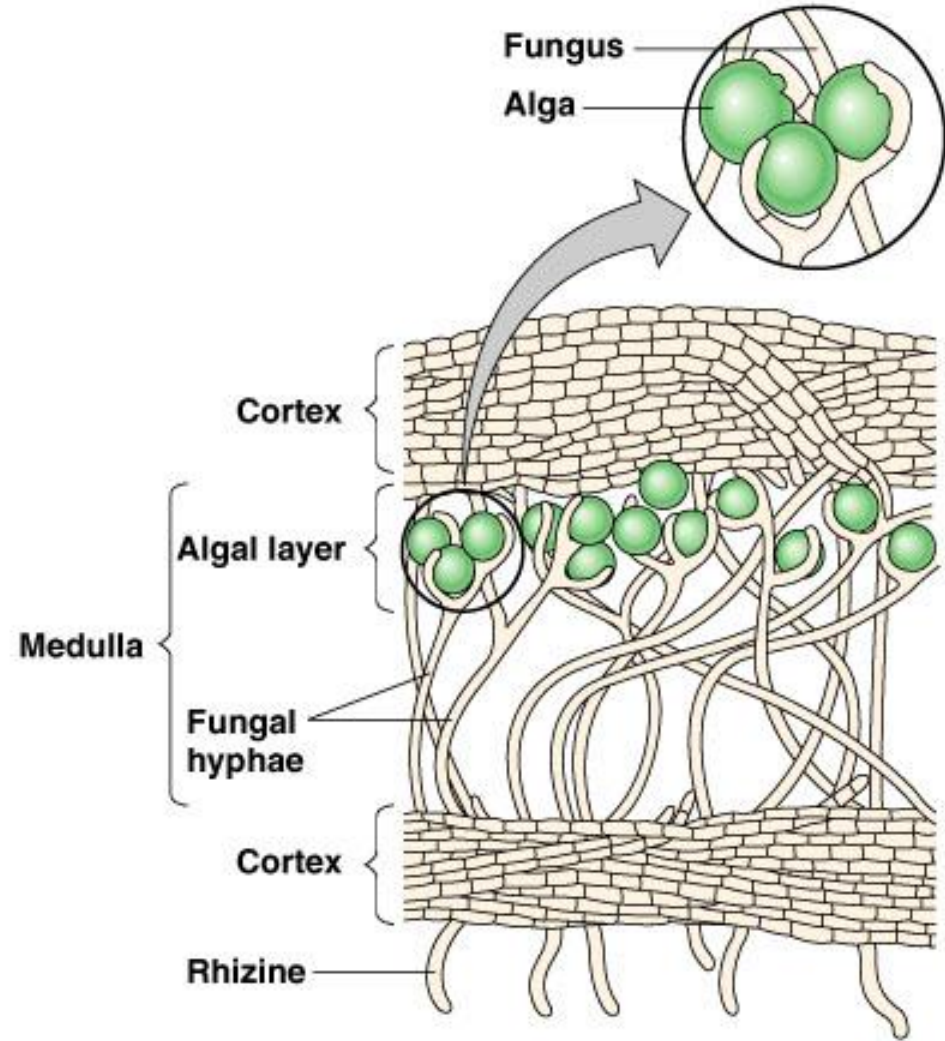


Talo heterómero



(a) Three types of lichens

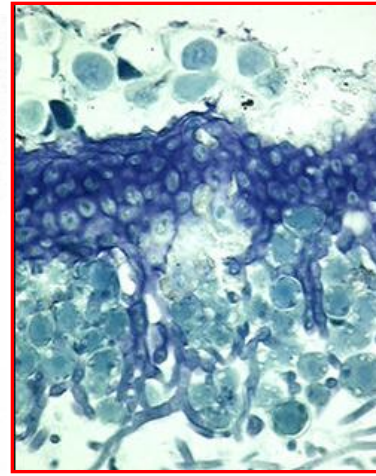
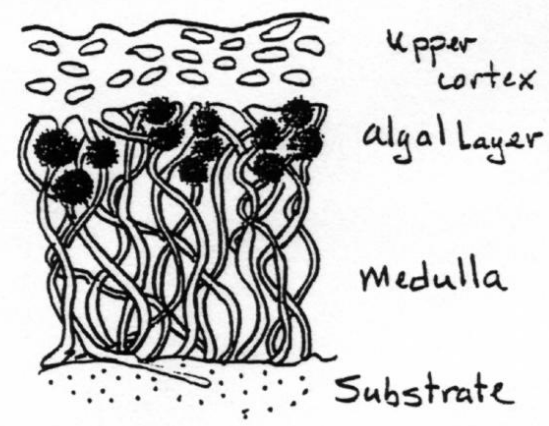
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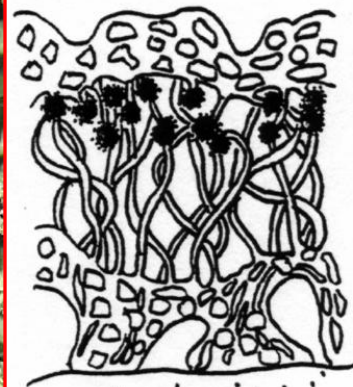
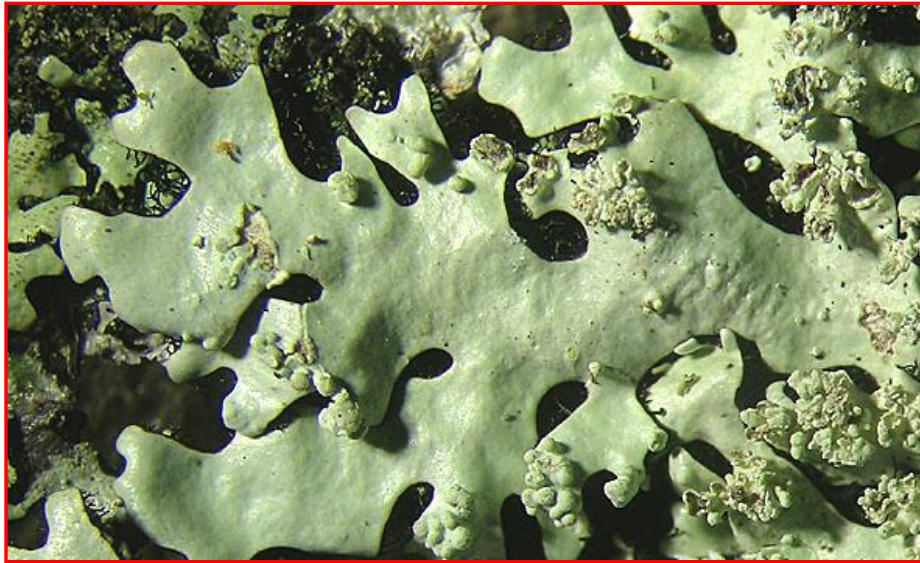
(b) Lichen thallus

Morfología del talo liquénico

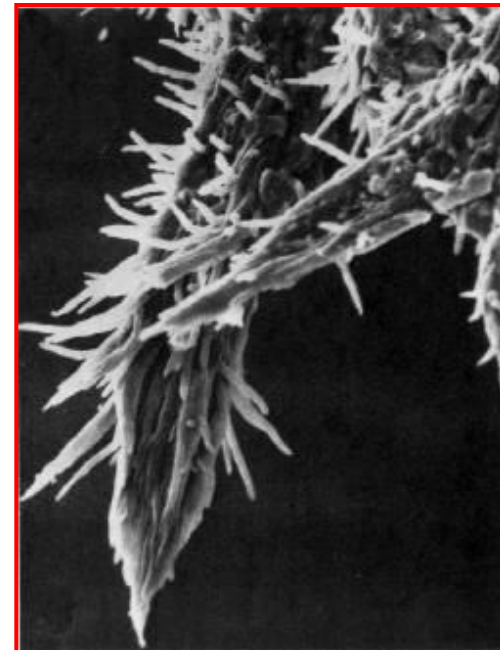
Crustoso



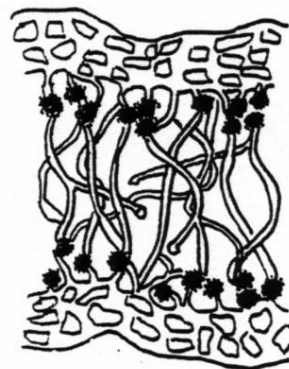
Foliose



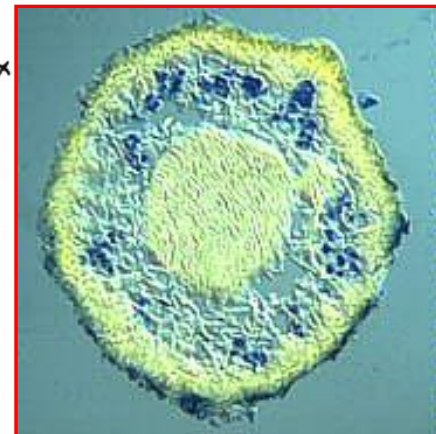
upper cortex
Algal layer
Medulla
Lower cortex
Rhizine
Substrate



Fruticulosos



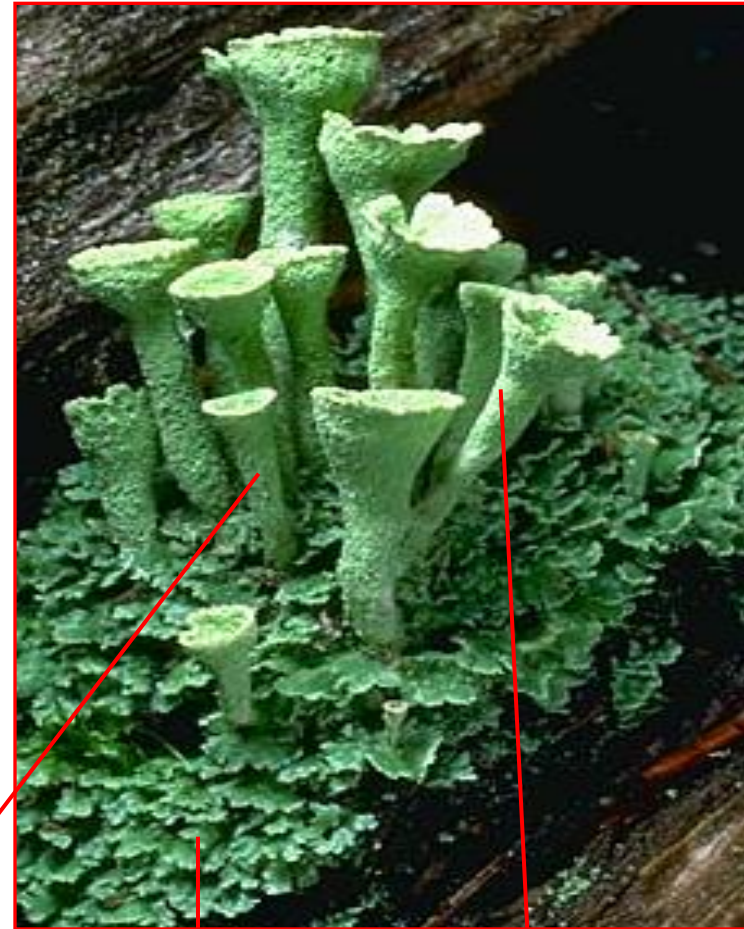
Upper cortex
Algal layer
Medulla
Algal layer
Lower cortex



Talo dimórfico



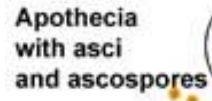
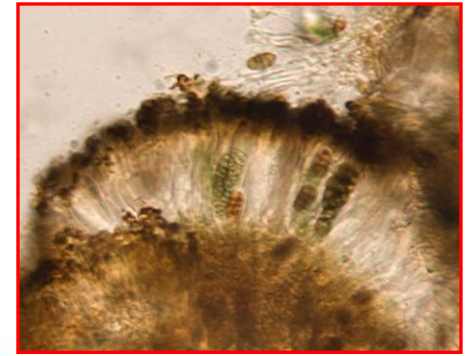
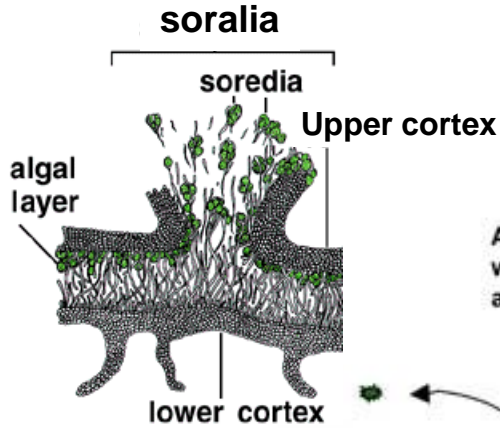
Podecios



Talo crustoso
(talo primario)

Talo fructiculososo
(talo secundario)

Tipo de reproducción



Sexual reproduction and re-lichenization

Fragmentation

Vegetation reproduction

Vegetative cells

zoospores

gametes

meiosis

plasmogamy

karyogamy

Isidios



fragmentación



Importancia

- Comestibles (Equimales y siberianos).
- Alimento de animales (*Cladonia rangiferina* o líquen del reno).
- Colorantes (Tornasol)
- Antibióticos o antisépticos (*Usnea*)
- Metabolitos secundarios
- Formadores de suelo (degradadores de rocas)
- Fijación de nitrógeno
- Bioindicadores



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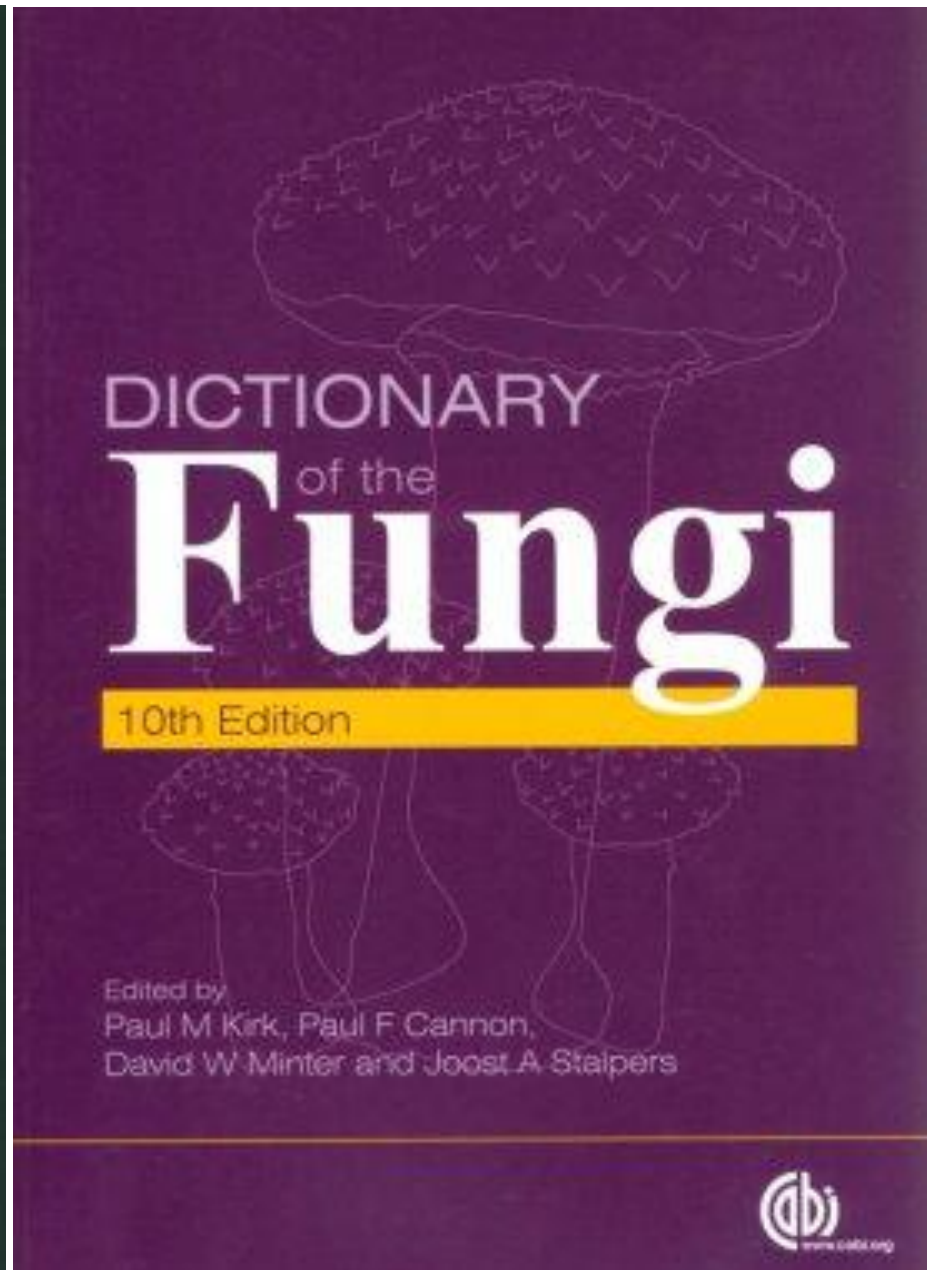
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C. W. MIMS

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