

embriofite

Piante vascolari

Piante a seme

Briofite

Pteridofite

Progimnosperme

gimnosperme

angiosperme

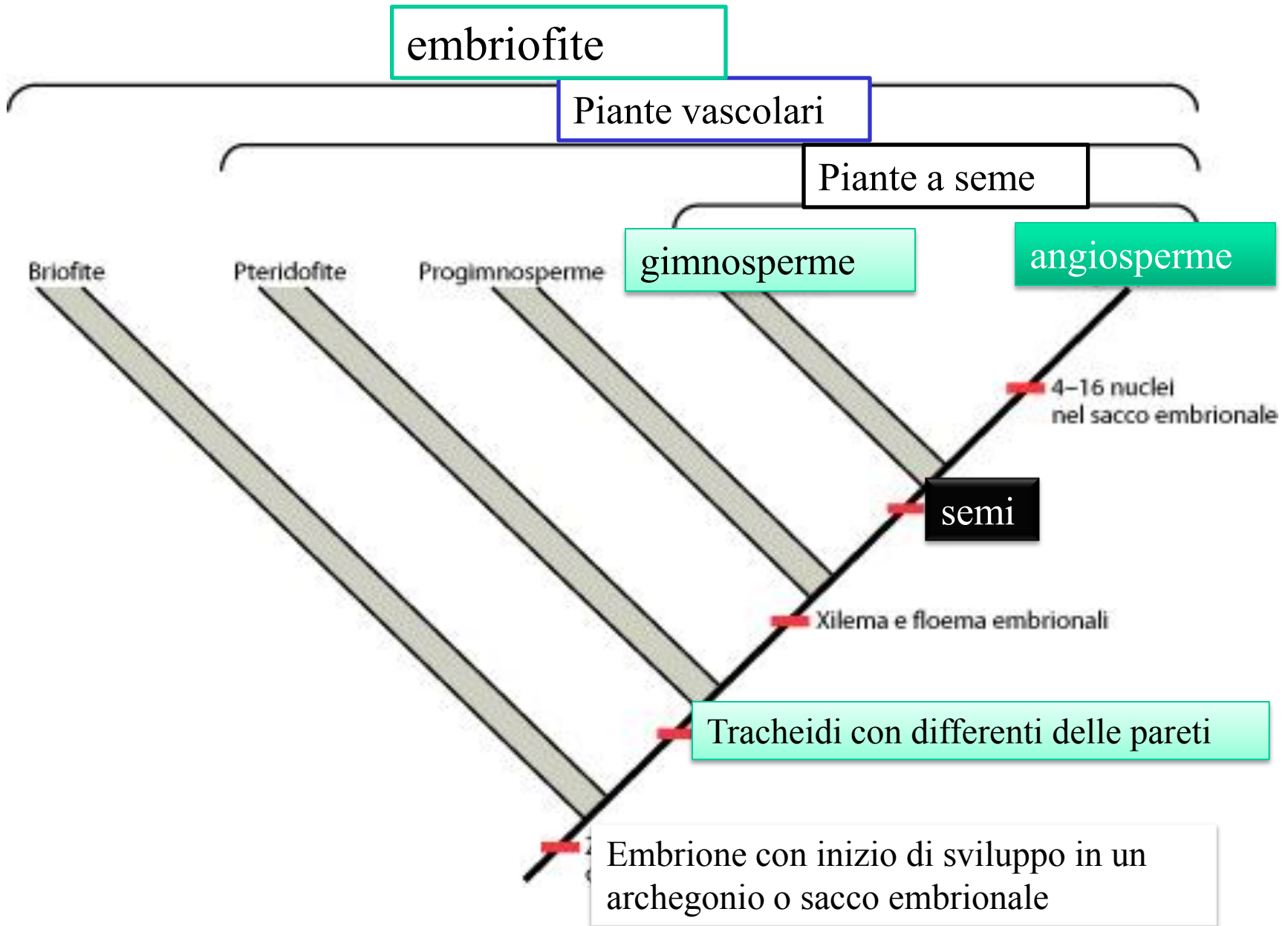
4-16 nuclei
nel sacco embrionale

semi

Xilema e floema embrionali

Tracheidi con differenti delle pareti

Embrione con inizio di sviluppo in un
archegonio o sacco embrionale



PALEOZOIC

MESOZOIC

CENOZOIC

PTERIDOPHYTES SEED FERNS

CYCADOFILICALES
(Pteridospermales)

simple
leaves

Rhabdotaenia

Paleocycas
(*Bjuvia simplex*)

Dioonitocarpidium

Nilssonia

Androstrobilus wonnacotti

cones

Androstrobilus prisma
Beania gracilis

compound
leaves

CYCADALES

Pterophyllum

Lesleya
Cycadopites

Archaeocycas

Taeniopteris
Pteronilsson
Phasmaticycas

Antarcticycas

Lyssoxylon

Glandulataenia

Cycadospadix
(*Crossozamia*)

Aricycas

Nilssonia

Ctenis

Pseudoctenis

Cycadites

Cycadinorachis

Neozamites

Paracycas

Nilssoniocladus

Sanchucycas

compound
leaves

Lepidozamia hopeites

Cycas fujian

Bowenia eocenica

Bowenia papillosa

Encephalartos cretaceus

Encephalartos gorceixianus

Bucklandia niersteinensis

Bucklandia sp.

Cycas sp. (Britain)

Gymmovulites

Zamia mississippiensis

Dioon inopium

Ceratozamia wrightii

Dioon prespinulosum

Zamia tennesseana

Zamia collazoensis

Zamia praecedens

Zamia australis

Zamia noblei

Zamia tertiaria

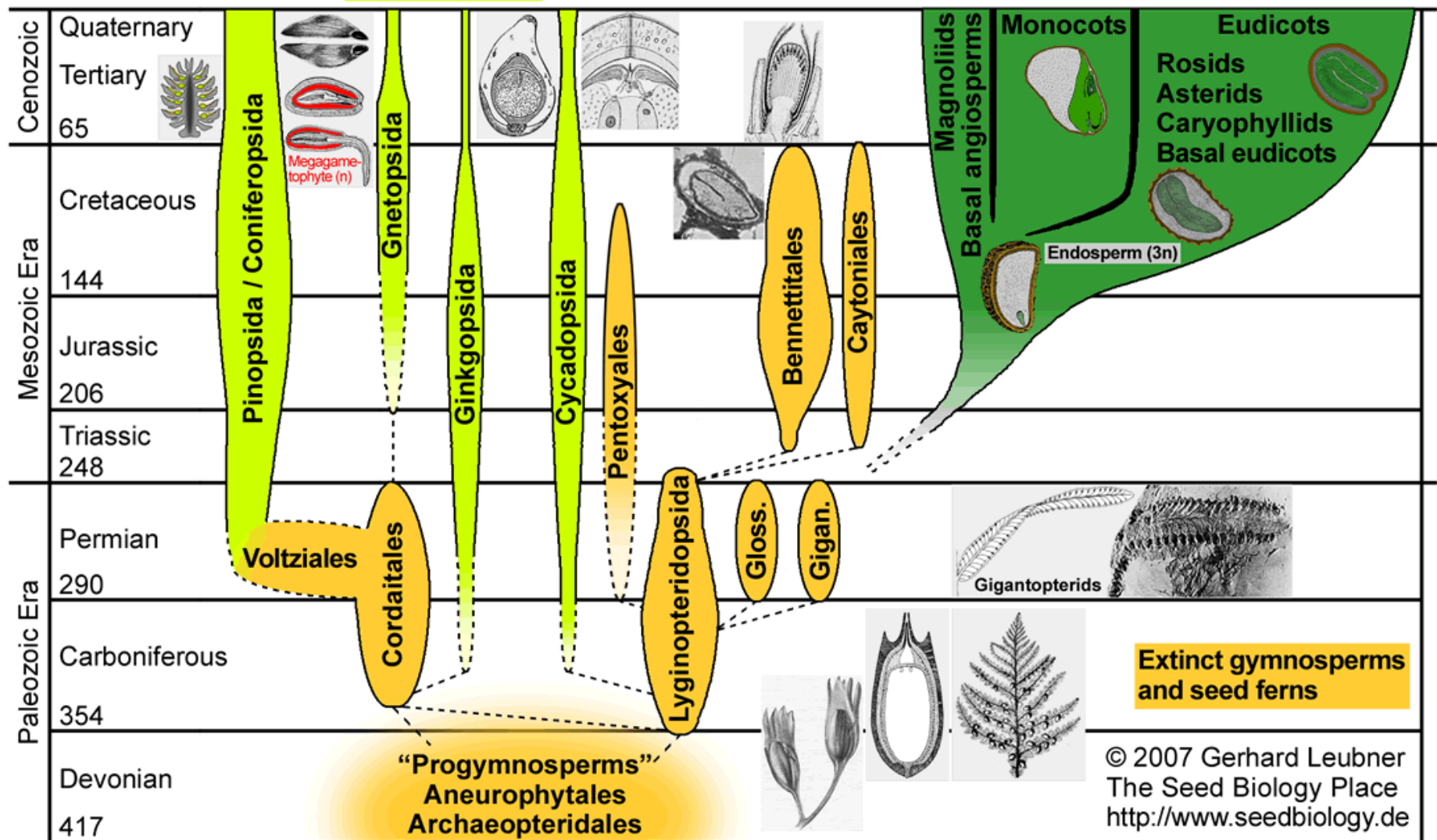
Wielandiellaceae
Williamsoniaceae
Williamsonia gigas

Cycadeoideae
Cycadeoidea etrusca

BENNETTITALES

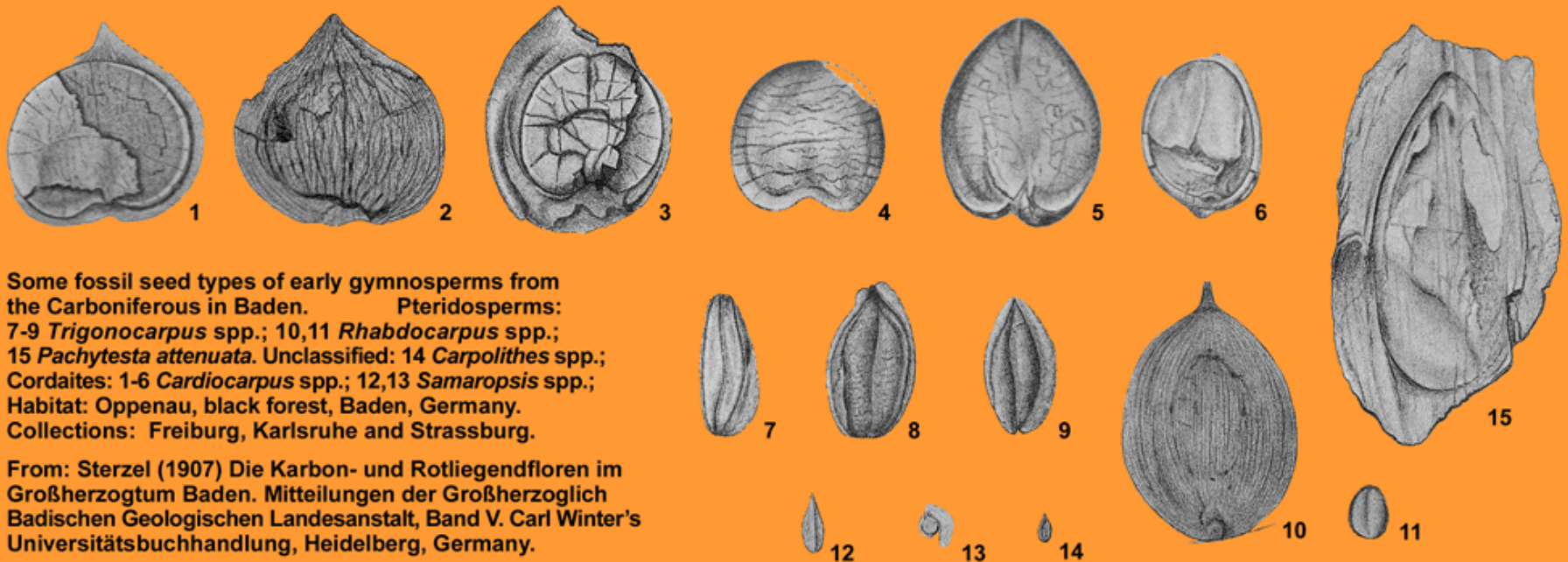
Gymnosperms

Angiosperms



Seed plant phylogenetic tree considering major gymnosperm and angiosperm clades. Note that the precise evolutionary connections between the different gymnosperm groups are unknown and that the ancestors of angiosperms are unknown. Typical seed types visualize steps in the evolution of the seed. Extinct gymnosperm groups (fossils): Lyginopteridopsida (seed ferns, "Samenfarne", includes Devonian/Carboniferous Lyginopterids and Carboniferous/Permian Medullosans and other subgroups), Cordaitales, Voltziales, Pentoxylales. Bennettitales (cycadeoids), Caytoniales, Glossopteridales (glossopterids), Gigantopteridales (gigantopterids). Extant gymnosperm groups: Pinopsida/Coniferopsida (conifers, "Nadelbäume"), Ginkgopsida (ginkgos), Cycadopsida (cycads, "Palmfarne"), Gnetopsida (gnetophytes: Ephedridae, Gnetidae, Welwitschiidae). Angiosperms (flowering plants): Most important groups depicted. Time scale: Geological eras, periods, time in MYBP (million years before present). © 2007 G. Leubner, "The Seed Biology Place", <http://www.seedbiology.de>

SEMI FOSSILI



Conifers

Ginkgoales



Callistophytales

Corynospermales

Cordaitales

Glossopteridales



Cycadales



Caytoniales

Medullosales

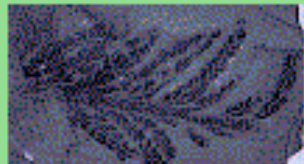
Anthophyta



"lyginopterids"



"progymnosperms"



Bennettitales

Gnetophyta

Tutte le piante a seme sono eterosporee
(megaspore e microspore)

Produzione di semi.

Il seme è un ovulo maturo che contiene un embrione

Ovulo immaturo contiene un megasporangio rivestito da
1 o due strati di TEGUMENTO

Ritenzione della megaspore all'interno del megasporangio
(nocella)

Riduzione a una sola cellula madre della megaspore

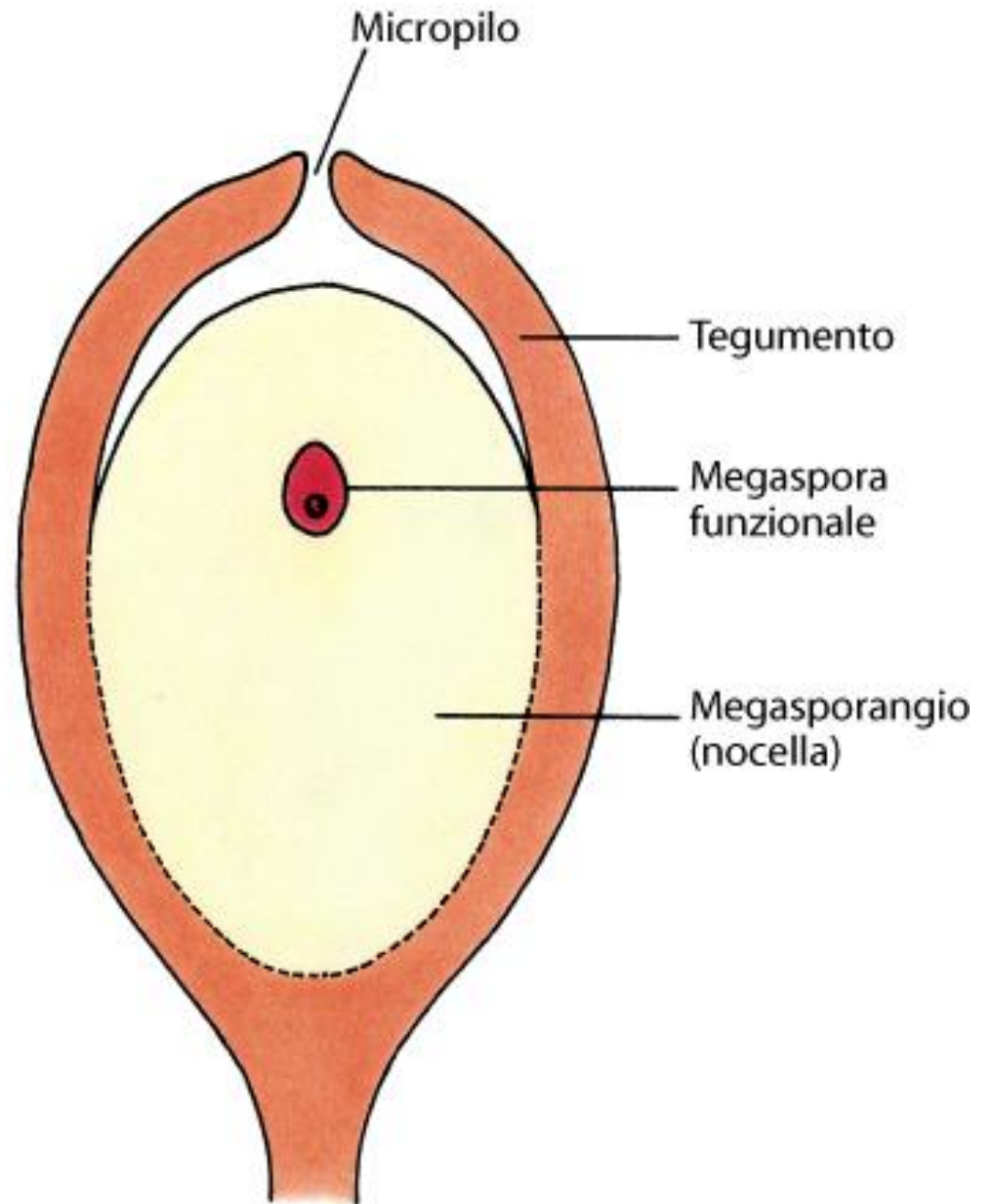
Riduzione a una sola cellula madre della megaspora

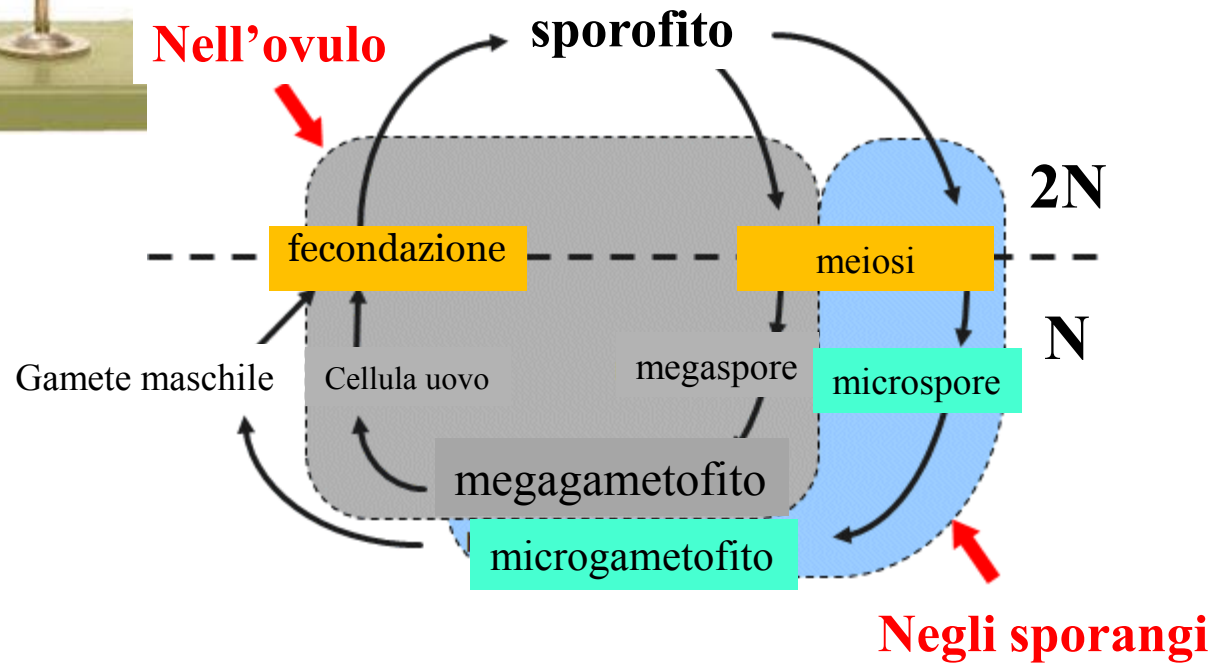
Sopravvivenza di solo una delle 4 megaspore

Formazione di un megagametofito estremamente ridotto all'interno della megaspora che è trattenuta nel megasporangio

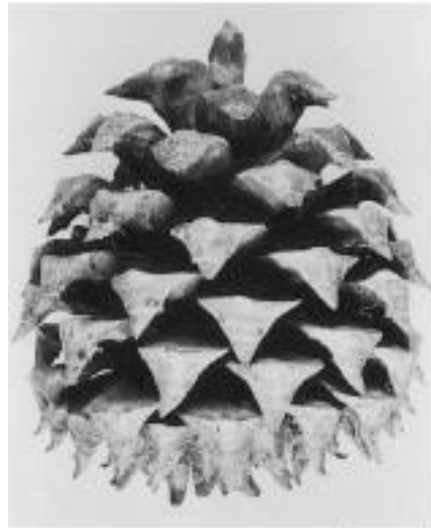
Sviluppo dell'embrione all'interno del megagametofito

Ovulo





Coni ovulati o strobili



(a)



(b)



(c)



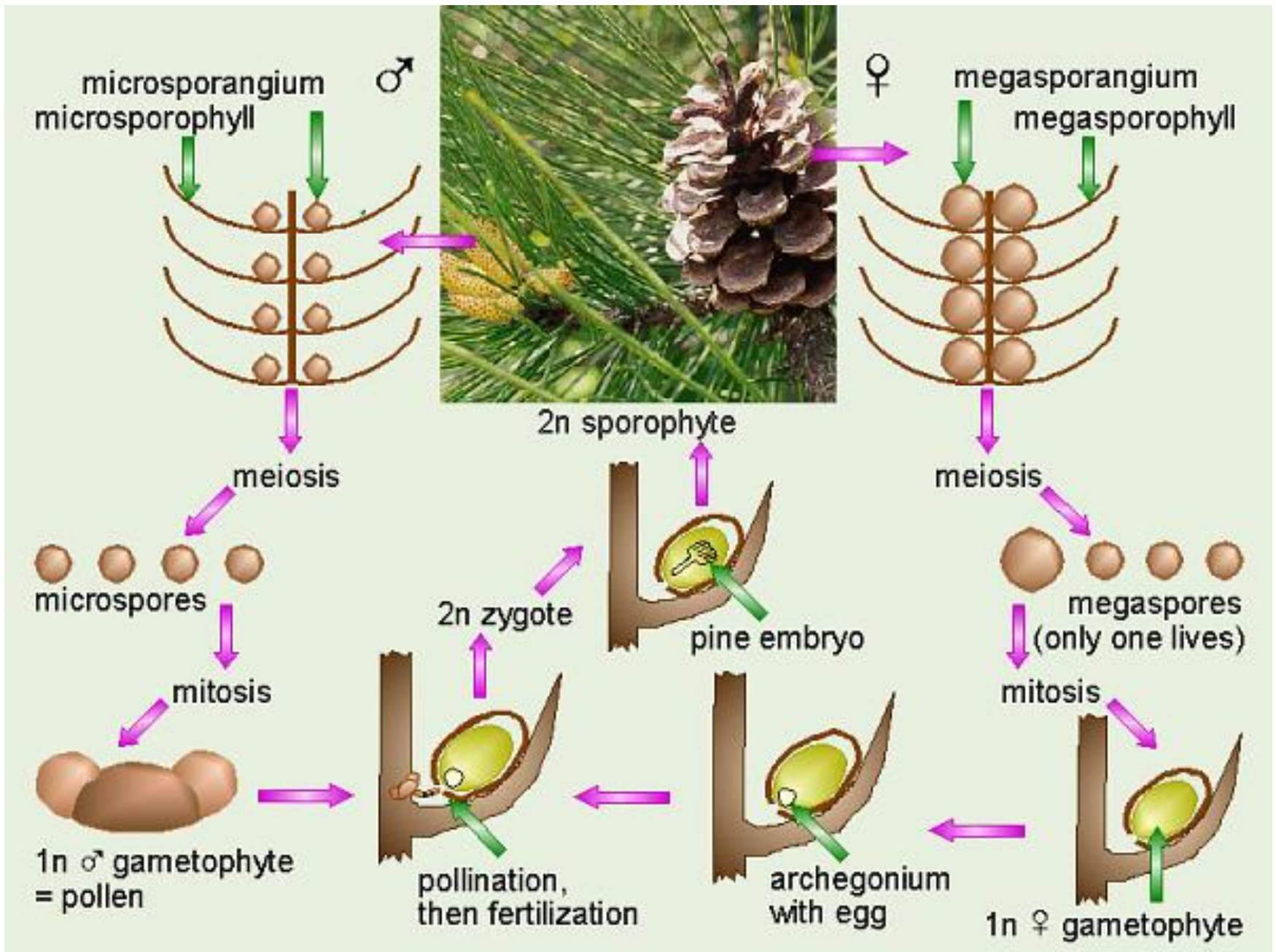
(d)



(e)



(f)



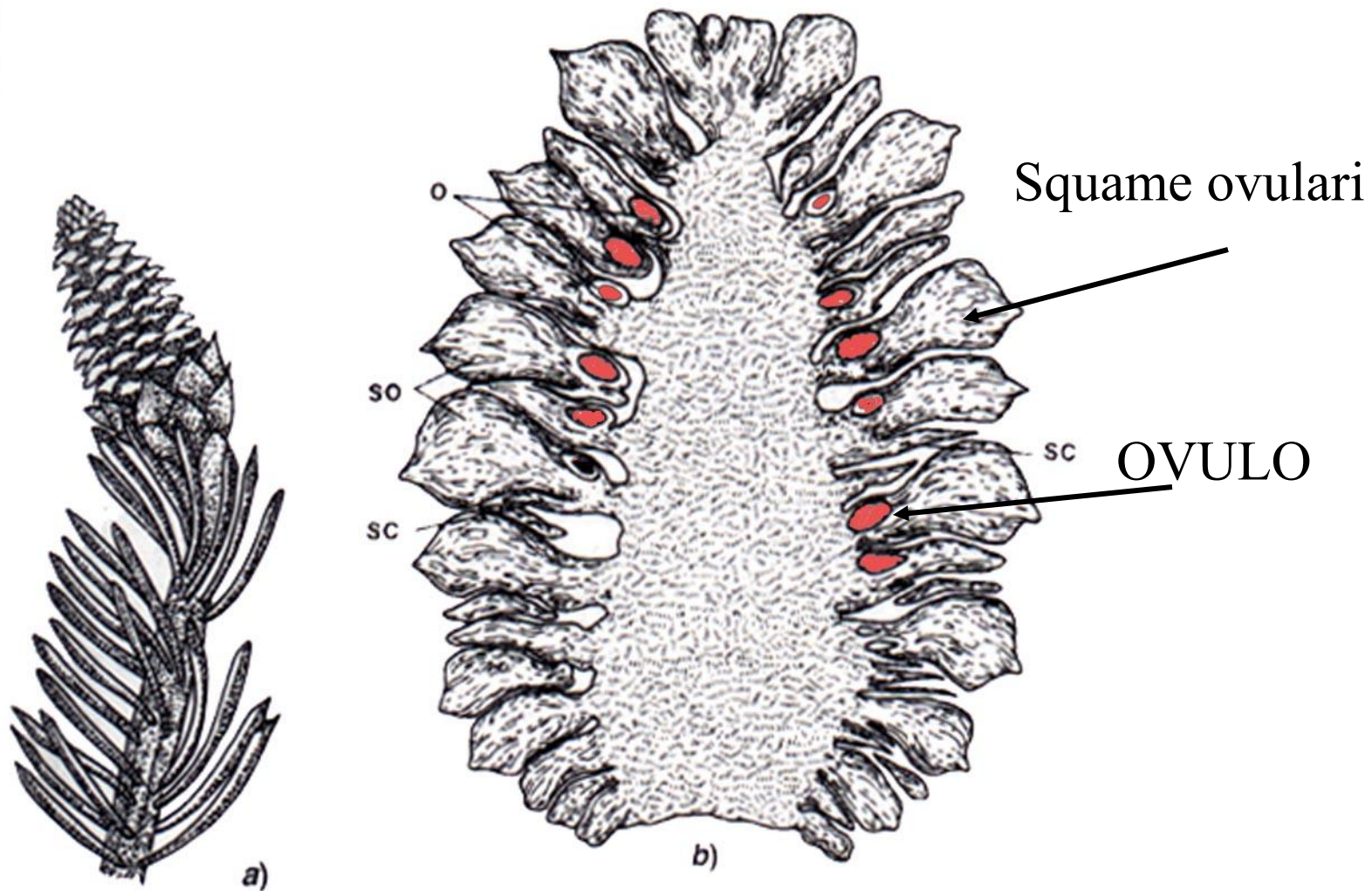
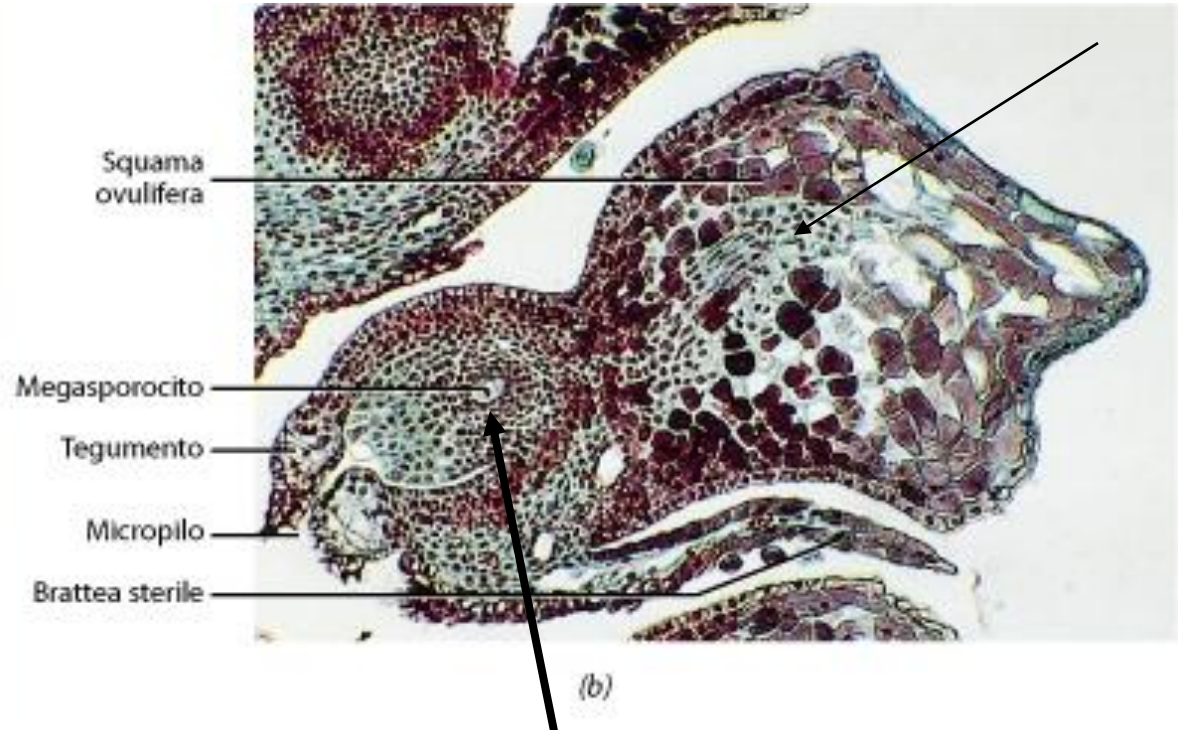


FIG. 42.9 • Strobilo (**a**) di macrosporofilli di Abete rosso, al momento della «fioritura» e (**b**) sezionato longitudinalmente, al momento della produzione dei semi; so = squame ovulari; sc = squama copritrice; o = ovulo.

Squama ovulifera



cellula madre della megaspora

Ovulo

Megasporangio (nocella pluricellulare) con 1 singola cellula madre della megaspore che subisce la meiosi dando 4 megaspore: solo 1 è funzionale

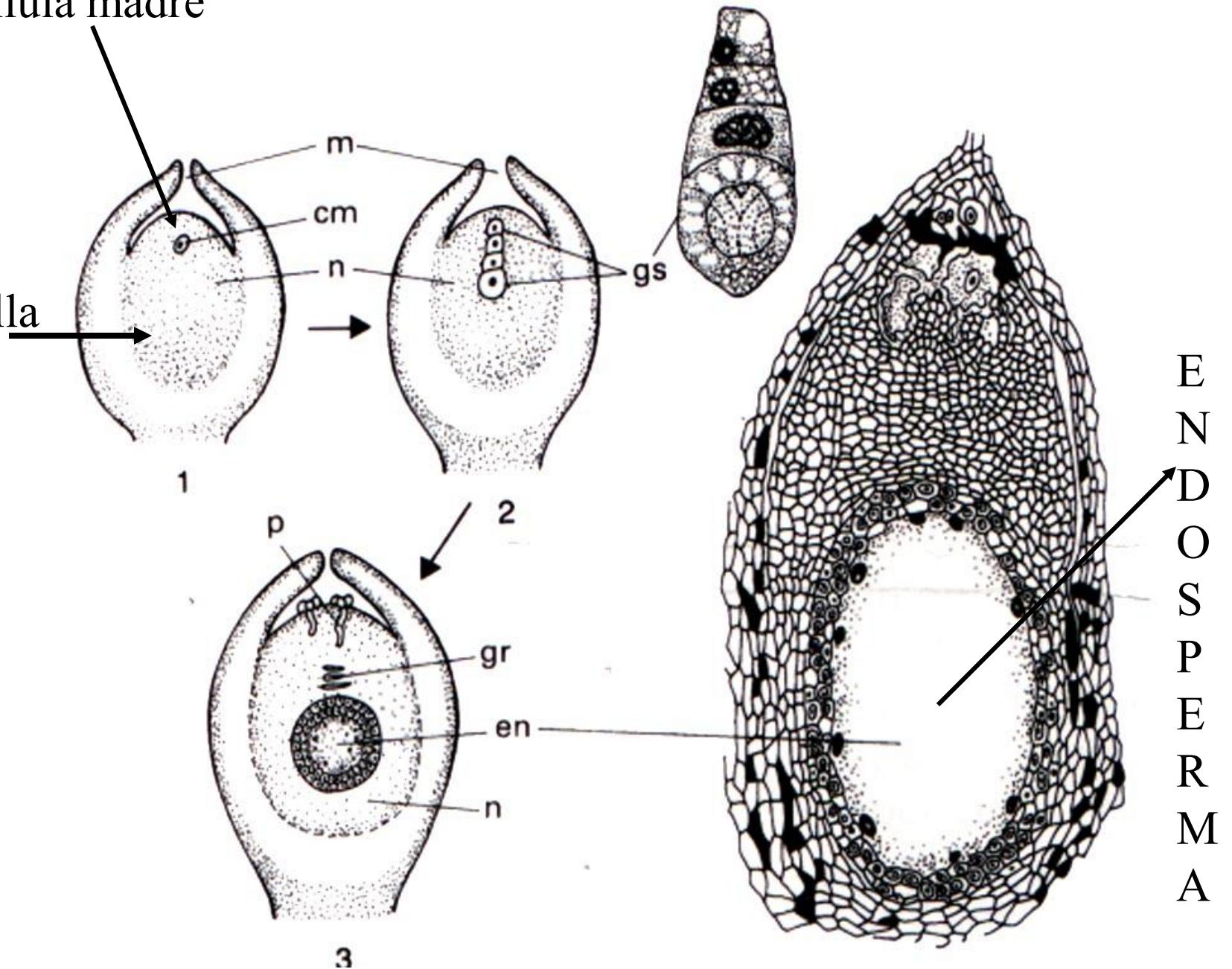
Dalla megaspore si sviluppa il megagametofito

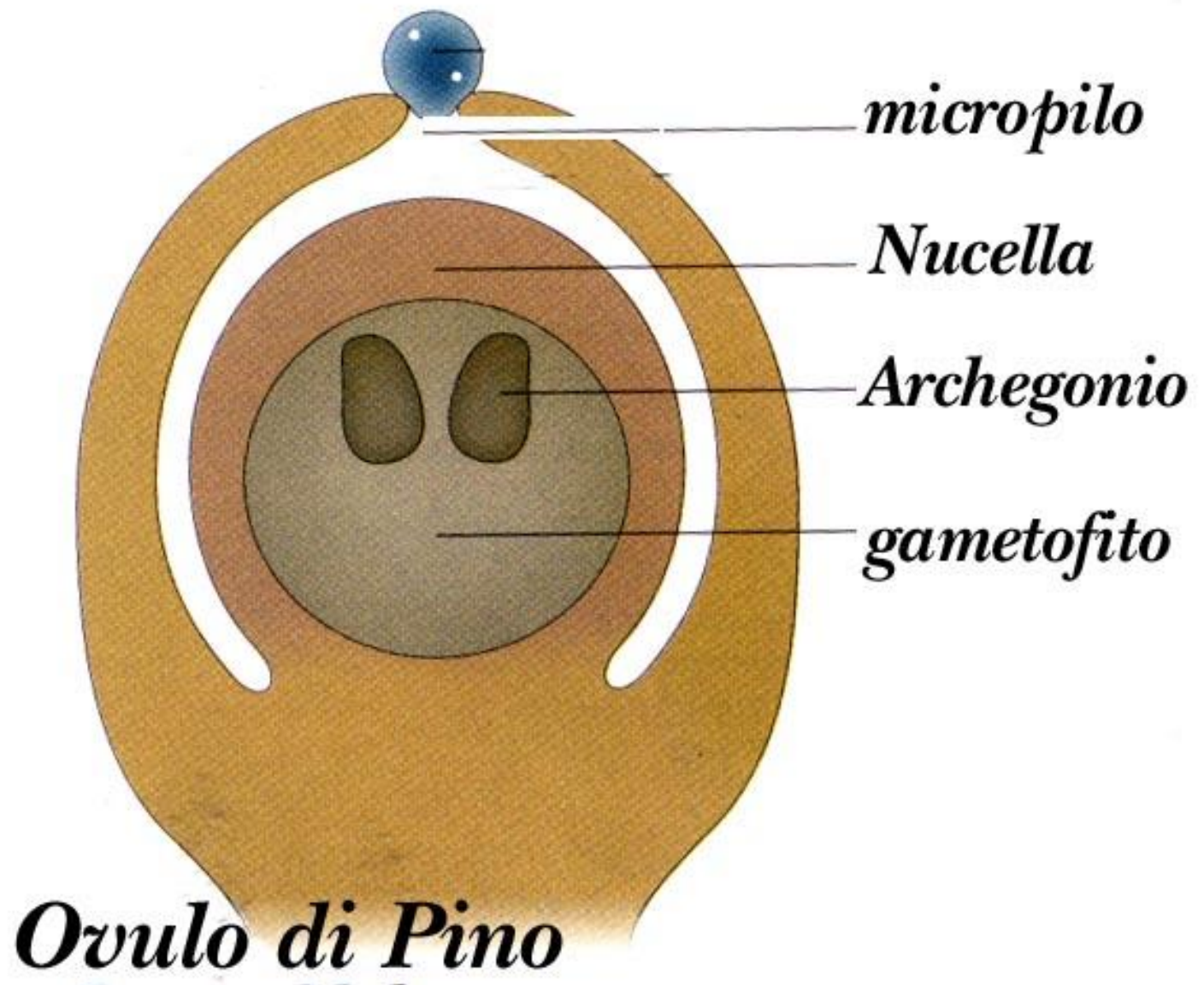
Formazione di archegoni (2/ 3) nel gametofito femminile

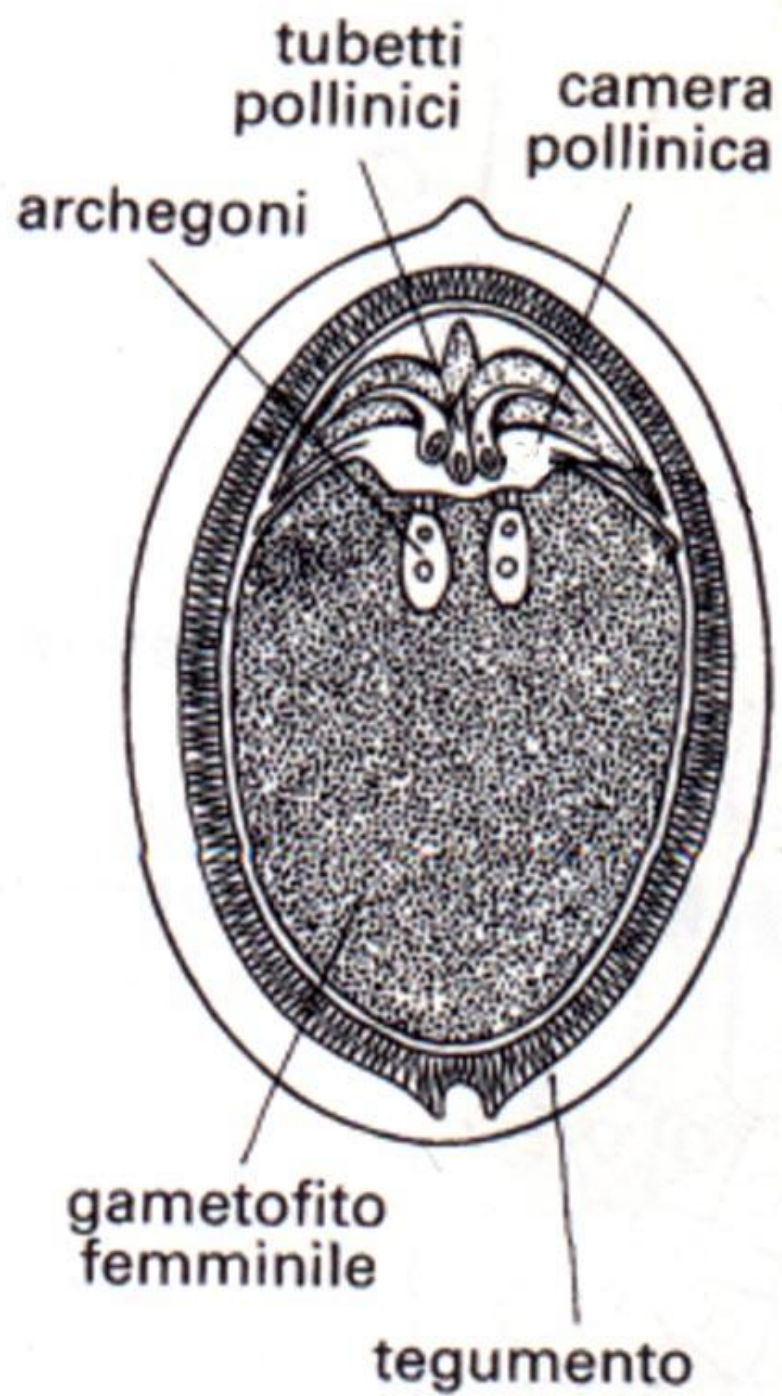
Spesso tegumento

Cellula madre

nocella







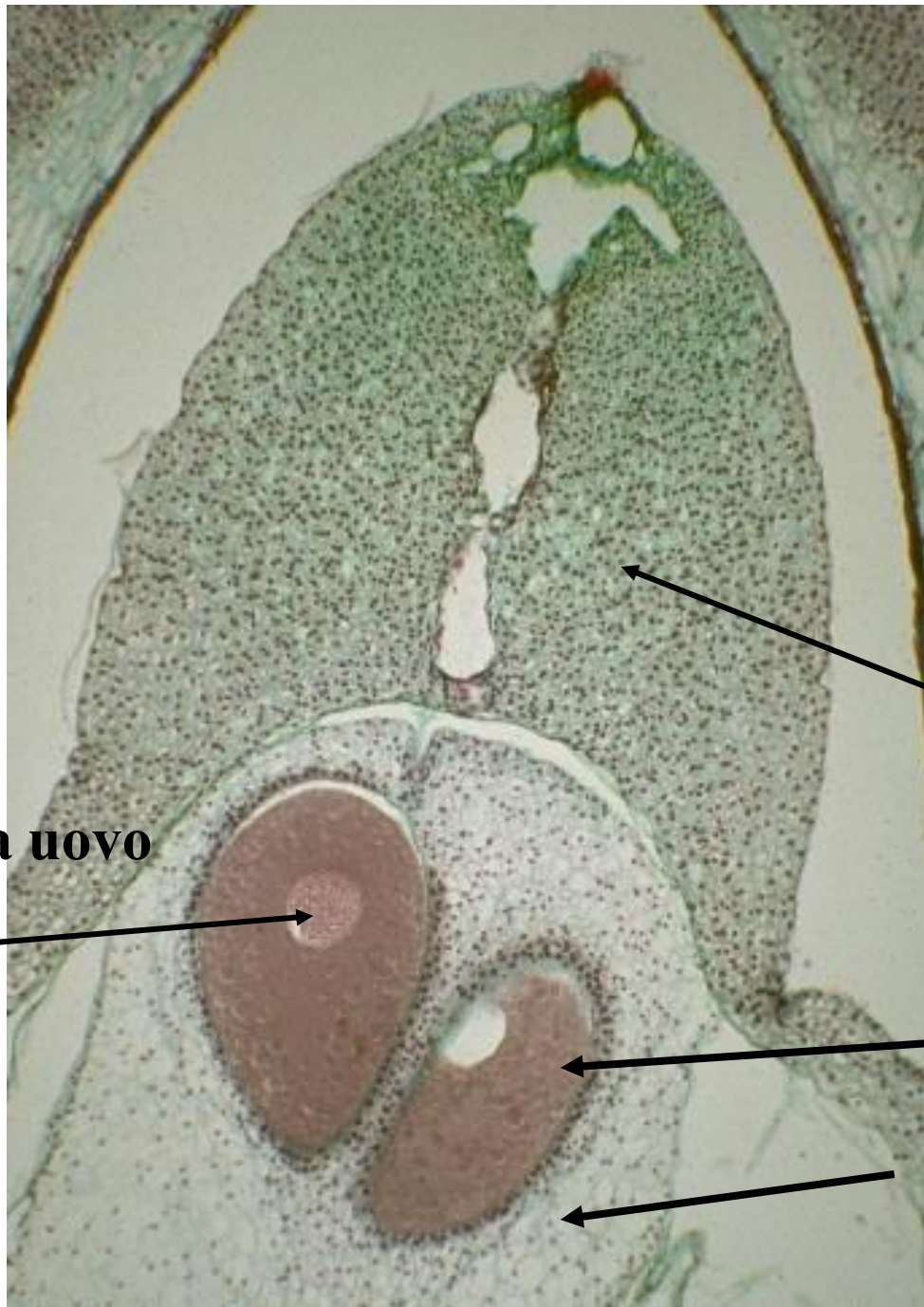
Cellula uovo

nocella

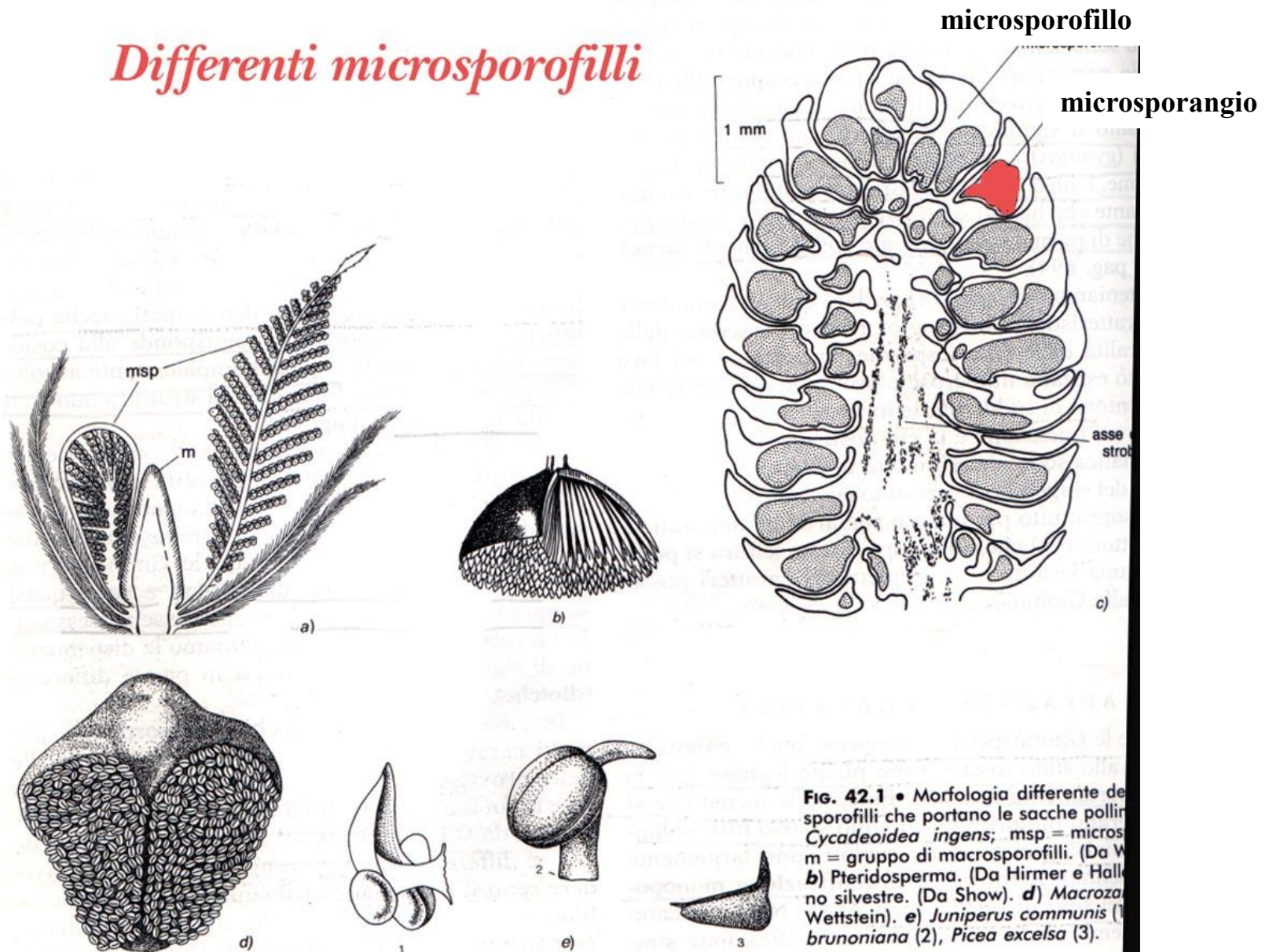
archegoni

endosperma

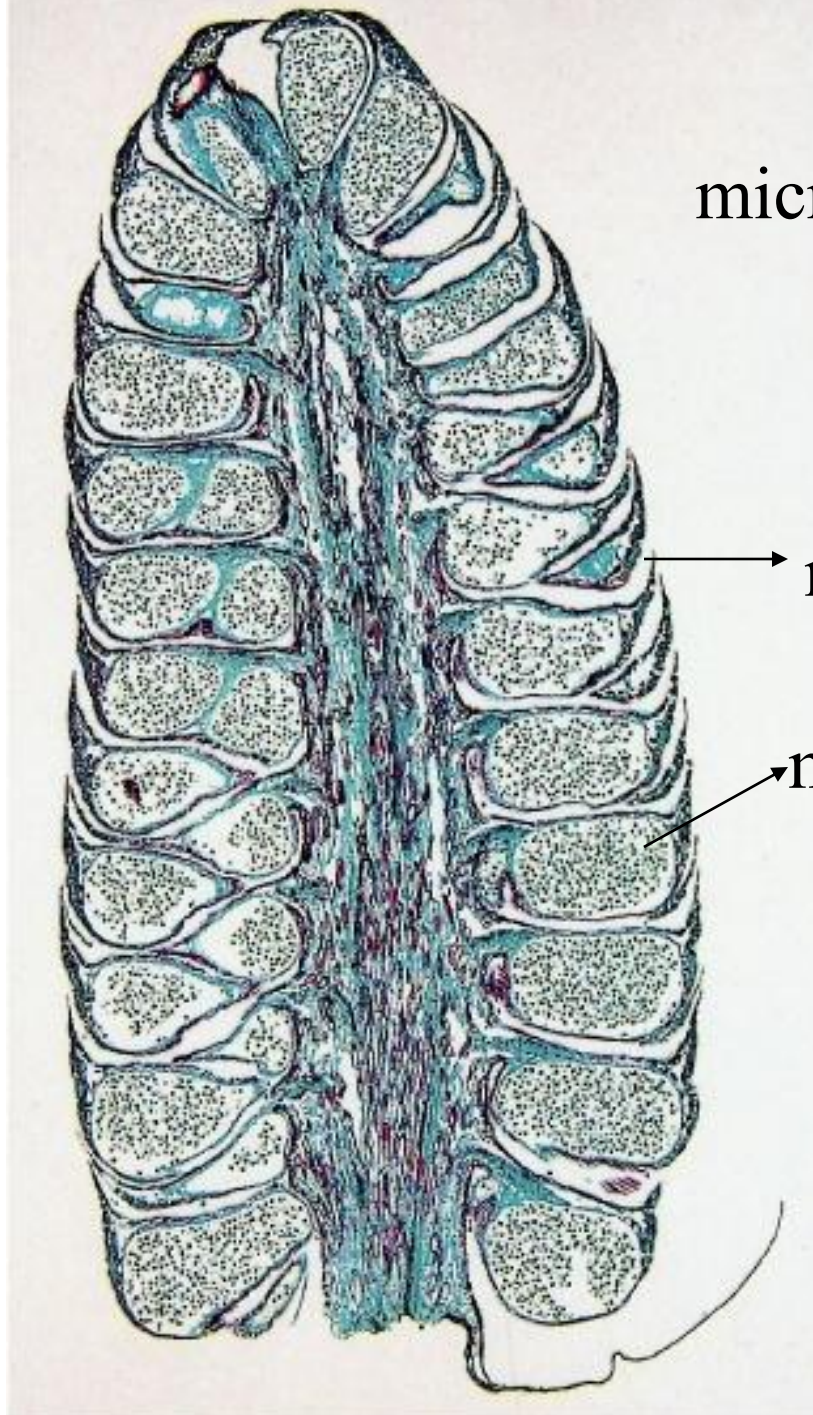
G
A
M
E
T
O



Differenti microsporofilli



Cono microsporangiato

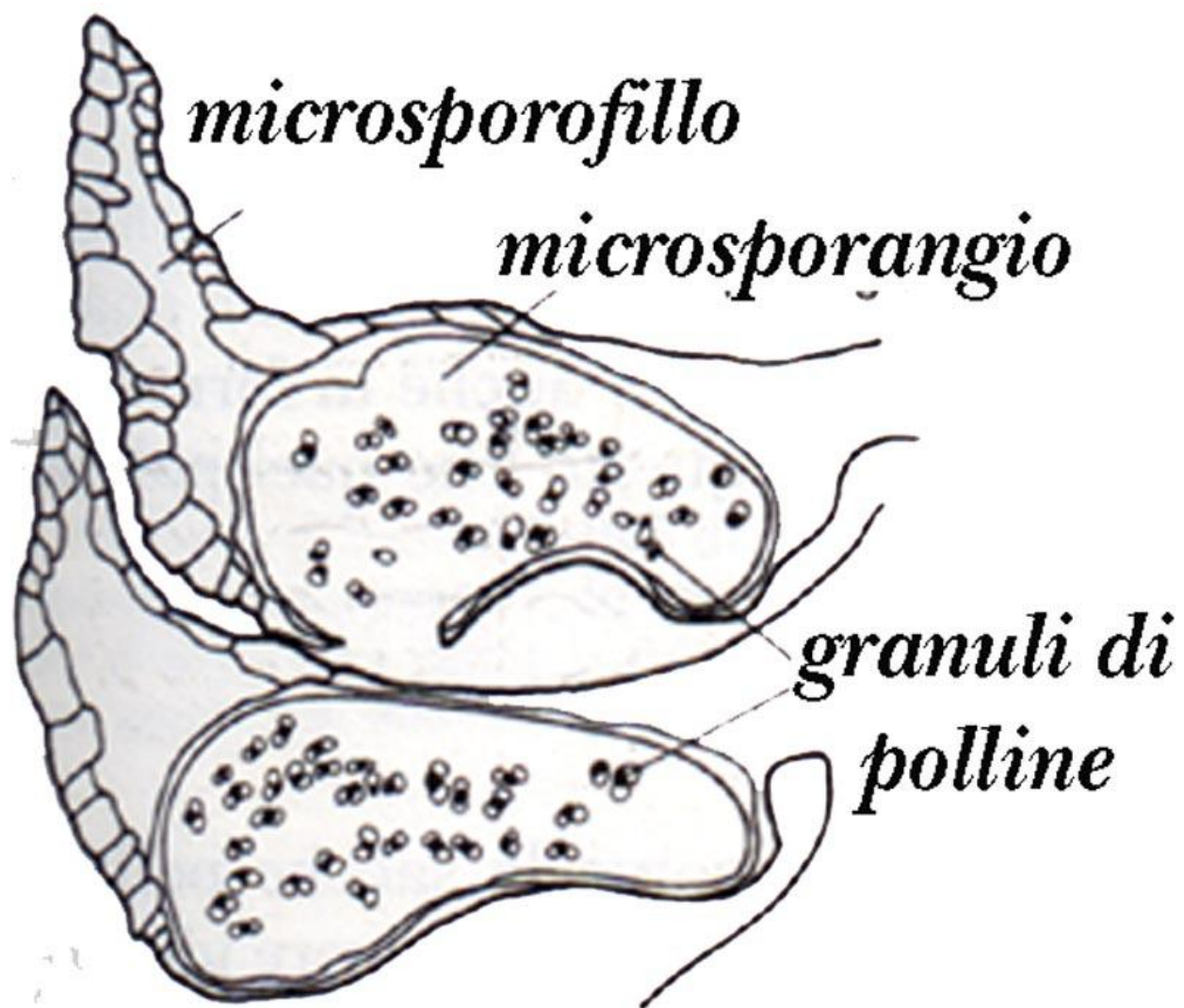


microsporofillo

microsporangio



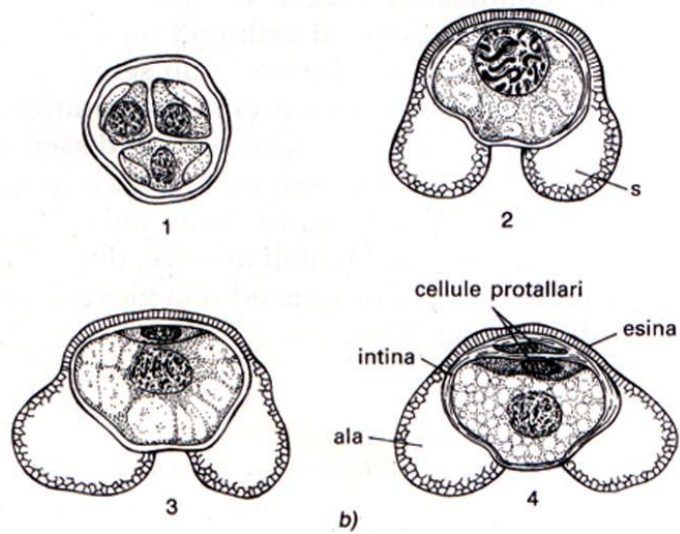
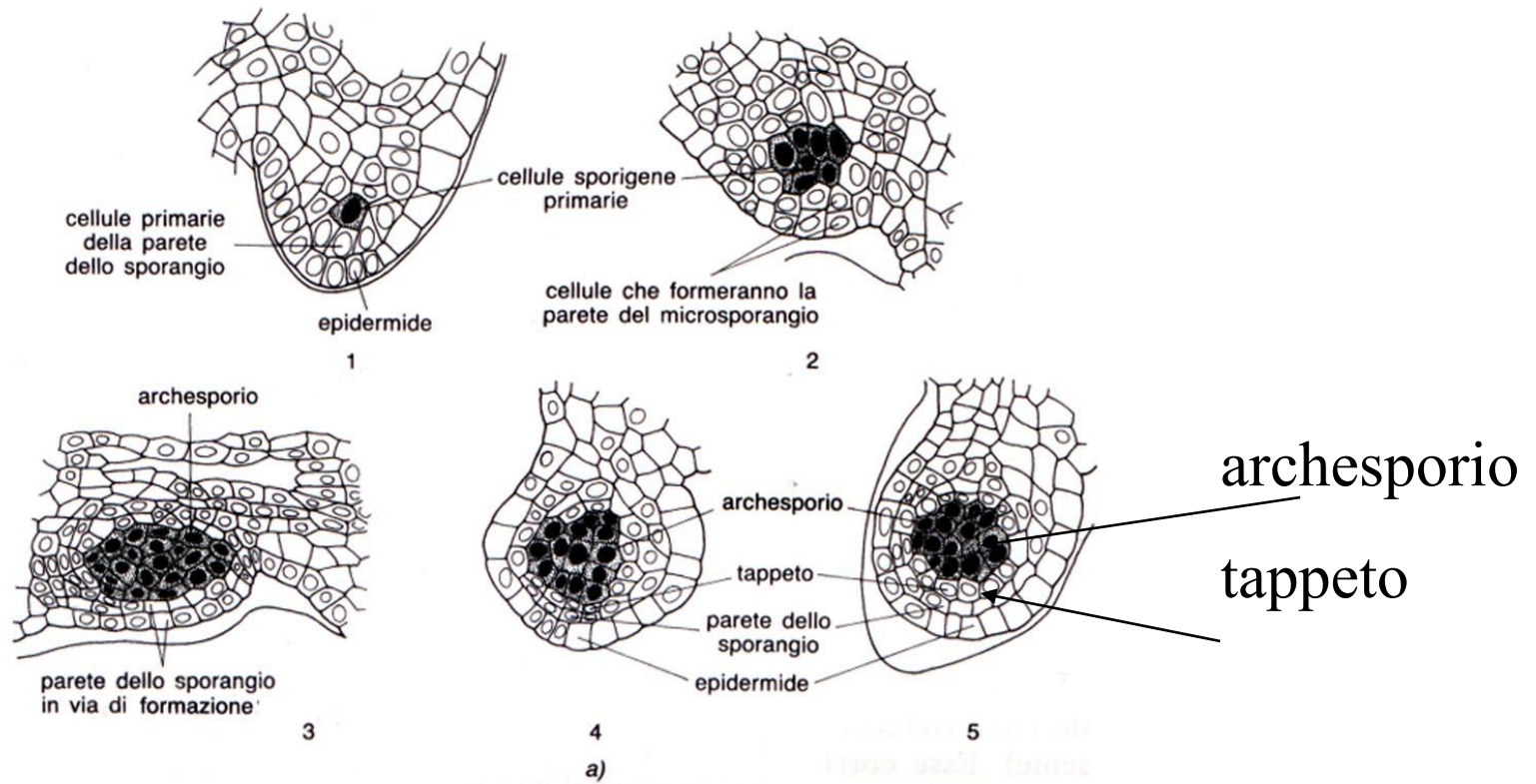
Coni
microsporangati

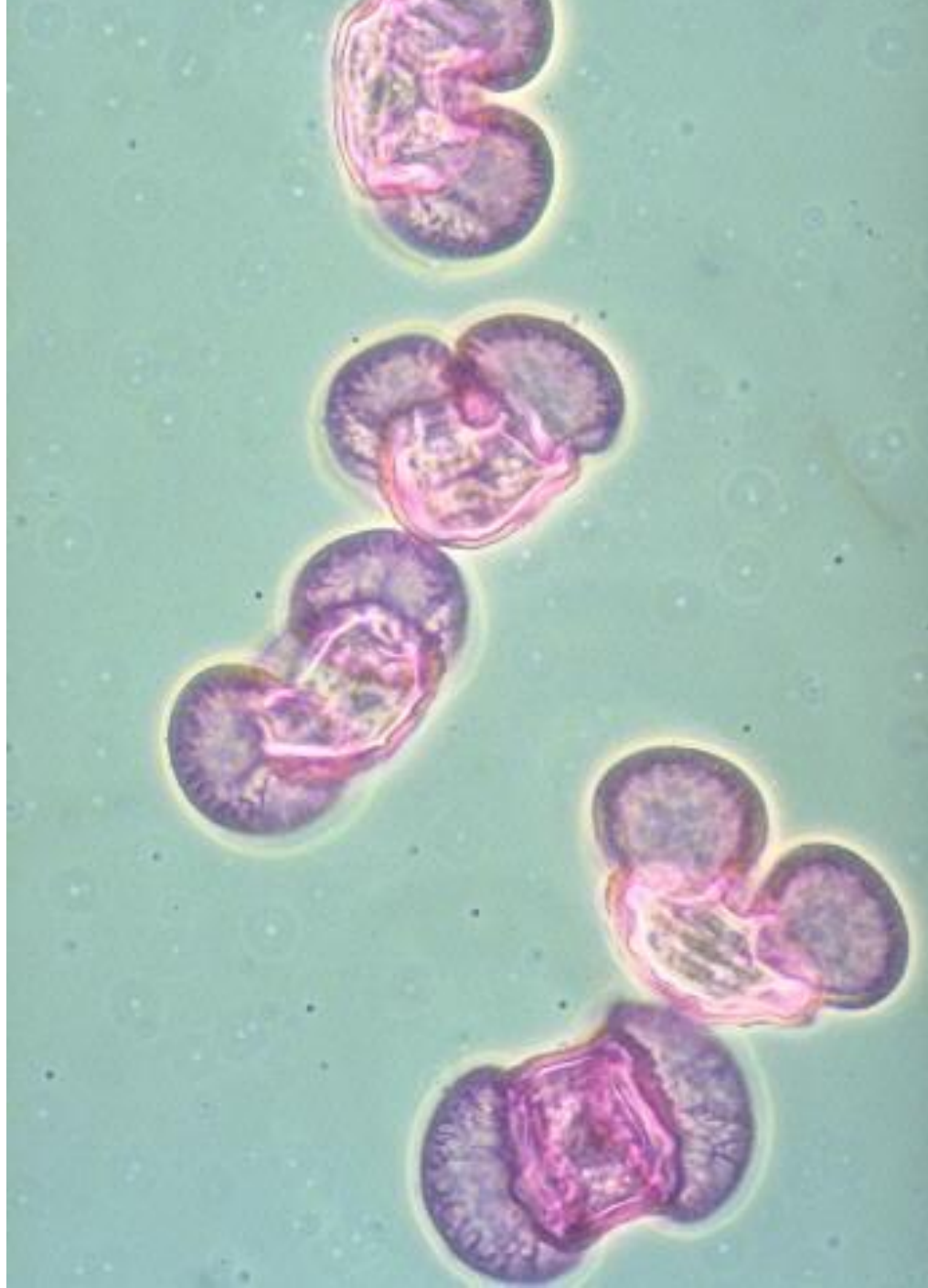


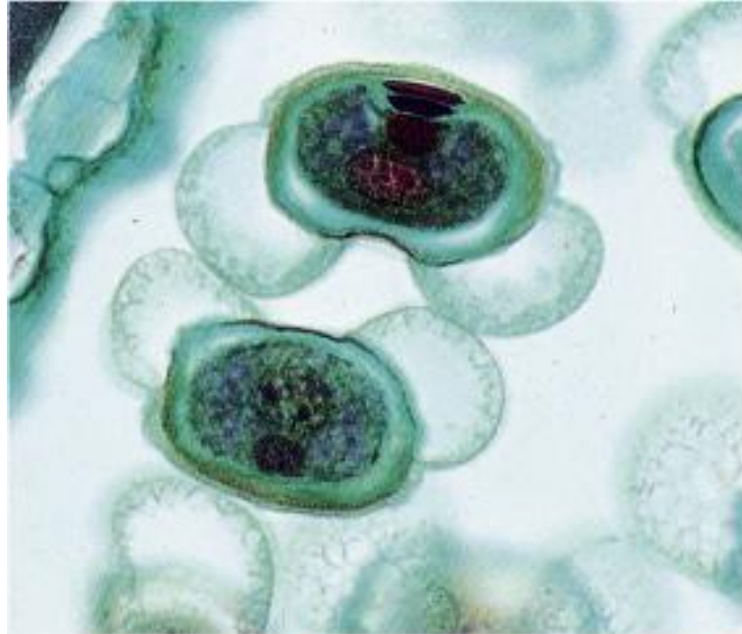
Il polline si sviluppa dalle 4 microspore originate dalle cellule madri delle microspore per meiosi

**Il granulo pollinico è costituito da 2 cellule protalliali,
1 cellula generativa e 1 cellula del tubetto
(tetracellulare)**

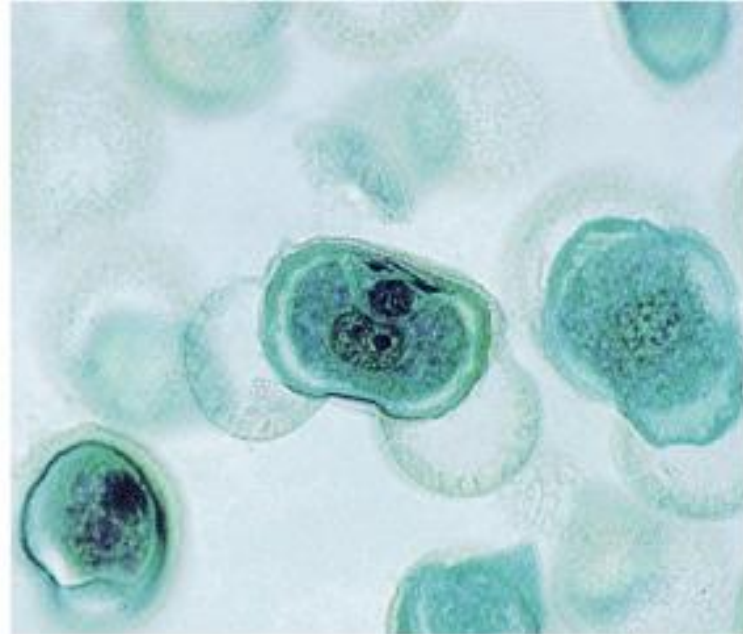
Il granulo pollinico è il gametofito maschile



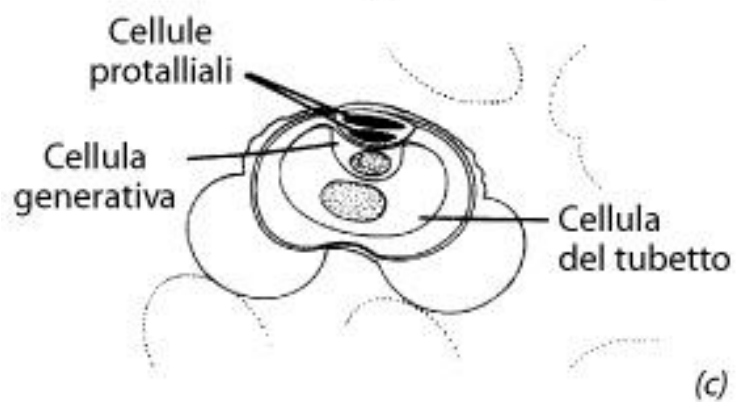




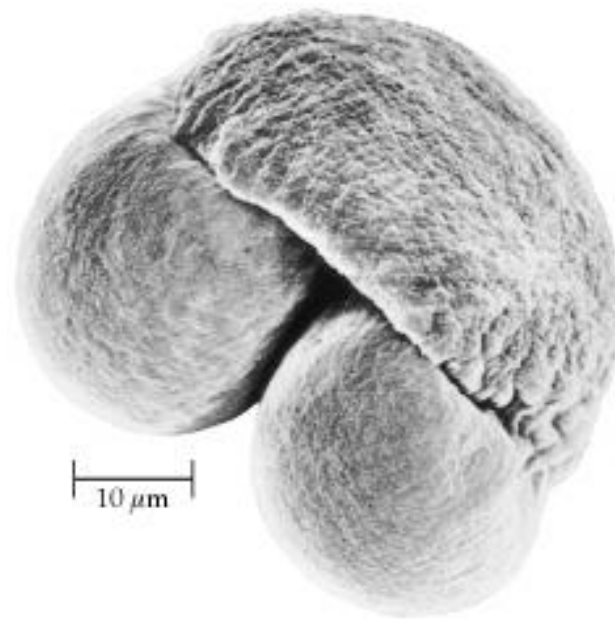
(a)



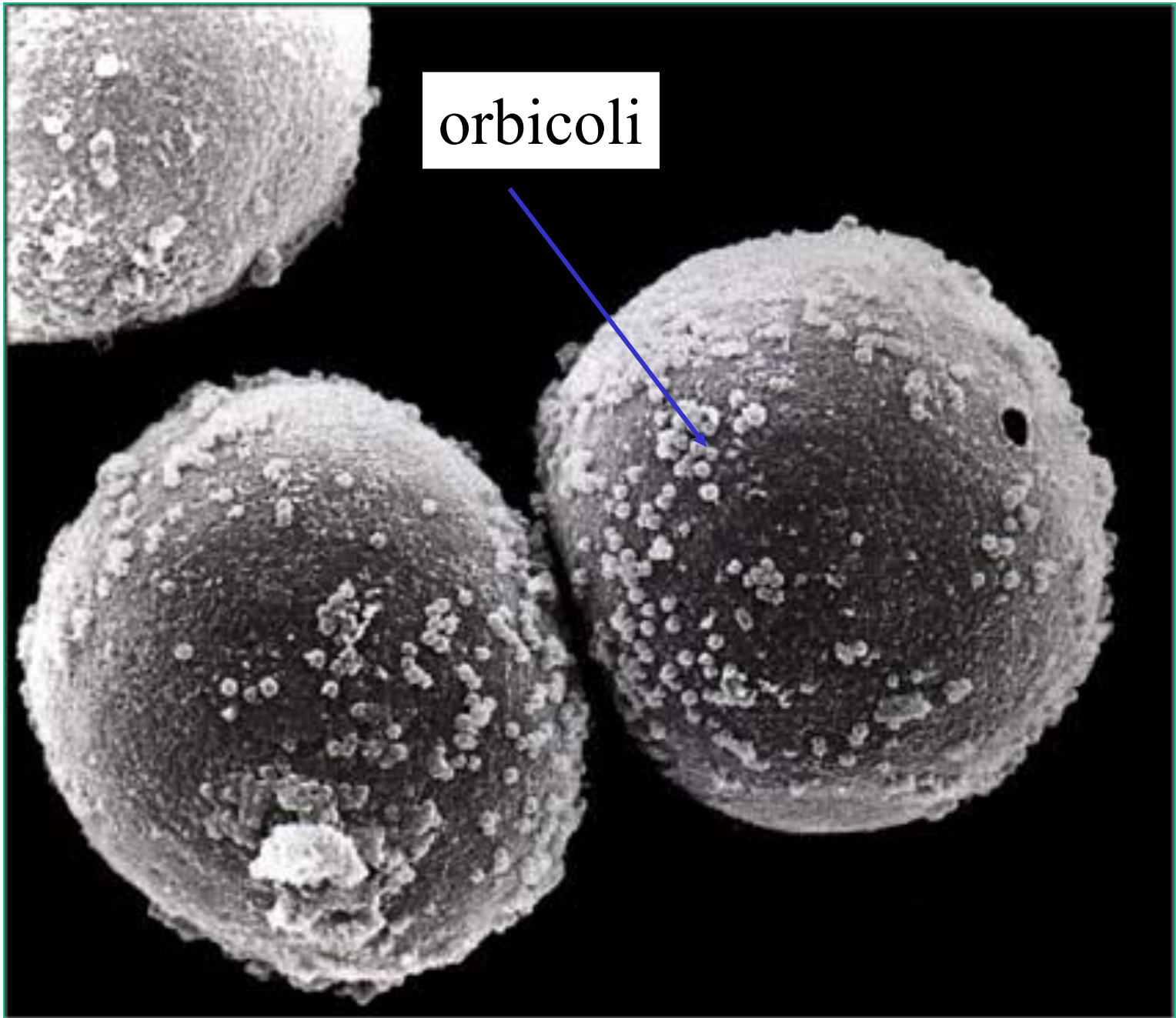
(b)



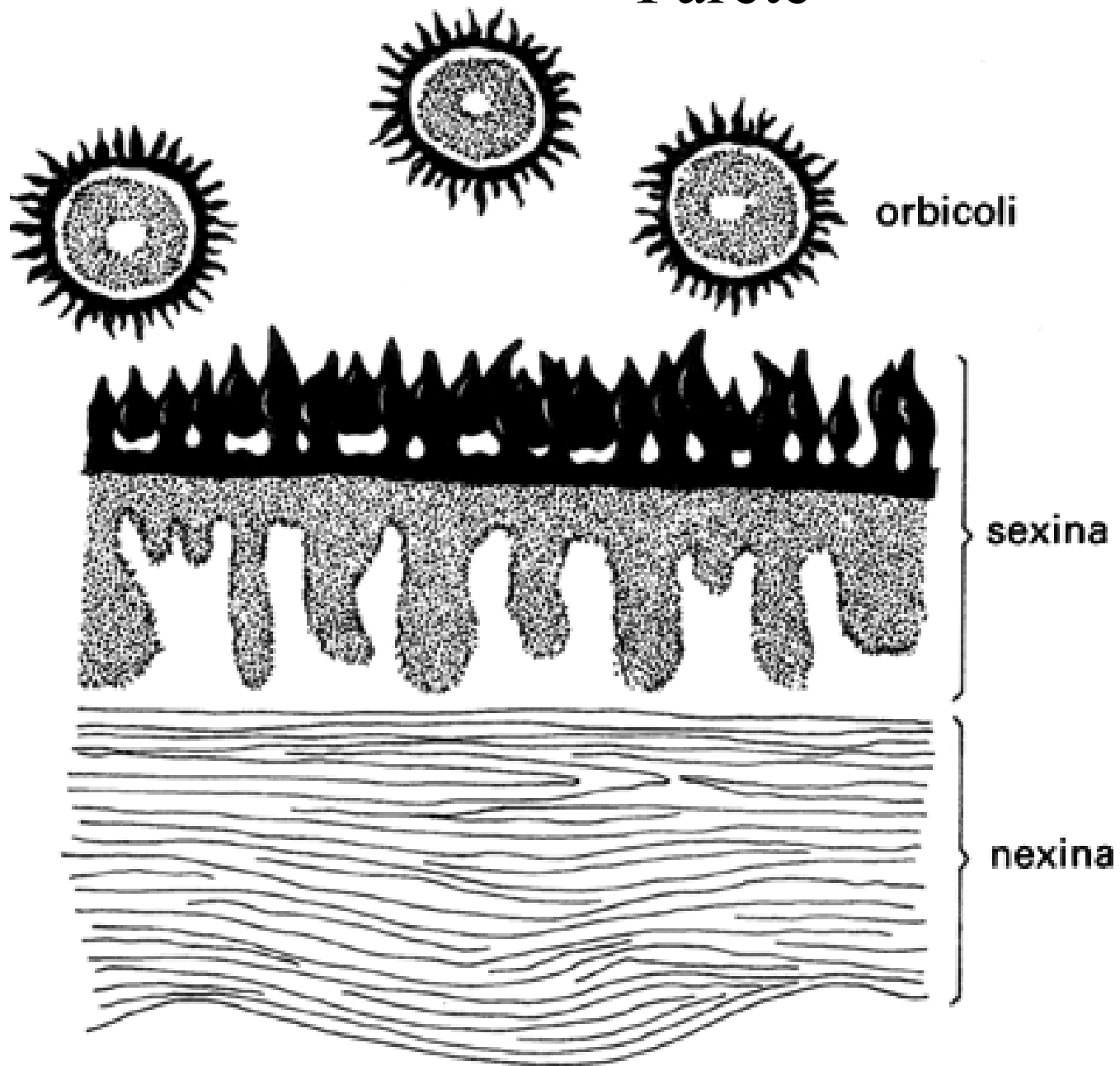
(c)



orbicoli



Parete



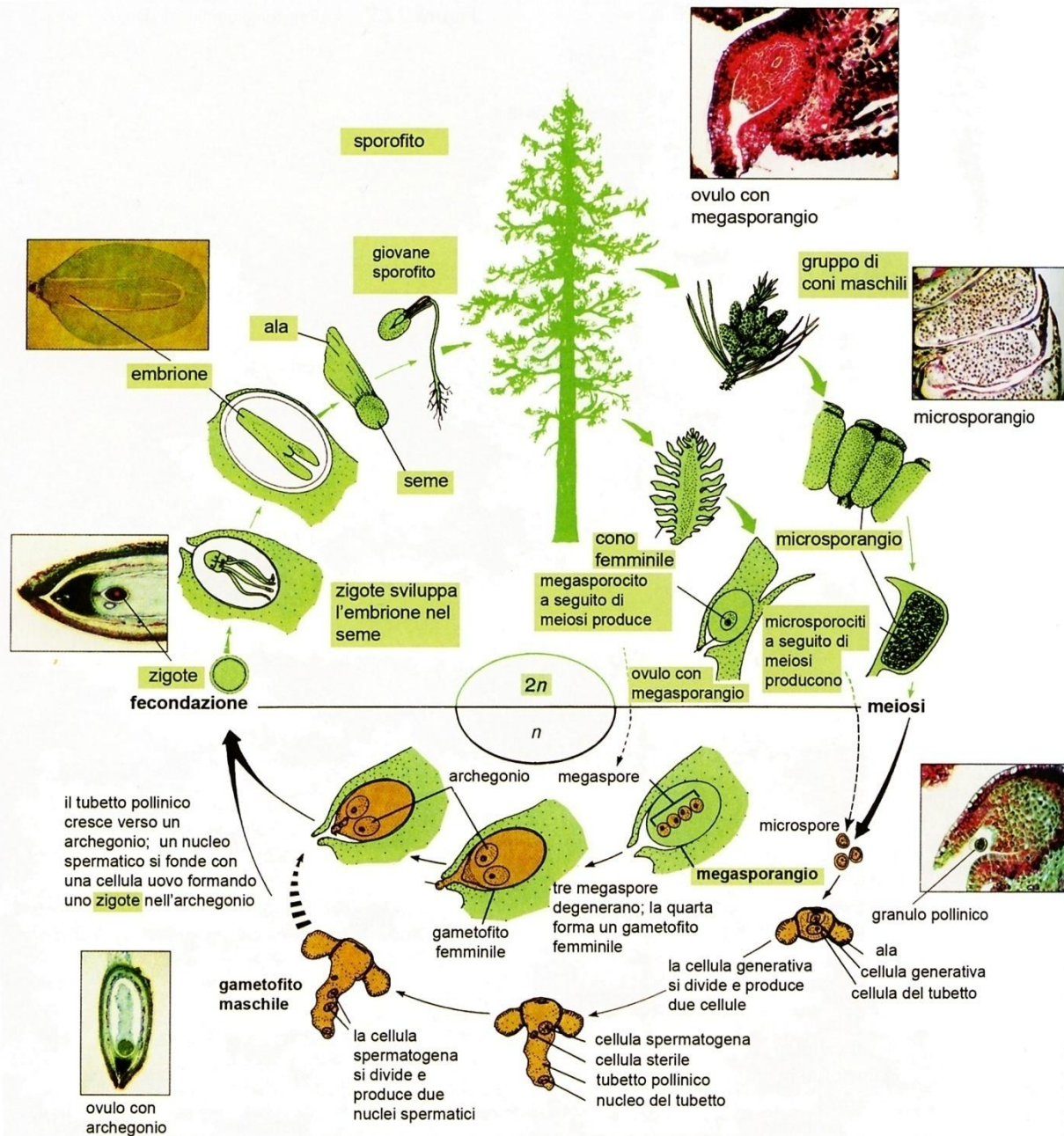
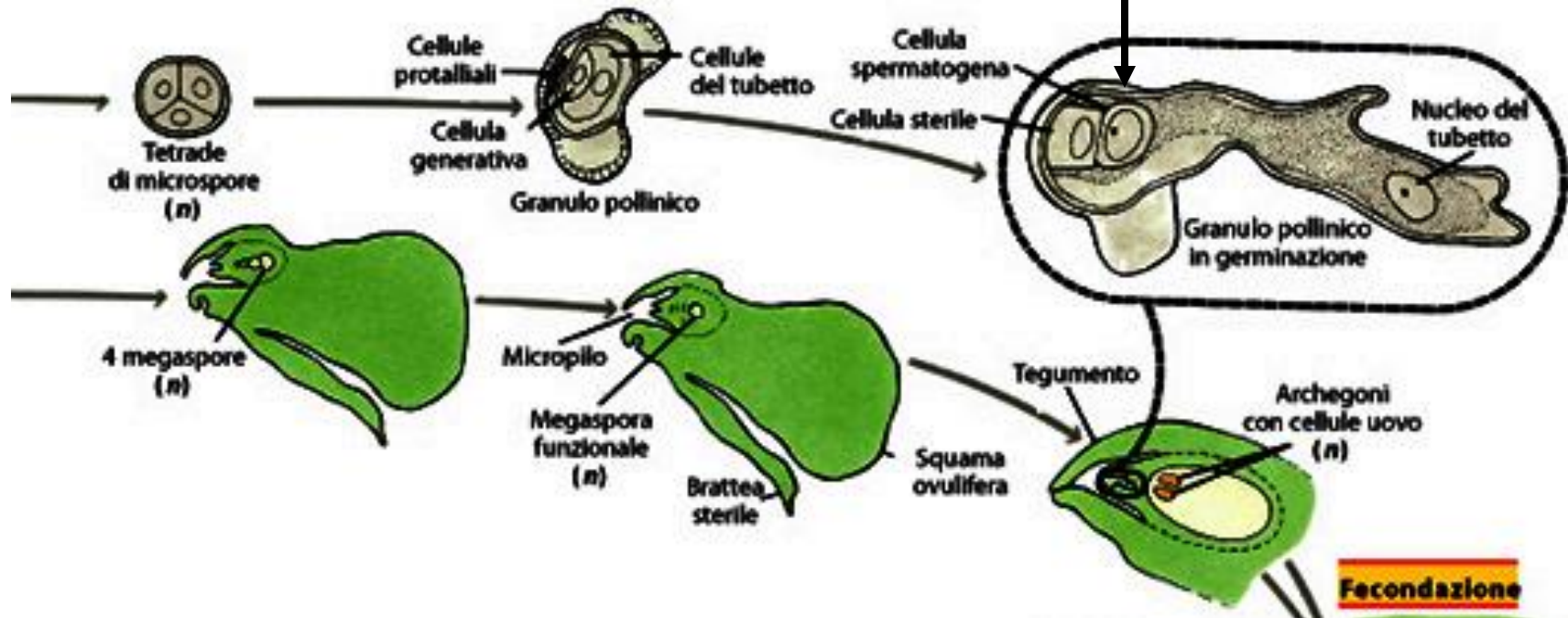


Figura 22.8 Ciclo vitale di un Pino.

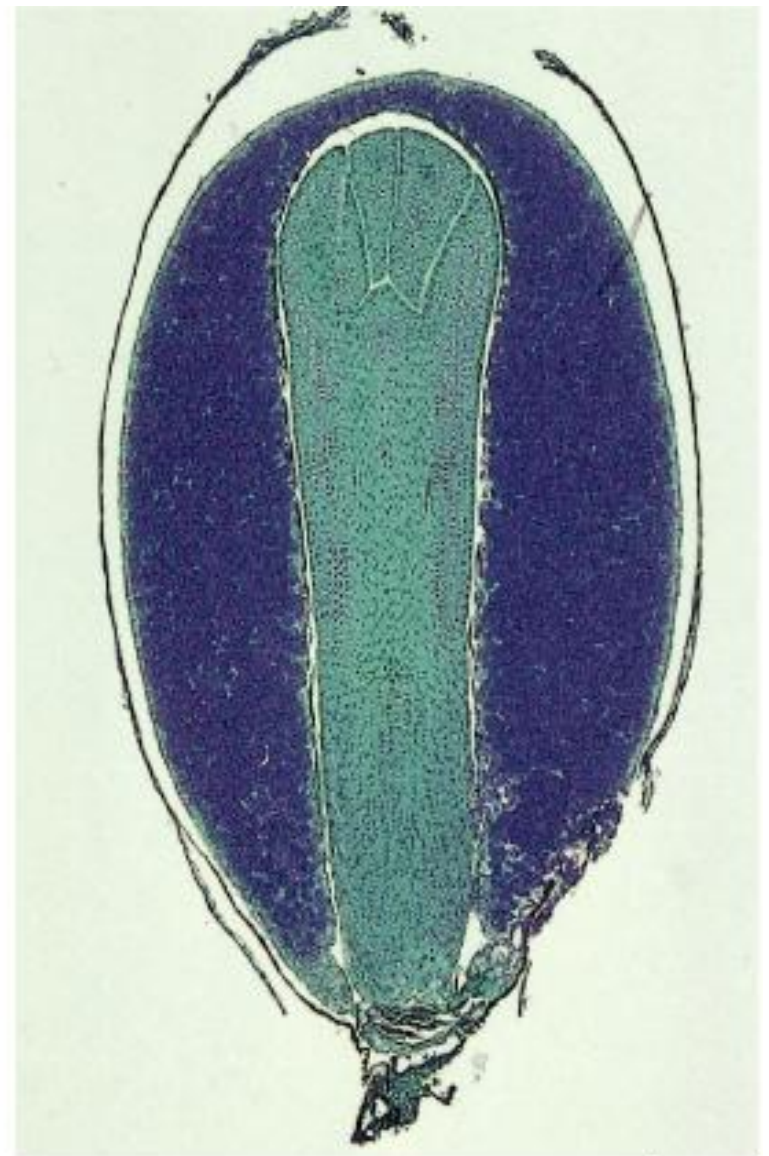
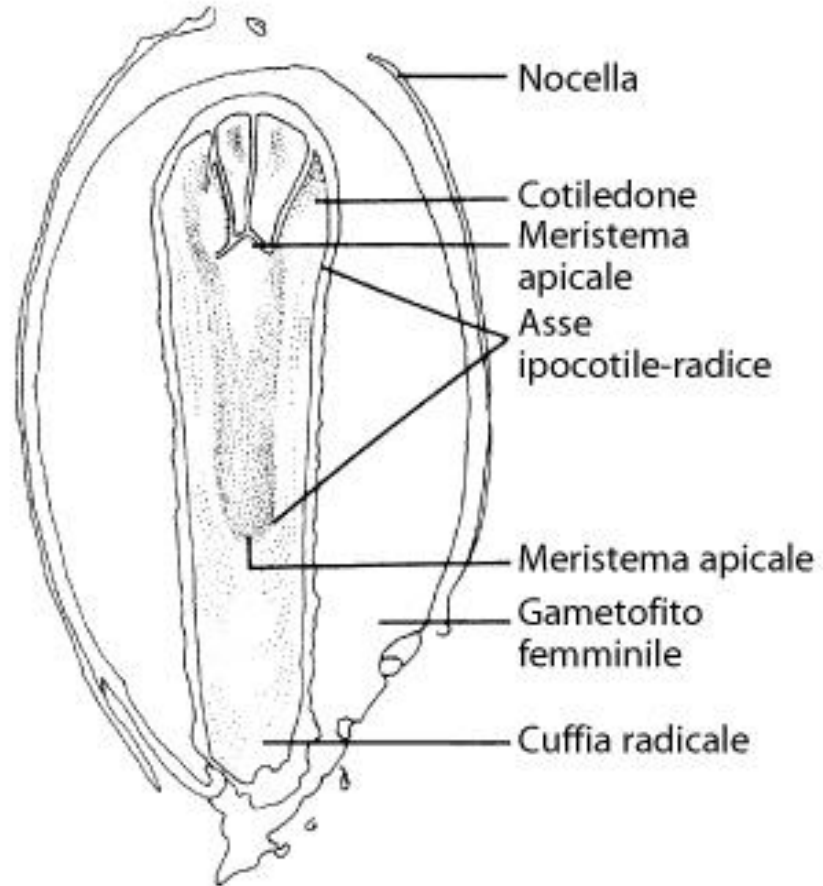
Cellula spermatogena



Seme costituito da:

Generazione sporofitica diploide
(tegumenti e resti della nocella)
Embrione

Gametofito, aploide, con funzione di riserva



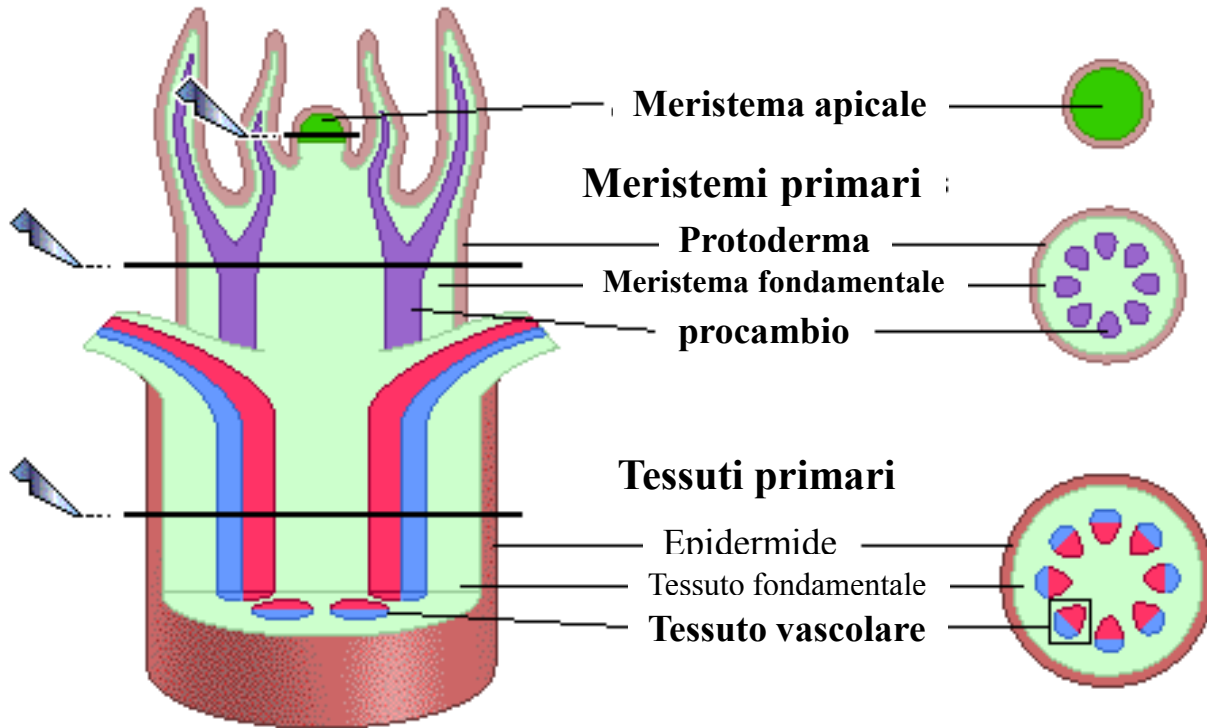
500 μm

Divisione cellulare

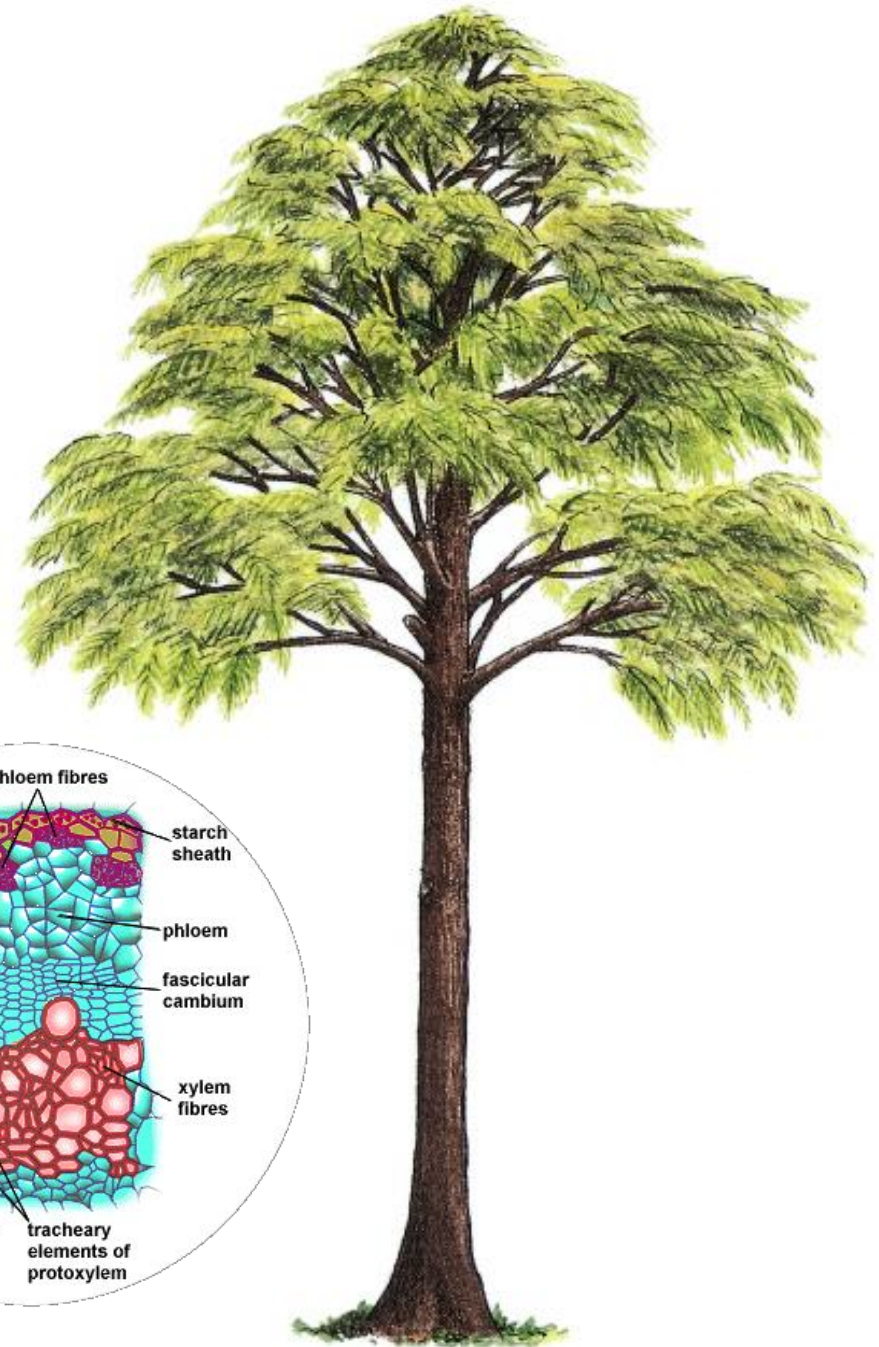
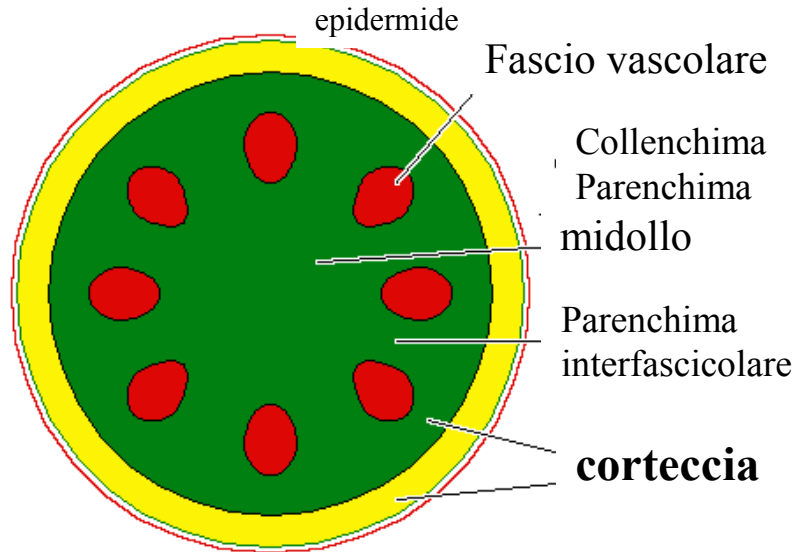
differentenziamento



Allungamento

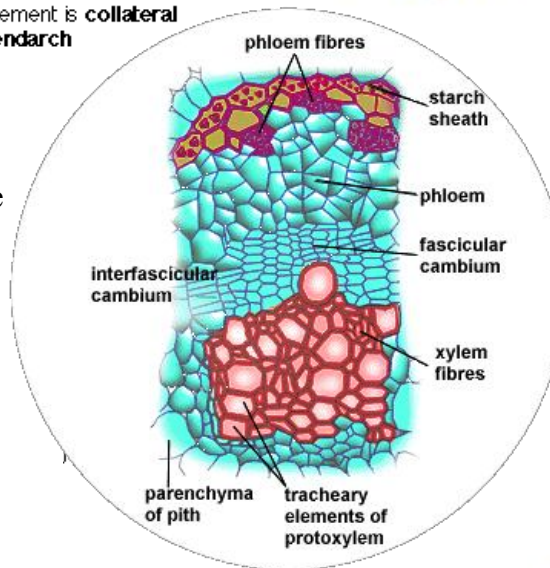
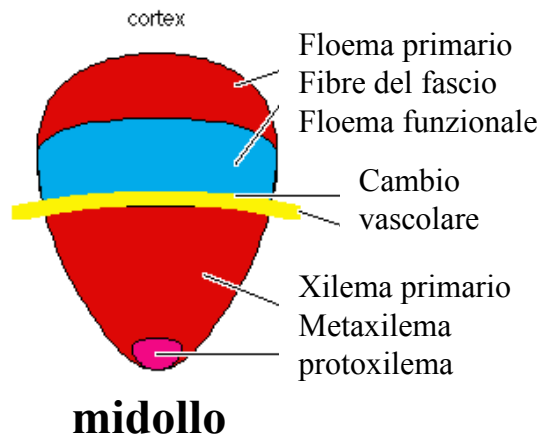


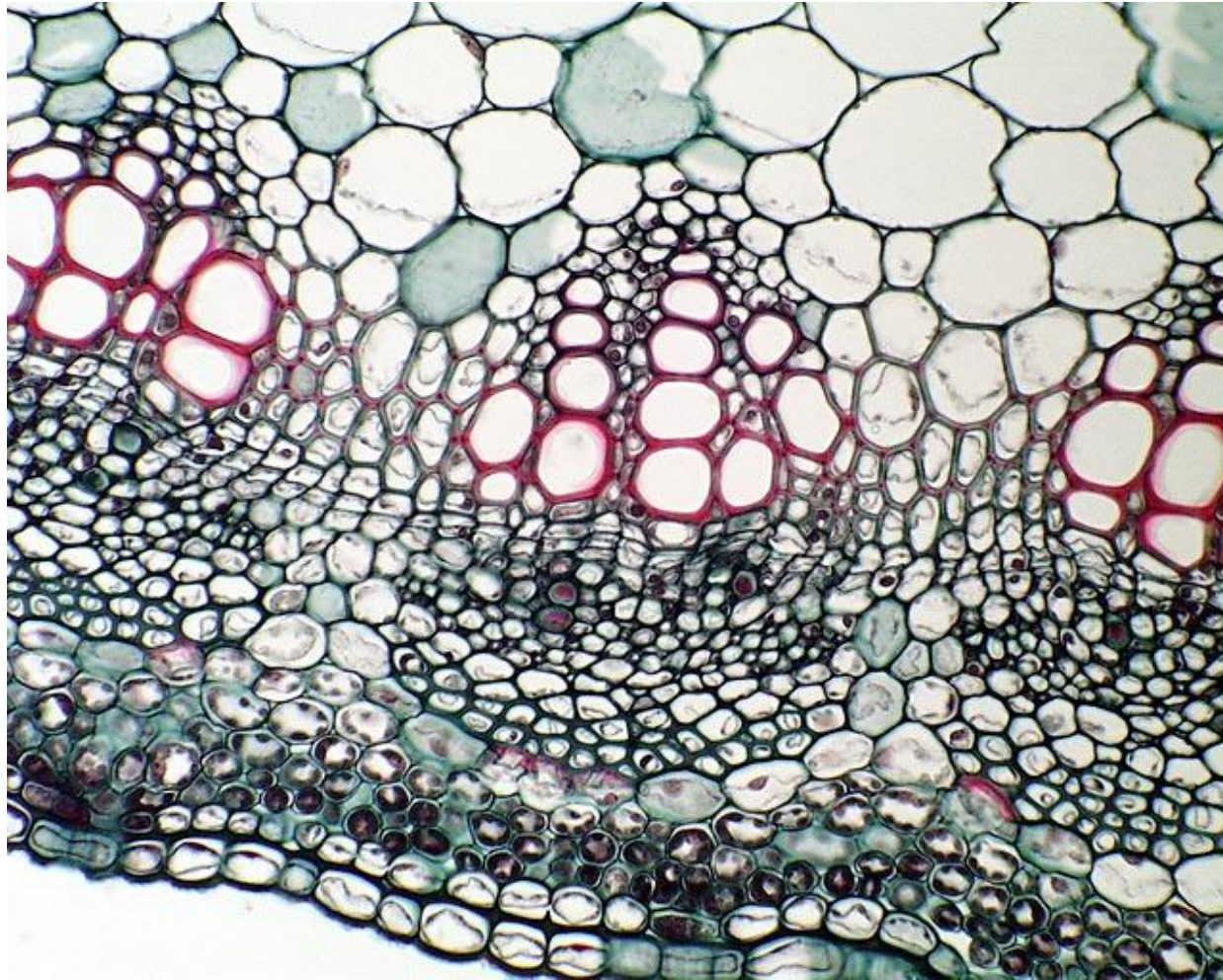
Corpo primario di un fusto

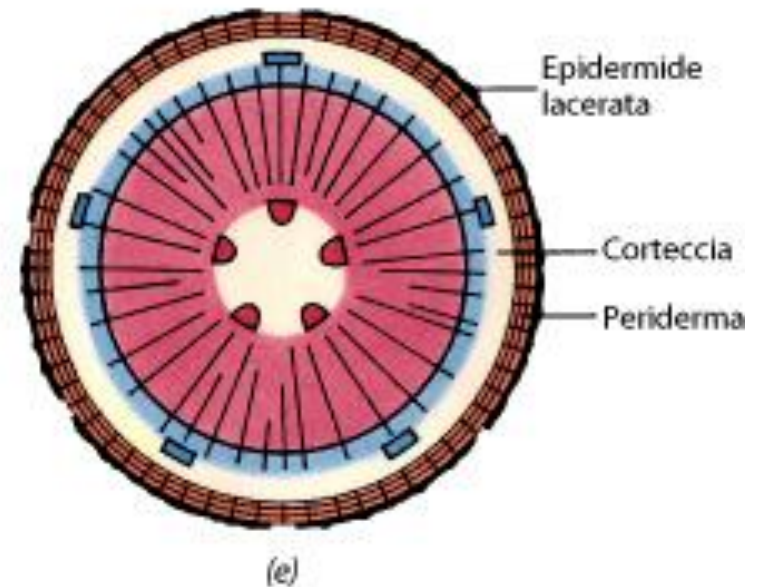
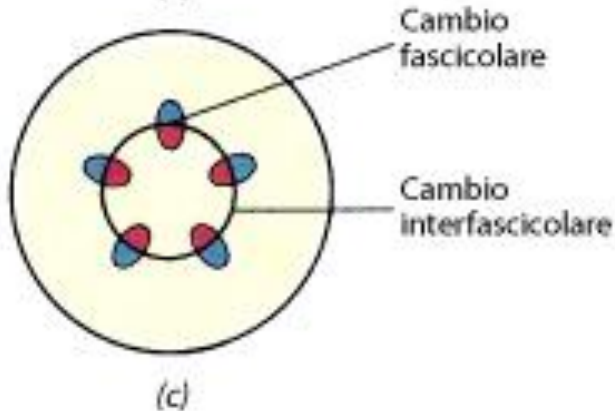
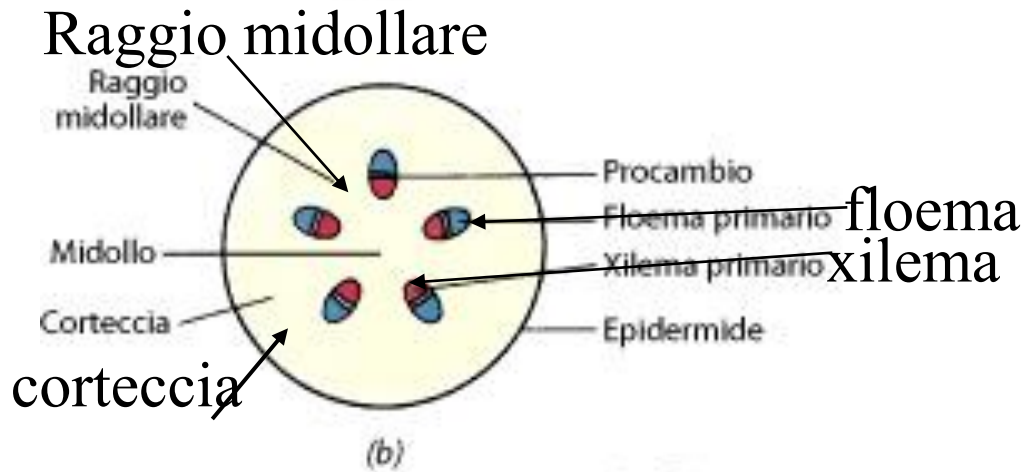
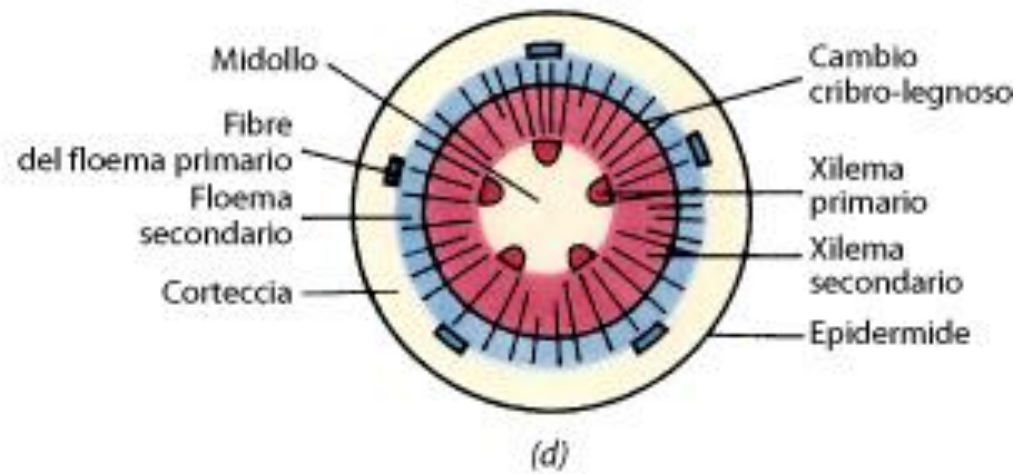
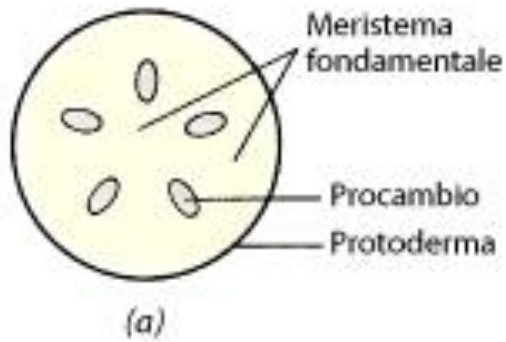


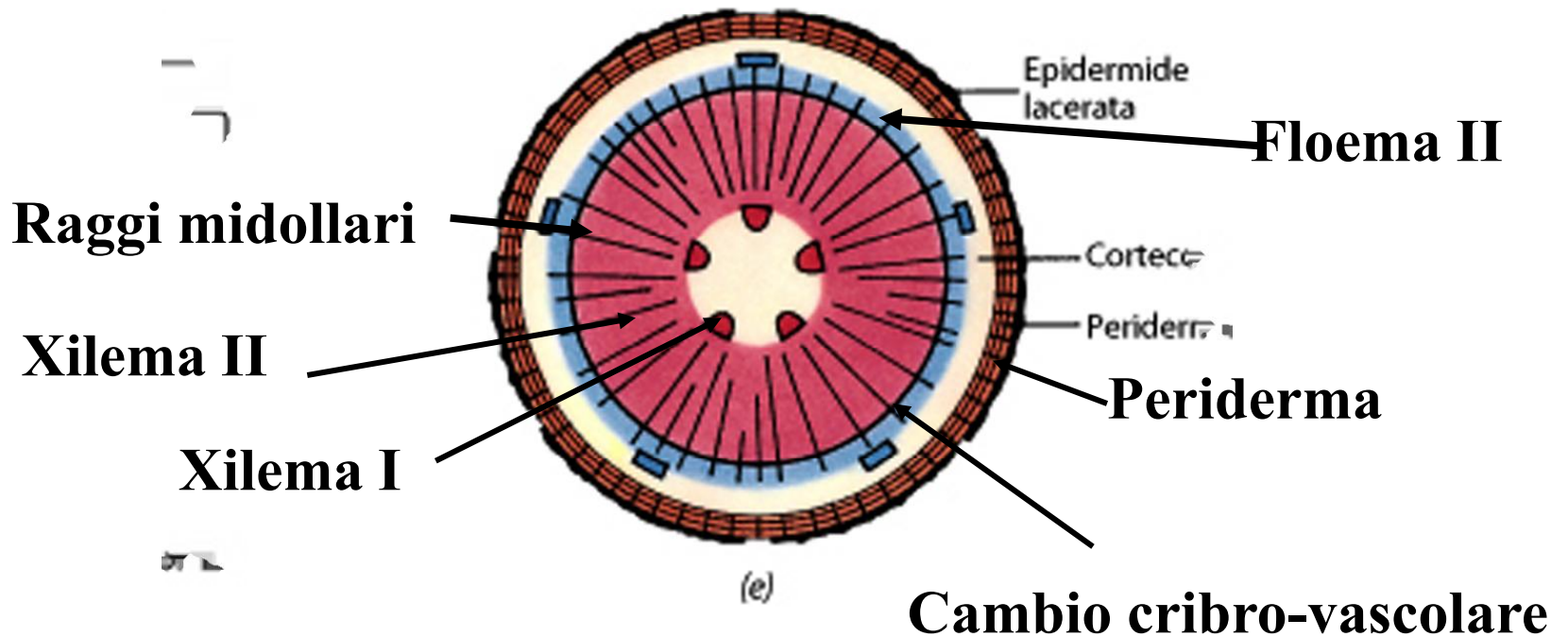
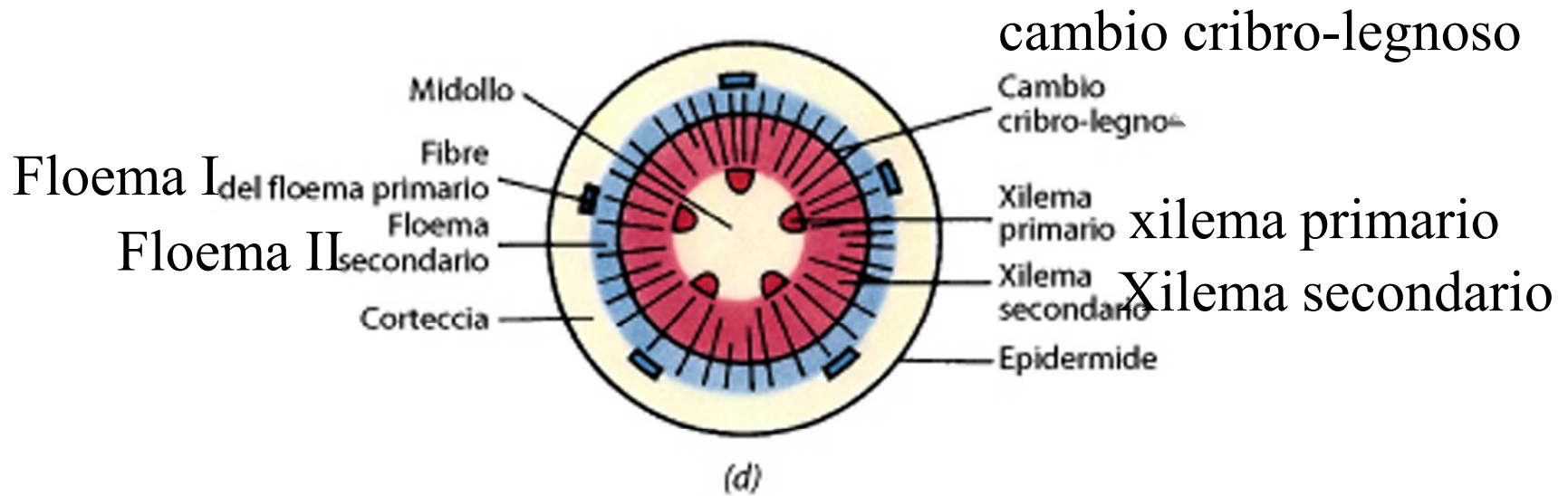
Fascio vascolare

xylem/phloem arrangement is **collateral**
xylem maturation is **endarch**









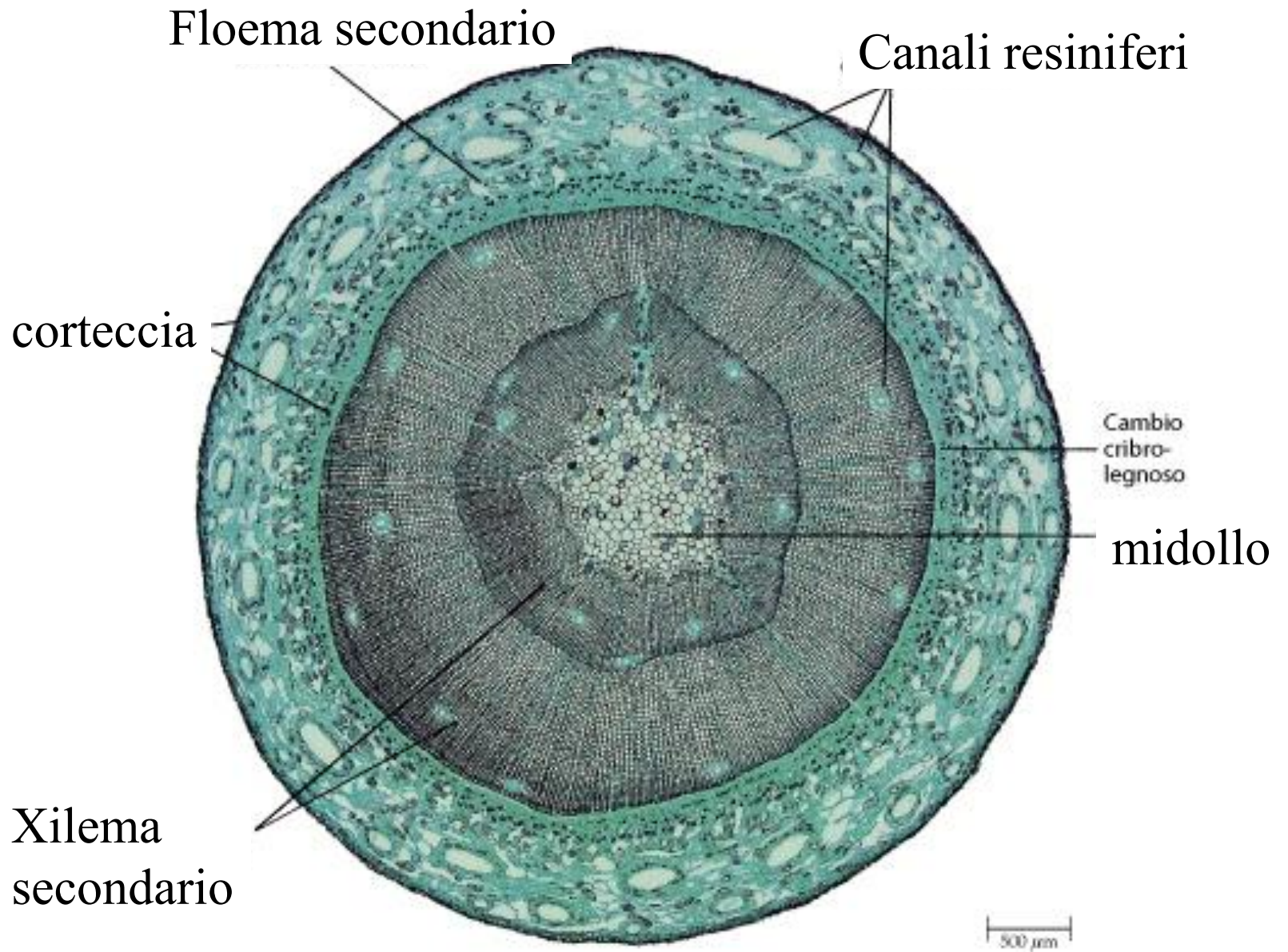


Tavola tagliata
tangenzialmente

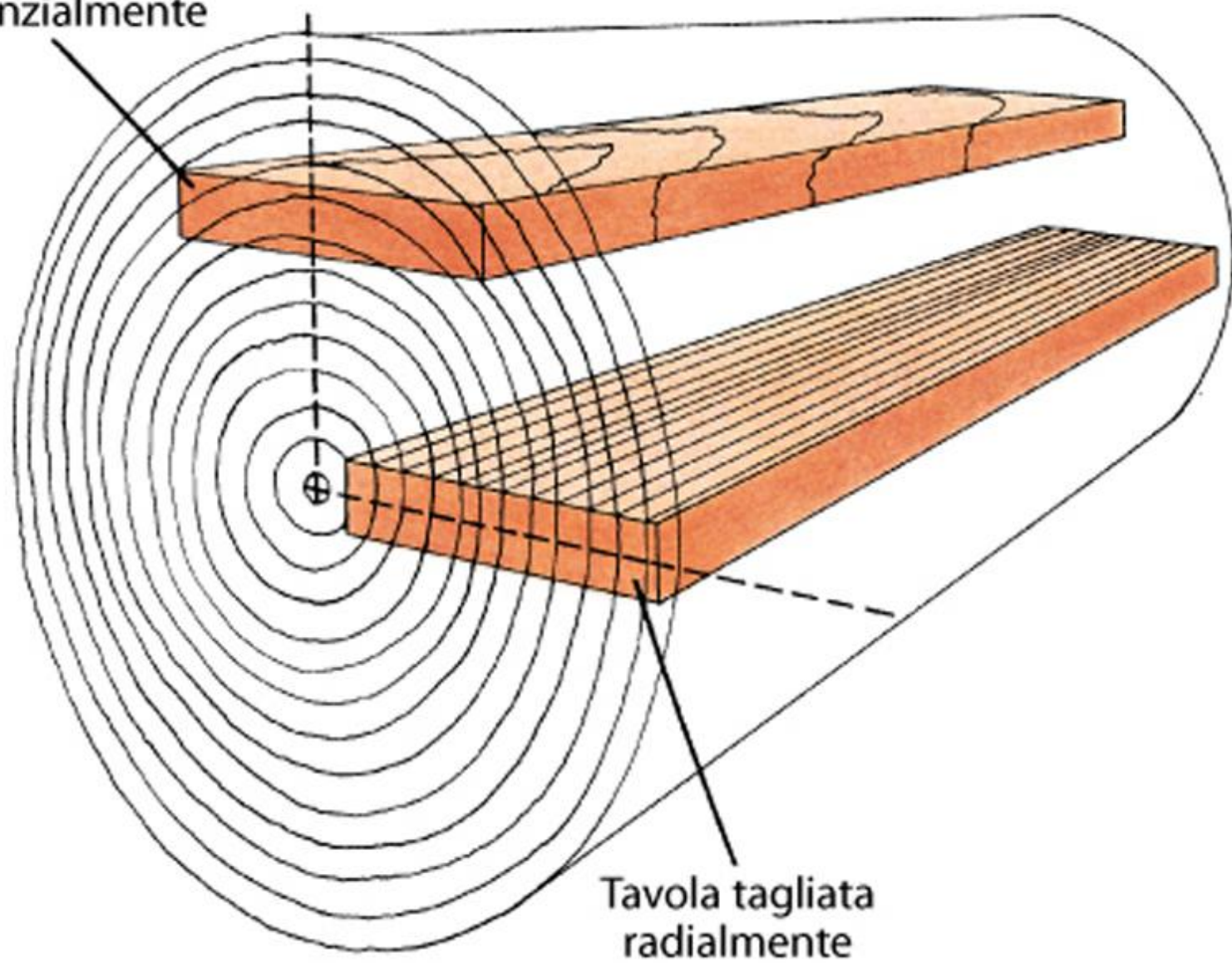
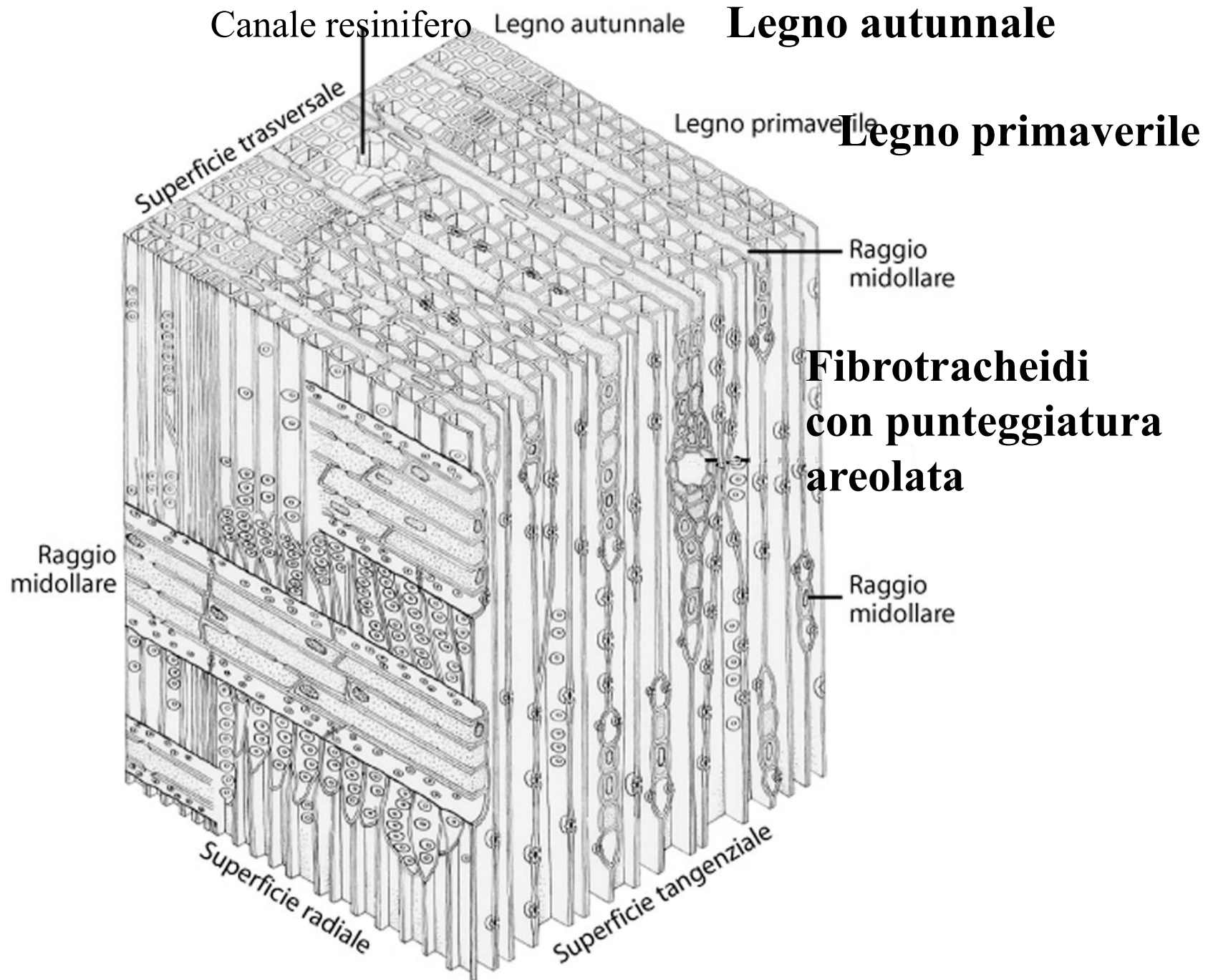
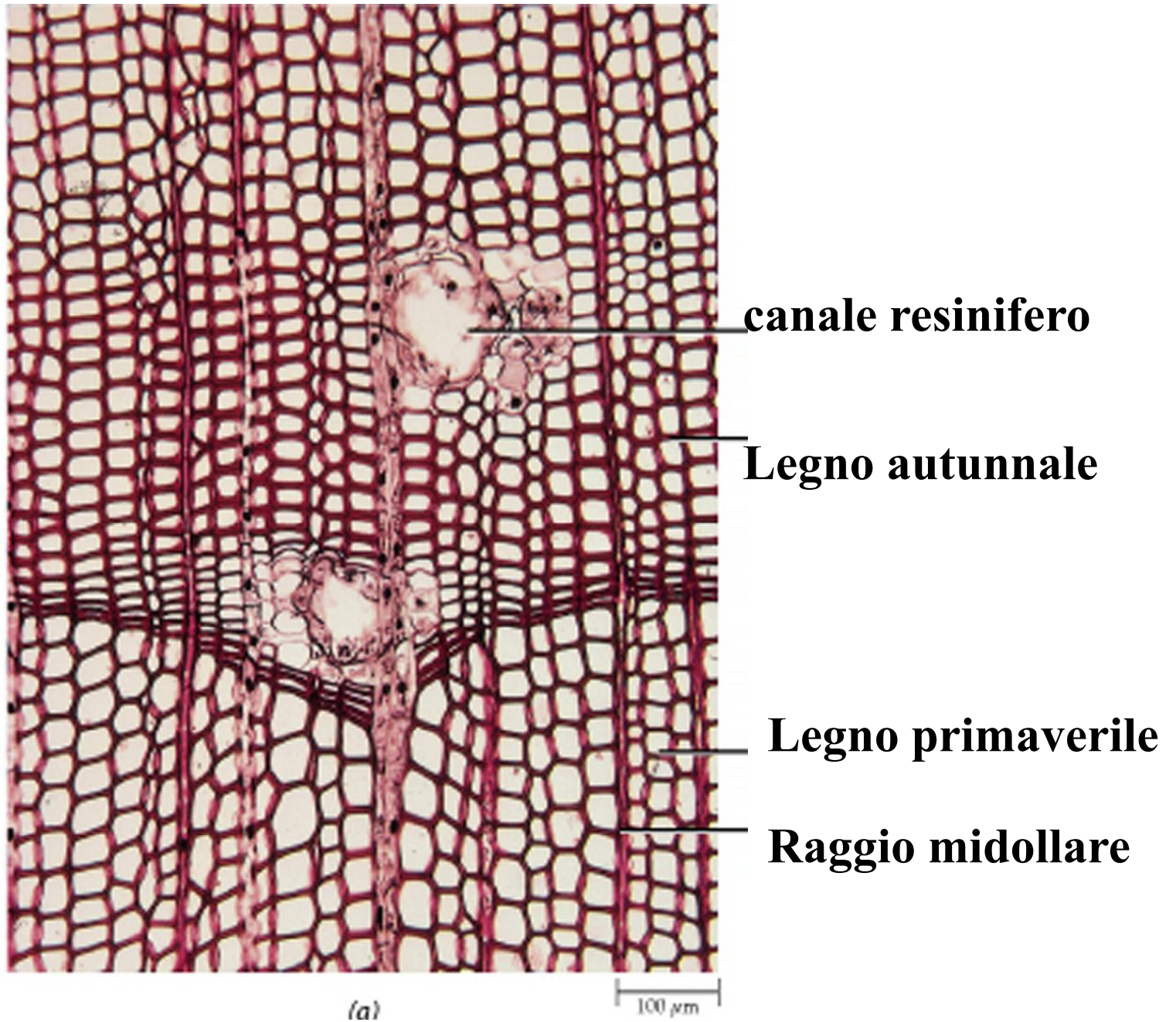


Tavola tagliata
radialmente

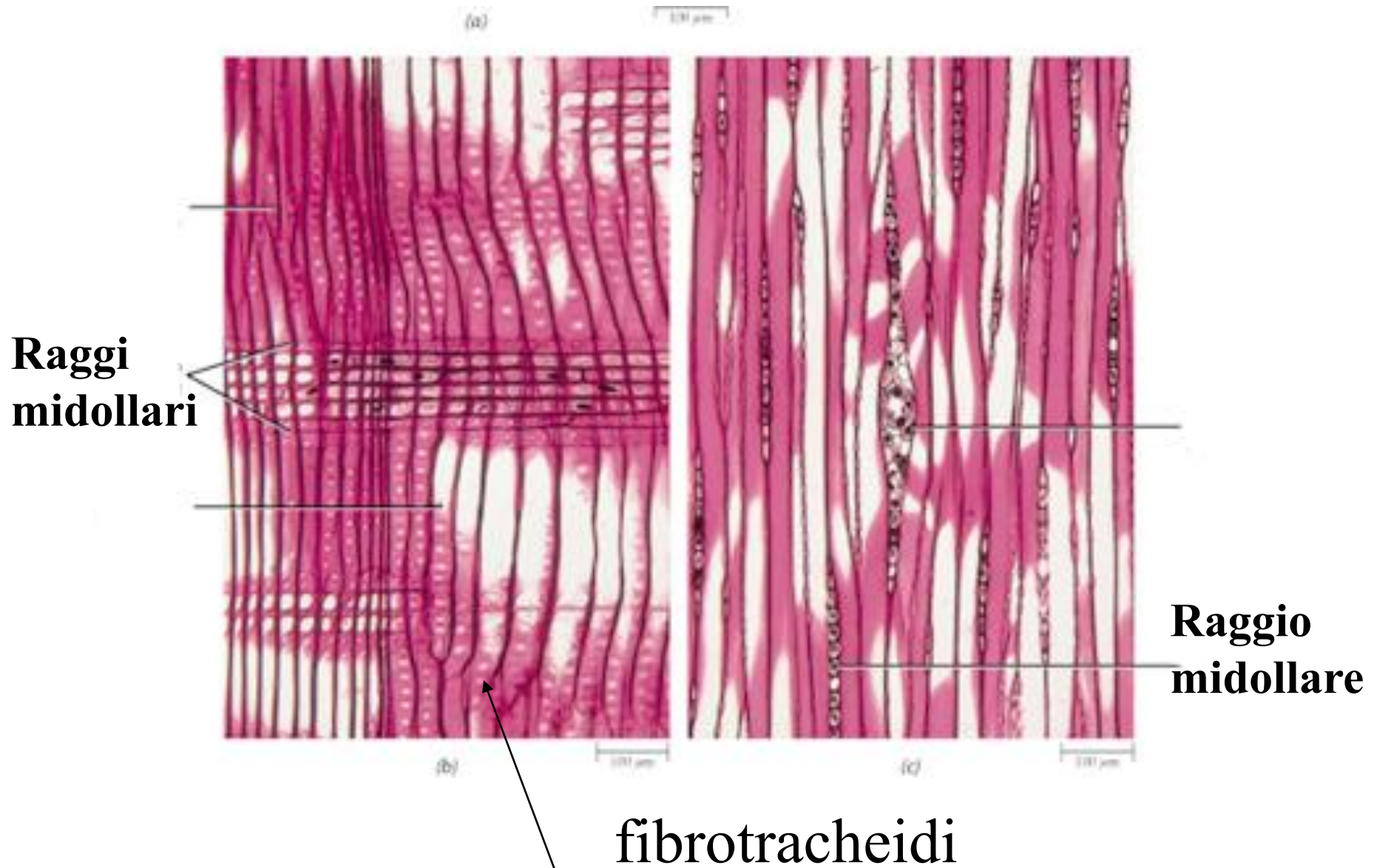


Sezione trasversale di legno



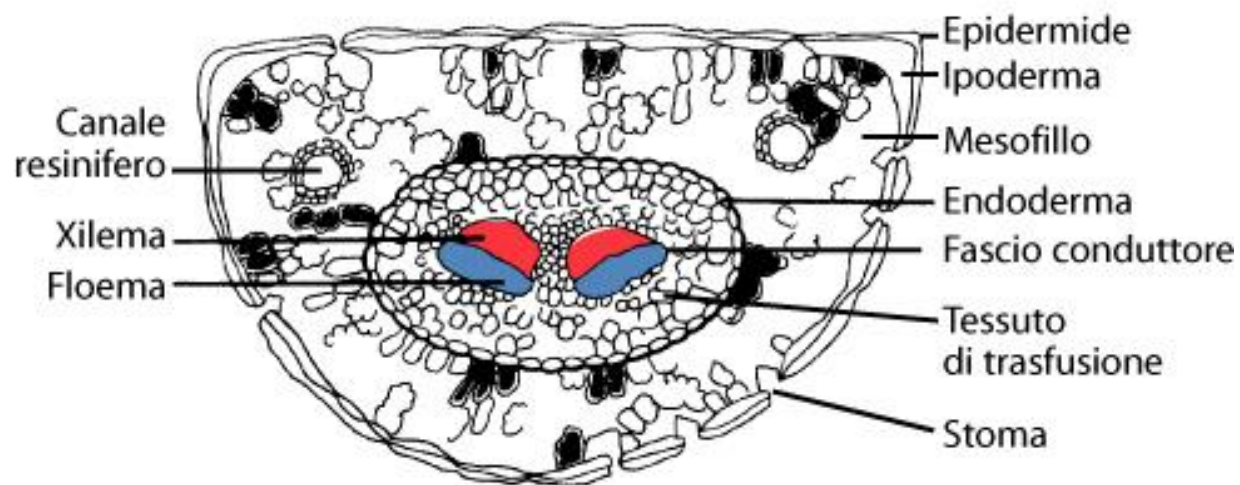
Sezione radiale

Sezione tangenziale

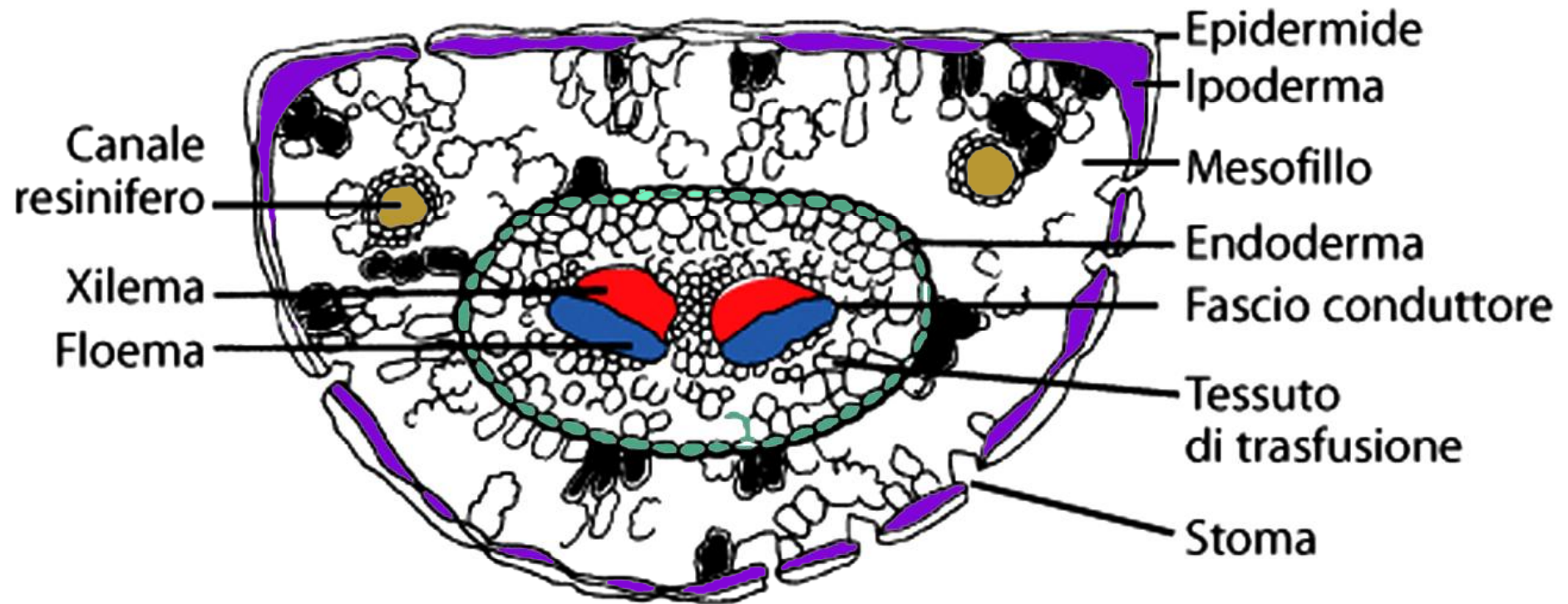




200 μm



Schema ago di pino



epidermide

mesofillo

nervature

endoderma

Tessuto di trasfusione

