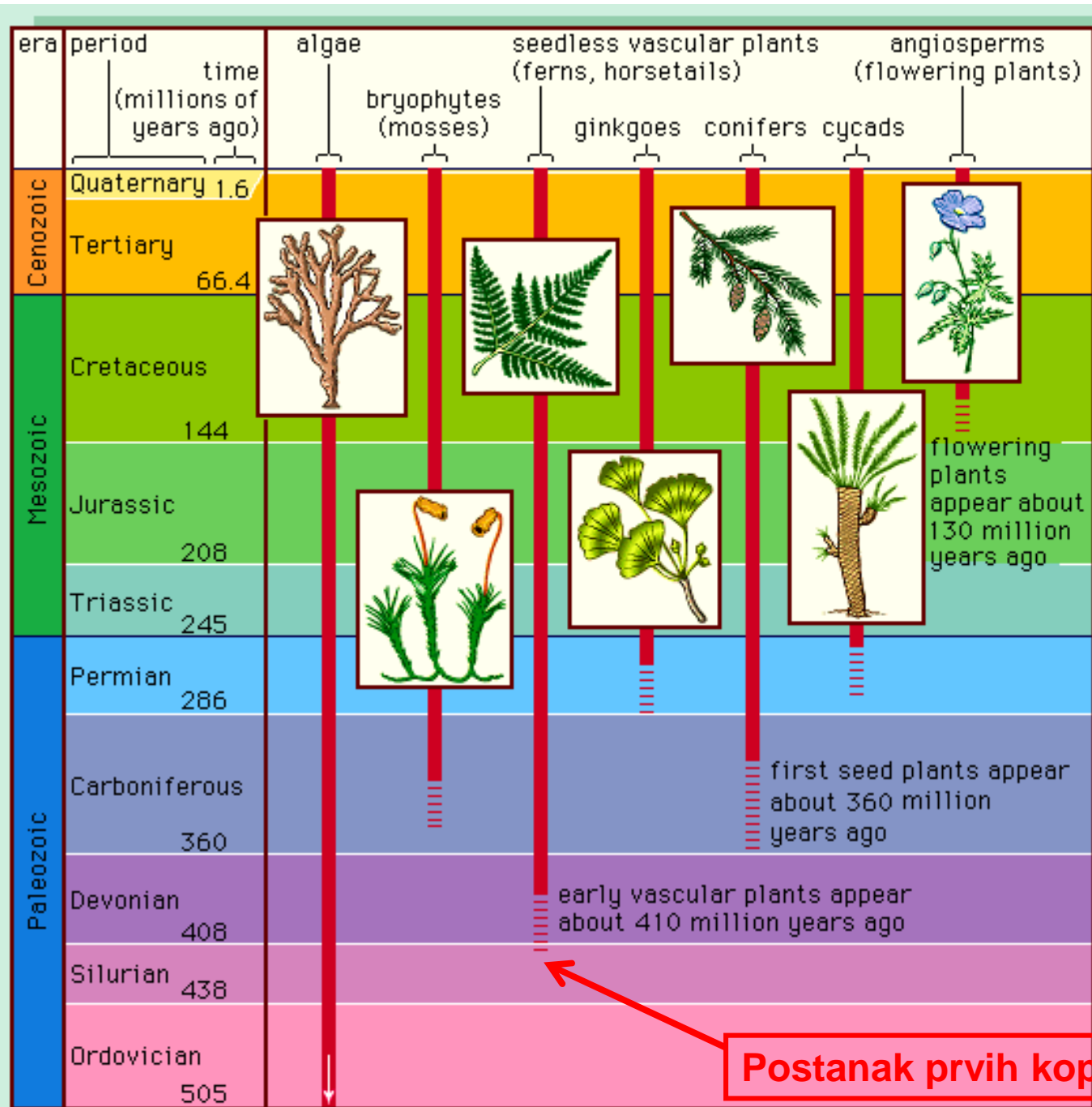


Embriophyta (kopnene biljke)



Postanak prvih kopnenih biljaka

Klasifikacija

- Anthocerotidae
- Bryidae
- Marchantiidae

- Lycopodiidae
- Equisetidae
- Marattidae
- Psilotidae
- Polypodiidae

- Ginkgoidae
- Cycadidae
- Pinidae
- Gnetidae
- Magnolidae

Monosporangiate

Polisporangiate

Biljke sa sjemenom

Prilagođenostina uslove kopnene sredine

- Evolucija embriona, diferencijacija sporofita (dominacija sporofit generacije)

- Diferenciranje tkiva:

Pokorično tkivo (epidermis sa kutikulom), stome

Mehaničko tkivo, parenhimsko, provodno tkivo (leptoide, hadroide, floem, ksilem...)

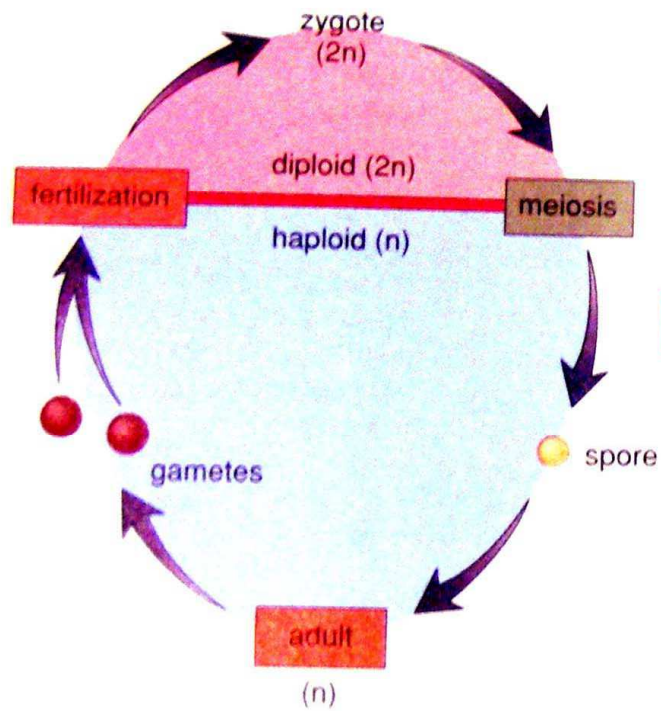
- Diferenciranje organa

Korijenov sistem

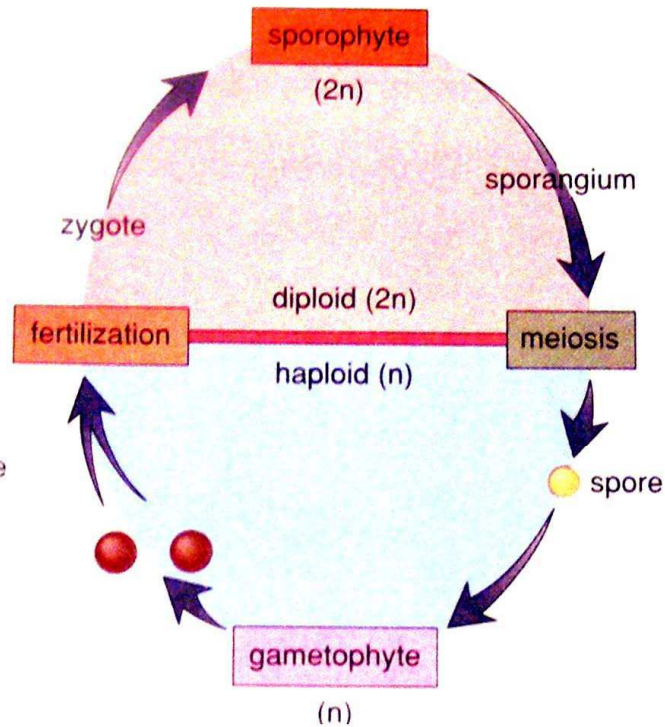
Višćelijske reproduktivne strukture...

- Biohemijske prilagođenosti
- Pojava novih životnih formi ...

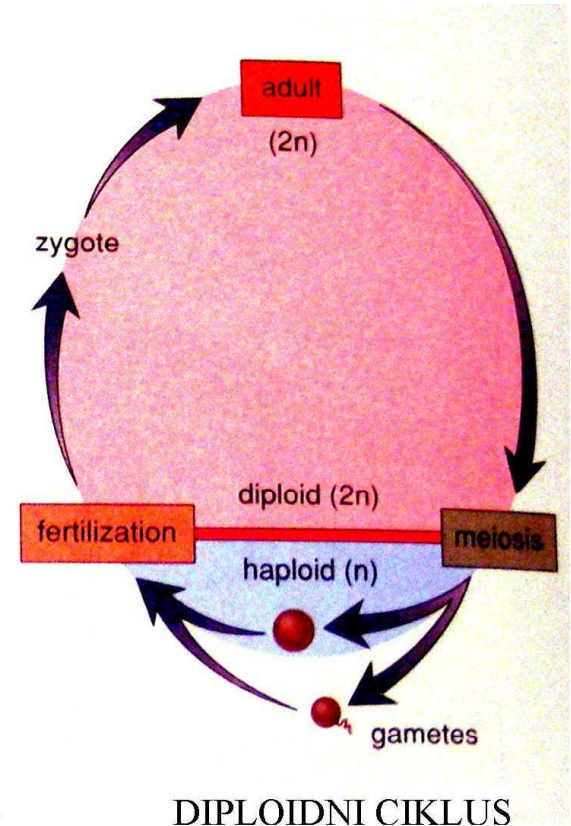
Smjena generacija ...



HAPLOIDNI CIKLUS



RAVNOPRAVNA SMJENA GENERACIJA



DIPLOIDNI CIKLUS

Izosporija, heterosporija, biseksulani gametofiti, gametofiti odvojenih polova ...

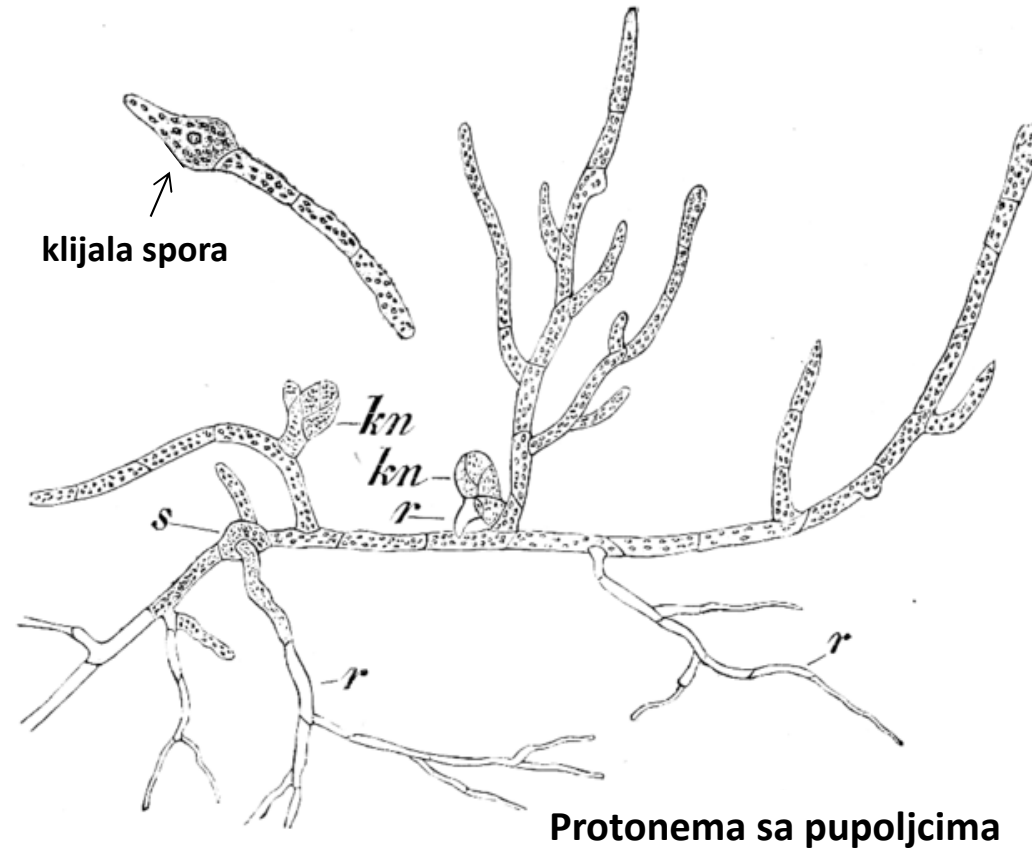
Osobina	Mahovne	Papratolike biljke	Sjemenjače
Dominantna generacija	Gametofit	Sporofit	Sporofit
Tip spora	Izospore	Uglavom izospore	Heterosporne
Razvoj gametofita	Egzosporan	Uglavnom egzosporan	Endosporan
Gametofit i sporofit	Povezani	Odvojeni	Povezani
Veličina gametofita i fotosintetska aktivnost	Najveći kod kopnenih biljaka (nekad dugačak i preko metra), fotosintetski aktivan	Nekoliko mm, uglavnom fotosintetski aktivan	Najmanji kod kopnenih biljaka, fotosint. Nekativan i nesamostalan- u potpunosti zavisi od sporofita!!!

MAHOVINE

(Anthocerotidae, Marchantiidae, Bryidae)

- Dominacija gametofit generacije
- Protonema, sporogon, kolumela...
- Talusoidne, listolike
- Rizoid= korjenčić (jednoćelijski, višećelijski), kauloid= stabaoce, filoid= listovi
- Epidermis, kutikula, stome
- Leptoide, hadroide ... (izostaju iz rizoida!)

Protomena *Funaria hydrometrica*



S- spora, kn- pupoljak, r- rizoid

Klasifikacija

- Anthocerotidae



- Bryidae

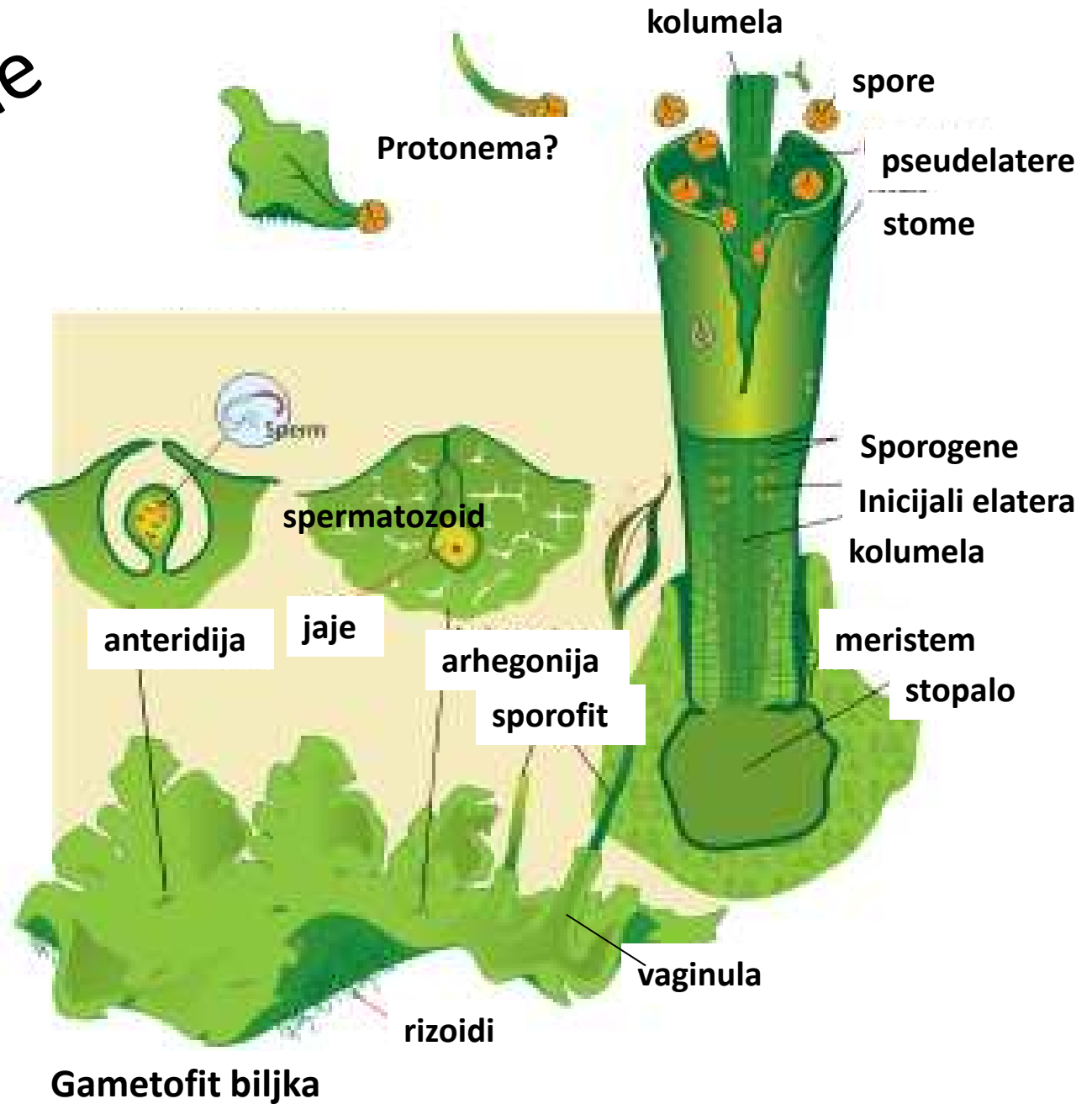


- Marchantiidae



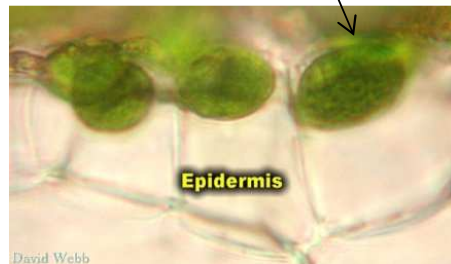
Anthocerotidae

U starijoj klasifikaciji Anthocerotidae su svrstavane u klasu Hepaticae!

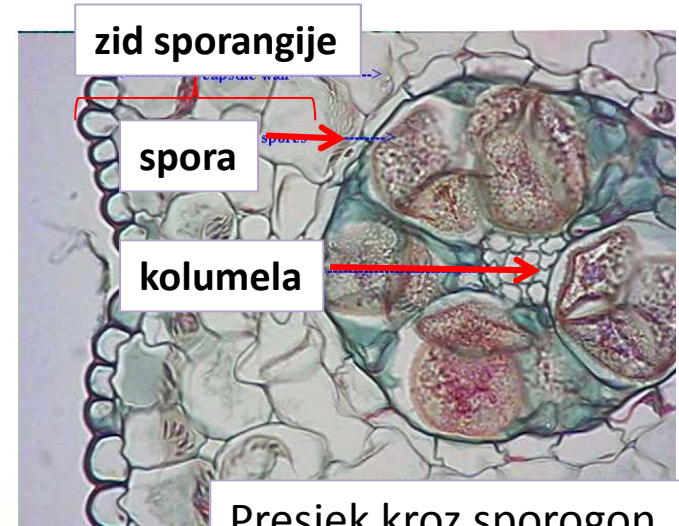




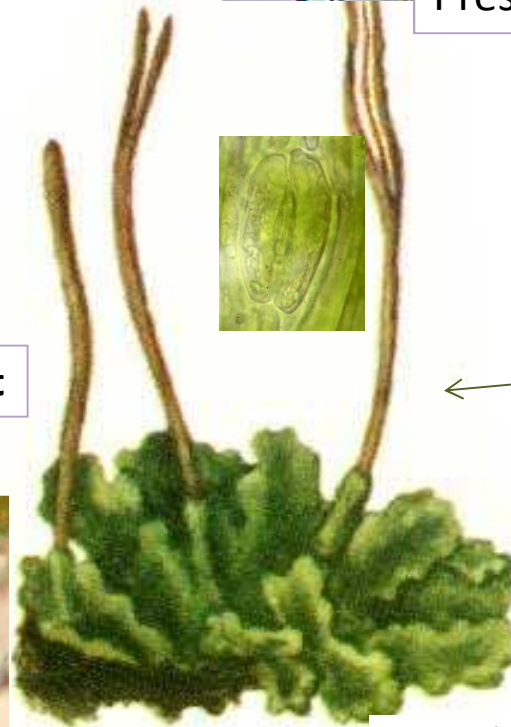
Anthoceros sp.
Fam. Anthocerotaceae
Ordo. Anthocerotales



Krupni hloroplast



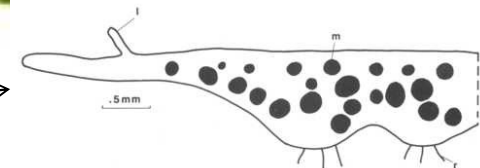
Presjek kroz sporogon



Sporogon
sa stomama i
meristemskih
tkivom u
osnovi

← gametofit

Mucilagene šupljine sa *Nostoc* spp. ili drugom cijanobakterijom



Marchantiidae



gametofori

Talusna forma



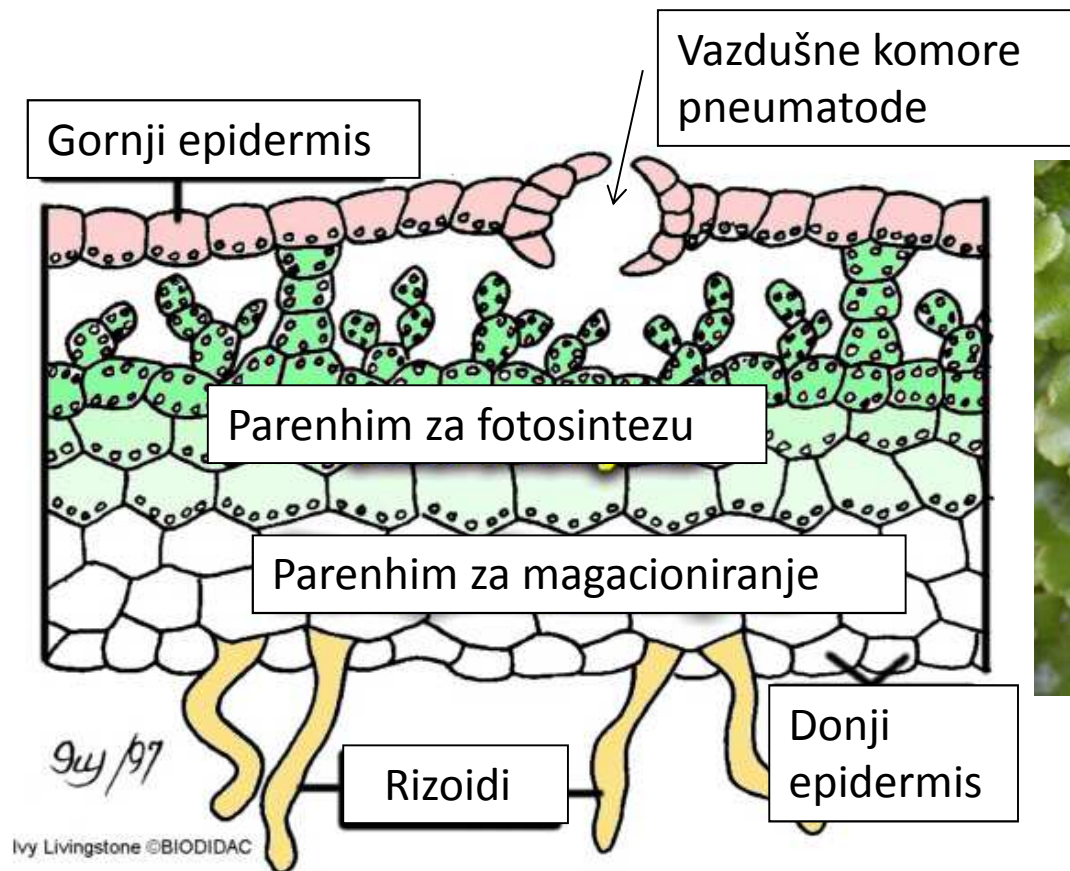
amfigastrije

Listolika forma

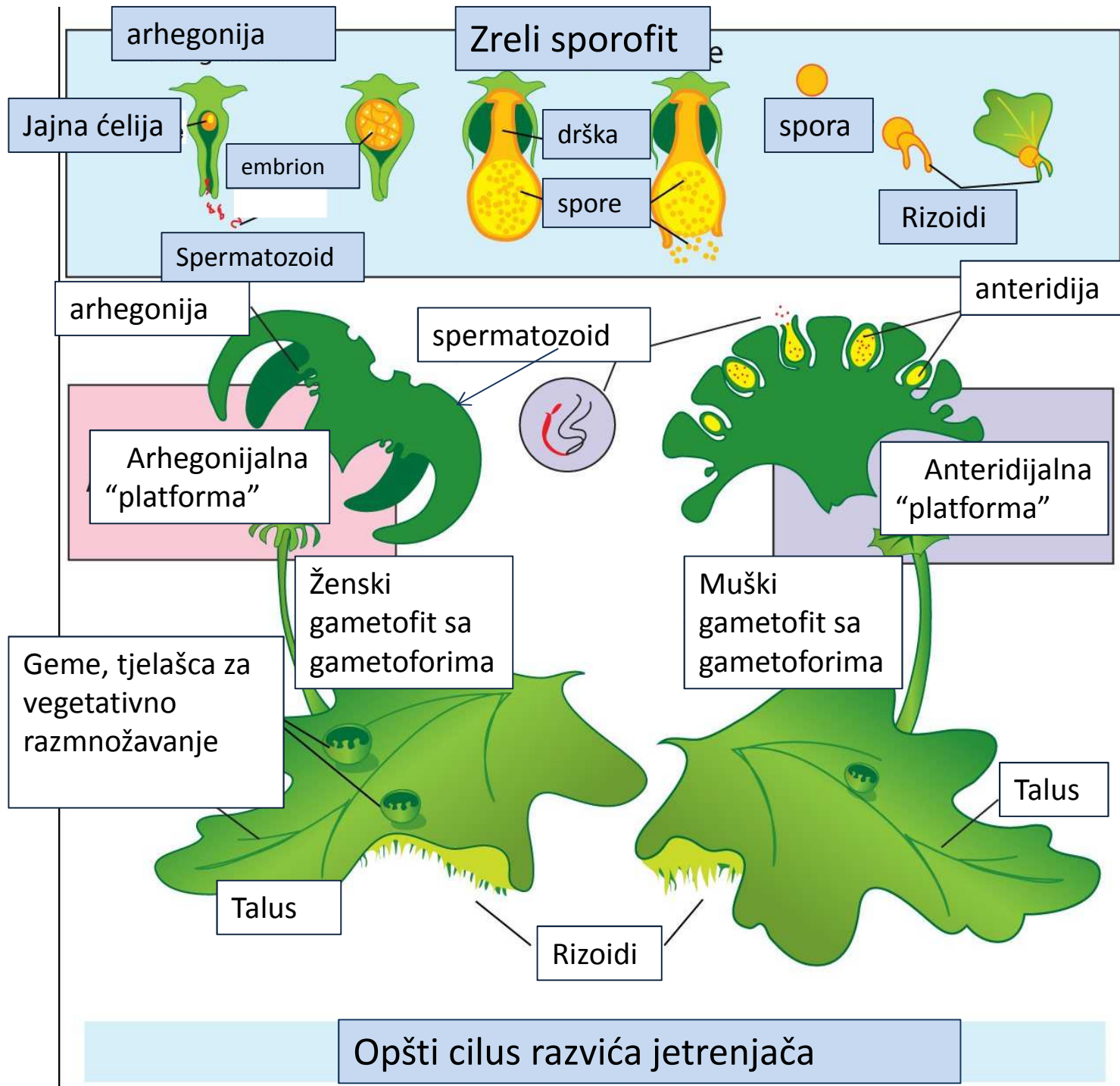
U starijoj klasifikaciji
Marchantiidae su
imale status klase
Hepaticae!

Red. Marchantiales

- Isključivo talusoidne jetrenjače, sa prilično kompleksnom građom gametofita, koji po pravilu nosi gametofore (arhegoniofore i anteridiofore)

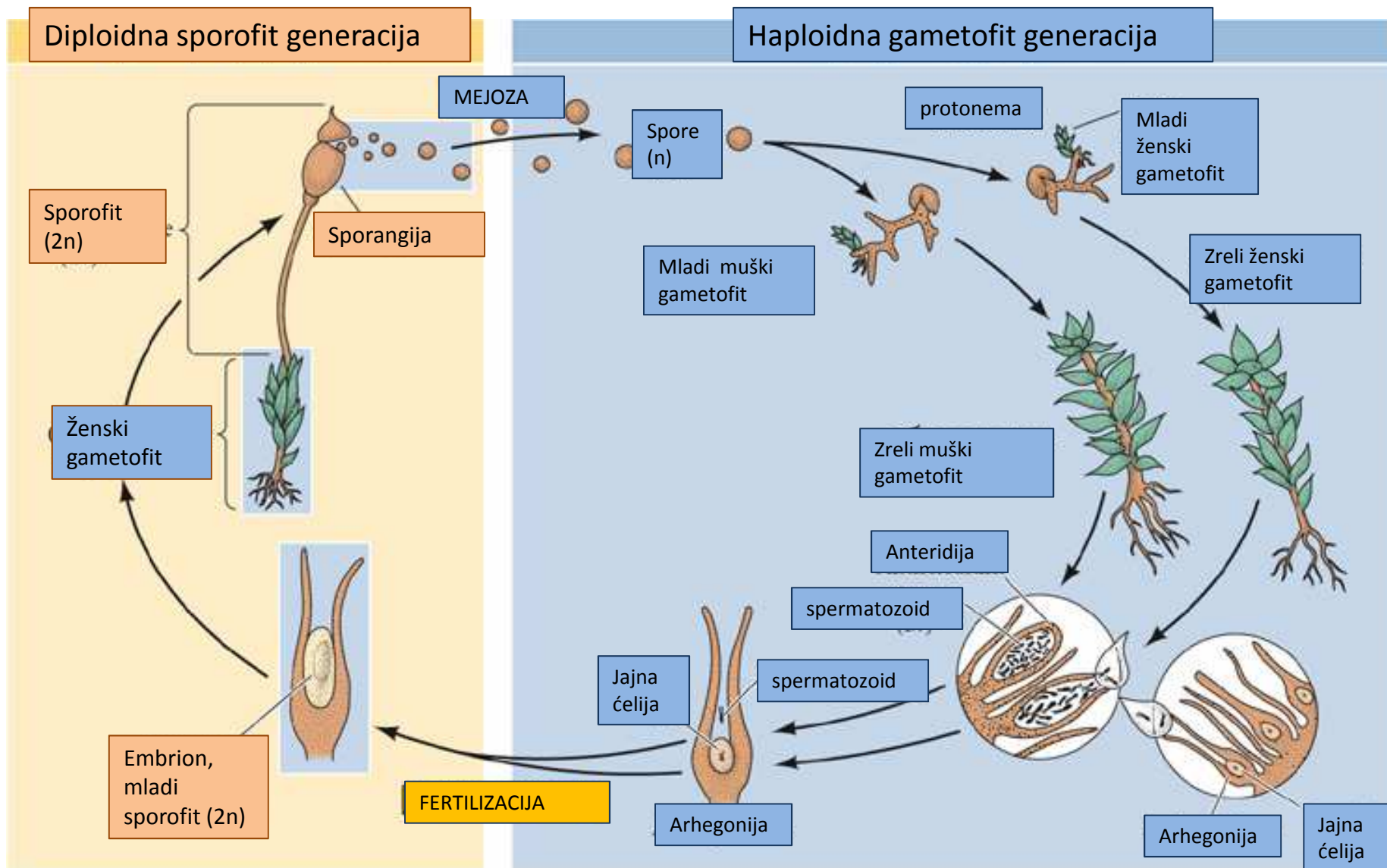


Marchantia sp.
Fam. Marchantiaceae

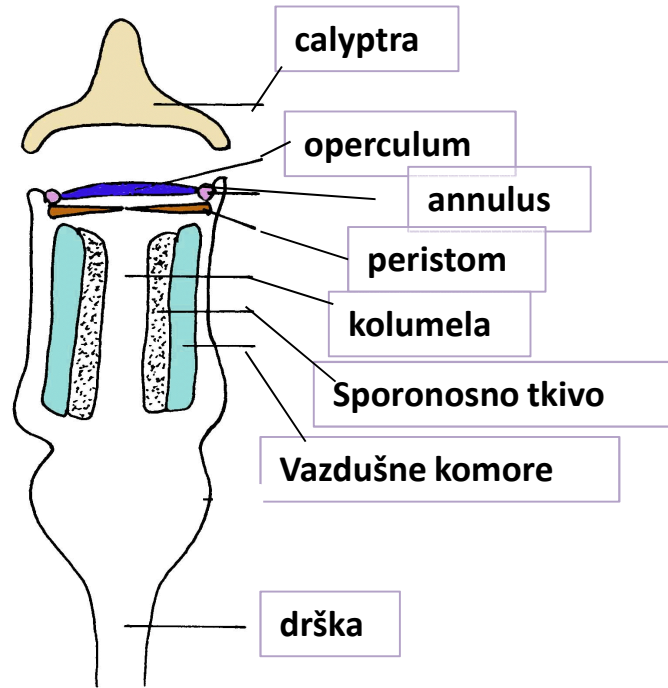


Bryidae- opšti ciklus razvića

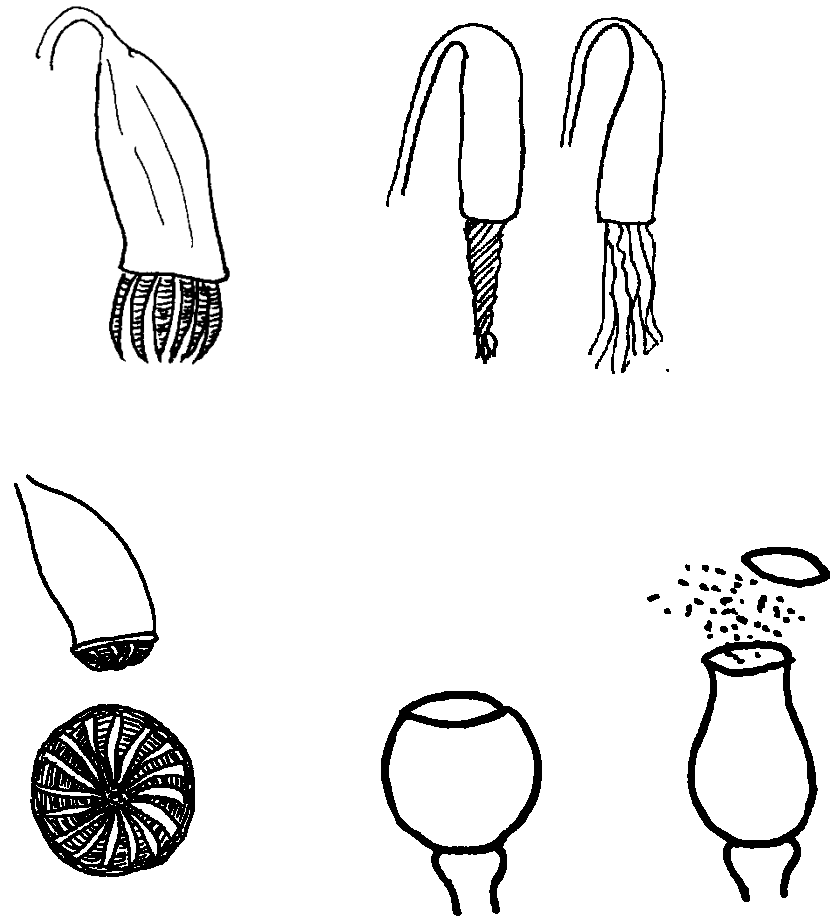
U starijoj klasifikaciji Bryidae su imale status klase Musci!



Opšta građa čaure



Tipovi peristoma

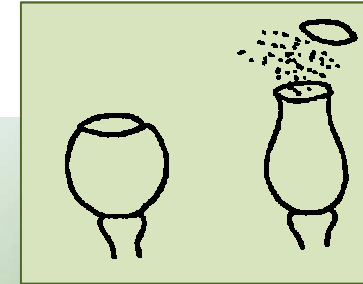
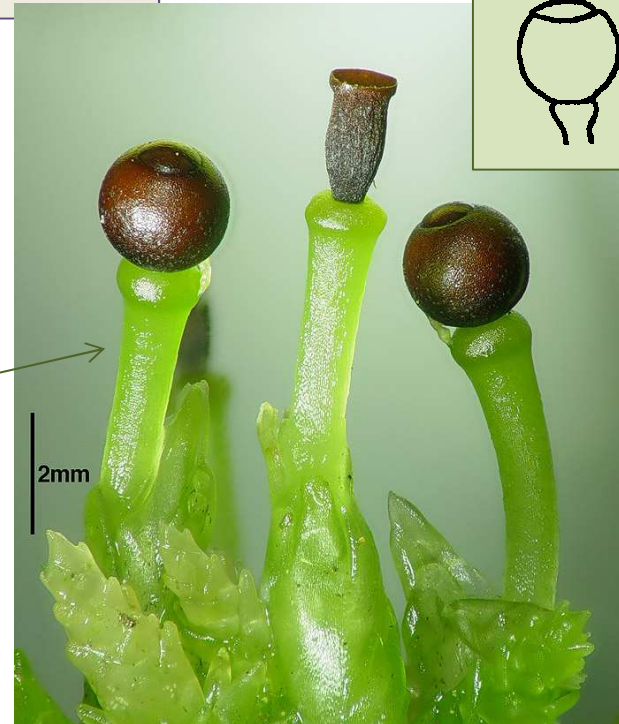


- Sphagnales- sfagnumske mahovine

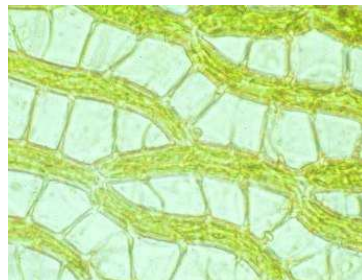
Protonema nije končasta, nego pločasta i liči algi Coelema.



Pseudopodijum (n)

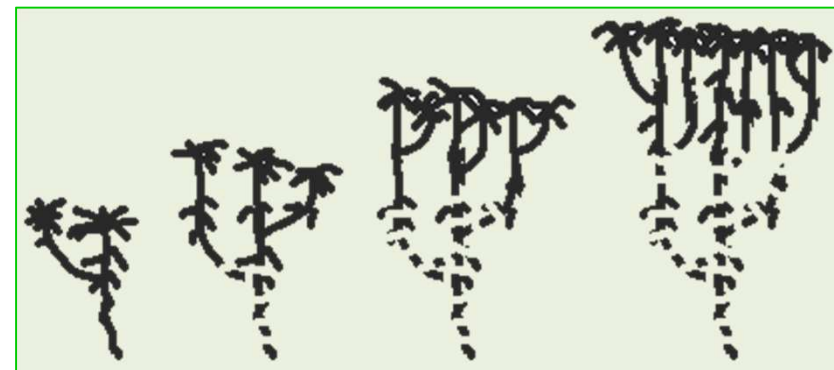


Gametofit nema rizoida!!!



Hidrocite ...

Sporogon nema dršku već se nalazi na pseudopodiji, koja predstavlja dio gametofita.



Polytrichum commune

Fam. Polytrichaceae

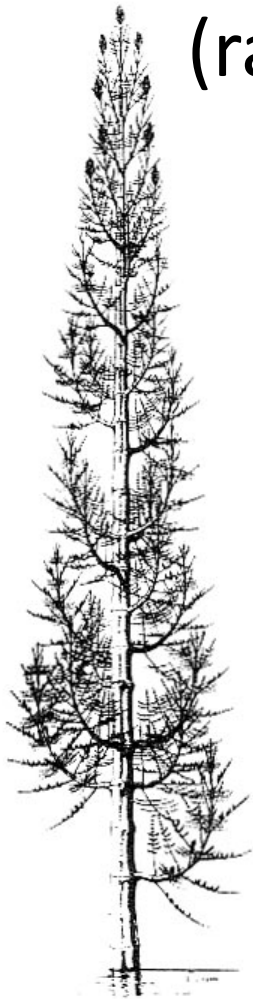
O. Bryales



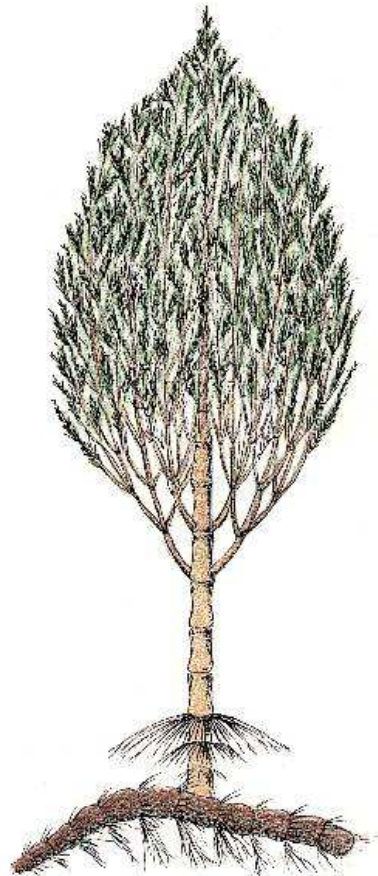
Equisetidae

(rastavići)

U starijoj klasifikaciji Equisetidae su imale status klase Equisetatae!



Pseudobornia ursina

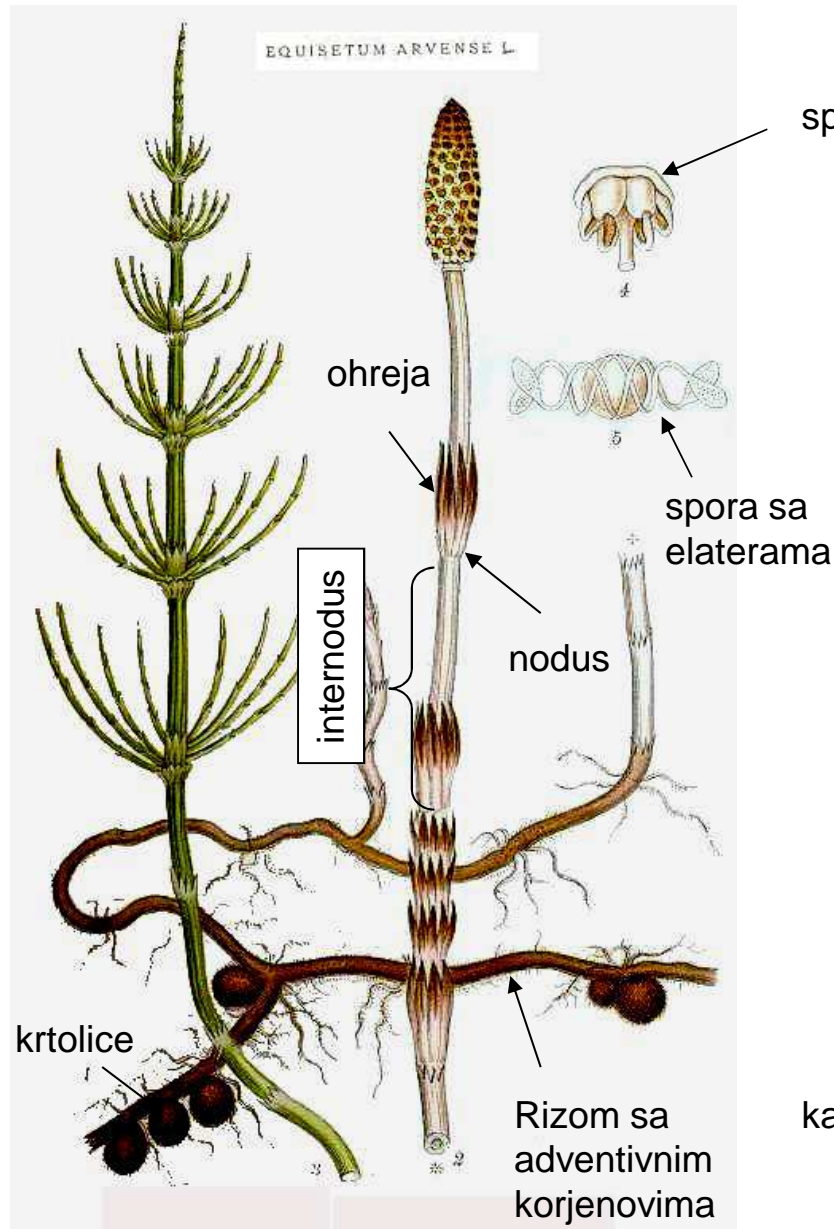


Calamites sp.

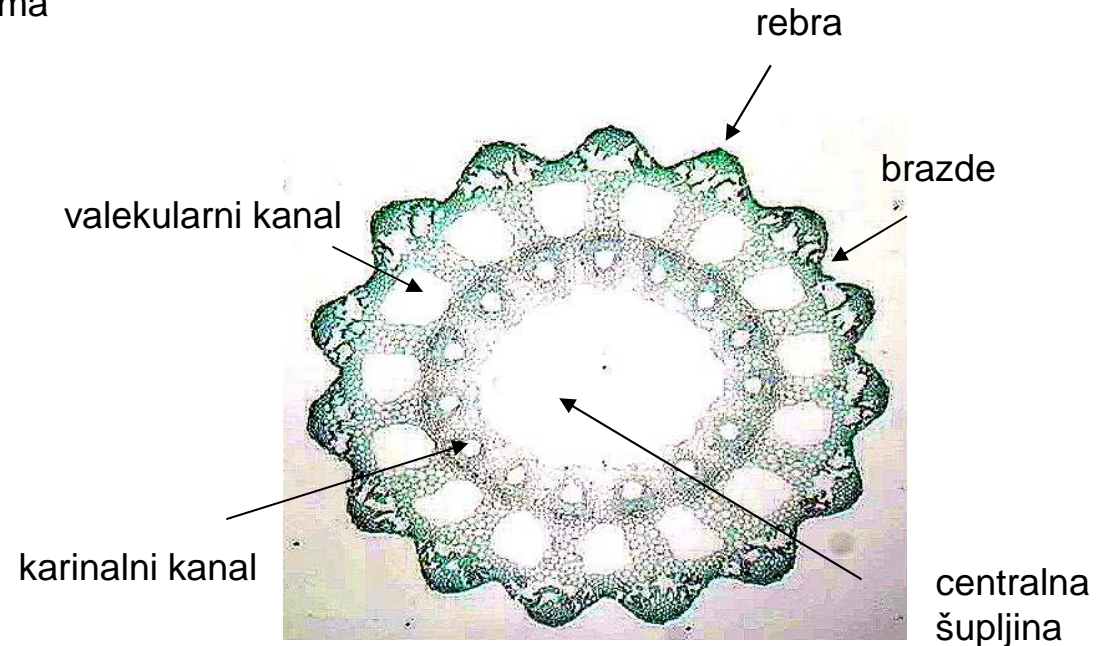


Equisetum arvense

Morfološke odlike vrste *Equisetum arvense*



Člankovitost građe
Odsustvo trajnog primarnog korjena
Redukovani listovi
Ohreje
Elatere
Izosporija

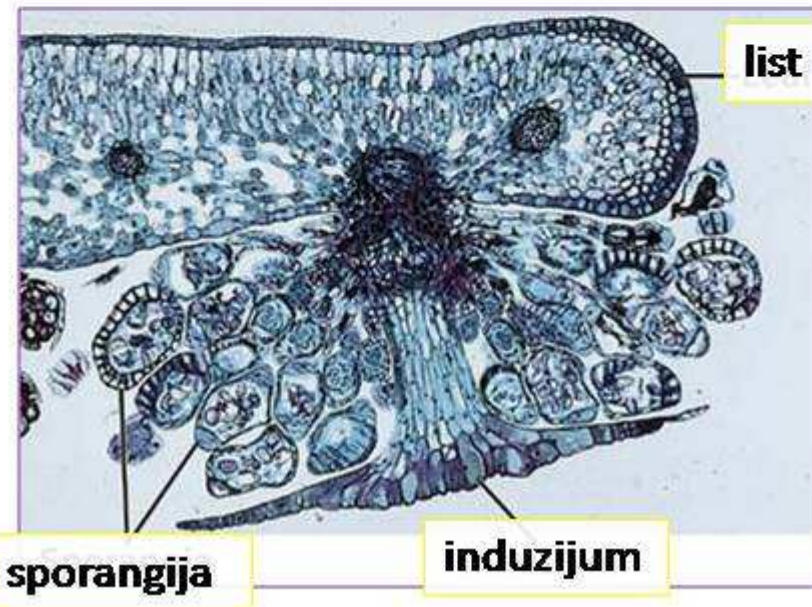
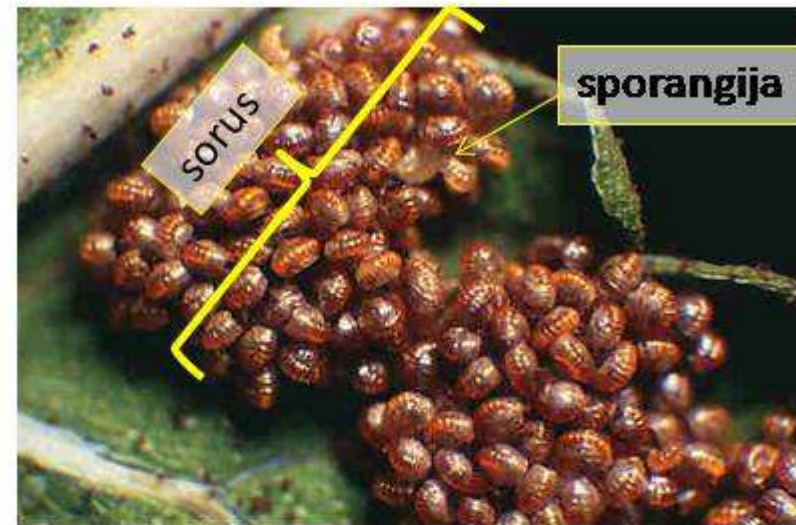


Polypodiidae

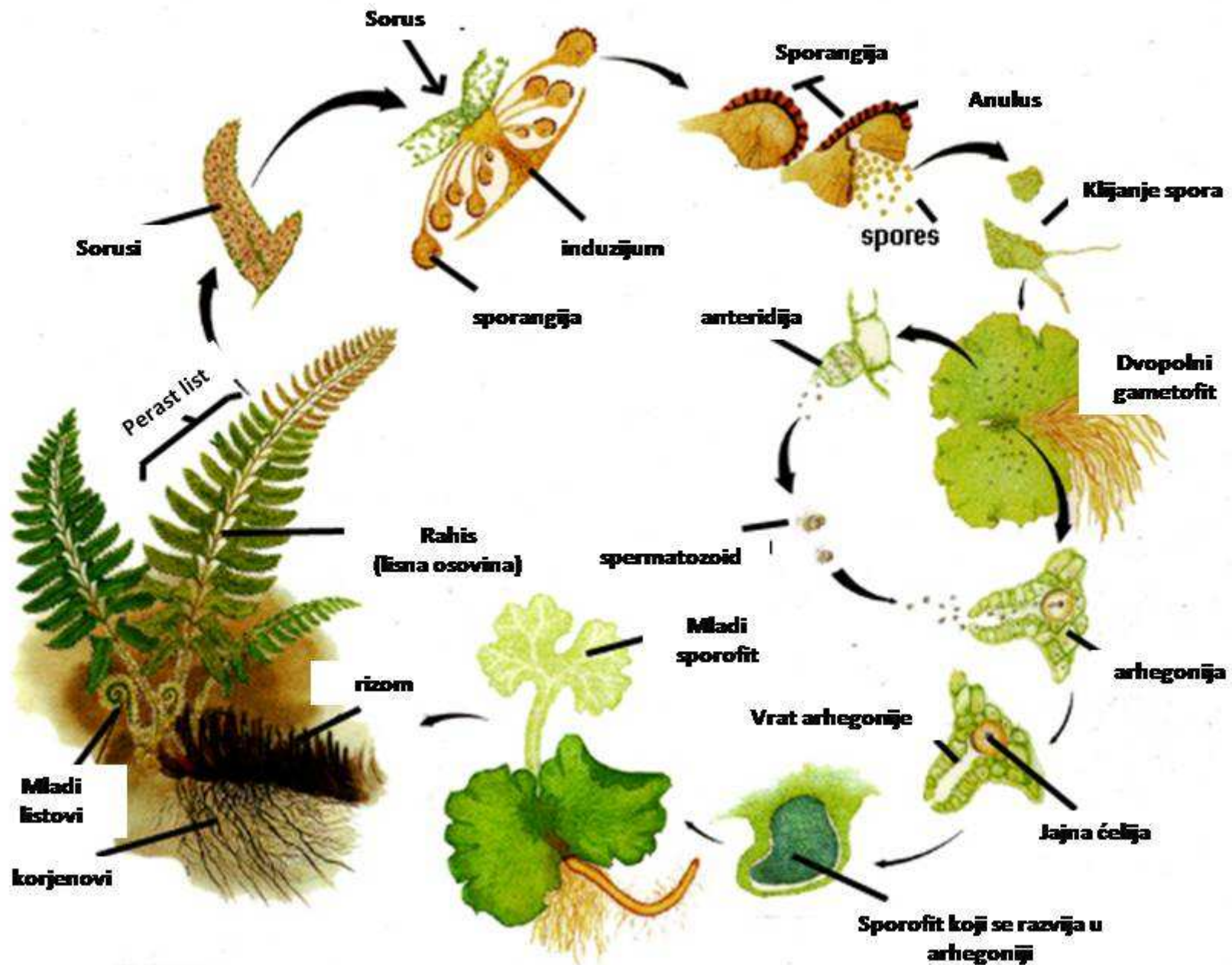
U starijoj klasifikaciji Polypodiidae su imale status potklase Leptosporangiatae!

Nadzemni dio predstavljen listom, rizom, izo-, heterosporija

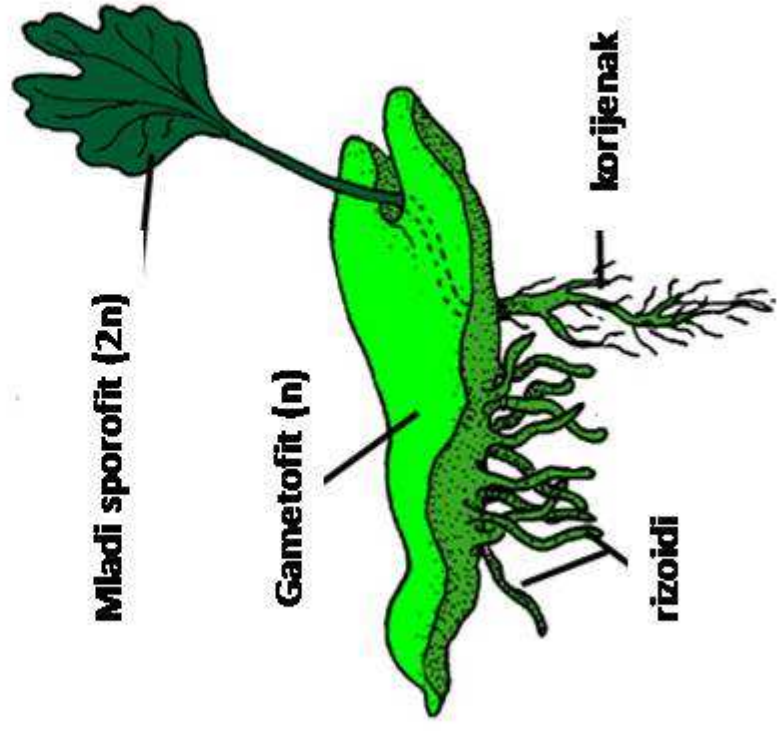
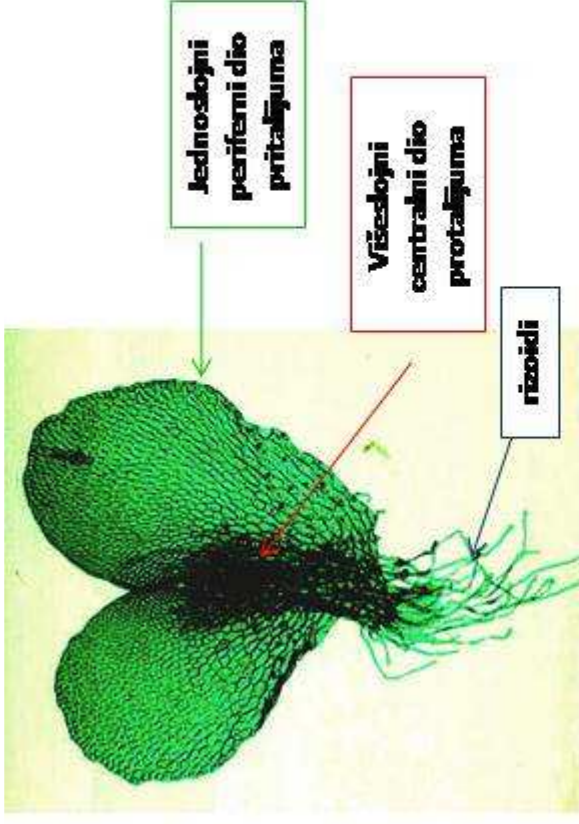
List uvijen u obliku puževe kućice



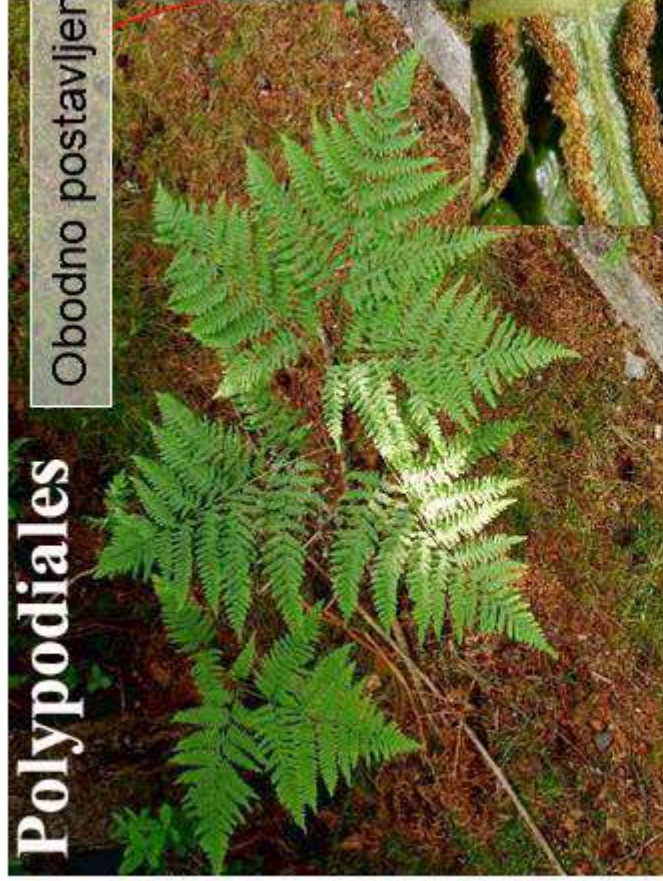
Opšti ciklus razvića kopnenih i izospornih paprati



Protalijum (autotrofan!)



Polypodiales



Obodno postavljeni sorusi



Induzijum razdijeljen



Induzijum cio i u vidu kišobrana



Induzijum jajast i jednostrano pričvršćen





Pteridium aquilinum- kisela paprat



Phyllitis scolopendrium- jelenji jezik

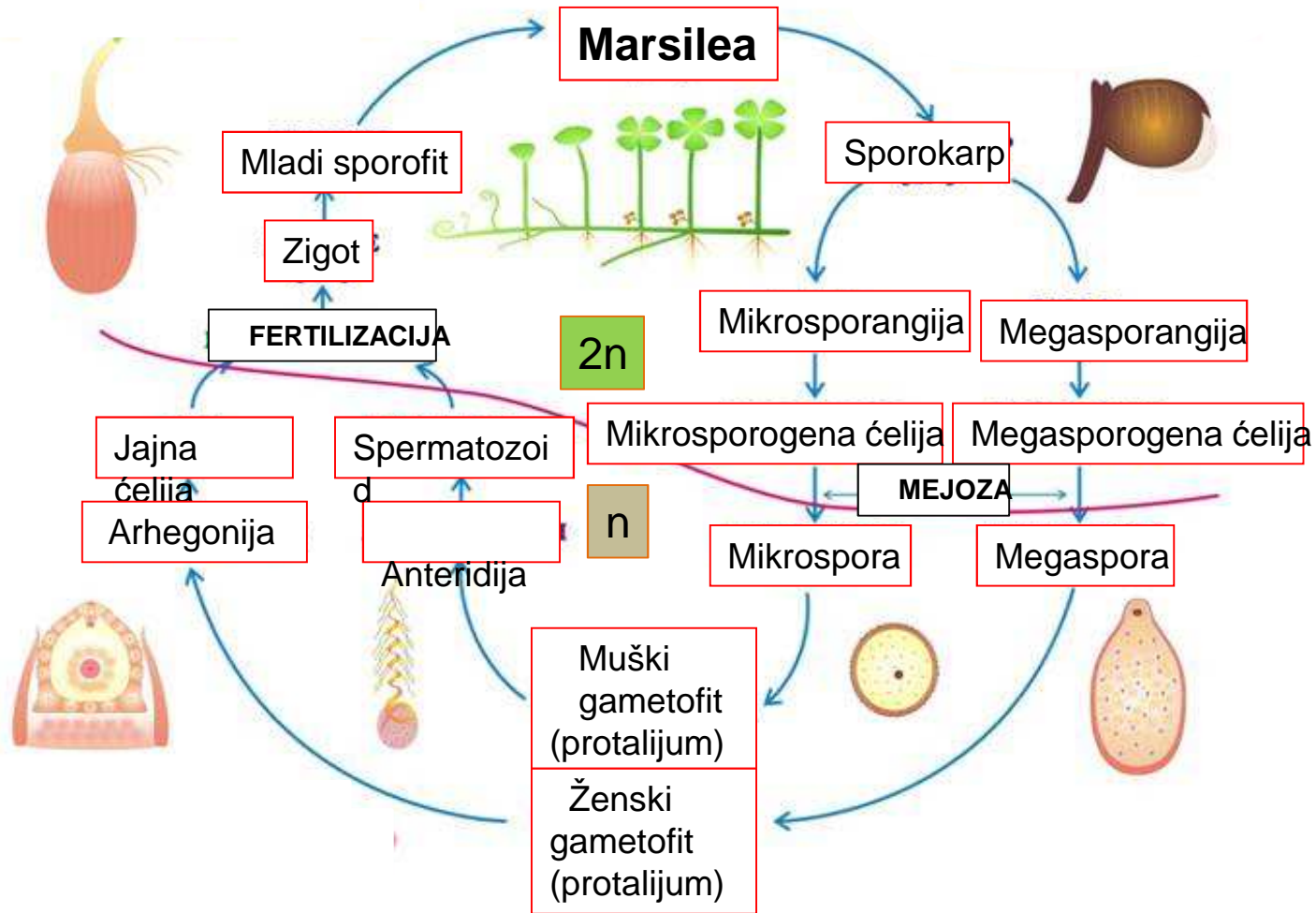


**Ceterach officinarum
zlatna parat**



Polypodium vulgare- slatka paprat

Ciklus razvića vodenih i heterospornih paprati



Marsileales

U starijoj klasifikaciji redovi Marsileales & Salviniiales su svrstavani u potklasu Hydropterides!

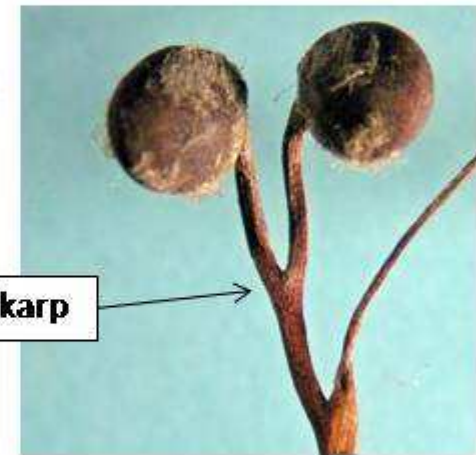
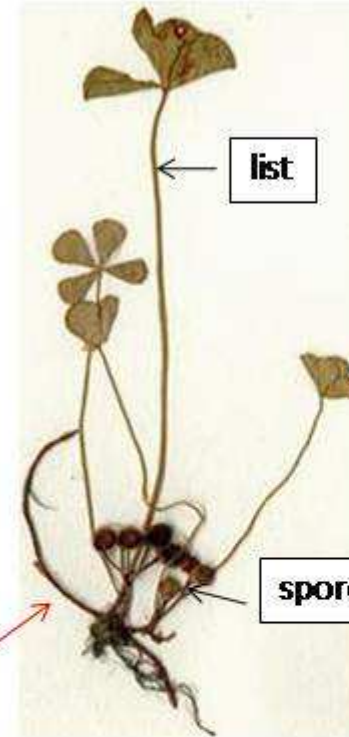


Marsilea quadrifolia

rizom

Marsileaceae

Zastupljena u flori CG,
i na listi zakonom zaštićenih vrsta



Spoljašnji čvrsti zid sporokarpa

Galertrni sloj

Salviniales



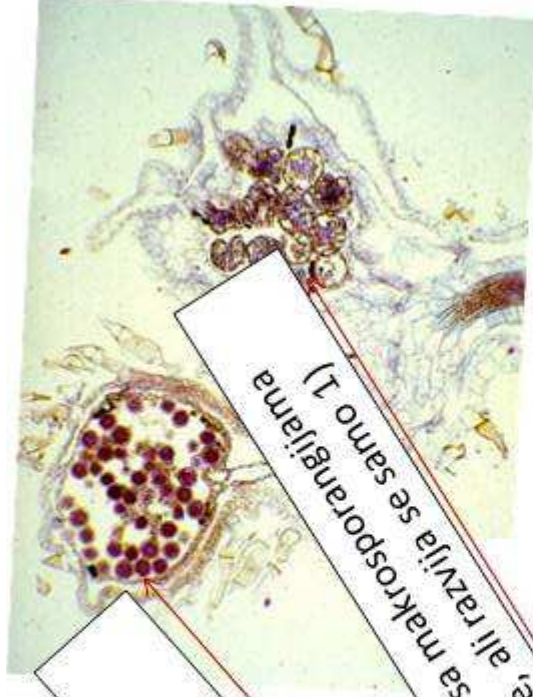
Bradavice i
dlačice na listu



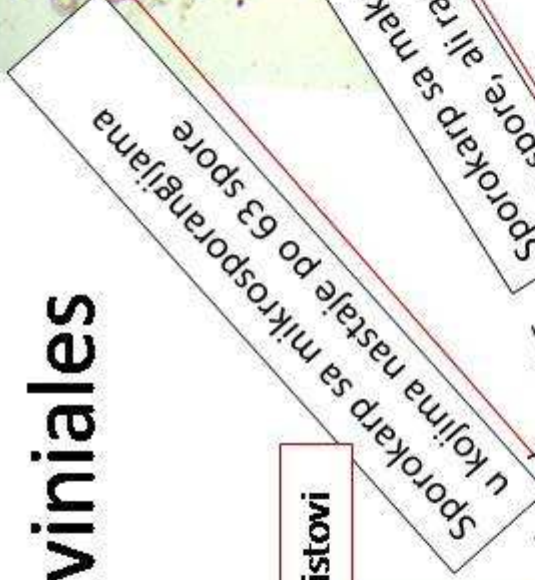
Flotantni listovi

Salvinia natans

Podvodni
končasti listovi!



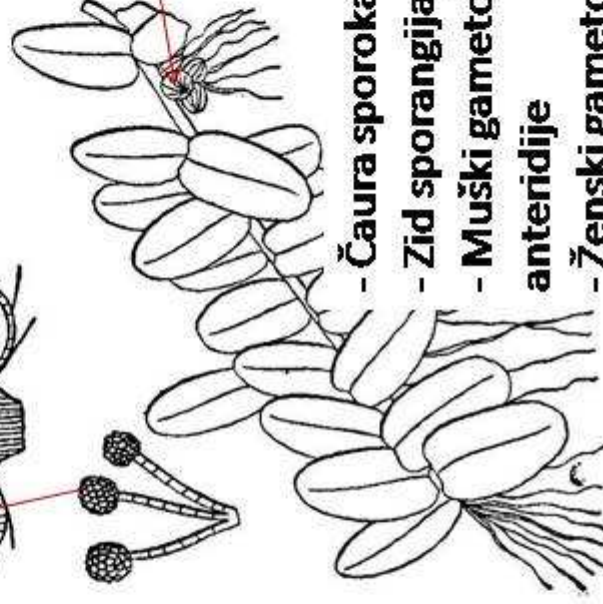
Sporokarp sa makrosporangijama
(32 spore, ali razvija se samo 1)



Sporokarp sa mikrosporangijama
u kojima nastaje po 63 spore



Sporokarp (sorusi)



- Čaura sporokarpa dvojna
- Zid sporangija jednoslojan!
- Muški gametofit= protalijum sa 2 anteridije
- Ženski gametofit= protalijum sa 1 arhegonijom

Klasifikacija biljaka sa sjemenom (Spermatophyta)

Gymnospermae
golosjemenjače

- Ginkgooidae (nekad klasa Ginkgoatae)
- Gnetidae (Gnetatae)
- Pinidae (Pinatae)
- Cycadidae (Cycadatae)

Angiospermae
skrivenosjemenjače

- Magnoliidae (Magnoliophytina)

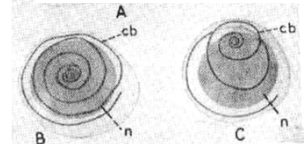
Ginkgooidae

Sjemeni zametak



Muški strobilus

spermatozoidi



ženska jedinka

muška jedinka



Ginkgo biloba

Cycadidae

Cycadales

Cycadaceae

Cycas revoluta



ženska jedinka



muška jedinka



Megasporofili sa
sjemenim zamecima

Mikrosporofili sa
polenovim kesama

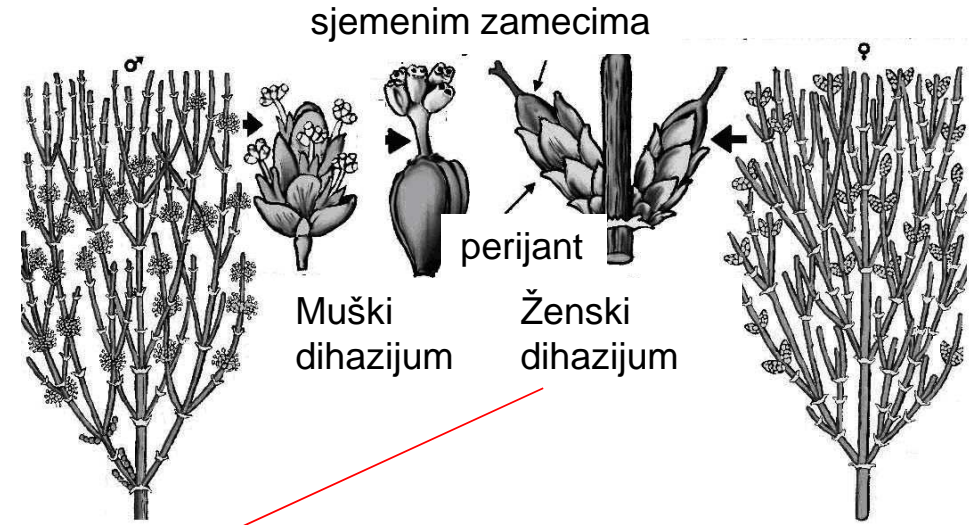
Gnetidae



Ephedra campylopoda, Ephedraceae



Welwitschia mirabilis, Welwitschiaceae



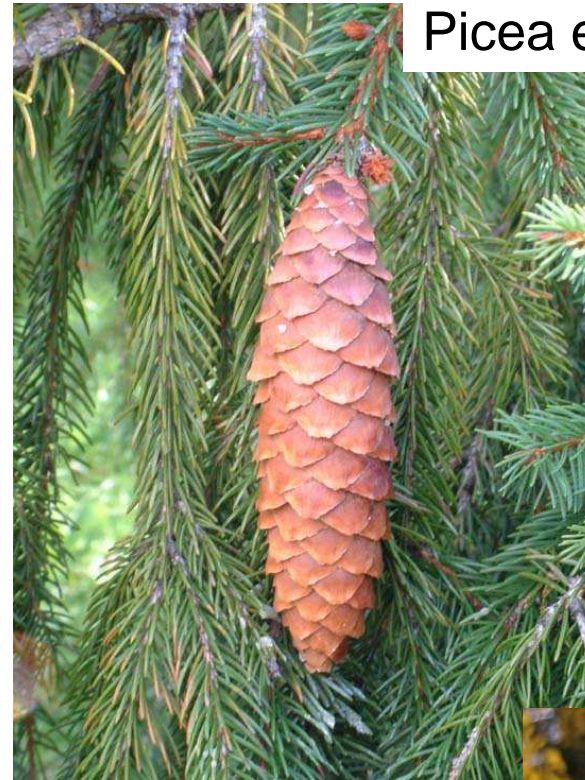
Pinidae

Pinales

Pinaceae



Pinus nigra- crni bor



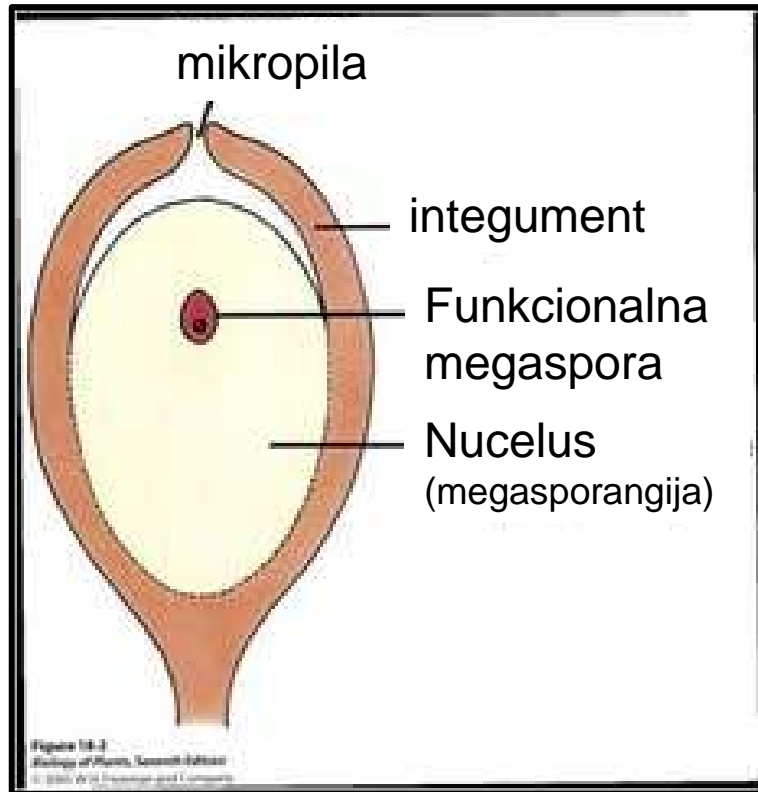
Picea excelsa - smrča



Abies alba - jela



Grada sjemenog zametka

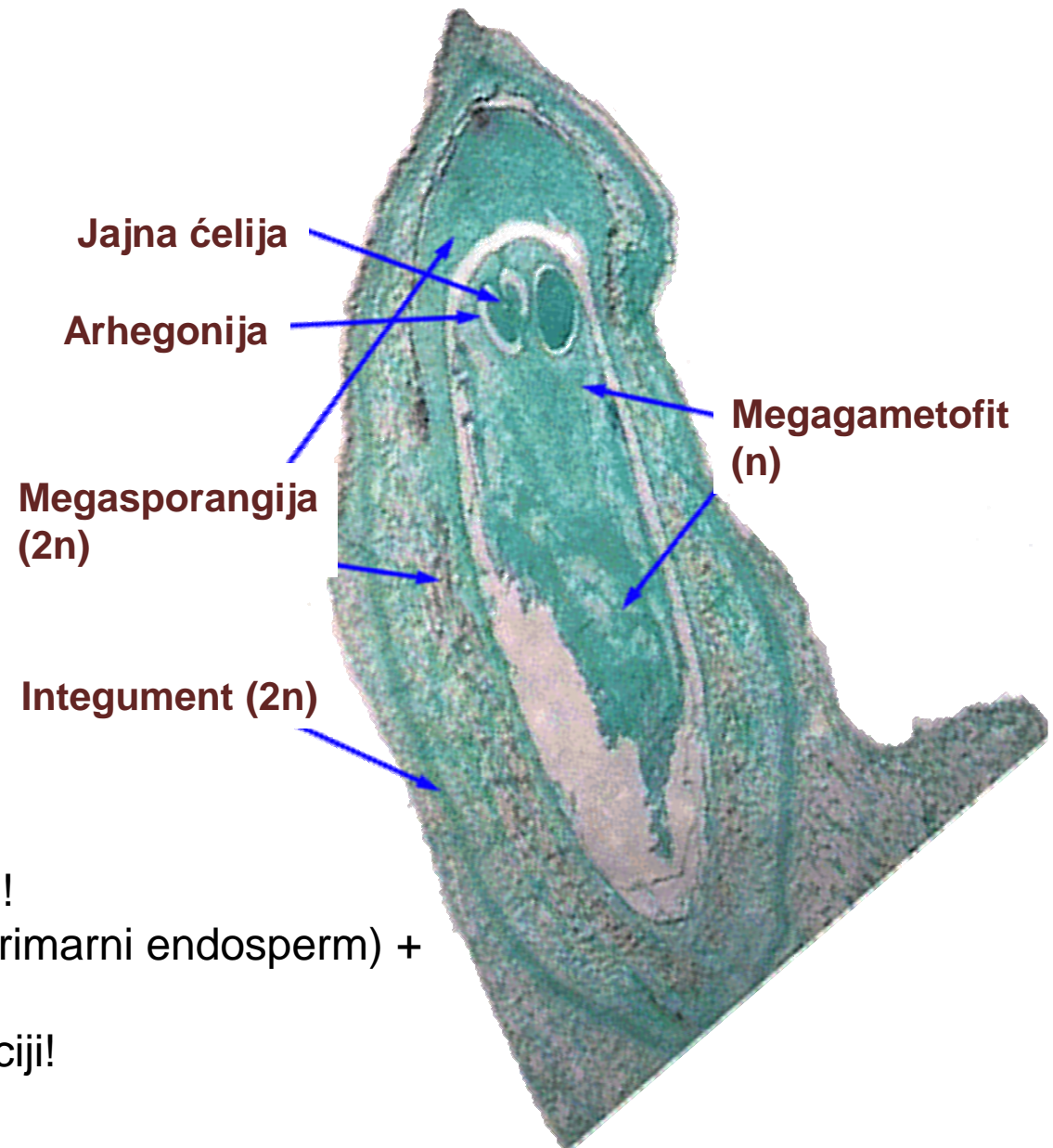


Nucelus je homolog megasporangiji!

U megaspori se razvija protaljum (primarni endosperm) + 2 arhegonije sa jajnom ćelijom.

Integument- nova tvorevina u evoluciji!

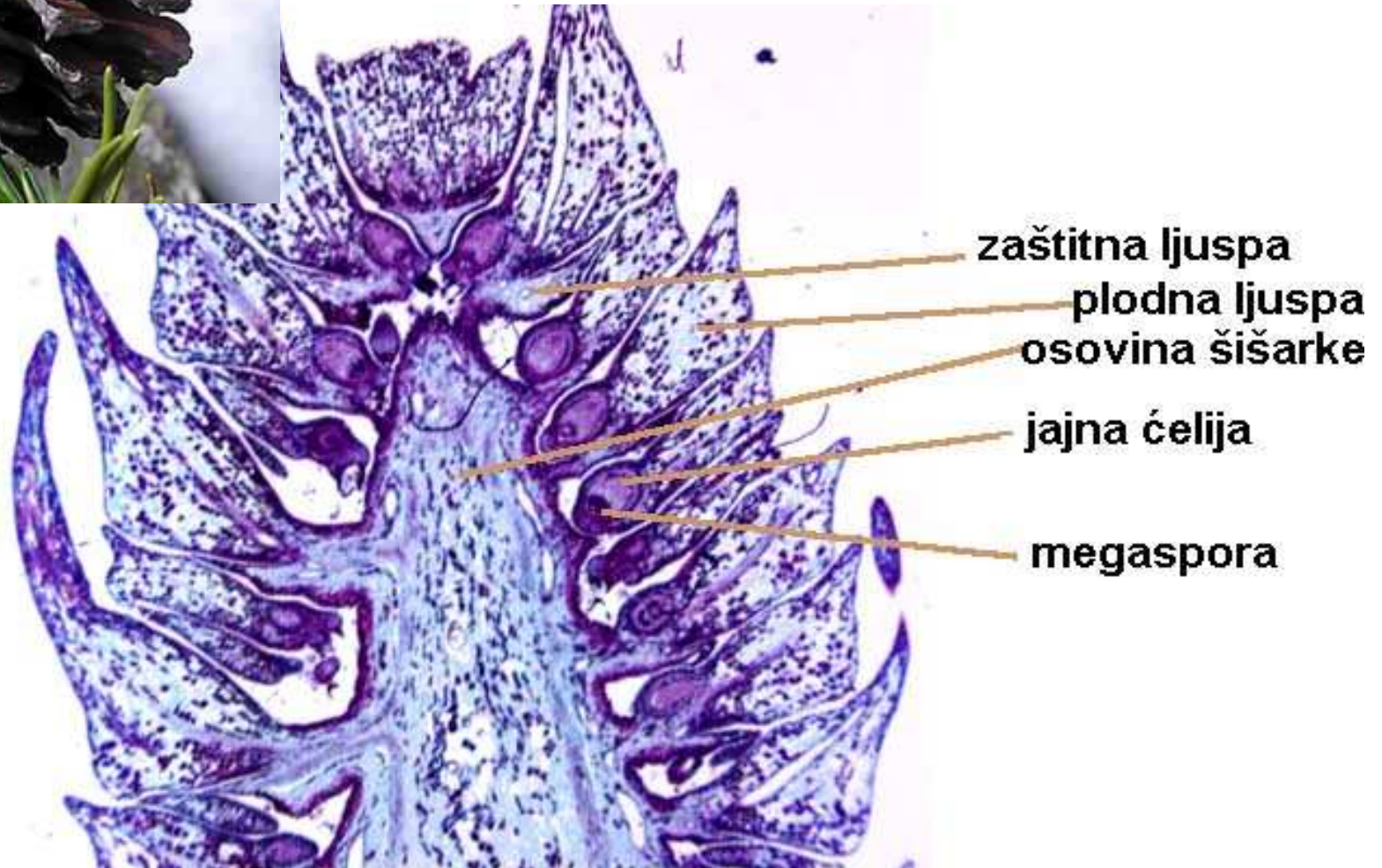
Sjemeni zametak bora (Pinus sp.)



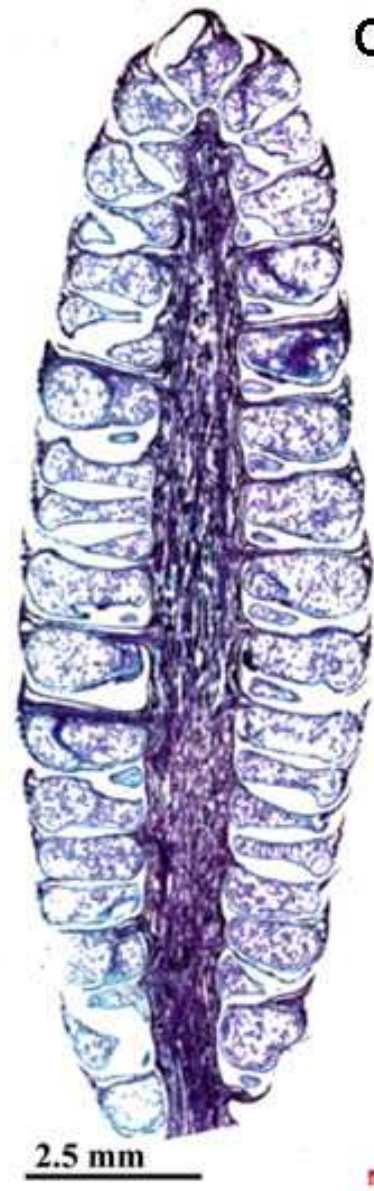
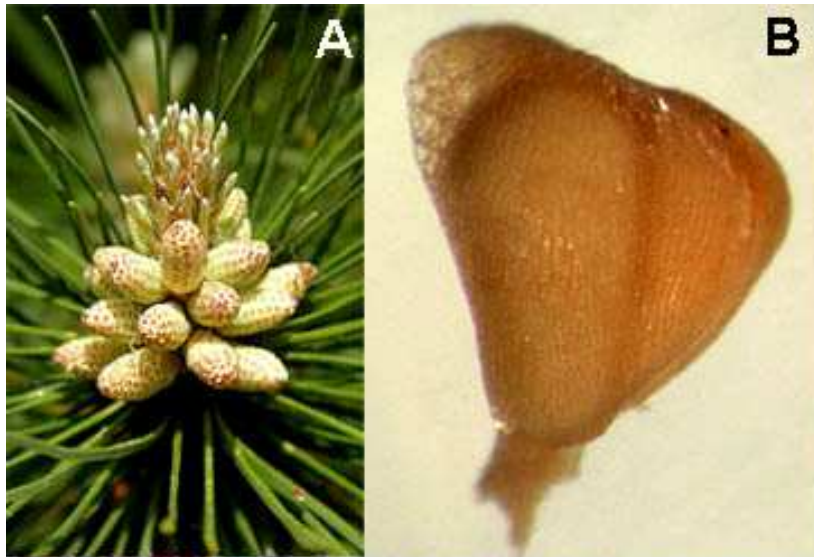


STROBILUSI

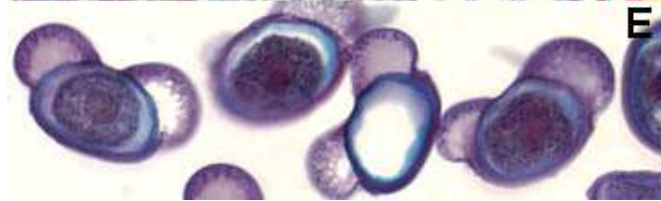
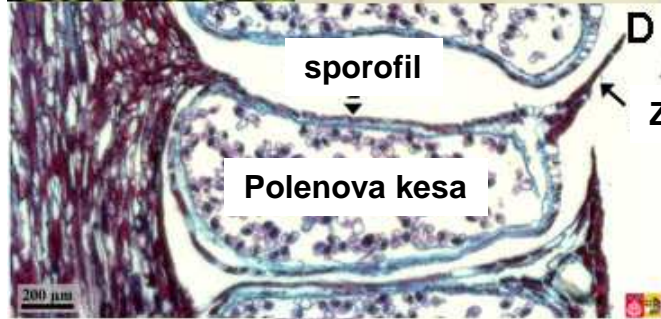
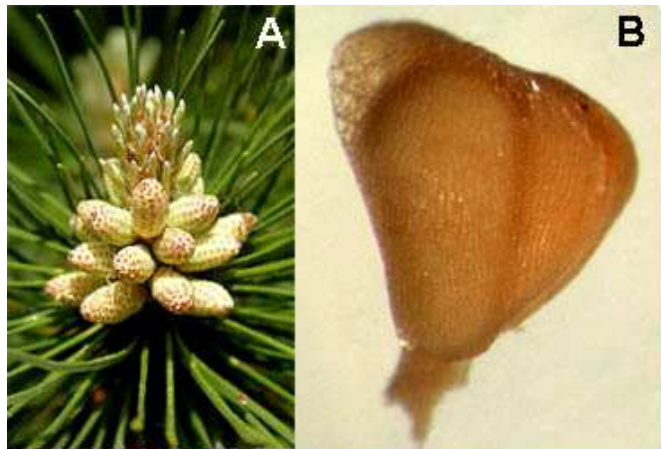
Ženska šišarka bora



Muška šišarka bora



- A- izgleda muške šišarke
- B- zaštitna ljuspa i mikrosporofil i sa polenovom kesom
- C- uzdužni presjek kroz šišarku
- D1- zaštitna ljuspa, 2- mikrosporofil, 3- polenova kesam
- E- polenova zrna sa vazdušnim kesama



Muška šišarka

Osovina šišarke



Ženska šišarka



Pinales, Cupressaceae



Cupressus sempervirens- čempres

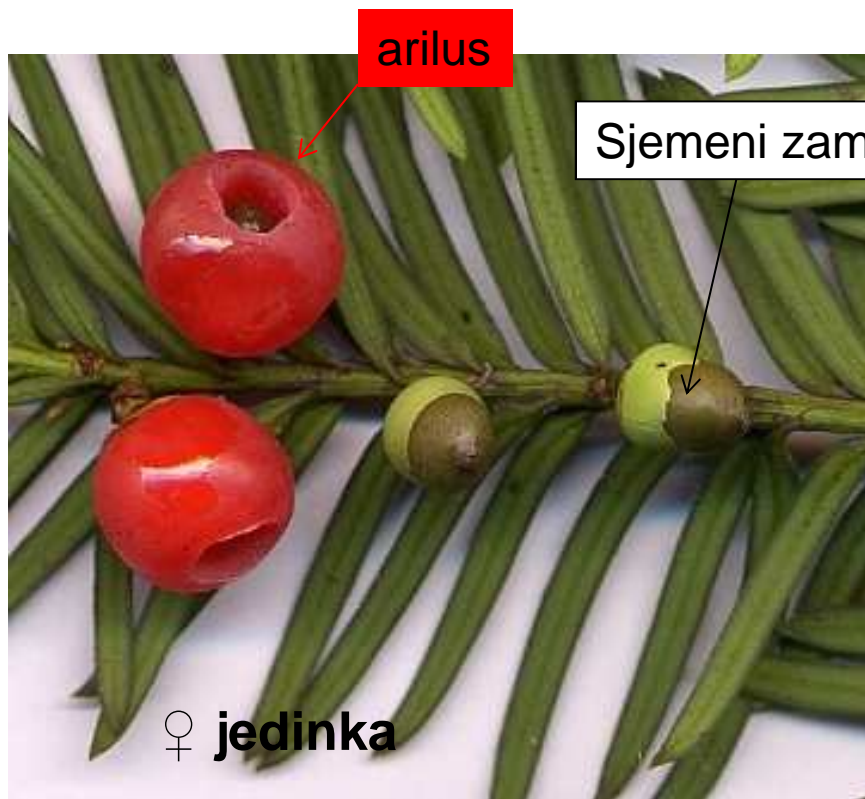


Juniperus oxycedrus- primorska kleka



Juniperus communis- obična kleka

Taxales, Taxaceae



U starijoj klasifikaciji red Taxales je imao status potklase Taxidae!

Taxus baccata- tisa