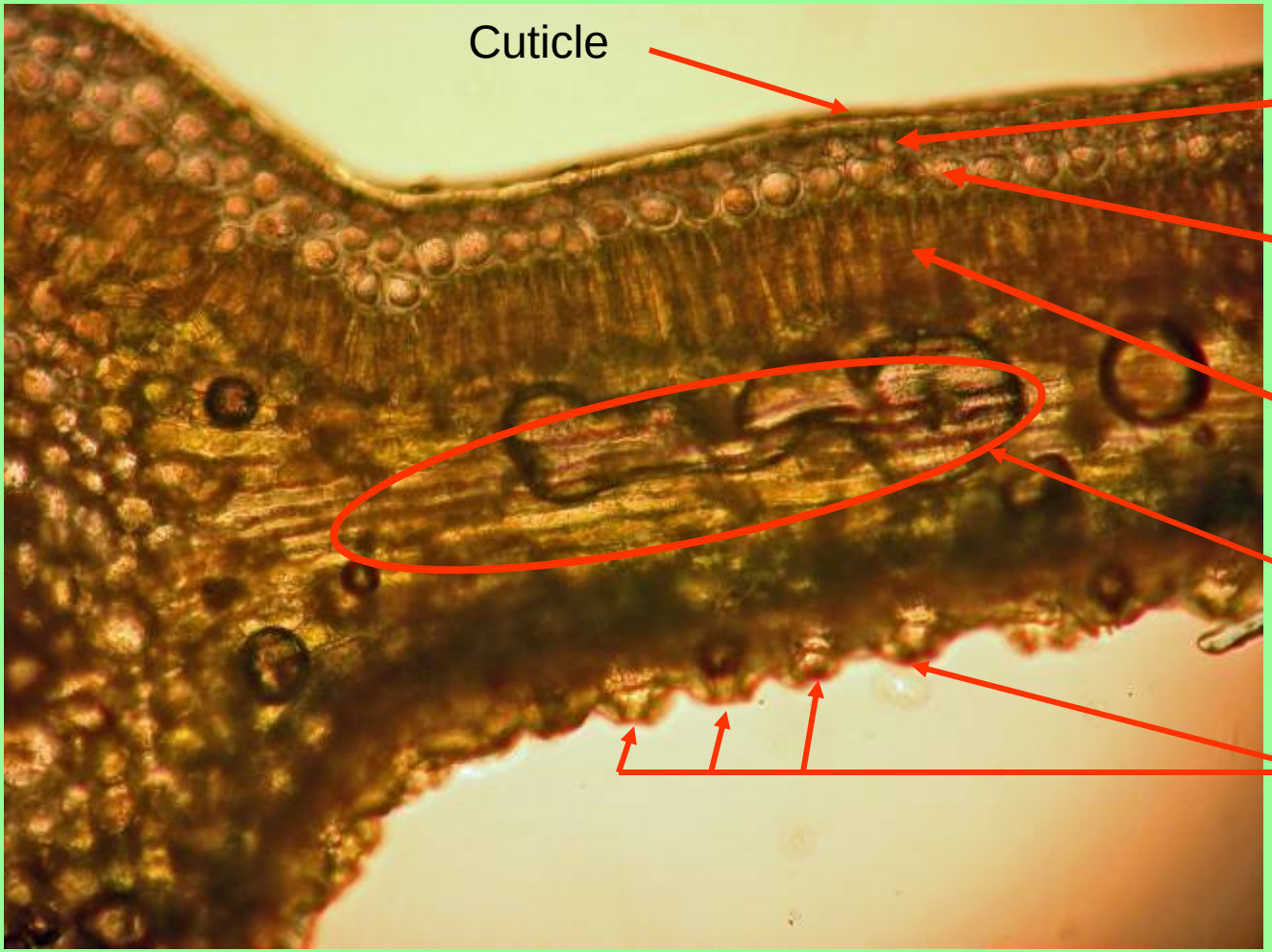
CYCADS (*Zamia* & *Cycas*) – (Ancient, 200 Ma., Tr-R, 'Living Fossil' Gymnosperms): Herbivorous Dinosaur Food

Cycas revoluta – the ‘sago palm’

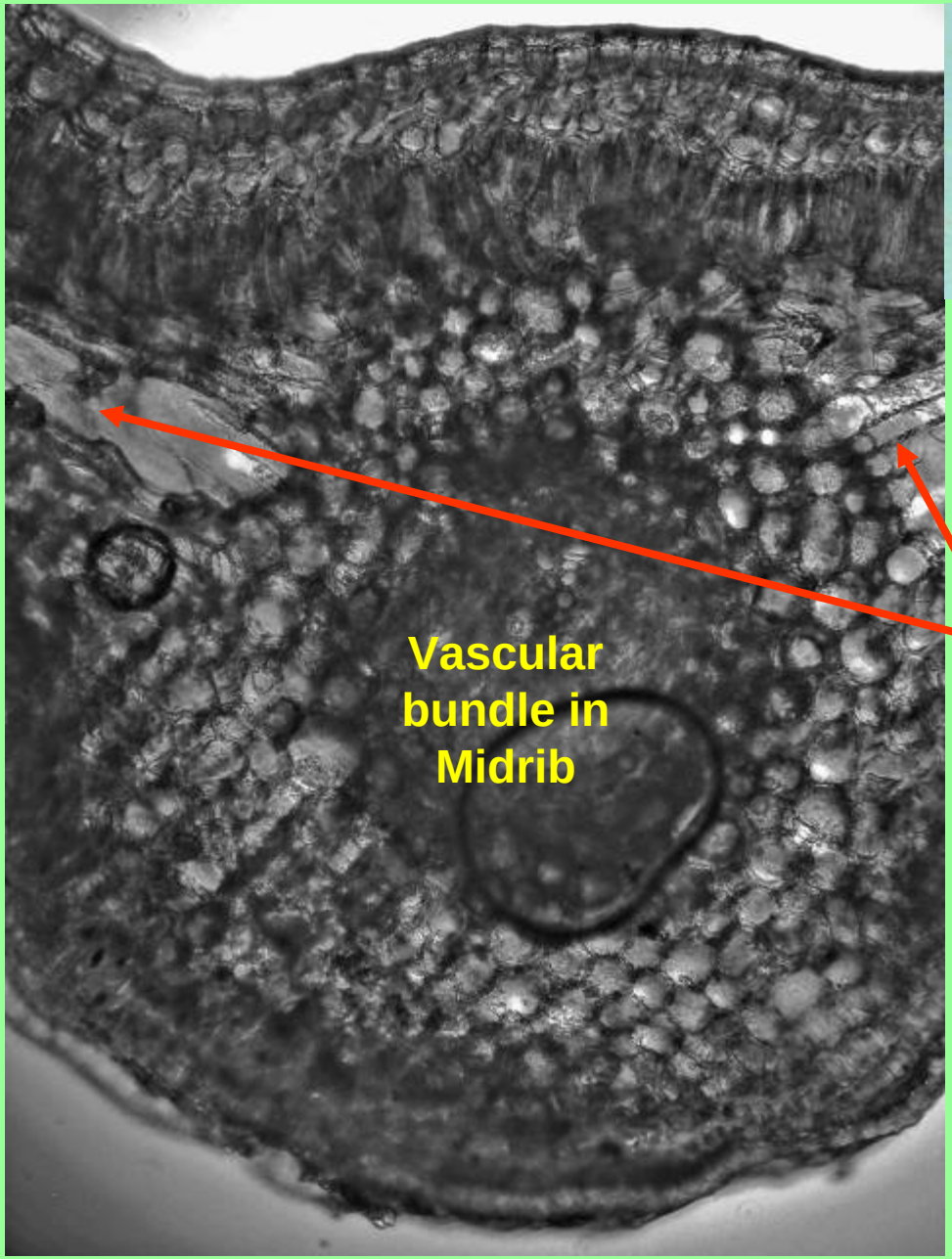

NEW pinnate leaf crown: 1-2 times per year

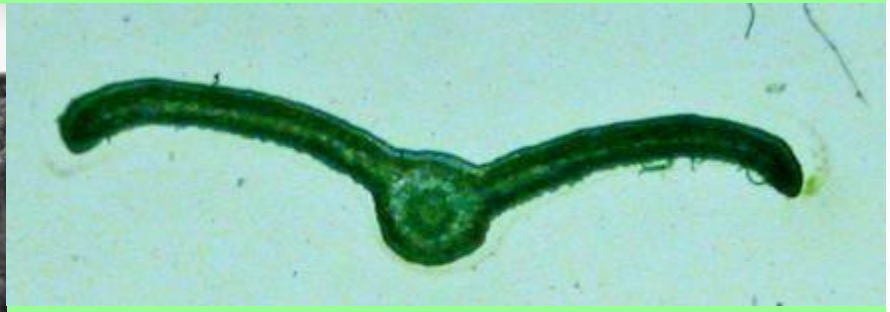

Zamia: female plant



Midrib and Vascular Bundle

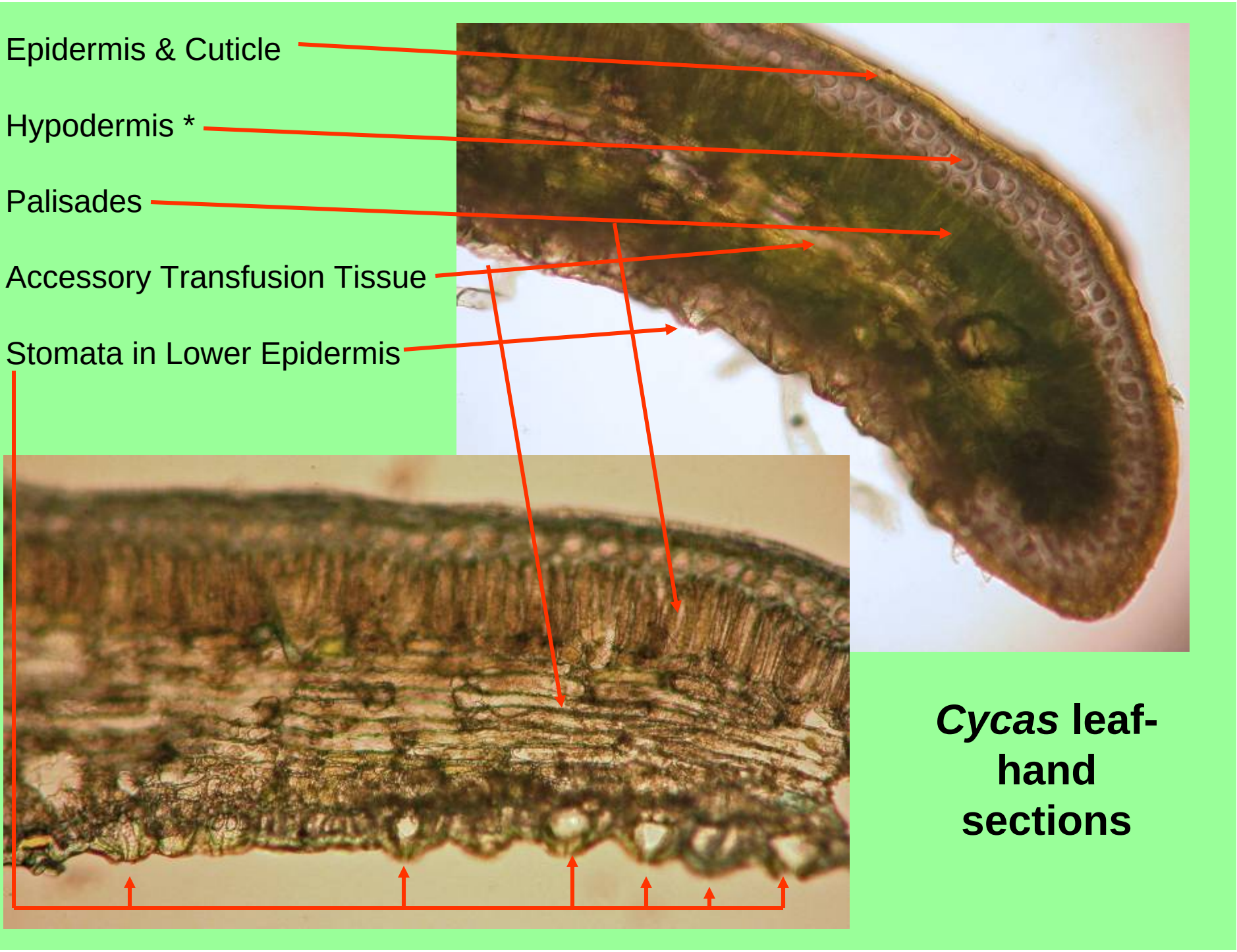
Cycas leaf-hand sections





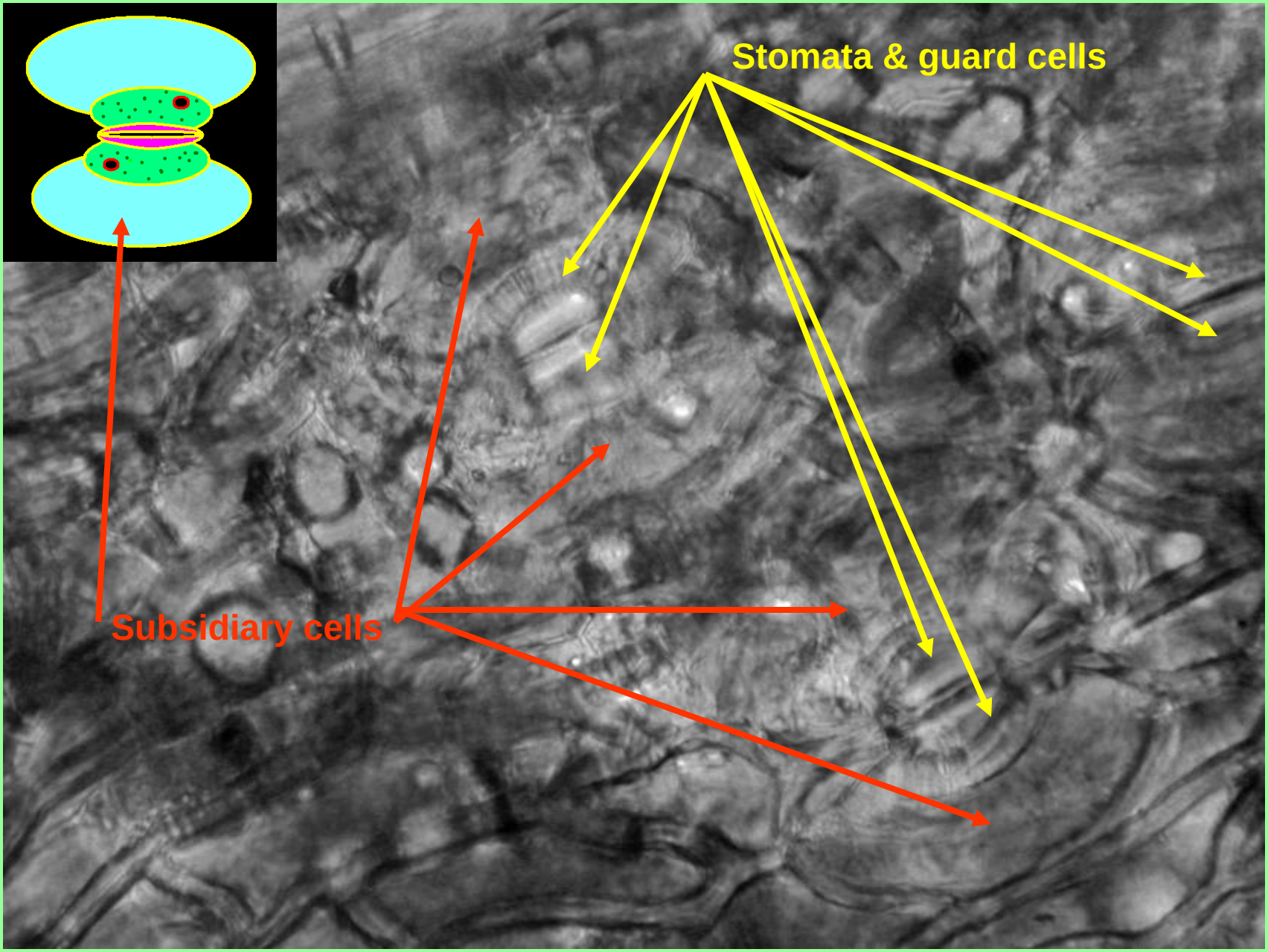
Accessory Transfusion Tracheids and Tissue

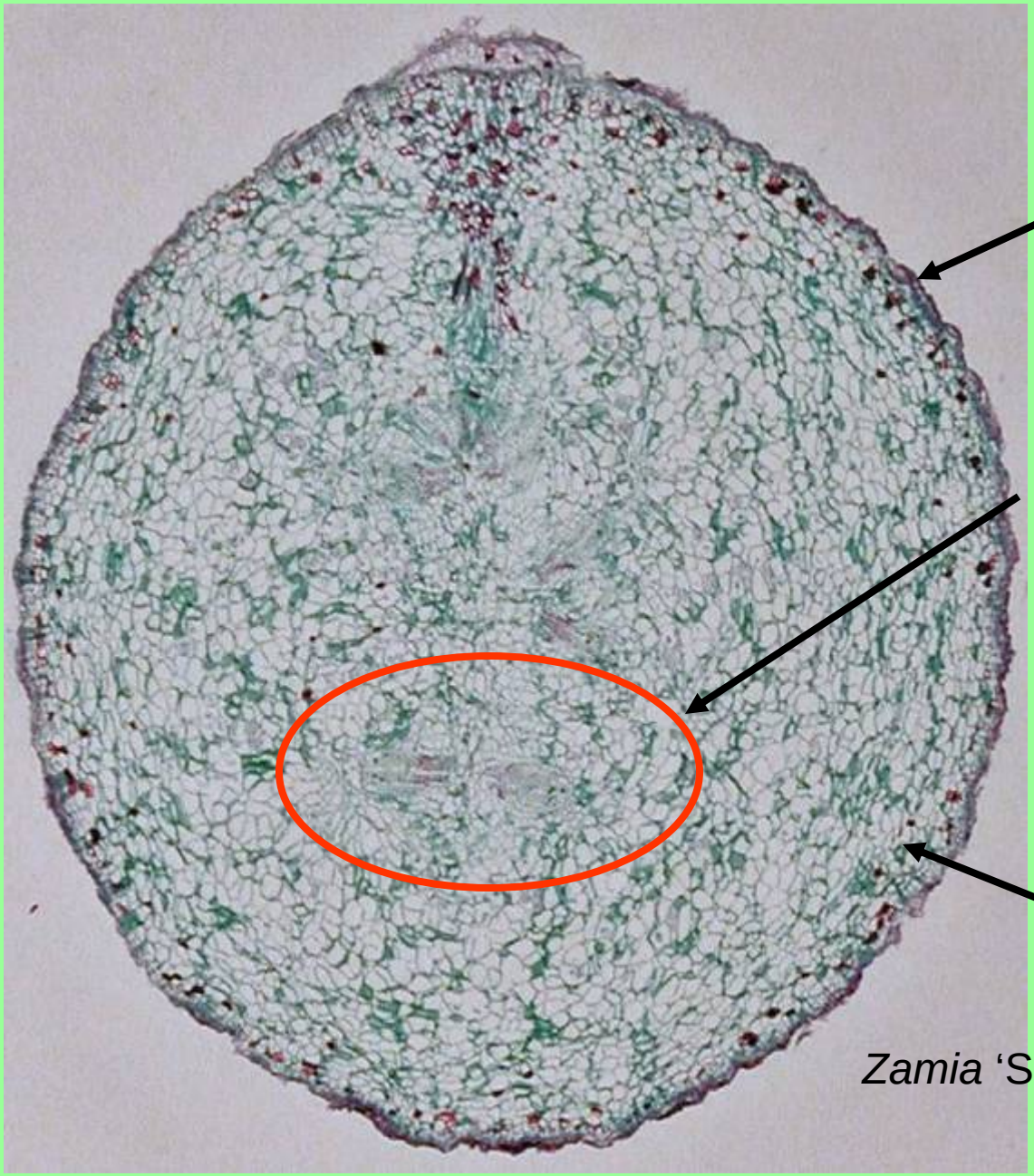
Cycas leaf-hand sections

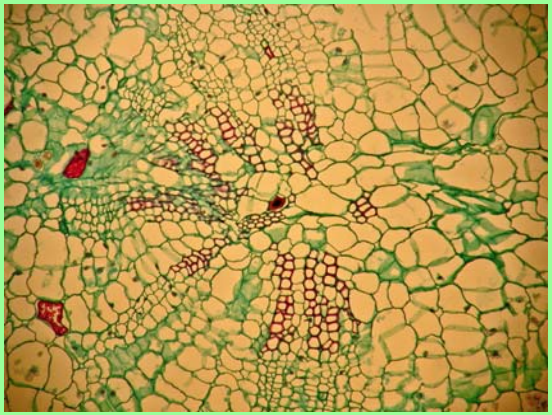


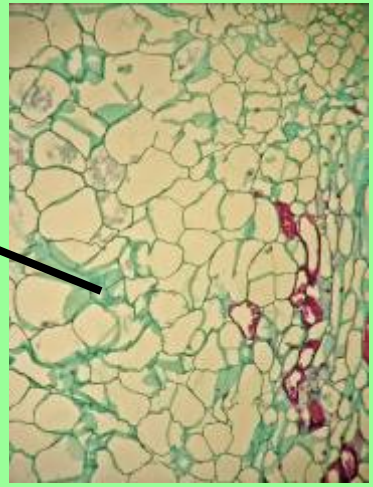
***Cycas* leaf-hand sections**

***Zamia*: WM, lower epidermis**





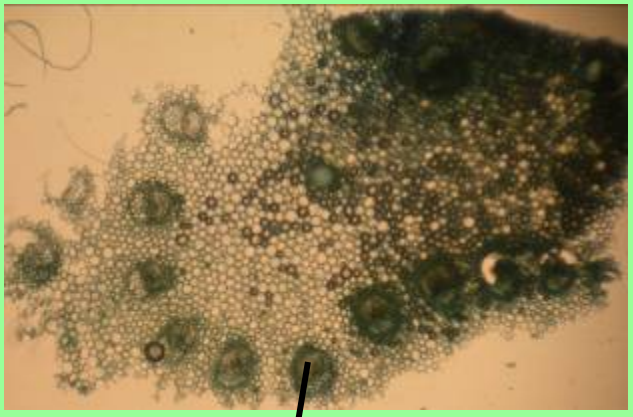


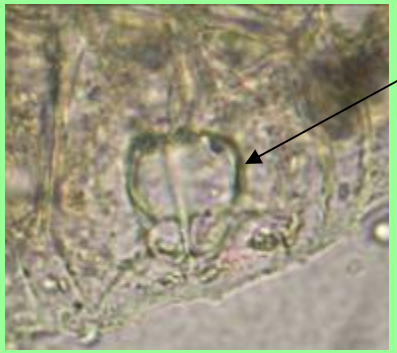


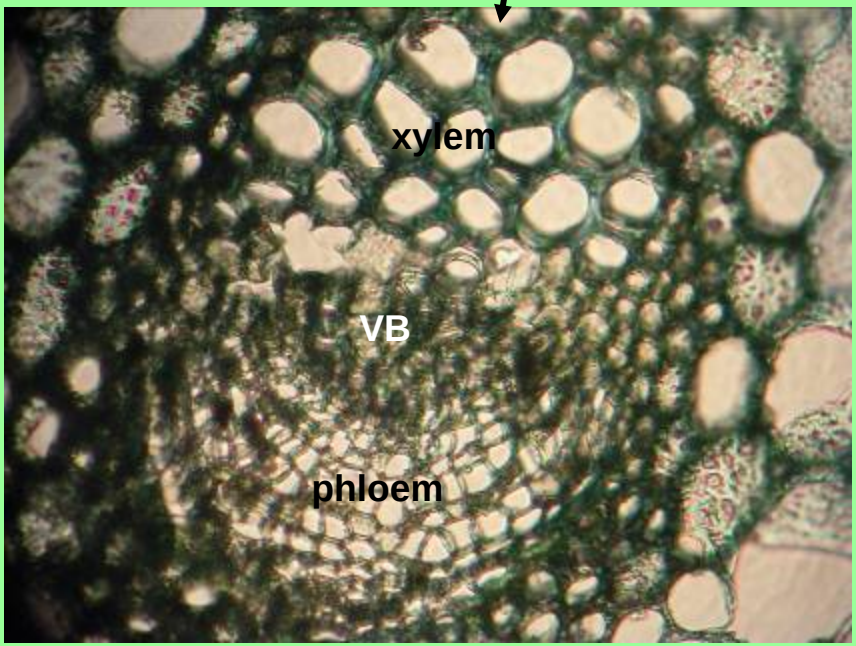
Zamia ‘STEM’


Radial cell lineage
2ndary phloem
Zamia 'STEM'
2ndary xylem
Vascular cambium

***Zamia* leaf**







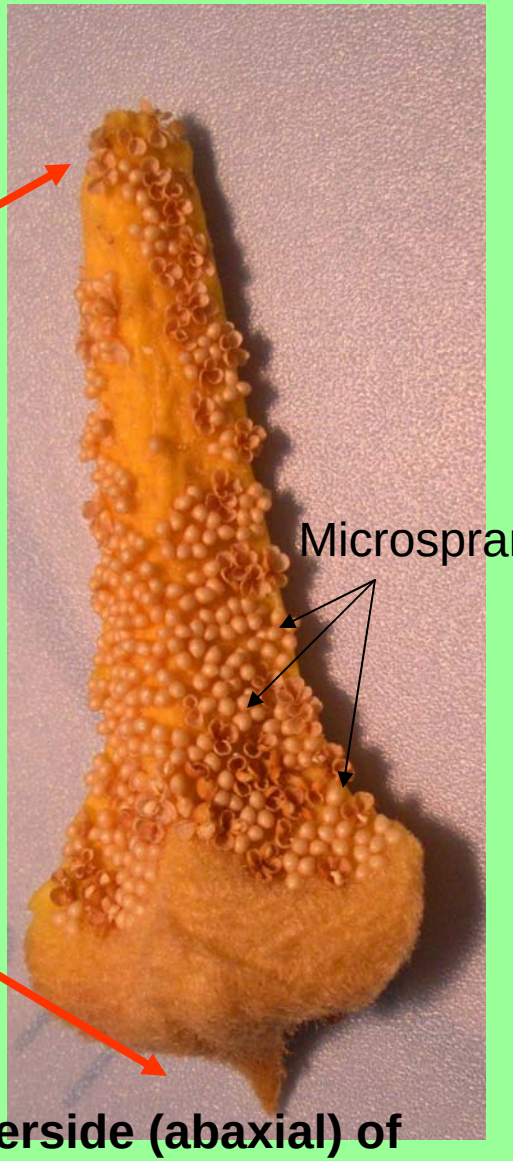
***Cycas* petiole**

♂ **Strobilus (cone)**

Suddenly appears in May when plant matures (years)

15” male strobilus

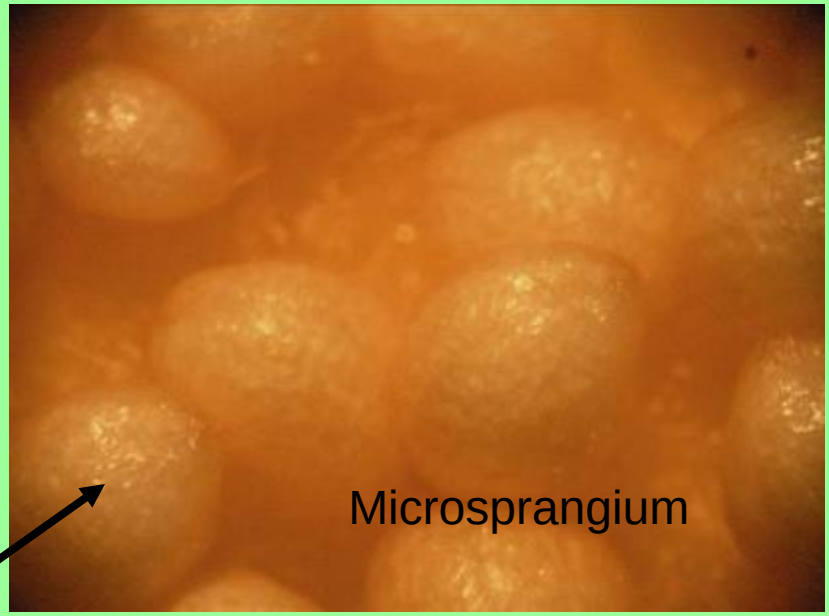
MICROSPOROPHYLL

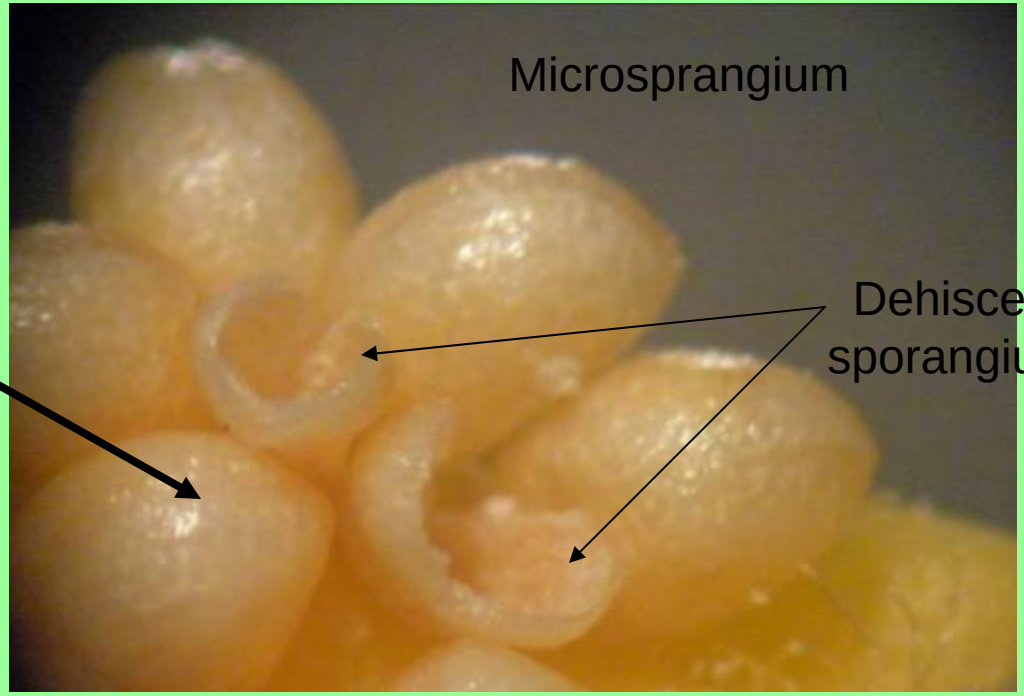


Underside (abaxial) of strobilar scale or microsporophyll

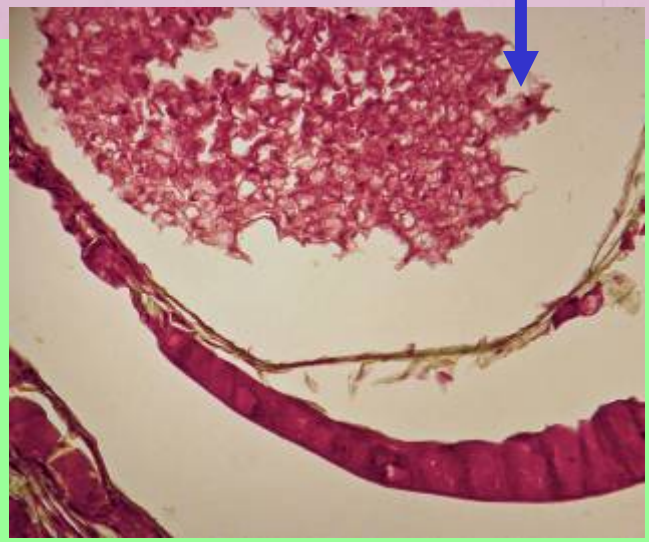
MICROSPOROPHYLL

Cycas revoluta

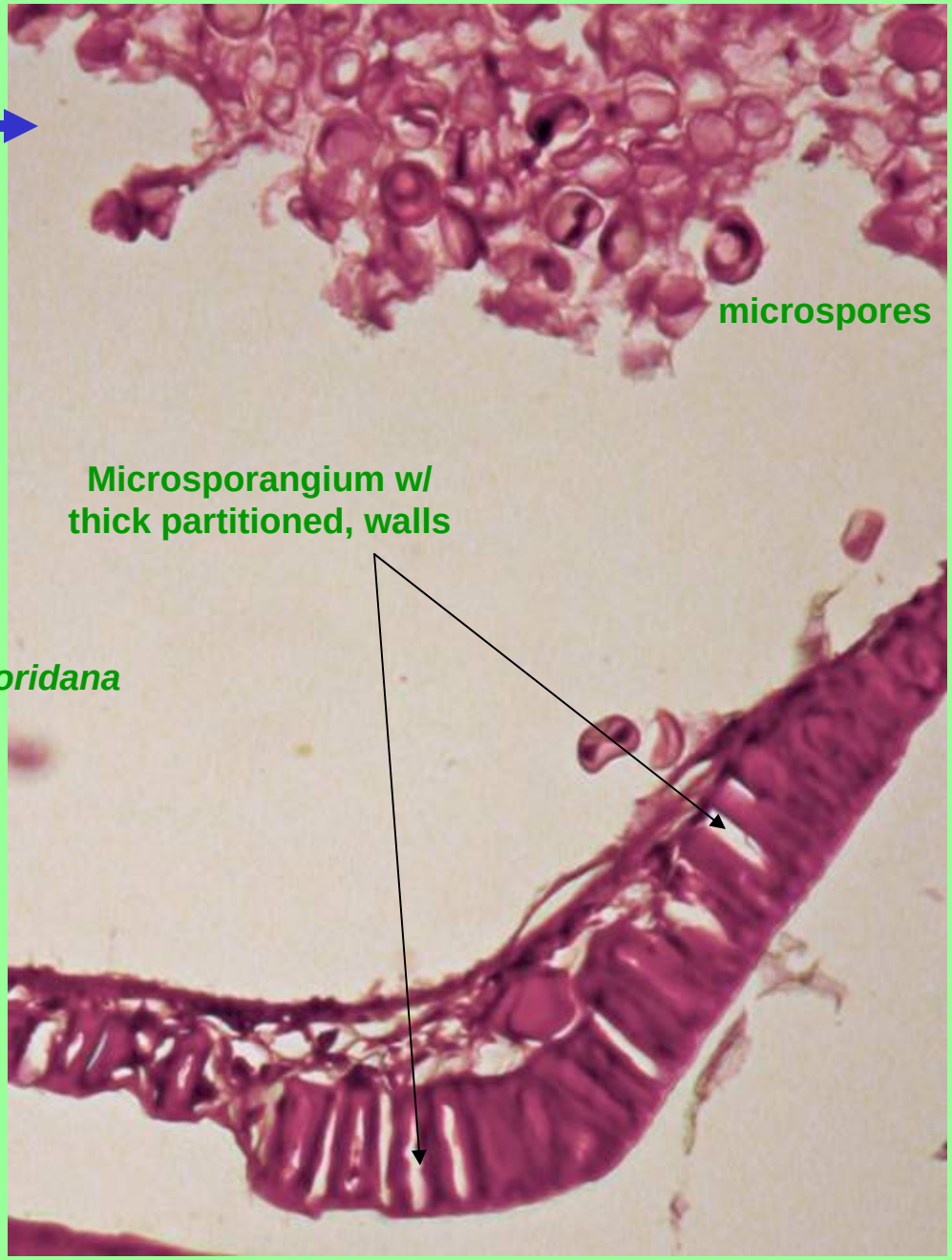




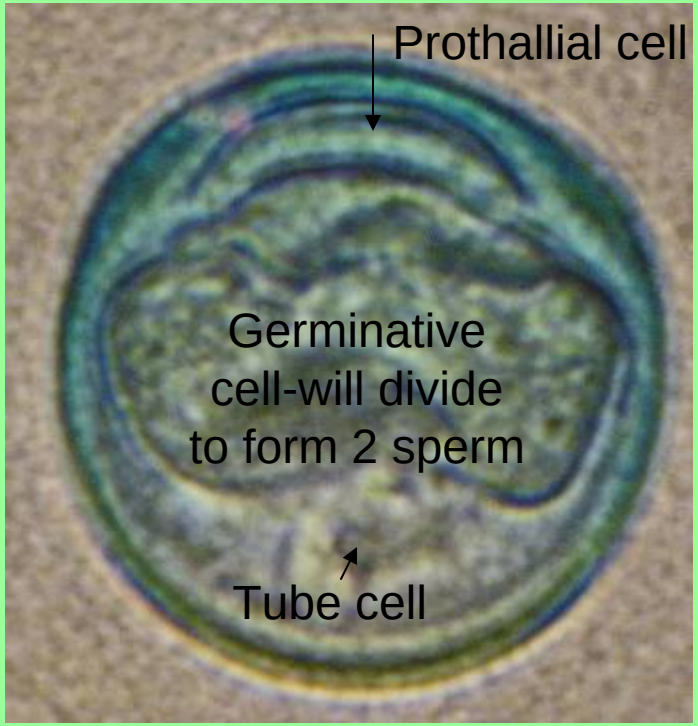
CS of axis of male cone or strobilus

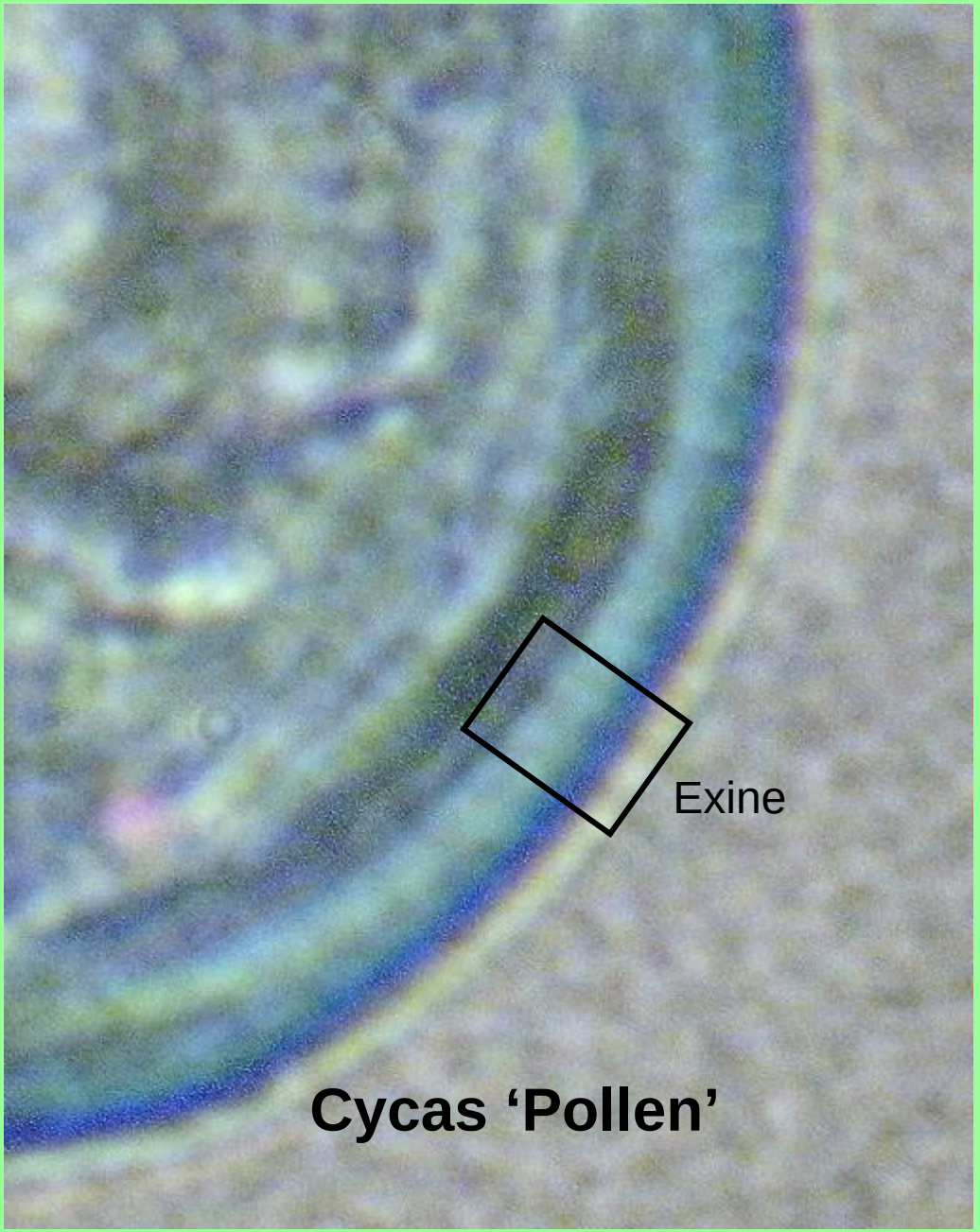


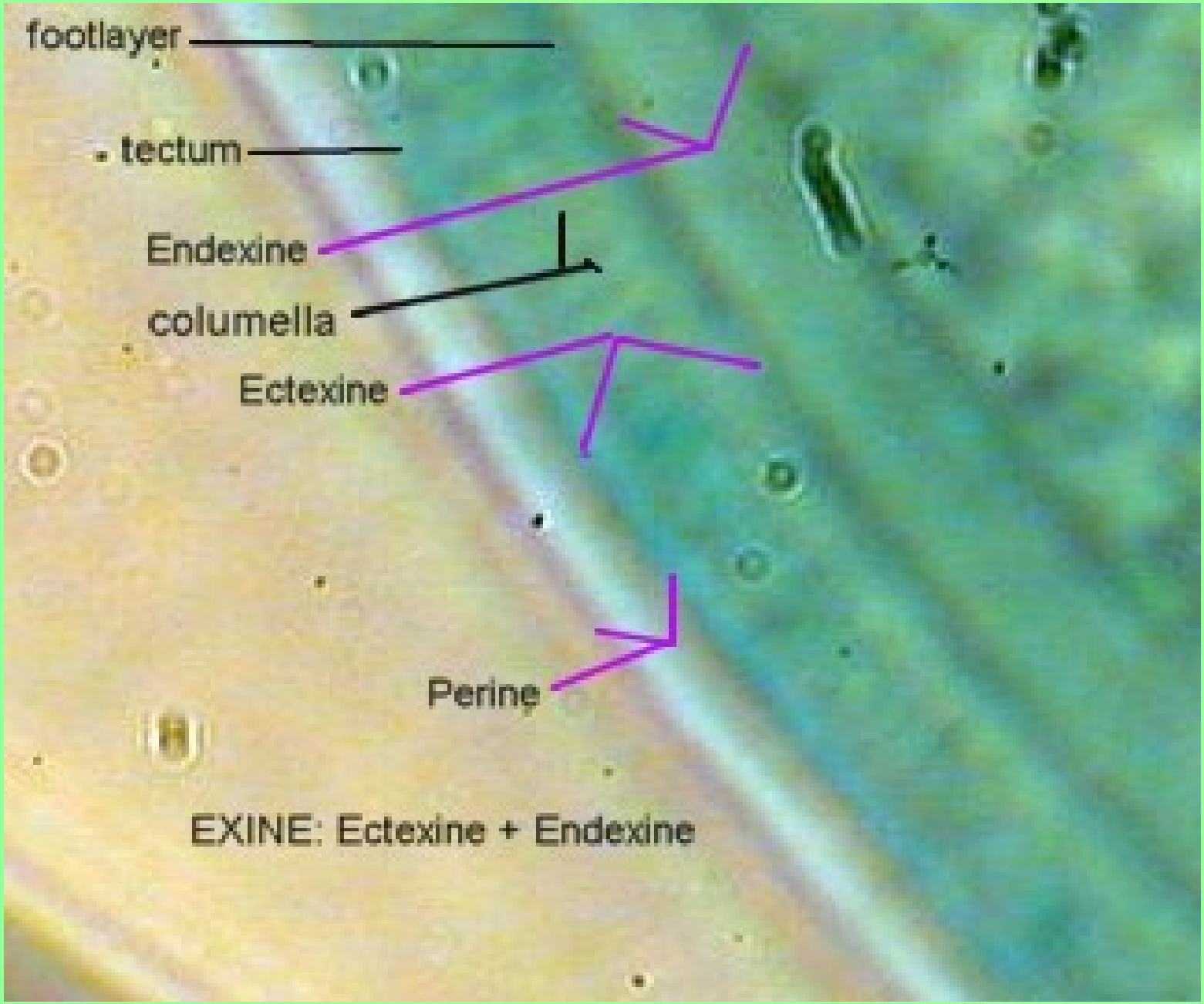
Zamia floridana




Microspore with
microgametophyte (pollen)

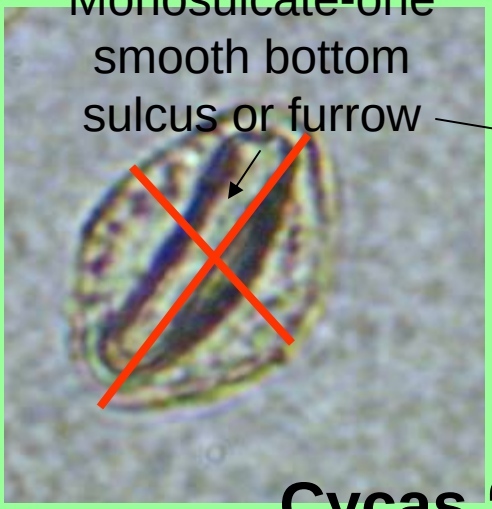

Prothallial cell
Germinative
cell-will divide
to form 2 sperm
Tube cell

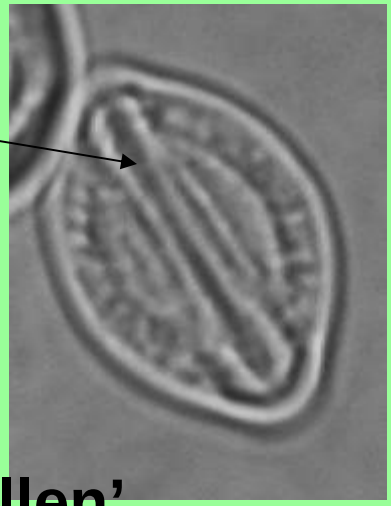

Exine
Cycas ‘Pollen’


footlayer
tectum
Endexine
columella
Ectexine
Perine
EXINE: Ectexine + Endexine

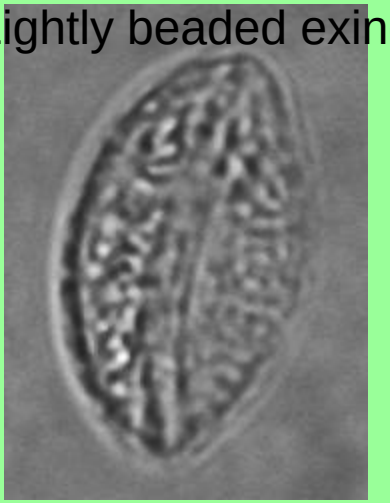
26 *u*m Polar L by17 *u*m Eq W

Monosulcate-one smooth bottom sulcus or furrow

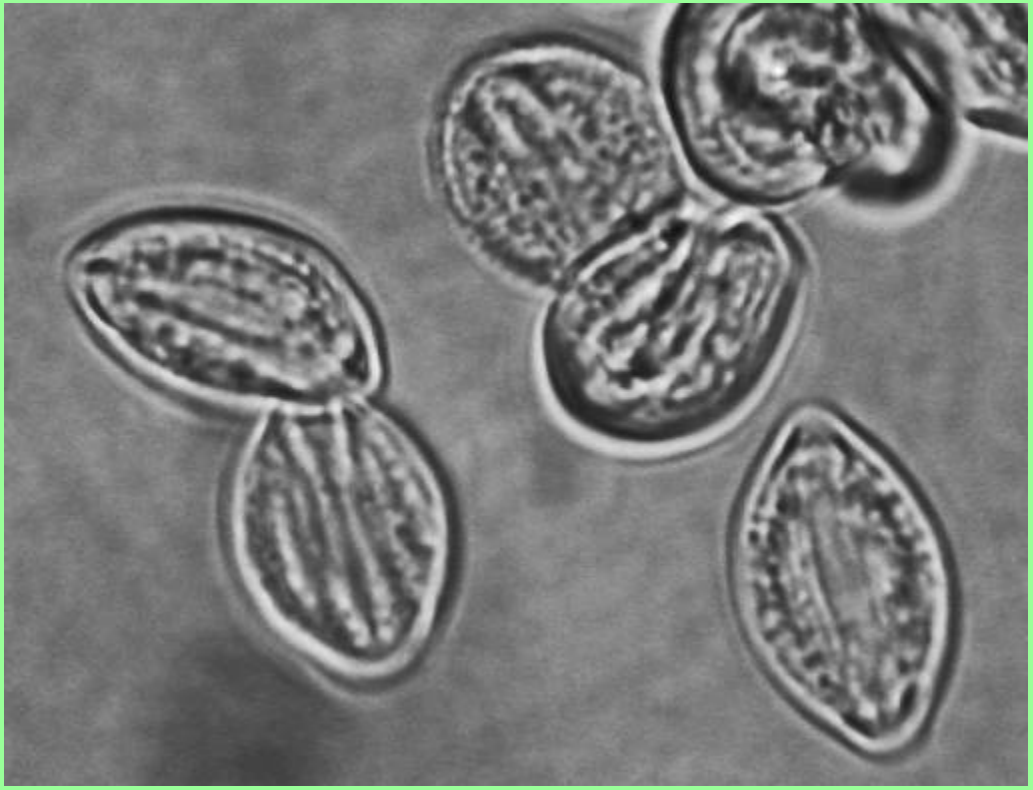




Lightly beaded exine



Cycas ‘Pollen’



Pollenator: Thrips and beetles & WIND

***Cycas revoluta* Female Strobilus**

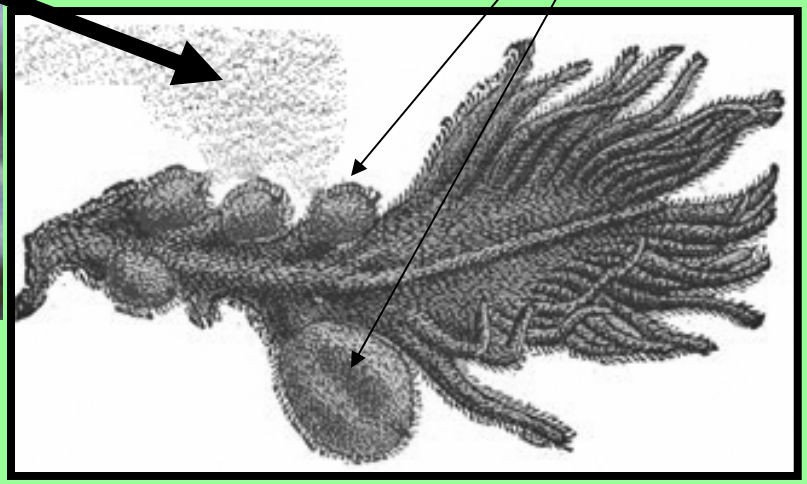
Ovules on megasporophylls of *Cycas*

♀

Strobilus

Suddenly appears in May when plant matures (years)

Ovules on Megasporophyll (Female strobilar scale)



2nd year

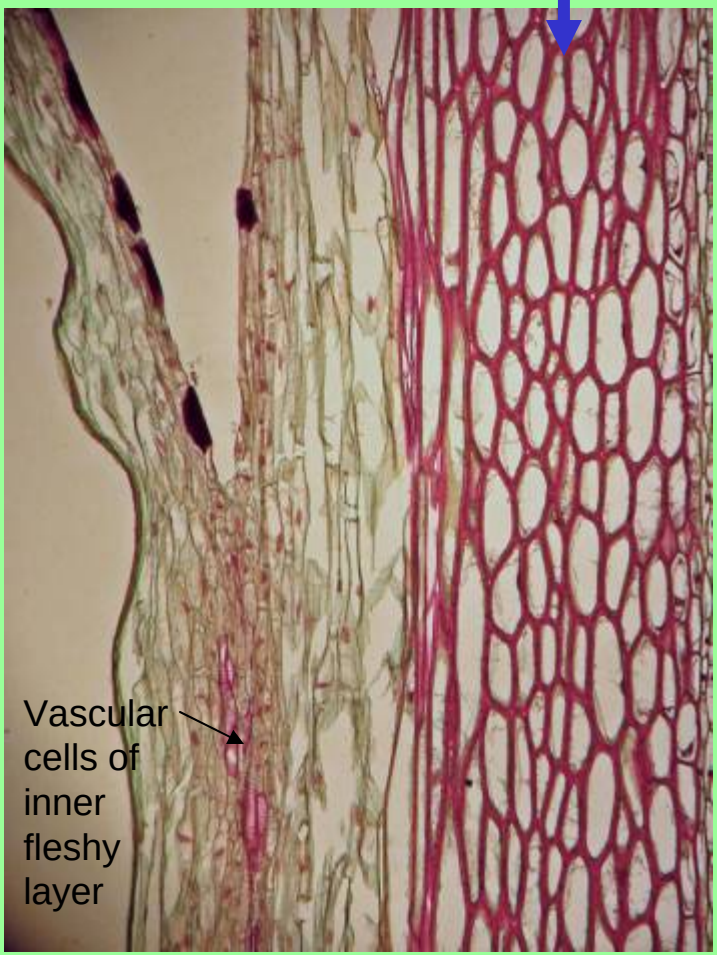
1st year

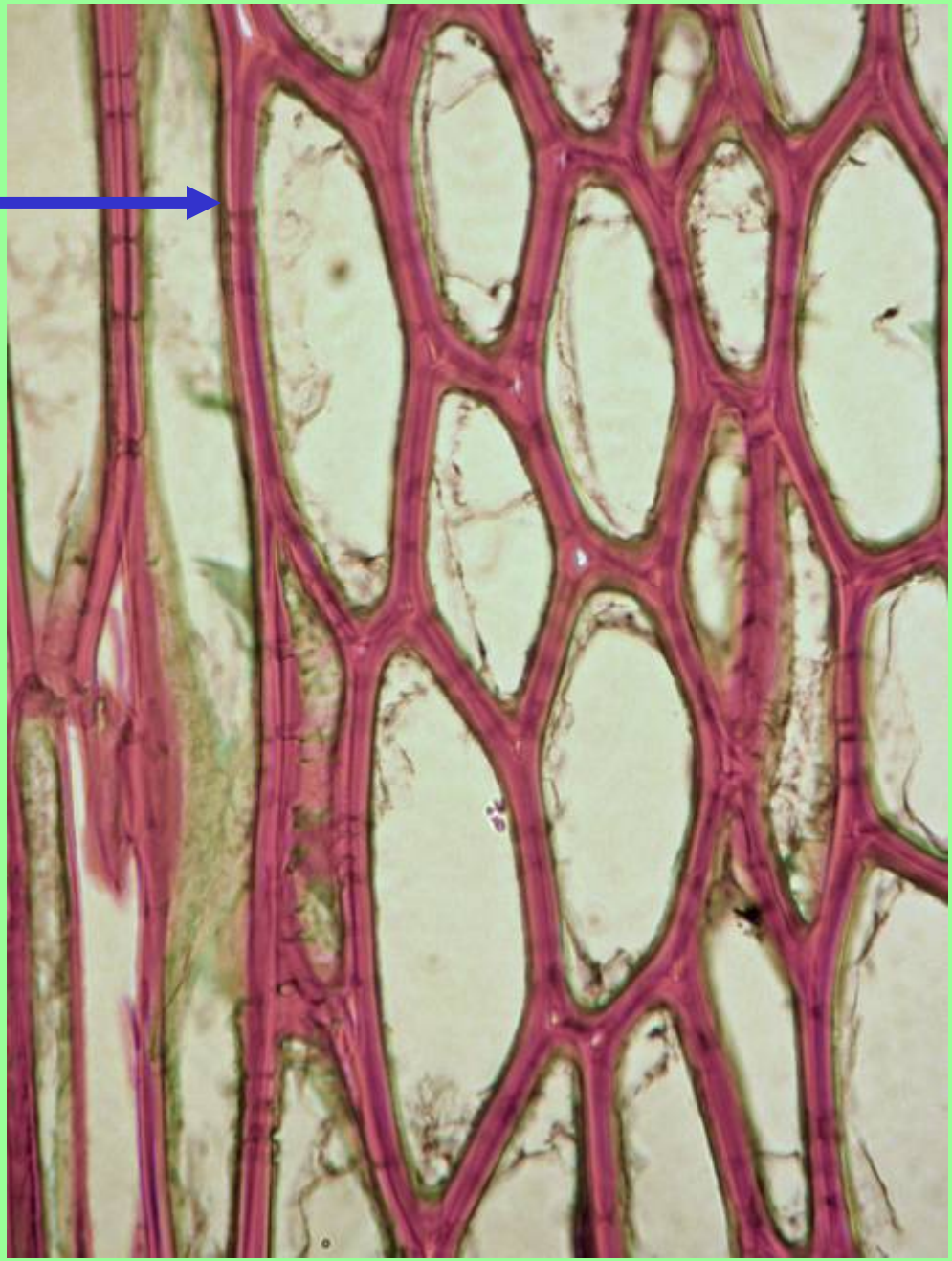
Zamia female strobilus

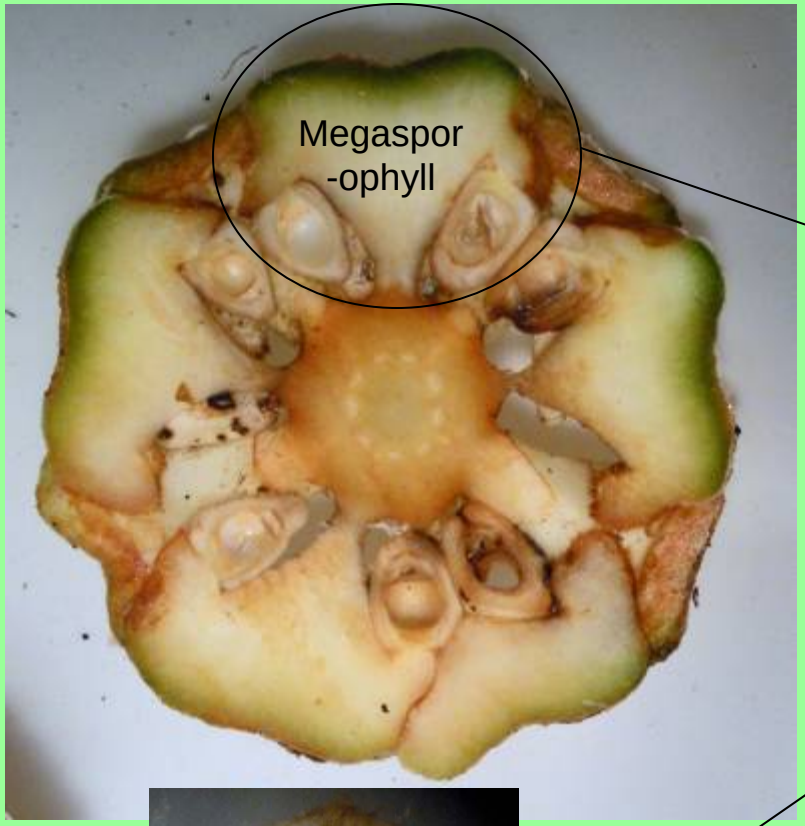
Zamia strobilus:3 Megasporophylls, each with 2 unpollinated/unfertilized ovules

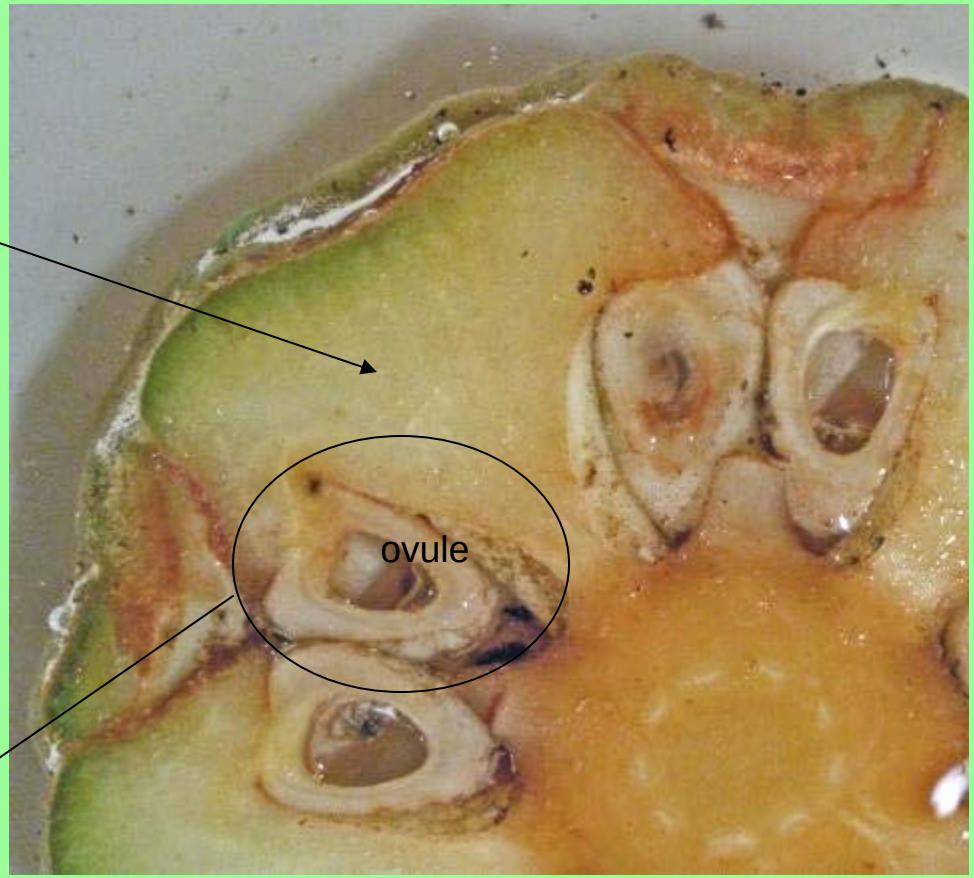

'Seeds' with and without outer fleshy seed coat
Zamia floridana
Stony layer below outer fleshy layer
2
3
4
5
6
7
8
9
10
11
12
13

Thick-walled cells of stony layer surround the ovule

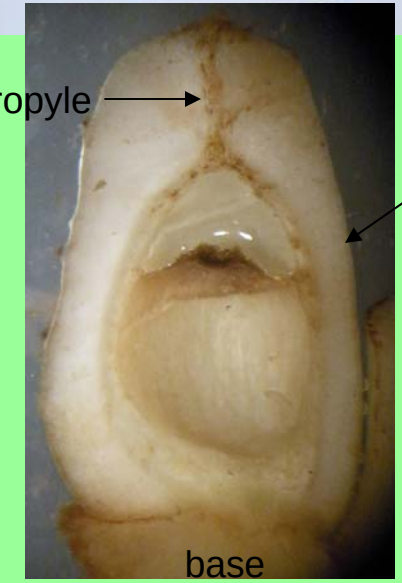






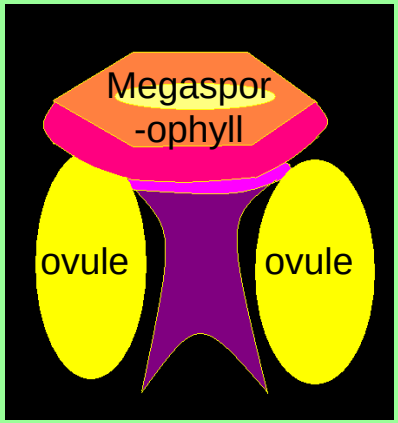


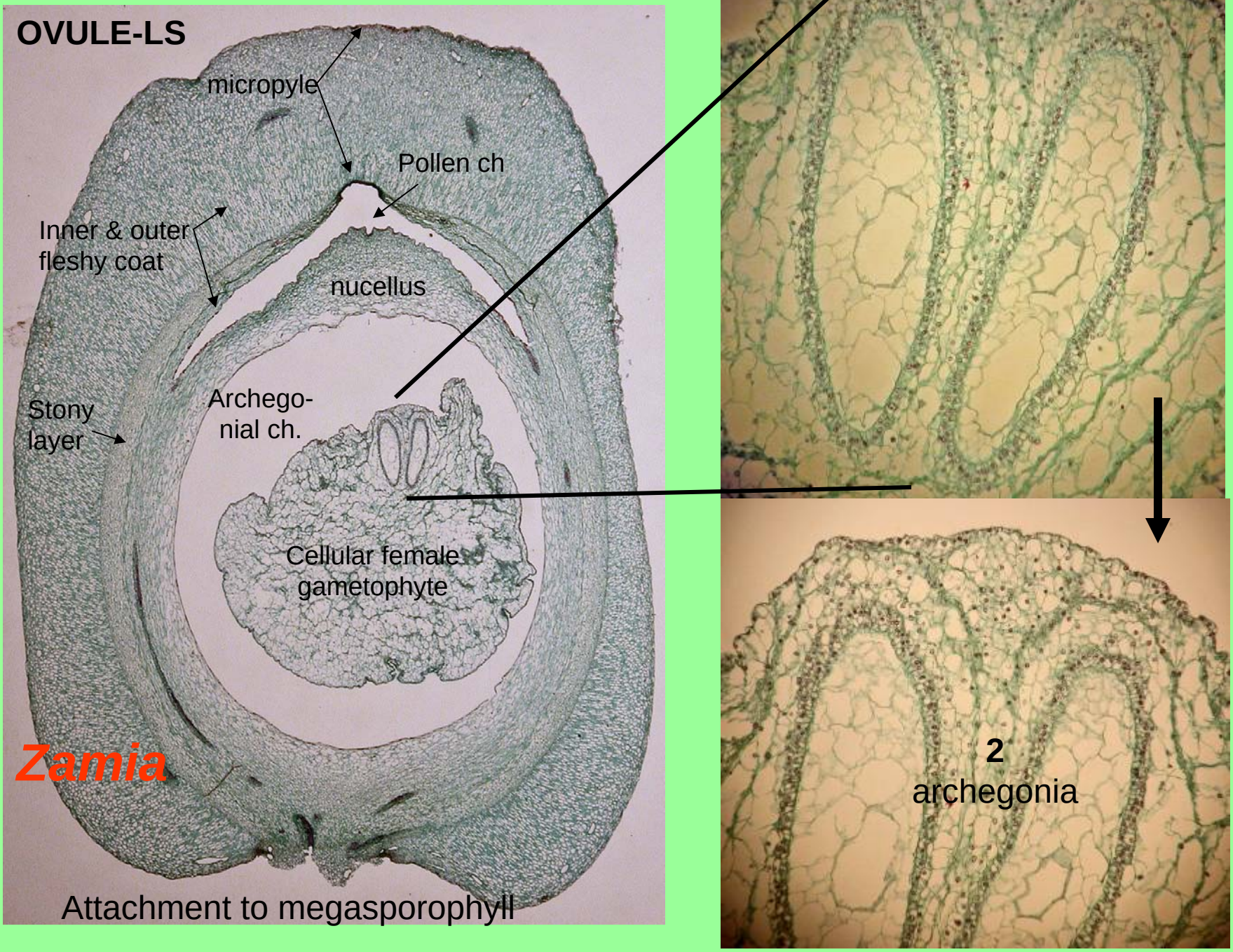
micropyle



ovule

***Zamia*: CS Female strobilus showing 5 megasporophylls in whorl and progressively larger views of an OVULE**




OVULE-LS
micropyle
Pollen ch
Inner & outer fleshy coat
nucellus
Archego-nial ch.
Stony layer
Cellular female gametophyte
Zamia
Attachment to megasporophyll
2
archegonia

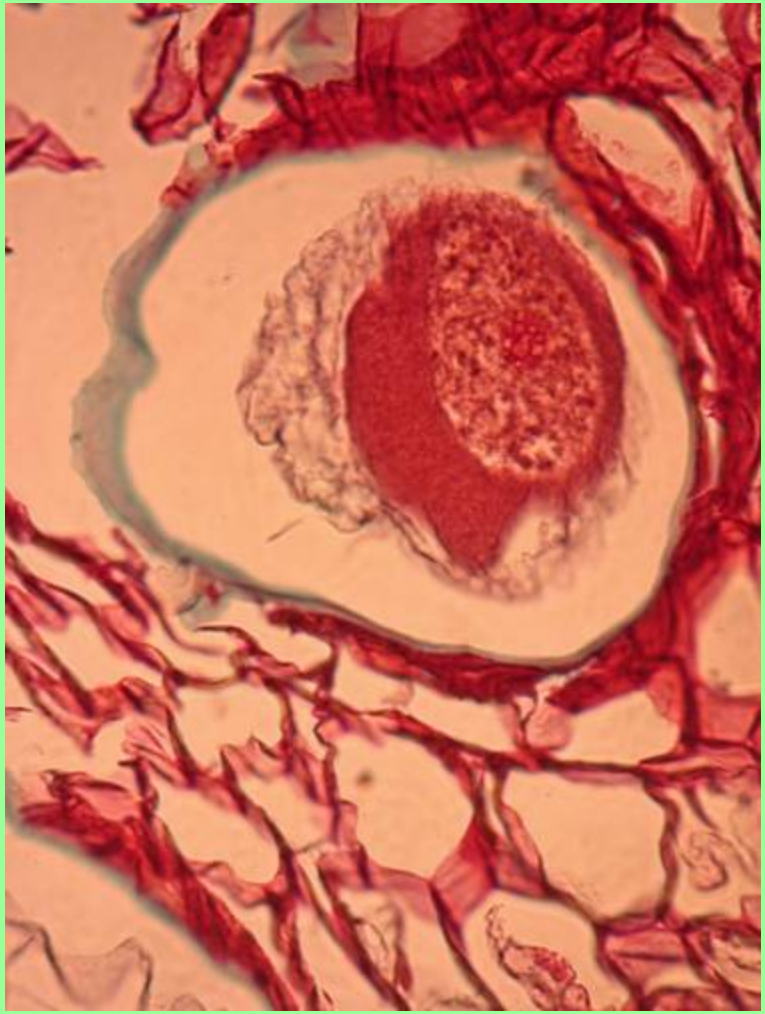
Micropyle: pollen tubes descend through here

Sperm w/ whorls of flagella

Nucellus w/ pollen tubes and sperm (from body cell of pollen dividing)

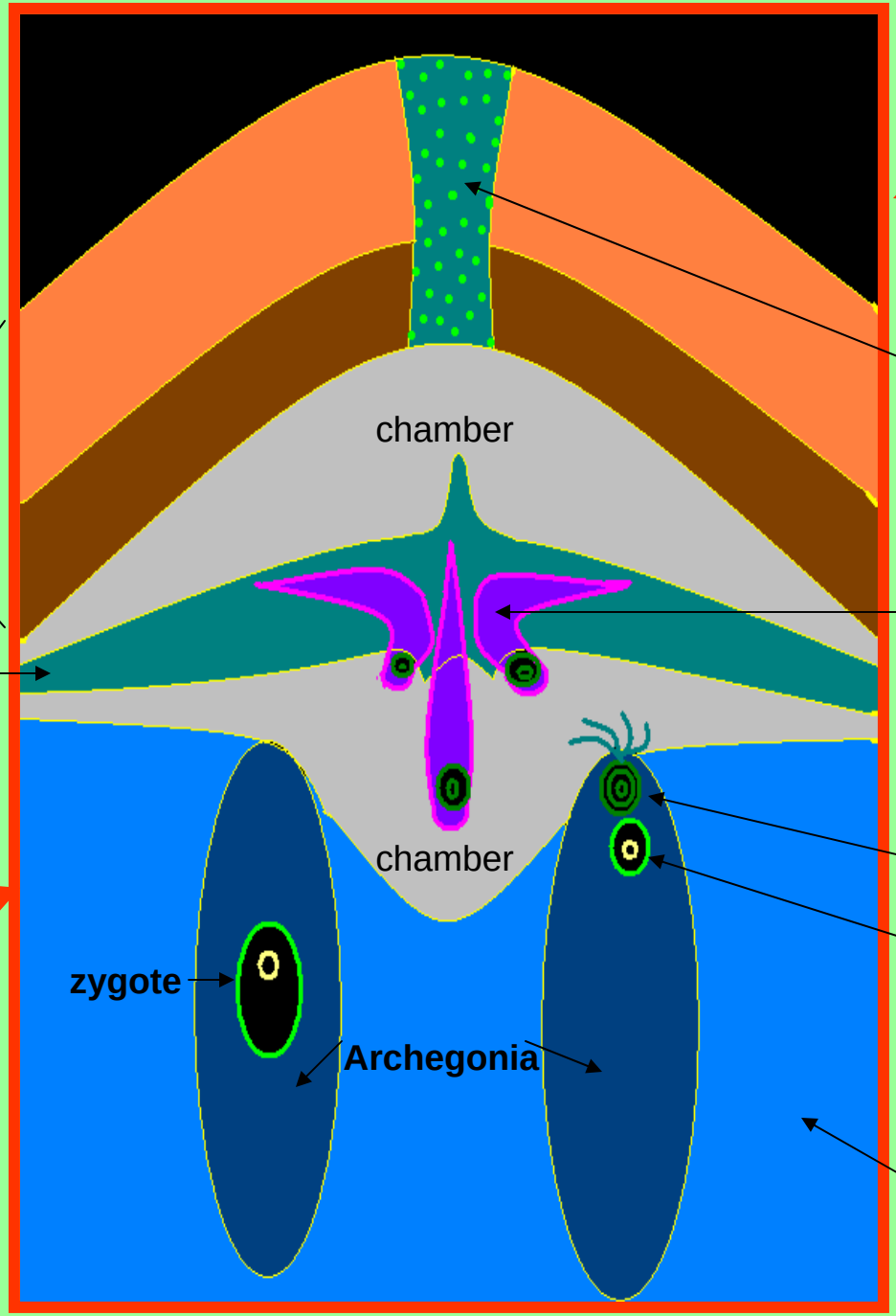
parts of 3 Archegonia in endosperm filled Megagametophyte

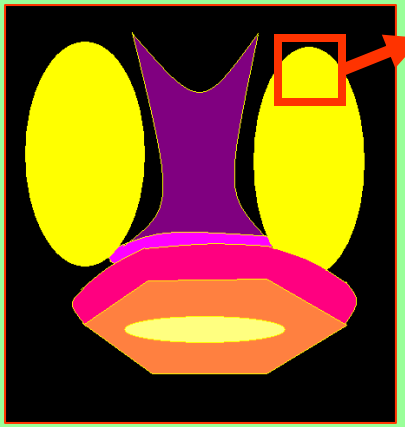
LS through micropylar tube



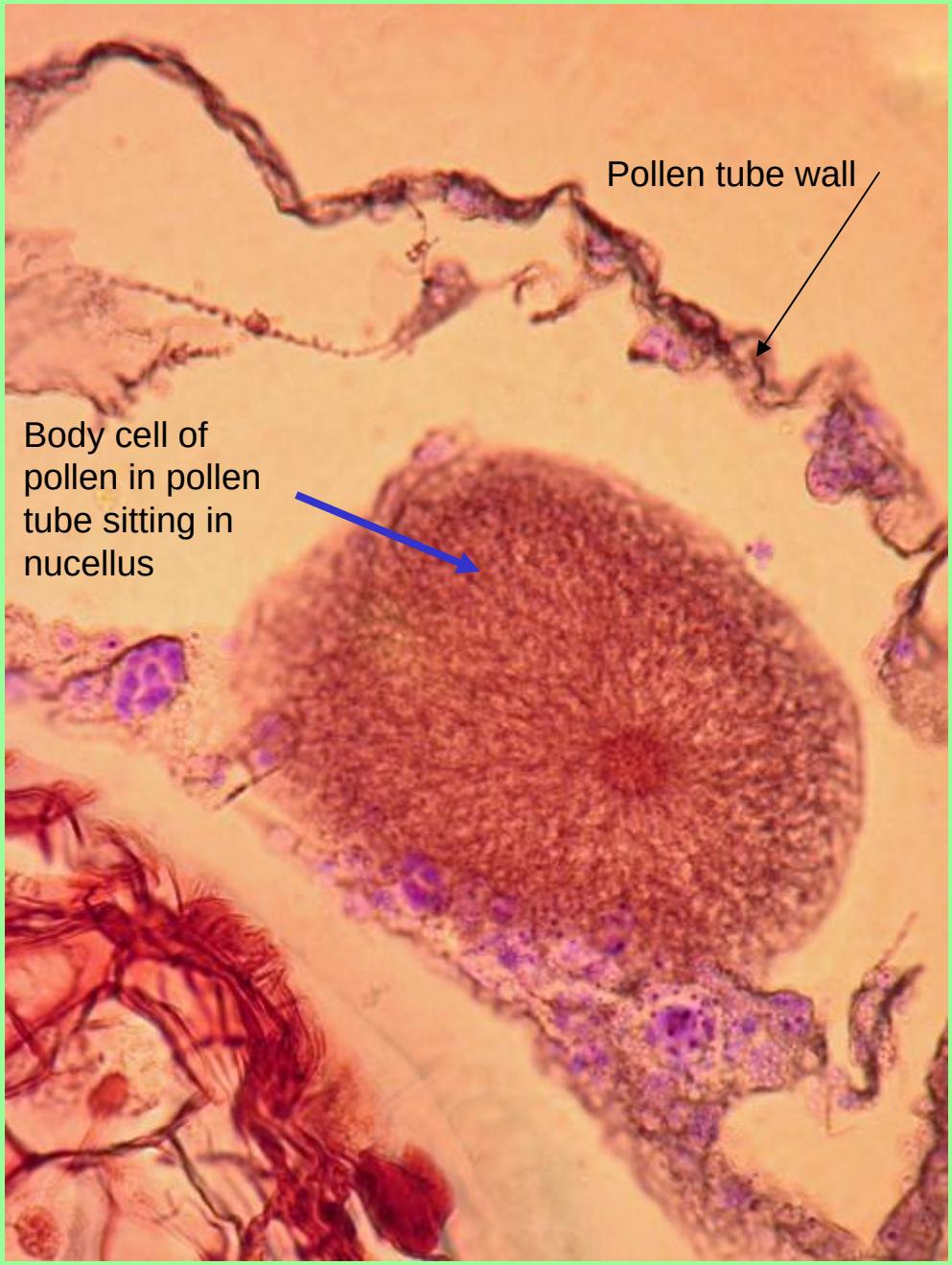
Nucellus w/ pollen tubes and sperm
(from body cell of pollen dividing)

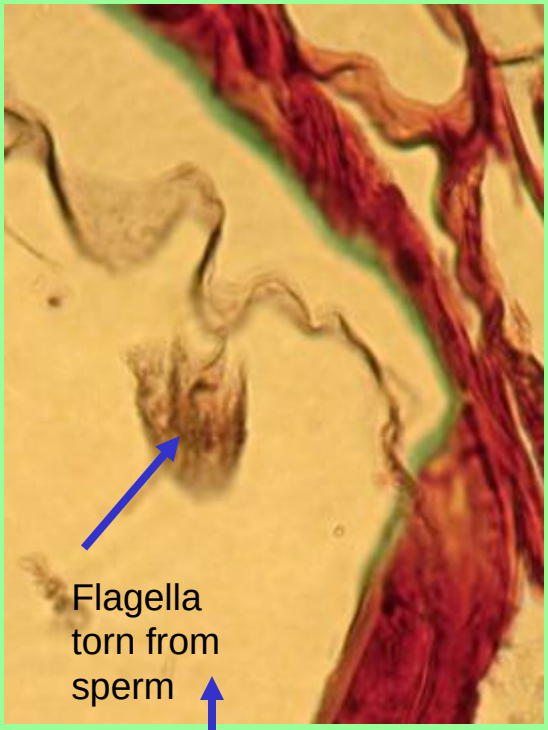
LS OVULE

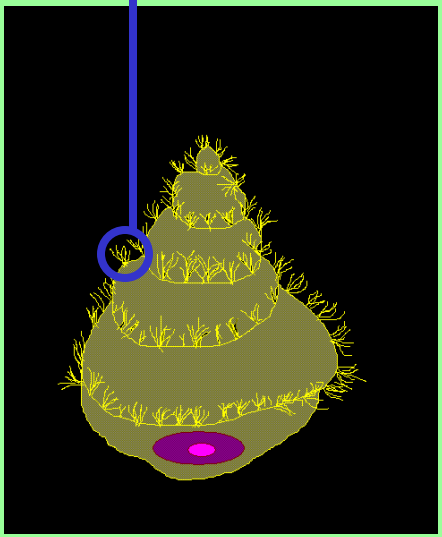

micropyle
chamber
Integument
Germinating pollen grains and pollen tubes with sperm
nucellus
chamber
sperm
egg
zygote
Archegonia
Female gametophyte



Body cell of pollen in pollen tube sitting on nucellus

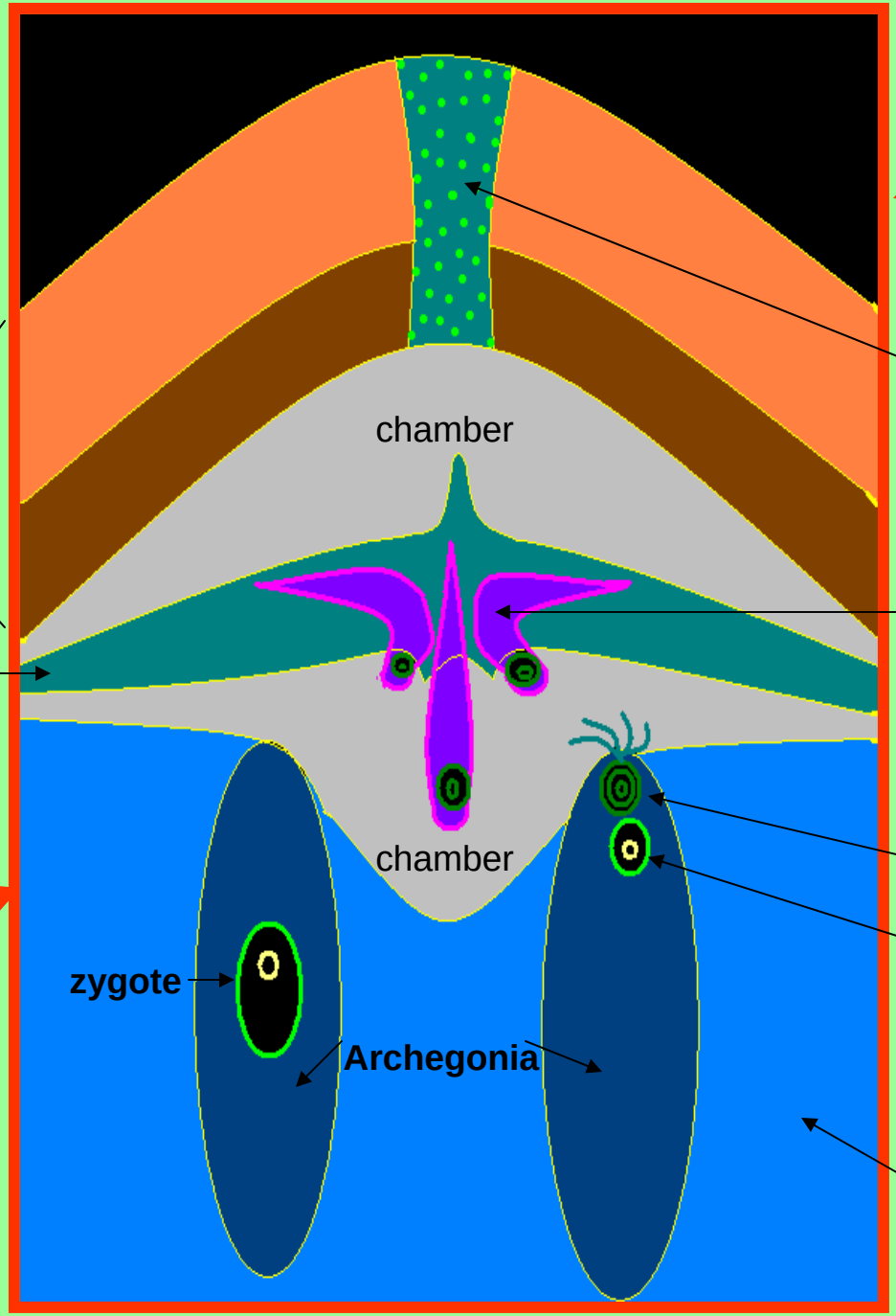

Pollen tube wall
Body cell of pollen in pollen tube sitting in nucellus

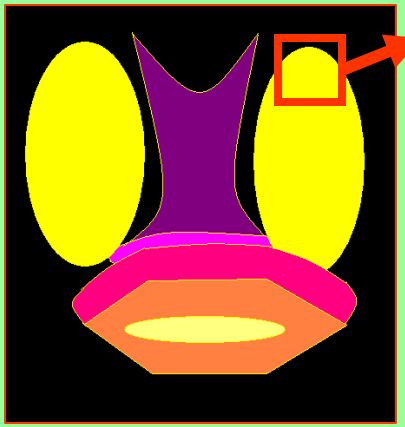

Flagella torn from sperm




Neck cells

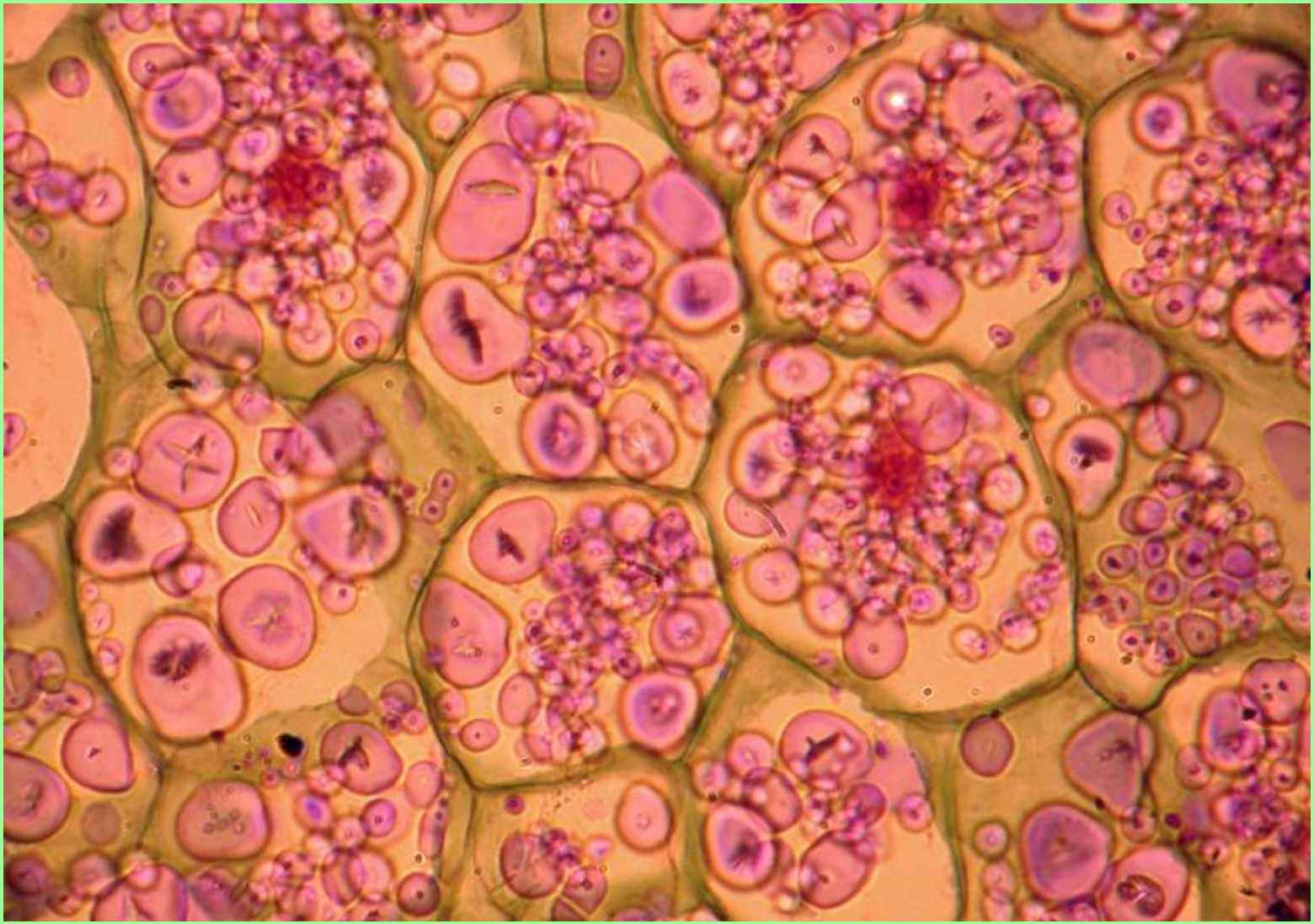
LS OVULE


micropyle
chamber
Integument
Germinating pollen grains and pollen tubes with sperm
nucellus
chamber
sperm
egg
zygote
Archegonia
Female gametophyte



2 neck cells from the division of 1 neck cell in turn from the division which produced the that neck cell and the egg cell

Starch grain-filled
cells of ovule



Starch grain-filled cells of ovule

Zamia floridana
Embryo in seed

Seed

Mucillage cells in Cotyledons

Leaves & shoot of embryo

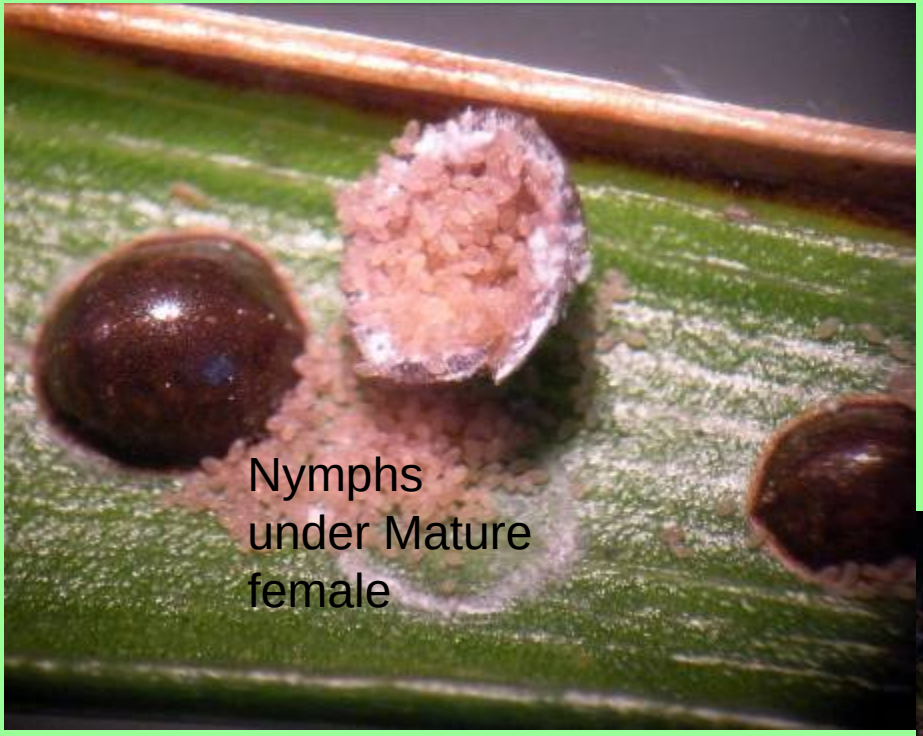
Root or radicle of embryo

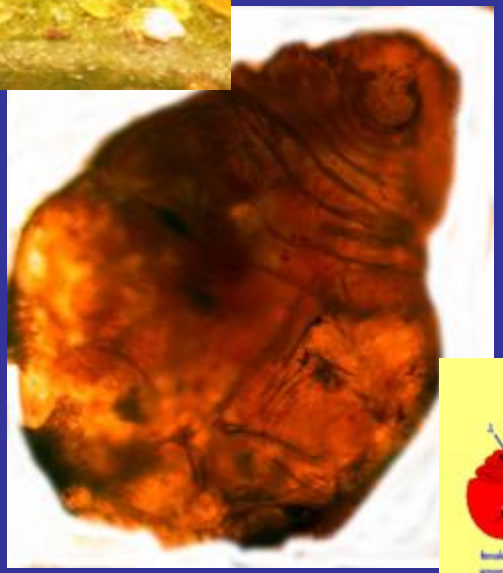
Coleorhiza

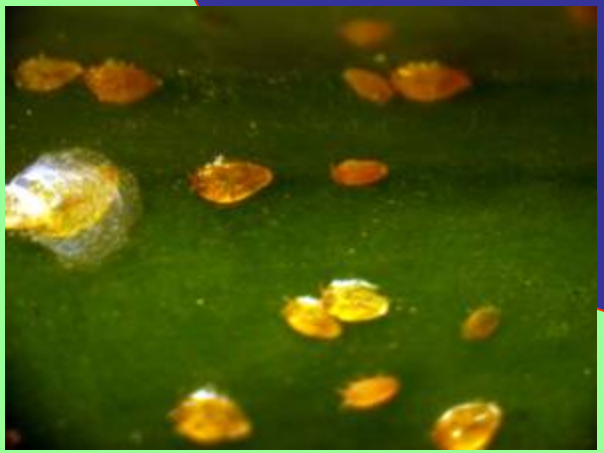
Cells of embryo

Scale insects (Hemiptera) attack cycads

Soft brown scale on *Zamia*







Aulacaspis yasumatsui,

Cycad scale