

Selaginella, Cycads, and Ginkgo

Name _____

Finish your Fern exercise by wet-mounting some of the male and female gametophytes under a single coverslip as directed in that handout. Then proceed with today's exercise...

I. Heterosporous ferns

Available from our greenhouse are some specimens of *Salvinia*. While we may not have reproductive material available this year, this fern is interesting because it is aquatic and floats by an interesting mechanism. Use a dissection microscope to examine the sporophytes, sketch and label completely. Tell how these sporophytes float!

Also available today are the sporocarps of the heterosporous aquatic fern *Marsilea*. The sporophyte looks vaguely like a large four-leaf-clover, but in fact the leaves show the prominent dichotomous venation of ferns which are not found in either shamrocks (*Oxalis*) or clover (*Trifolium*) which are flowering plants with netted venation. The small sporocarps are dried down, but you can hydrate a few of them in a Petri dish with some water. After softening briefly, you can try to dissect or break the sporocarps open. A raft of spores in mucilage will emerge and float away. Microscopic examination of this material should reveal the heterosporous condition of *Marsilea*. Make a sketch of what you have available to you in the space below...label completely!

II. Life Cycle Of *Selaginella*

Observe what is available in terms of living specimens and stages of development. Vocabulary includes: microphyll, leaf, stem, rhizophore, root, strobilus, microsporophyll, microsporangium, microsporocyte, megasporophyll, megasporangium, megasporocyte.

Make sketches of prepared slide sections of stem, rhizophore, leaf, root, strobilus, and sporelings. Vocabulary includes: epidermis, cortex, mesophyll, vascular bundle, xylem, phloem, protostele, plectostele, exarch, amphiphloic, endodermis, trabeculae, Casparian strip, stalk, sterile jacket, megaspore, microspore, megasporangium, microsporangium, megasporophyll, microsporophyll, endosporic, megaspore wall, megagametophyte thallus, rhizoids, oil droplets, embryo, suspensor, root apex, root hairs, stem axis, cotyledons, apical bud, microgametophyte, microspore wall.

<i>Selaginella</i> stem cs	<i>Selaginella</i> rhizophore cs (on same slide as left)
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<i>Selaginella</i> leaf cs	<i>Selaginella</i> strobilus ls
<i>Selaginella</i> sporeling wm	<i>Selaginella</i> sporeling wm cotyledons & root

III. Cycadophyta

The nine living genera of cycads are widely and sparsely scattered in the tropics and subtropics. They have the general appearance of tree ferns or palms with a short tuberous, or long unbranched, trunk topped with a crown of large compound leaves. All are dioecious with any one plant bearing only microsporangia or only megasporangia. Except for the megasporophylls of *Cycas*, the sporophylls are grouped together to form distinct, and in some genera, very large cones. The cycads available for observation are not as large as some genera may get in the wild (up to 60 feet tall). Eastern's largest cycad is in the lobby of Winthrop Hall.

In the greenhouse, observe the gross appearance of our cycad plants.

The leaves of cycads are Simple Compound

The venation of the leaflets is Dichotomous Parallel Net

The vernation of the leaves is Circinate Intercalate

Dr. Koning will prune some of the cycad cones to return to the classroom for dissection.

Observe a slide showing a *Zamia* cone axis cross-section.

The stem of *Zamia* has a protosteles siphonostele eustele core tube bundles

The xylem/phloem arrangement is Radial Amphiphloic Bilateral Bicircular

The xylem maturation is Axarch Mesarch Endarch

A vascular cambium is present absent

The cortex has lacks cells loaded with nasty chemicals that pick up red dye.

The cortex has lacks latex ducts.

The cortex stores lacks starch.

The stem shown in the microscope would appear Smooth Hairy

Observe a cross section of a microsporophyll of *Cycas*

Using the xylem/phloem arrangement observed in the microsporophyll as your evidence, the microsporangia are attached to the Upper Lower epidermis.

How many sporangia are there on the microsporophyll? One Few Many

How many microspores are there in the sporangium? One Few Many

Notice the stalk and sterile jacket arrangement of the microsporangium. It is vaguely reminiscent of the sporangia of Moss *Psilotum* *Quisetum* Ferns

Is the microsporangium stalk near a vascular bundle? Yes No

It may not be obvious in this slide (as many are immature), but if the mature structures inside the microsporangium (with the thick purple wall) are shed when they contain more than one cell, then what is shed from this microsporangium?

Sperm Spore Microspore Pollen

Observe microsporangiate and megasporangiate cones of *Zamia*.

The smaller tan structures in the microsporangiate cones are _____.

The larger tan structures in the megasporangiate cones are _____.

The dark brown stalk with a swollen end on the megasporangiate cone is a _____.

Observe a longitudinal section of the *Zamia* archegonium.

The structure sectioned here is an ovule. You should be able to locate the integument, the nucellus, the megagametophyte, with archegonium and egg. The integument is thick near the end that has the egg. Just above the eggs and nucellus you should be able to see (on the inside of the integument) the curving area of the micropyle.

What entered the ovule via the micropyle? _____

The nucellus tissue is stained quite red in the area just beneath the micropyle. This area is exposed (via the micropyle) to the outside world.

The red stain in the nucellus is a likely indication of: lignin suberin cutin

Through the nucellus you should find five blue squiggles pointing toward the eggs.

What are these? _____

The megagametophyte shows longitudinal sections of three archegonia.

What color is the sterile jacket of the archegonium? _____

Inside each archegonium is an egg. Look at the egg in the upper archegonium.

Where is the nucleus (with prominent red nucleolus)? center chalazal micropylar

How many vacuoles are in the egg cytoplasm? one none few many

This egg cell is the smallest in the view moderate largest in the view

With the large *Zamia furfuracea* cone and large *Zamia pumila* cone from our greenhouse, dissect out some of the sporophylls. Are these mega- or micro-sporangiate cones? Sketch what you find in terms of sporophylls and what is between the sporophylls. Label completely. Cut a longitudinal section of a sporangium (or ovule) and observe what you can in a dissection microscope. Sketch and label completely what you observe:

IV. Ginkgophyta

Ginkgo biloba, the maidenhair tree, is the only living species of this once-extensive division. Surprisingly, *Ginkgo*, thought to be alive today only because it has been cultivated for thousands of years in temple gardens of China, is very resistant to many of our modern diseases and to smog; as a result it is grown extensively in many of our northern cities. Young trees show the spire shape one tends to associate with gymnosperms, but older trees do not. The deciduous leaves are fan shaped with dichotomous venation. Seeds are in groups of two or three at the end of short stalks, not in cones. The microsporangia occur in loose catkin-like structures. The seeds and microsporangia occur on different trees; i.e., *Ginkgo* is dioecious.

Observe the branches of the sporophyte *Ginkgo* tree.

What is unusual about the stem growth of *Ginkgo*? _____

What would you call the tiny branch broken off from the older branch? _____

Considering the diameters of the young and old branches, what tissue layer would you expect to find in *Ginkgo* stem? _____

Observe a longitudinal section of the *Ginkgo* male strobilus.

About half-way up the strobilus you get a longitudinal section of the stem. You should be able to locate pith and some longitudinal sections of vascular bundles. Notice that the vascular bundles have spiral thickenings in some of the cells.

Such cells would be called protoxylem metaxylem

Notice that the maturing xylem elements are toward the epidermis with respect to the cells with spiral thickenings.

This fact makes the xylem maturation exarch mesarch endarch

Near the upper end of this strobilus is a nice section of an attached microsporangium.

Does the sporangium have a vascular bundle? Yes No

Look closely at what is inside the sterile jacket. These cells have a heavily cutinized wall.

How can you tell this? _____

These cutinized cells mostly appear to contain one nucleus with prominent nucleolus.

What would these one-celled structures be called? _____

Later on, the cell inside the cutinized wall will divide to make more cells inside the wall.

What will the structure be called then? _____

If you look around you may actually find a few cells that, indeed, contain more than one cell.

Observe the plastomount of *Ginkgo* life stages. Please **handle the plastomount carefully** to avoid scratching it! The plastic is SOFT!

The young ovules are are not in a megastrobilus.

The leaves are shaped like a _____. The leaves have lack a petiole.

The venation pattern is: dichotomous parallel net . The back side is best!

The whitish swollen sacs on the catkin-like microstrobilus are: _____

The mature ovule (on the right) that is whole has a point of attachment to the stem in a deep depression. At the other end of the ovule (turn the plastomount to view through the front) is a tiny darker brown spot.

What is this spot called? _____

