Laboratory 8: Ginkgo, Cycads, and Gnetophytes

This is the third and final lab concerning the gymnosperms. Today we are looking at Ginkgo, the Cycads, and the Gnetophytes, the so-called non-coniferous gymnosperms. While these groups do not have cones like the true conifers, many do produce strobili.

Order Ginkgoales: leaves simple (with dichotomously branching venation); dimorphic shoots; water-conducting cells are tracheids; dioecious; generally two ovules produced on an axillary stalk or "peduncle"; microsporangiate strobili loose and catkin-like; multi-flagellate sperm.

Ginkgoaceae – 1 genus, 1 sp., cultivated relict native to China
Tree, tall, stately with curving branches attached to a short trunk. Leaves fan shaped, deciduous, attached in whorls to the end of "short shoots" growing from the longer branches ("long shoots"); veins of the leaves dichotomously branched; dioecious; paired ovules at the end of a stalk and naked, hanging like cherries; seeds enclosed in a fleshy whitish-pink covering.

Ginkgo

Order Cycadales: pinnately-compound leaves, whorled, attached spirally at the stem apex; main stem generally unbranched; circinate vernation in some representatives; water-conducting cells are tracheids; dioecious; both male and female cones are simple structures; seeds generally large and round, unwinged; numerous microsporangia per microsporophyll; multi-flagellate sperm.

Cycadaceae – 1 genus, 17 spp., Africa, Japan, and Australia
Stems palm-like and rough, usually not branched; leaves fern-like, pinnately compound, thick and leathery; attached spirally at the stem apex, young pinnae with circinate vernation, leaf bases remaining after the leaves drop; dioecious; whorls of wooly-covered micro- and megasporophylls alternate with whorls of scales and foliage leaves at the stem apex; ovules born along the sporophyll margins; seed almond or plum like; ovules borne along the margin of the leaf-like megasporophyll.

Cycas

Zamiaceae – 8 genera, 125 spp., tropical America
Stems palm-like and rough, usually not branched; leaves pinnately compound, thick and leathery, some may reach 3-4 m in length, attached spirally at the stem apex; the young pinnae or leaves of some species have circinate vernation, others are straight; dioecious; microsporangia and megasporangia produced in strobili, ovules attached to megasporophyll, strobili vary greatly in size up to 7 dm in length; seeds are cherry like and may be brightly colored.

Ceratozamia
Encephalartos
Zamia
Order Gnetales: leaves variable in size and shape but either opposite or whorled; sperm not flagellated (delivered to the egg by the tube nucleus); both male and female cones are compound structures; water-conducting cells are tracheids and vessel-members.

**Gnetaceae** – 2 genera, 29 spp., tropical

Woody vines, rarely shrubs or trees; **leaves opposite, simple, thick**, ovate to oblong with netted veins and resembling the leaves of flowering plants; dioecious; male strobilus slender elongate with **microsporophylls arising in the axis of bract-like leaves**, "inflorescence-like"; female strobilus with ovules in 5-8 separated whorls; seeds large, fleshy. Micropyle opening within an elongated extended tube.

**Gnetum**

**Ephedraceae** – 1 genus, 65 spp.; N hemisphere and South Am.

Shrubby or trailing, stems scraggly, diffusely branched, jointed, green and photosynthetic, "horsetail-like"; leaves decussate, opposite, or whorled reduced to dry brown-tan scales; usually dioecious; male pollen cone with compound, stalked microsporophylls; surrounded at the base by paired bracts; female ovulate cone reduced, 1-4 at a node; **ovules single or in pairs, surrounded by a fleshy cup attached at the base**, the micropyle opening within an elongated extended tube; strobili at maturity become dark and leather-like covered seeds, colored scarlet. Pollen striated “football shaped”.

**Ephedra**

**Welwitschiaceae** – 1 genus, 1 sp., Namib Desert

Woody, fleshy inverted conical stem, protruding slightly above ground level, may be over 1 m in diameter at ground level; **leaves 2, opposite, leathery ribbon-like**, continual basal growth persisting throughout the plant’s life, but becoming tattered and ripped by wind into many ribbons; dioecious with strobili on compound-branched axes; microsporophylls of male cone surround a sterile ovule (like stamen around a pistil) enclosed by bracts; fertile ovule of female cone enclosed by bracts. Pollen striated “football shaped”. Micropyle opening within an elongated extended tube.

**Welwitschia**