The “Early-Diverging” Flowering Plants
The Flower – 4 Basic Whorls

**Calyx [CA]**: the green sepals (#3)

**Corolla [CO]**: the showy petals (#4)

**Androecium [A]**: the stamens or male structures (#6-8)

**Gynoecium [G]**: the carpels or pistils or female structures that contain an ovary (#9-12)
Variation in flowers – immense and what makes them successful!

- number of parts
- symmetry
- fusion of like parts
- fusion of unlike parts
- placentation
- position of ovary
- inflorescence type

will use **floral formulas** as shorthand
Magnoliophyta - Flowering Plants

We will begin our survey of Great Lakes’ flowering plants by examining the “early diverging angiosperms”
The Flower

Early diverging angiosperms tend to have floral parts not fused

Connation: fusion of floral parts from same whorl

Adnation: fusion of floral parts from different whorls
The Flower

Early diverging angiosperms tend to have floral parts not fused . . . and have many parts at each whorl.
Magnoliaceae - magnolia family

Not found in Wisconsin, but part of the Alleghenian flora. Sub-tropical and warm temperate trees

P ∞  A ∞  G ∞

Tepals, laminar stamens, apocarpic

Fruit = “cone” of follicles
Dehiscent fruit with one suture, derived from one carpel
Derivation of the follicle fruit

1 floral ‘leaf’ or carpel with ovules

Folded carpel

1 carpel with 2 rows of seeds; the fruit opens along the 1 line of suture
Magnoliaceae - magnolia family

Tulip tree (*Liriodendron*) is also not native, but commonly planted. Pollinated by beetles
Aristolochiaceae - birthwort family

8-10 genera and about 600 species worldwide; 1 species in Wisconsin. Mostly vines in the tropical regions, but herbs in temperate regions.

*Aristolochia clematis*: doctrine of signatures
- birthwort, "well born", aristocrat
cordate or heart-shaped leaves.

*Aristolochia* - birthwort

*Asarum* – wild ginger
Aristolochiaceae - birthwort family

Asarum canadense - wild ginger

Used by eastern native Americans as a contraceptive, thick rhizome root can be cut up, boiled, and cooked in heavy sugar syrup to make candied ginger.
Aristolochiaceae - birthwort family

Asarum canadense - wild ginger

Rare pipevine swallowtail in WI – does shift from host pipevine (Aristolochia) to wild ginger (Asarum)
Aristolochiaceae - birthwort family

Asarum canadense - wild ginger

fly or beetle pollinated.

CA 3  CO 0  A 12  Ġ (6)

Inferior ovary with 3 sepals and the stamens arising from top.

The petals are almost absent.

Seeds are dispersed by ants; these seeds possess an aril-like structure.
Nymphaeaceae - water lily family

These are aquatic herbs and have an obvious ecological niche - they inhabit still waters.

Many of their characteristics reflect adaptations to this habitat.

- Floating or submersed leaves
- Air cavities in tissue
- Mucilaginous coverings
- Lack of vessels
Nymphaeae - water lily family

Convergence [unrelated plants with similar adaptations] common

Check out Birge Hall lobby “Aquatic Plants” display!

For extra credit on first exam, find one of two aquatic invasive genera in Great Lakes Region that have leaves just like *Nymphaea* – one is an Eudicot and the other is a Monocot:

N________ and H______________
Nymphaeaceae - water lily family

Nymphaea odorata - water lily

CA 3+  CO ∞  A ∞  G (∞)

• Showy flowers with strong scent
• Many parts at each whorl
• Flat, leaf-like stamens
• Superior, syncarpic pistil

Nymphaea odorata - water lily
Nymphaeaceae - water lily family

*Nuphar variegata* - yellow pond lily

- Petaloid sepals & reduced petals
- Leaf-like stamens grading from petals to pistils
Nymphaeaceae - water lily family

*Nuphar variegata* - yellow pond lily

Superior pistil of many carpels

Beetle pollination
Brasenia shreberi - water shield

Small clonal floating aquatic

Peltate leaves

Wind pollinated

Protogynous – female phase first, then male phase
Ceratophyllum demersum - hornwort, coon’s-tail
The Primitive Eudicots
Ranunculaceae - buttercup family

Largest family of the ranunculid lineage which is the first diverging group of true dicots = eudicots

Worldwide but is centered in temperate and cold regions of the northern and southern hemispheres. 13 native genera, 53 species in WI, 20 of these in *Ranunculus*

Important family of our Wisconsin “Spring Flora” – you will see these species!
Ranunculaceae - buttercup family

- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous
Ranunculaceae - buttercup family

Frank Cook – UK botanist
Ranunculaceae - buttercup family

- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous

Golden-seal

Black cohosh

Monk’s-hood
**Ranunculaceae - buttercup family**

- *Nigella sativa* (& *N. damascena*)
- Black seed tea (e.g., Egyptian tea)
- Condiments, Black seed bread
- Middle Eastern, Bengali cuisine
- flavor wines and snuff

**Nigella**
- Love-in-a-mist
- Black seed
- Black cumin
- Fennel flower
- Roman coriander
Other uses for *Nigella*
Other uses for *Nigella*

thymoquinone

Is Nestlé trying to patent the fennel flower?

No. We're not claiming to 'own' the fennel flower, nor are we trying to patent it. Our patent application relates only to the specific way that thymoquinone - a compound that can be extracted from the seed of the fennel flower - interacts with opioid receptors in the body and helps to reduce allergic reactions to food.

The fennel flower (also known as *Nigella sativa*, black seed and black cumin) is a natural species, and nobody could, or should, benefit from ownership over it. In accordance with the Convention on Biological Diversity, we fully support the principle of fair access and benefit-sharing when it comes to the raw materials we use.

FENNEL FLOWER: Also known as *Nigella sativa*, black seed and black cumin.
Ranunculaceae - buttercup family

- Herbs, sometimes woody or herbaceous climbers or low shrubs - often poisonous
- Leaves, alternate, usually basal and cauline, often divided or compound, or palmately lobed.
- No stipules.
Ranunculaceae - buttercup family

- Flowers very variable: except **many stamens and many free carpels** (apocarpic)

\[ \text{CA 3+ CO (0) 5+ A } \infty \text{ G 3+} \]
Ranunculaceae - buttercup family

Fruit Diversity!

Follicles = ∞ seeded dehiscent fruit
Berries = ∞ seeded fleshy fruit

*Caltha* - marsh marigold

*Actaea* - baneberry
Ranunculaceae - buttercup family

Fruit Diversity!

Achenes = 1 seeded indehiscent, dry fruit

*Anemone* - thimbleweed with wind dispersed achenes

*Ranunculus* – buttercup with animal dispersed achenes
Ranunculaceae - buttercup family

*Aconitum columbianum* - monks’ hood   *Aconitum 'noveboracense' - monks’ hood

Great Lakes – western North American disjunct pattern
Ranunculaceae - buttercup family

**Actaea rubra** - red baneberry

**Actaea alba** - white baneberry
Ranunculaceae - buttercup family

Anemone patens - pasque flower

Anemone canadensis
- Canada anemone
EXTRA CREDIT – digital image of pasque flower

Photo: John Zaborsky
Ranunculaceae - buttercup family

*Anemone quinquefolia* - wood anemone

*Anemone acutiloba* (Hepatica *acutiloba*) - sharp-lobed liverleaf
Ranunculaceae - buttercup family

Aquilegia canadensis - American columbine
Ranunculaceae - buttercup family

*Caltha palustris* - marsh marigold

No petals – only sepals
Follicle fruits
Ranunculaceae - buttercup family

*Enemion biternatum* [Isopyrum biternatum]  
- false rue anemone

One of most abundant spring ephemerals forming large colonies

No petals; 3-5 follicle fruits
Ranunculaceae - buttercup family

*Ranunculus abortivus* - cursed crowfoot

*Ranunculus acris* - tall buttercup

*Ranunculus hispidus* - bristly buttercup

sepals + petals
achenes
Ranunculaceae - buttercup family

*Thalictrum dioicum* - early meadow-rue

Large herbs of more open habitats; wind pollinated

**Dioecious**; with separate male and female plants
Ranunculaceae - buttercup family

Anemonella thalictroides - rue anemone

Original name after *Thalictrum* because the leaves were so similar, although showy, insect-pollinated flowers

Now called *Thalictrum thalictroides*

. . . and so it is “the thalictrum with the thalictrum-like leaves”!

Good example of the re-evolution of insect pollination within a wind pollinated group