

### TERM TEST III

Relationships among the basal angiosperms are just beginning to be understood. Perhaps the kinds of characters that we examined in lab and lecture might actually be useful in deriving a classification of these plants, which is your mission here. Nine genera of basal angiosperms are described above the dotted line, while the genus *Amborella* has been shown by recent molecular analyses to be the sister group to all remaining angiosperms, and hence an appropriate outgroup for this study.

***Nymphaea***: plants aquatic, herbaceous, and upright, with vessels but lacking alkaloids and latex; leaves alternate, without stipules, the blades expanded and entire; flowers axillary, the perianth with 2 distinct whorls, the petals white; stamens many, the anthers loculicidal, with psilate pollen; carpels free, closed, with non-dormant, non-aromatic seeds.

***Cabomba***: plants aquatic, herbaceous, and upright, with vessels but lacking alkaloids and latex; leaves alternate, without stipules, the blades threadlike and entire; flowers axillary, the perianth of 2 distinct whorls, the petals white; stamens many, the anthers loculicidal, with psilate pollen; carpels free, closed, with non-dormant, non-aromatic seeds..

***Austrobaileya***: plants terrestrial, woody, and twining, with vessels but lacking alkaloids and latex; leaves opposite, without stipules, the blades expanded and entire; flowers axillary, the perianth of 2 distinct whorls, the petals white; stamens 5, the anthers loculicidal, with rugulate pollen; carpels free, closed, with non-dormant, non-aromatic seeds.

***Kadsura***: plants terrestrial, woody, and twining, with vessels but lacking alkaloids and latex; leaves opposite, without stipules, the blades expanded and entire; flowers axillary, the perianth of 2 distinct whorls, the petals red; stamens 5, the anthers loculicidal, with rugulate pollen; carpels free, closed, with non-dormant, aromatic seeds..

***Illicium***: plants terrestrial, woody, and upright, with vessels, but lacking alkaloids and latex; leaves opposite, without stipules, the blades expanded and entire; flowers axillary, the perianth of 2 distinct whorls, the petals red; stamens 5, the anthers loculicidal, with rugulate pollen; carpels free, closed, with non-dormant, aromatic seeds.

***Sassafras***: plants terrestrial, woody, and upright, with vessels and alkaloids but lacking latex; leaves alternate, with stipules, the blades expanded and lobed; flowers terminal, the perianth homogeneous, the tepals white; stamens many, the anthers poricidal, with rugulate pollen; carpels united, closed, with dormant, non-aromatic seeds.

***Liriodendron***: plants terrestrial, woody, and upright, with vessels and alkaloids but lacking latex; leaves alternate, with stipules, the blades expanded and lobed; flowers terminal, the perianth homogeneous, the tepals white; stamens many, the anthers loculicidal, with rugulate pollen; carpels united, closed, with dormant, non-aromatic seeds.

***Drimys***: plants terrestrial, woody, and upright, without vessels or latex but with alkaloids; leaves alternate, with stipules, the blades expanded and entire; flowers terminal, the perianth homogeneous, the tepals white; stamens many, the anthers loculicidal, with rugulate pollen; carpels united, closed, with dormant, non-aromatic seeds..

***Sanguinaria***: plants terrestrial, herbaceous, and upright, with vessels, alkaloids, and latex; leaves alternate, without stipules, the blades expanded and entire; flowers terminal, the perianth homogeneous, the tepals white; stamens many, the anthers loculicidal, with rugulate pollen; carpels united, closed, with non-dormant, non-aromatic seeds.

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***Amborella***: plants terrestrial, woody, and upright, without vessels, alkaloids, or latex; leaves alternate, without stipules, the blades expanded and entire; flowers terminal, the perianth homogeneous, the tepals white; stamens many, the anthers loculicidal, with psilate pollen; carpels free, open, with non-dormant, non-aromatic seeds

#### The questions:

1. (20 points)

- In the order of the descriptions, list 20 binary (2-state) characters of these plants and give the plesiomorphic (ancestral) and apomorphic (derived) state for each.
- Representing plesiomorphic states by 0 and apomorphic states by 1, construct a data matrix of these 20 characters for the 9 described basal angiosperms.

2. (25 points)

- a) Construct a cladogram for the basal angiosperms from your character matrix using Hennigian analysis or character compatibility and indicate all character state changes on this cladogram. You may find it helpful to include the outgroup, although it will not be graded.
- b) Is there any homoplasy on the cladogram? If so, list the character(s) involved and indicate whether each shows parallelism or reversal.
- c) Are there any autapomorphies? If so, what character(s) is/are involved?

3. (28 points)

- a) Treating the 9 basal angiosperms except for *Amborella* as superorder Magnolianaes, make a formal, strictly cladistic classification of the basal angiosperms using the cladogram and as many of the following ranks as you need: order, suborder, superfamily, family, and subfamily. Make up names of appropriate form where necessary.
- b) Which characters are synapomorphies of each of your proposed families and orders?

4. (41 points)

- a) Construct a matrix of simple matching coefficients from your data matrix.
- b) Construct a single linkage phenogram from this matrix.
- c) Devise a formal phenetic classification for this phenogram using one or more phenon lines and appropriate ranks.
- d) Why does (or does not) this classification differ from the cladistic one?

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114 points total