I. Flowers

The flower may be regarded as a highly modified bisexual strobilus. Modifications in its form are related to the transmission of pollen and the mode of pollination largely determines the form of the flower. All organs of the flower have been drastically modified during the course of evolution, but the outer whorls better retain their leaf-like characteristics. For today's lab, observe as many flowers as you can from the fresh material available from outside and the greenhouse. As you dissect these flowers, consider how their form and function inter-relate and try to observe as many floral reductions, fusions and modifications as possible.

A. Calyx and Corolla

The most leaf-like organs in the flower are the calyx and corolla. How many traces are present? Are traces associated with a gap or interruption of the vasculature? When organs from one floral series fuse, this is called connation and the organs are said to be connate. When organs from different floral series fuse, this is called adnation and the organs are said to be adnate. When fusion occurs at the time the organ is initiated, it is congenital; when it is usually fused at a later stage of development after initiation, it is postgenital. Two spectacularly different flowers to observe are orchids, grasses and Euphorbias. Identify the sepals and petals on these different flowers. Could you clearly differentiate between monocots and dicots? Did you find any sepals or petals in Euphorbia flowers?

B. Androecium

The androecium consists of one cycle or more of stamens, each consisting of a filament and anther sac (morphologically termed, the microsporangium). Although its leaf-like nature is suppressed in most angiosperms, horticulturally-derived plants frequently have sterile stamens, known as staminodes that replace elements of the androecium with petal-like appendages. The staminode can be distinguished by the presence of an abortive anther at the tip of the organ; the edges of the filament are elongated into laminae! The androecial series is frequently fused to preceding series, and numerous terms are applied to different arrangements--some of which are evident in only a single family.

The primitively leaf-like nature is also evident in Drimys, water lilies (Nymphaea) and Magnolia, where the microsporangia are lateral and extend the length of the filament. Microsporangia in the flowering plants are typically simple, but as they mature, the septum between parallel anther sacs breaks down, resulting in a functionally synangiate microsporangium at anthesis.

C. Gynoecium

The least leaf-like series in the flower is the gynoecium, which truly appears leaf-like in the rarest of circumstances--the most commonly available example perhaps being the pea pod or bean, which is a fruit formed by a single carpel (= simple pistil). The carpel is the unit of organization in the female parts, but is so frequently fused into a compound organ that students sometimes get confused on what a carpel looks like and what it represents within the gynoecium. Without some experience, this is not usually immediately evident. The pistil is differentiated into a stigma--the pollen receptive area, a style--the pollen tube transmitting tract and an ovary--the region of the pistil containing the ovules.
As viewed by one major theory, the carpel is clearly represents a derived form of the megasporophyll obtained by a folding of the primitive seed leaf. Unfortunately, this is evident in very few plants, the most notable of them being in the woody Ranales, in the families Winteraceae and Degenariaceae--families also noteworthy in lacking vessels. Observe fixed or fresh flowers of Drimys, a member of the Winteraceae. What is the phyllotaxis of the floral parts of this plant? How many sepals? petals? anthers? carpels? Is there any fusion of floral parts evident in this flower? Can you see the conduplicate suture in this plant? the stigmatic crest? What is the path of pollen tubes in this plant?

Observing more complicated plants, it is possible to follow the means by which the carpels fused to give rise to the compound pistil. Usually, the attachment of the ovules to the interior of the carpel--known as the placentation gives a clue. Placentation is usually termed axile, parietal, basal or free central. *Axile* placentation results when the carpels fuse near their sutures; *parietal* placentation results when carpels fuse in the opposite orientation. *Basal* and *free-central* placentation involve the elimination of septae between carpels and is a derived characteristic. *Laminar* placentation, seen in genera like Drimys, is quite primitive and present in few plants. In a compound pistil, its multiple nature is usually reflected in the organization of the stigma (# of lobes = number of carpels), the symmetry of the style and the organization and vasculature of the ovary. In compound ovaries with septae, each locule corresponds to one carpel.

The location of the ovary relative to the sterile cycles determines whether it is *hypogynous*, with a superior ovary, *perigynous* with a fused *hypanthium* or *epigynous*, displaying an inferior ovary. Examine floral representatives available to determine their pattern of organization, placentation and means of carpel fusion. When you examine a representative of the epigynous ovary, determine what floral organs are fused in order to form the hypanthium. Are these connate or adnate? Congenitally or postgenitally fused?

### II. Inflorescence types

Inflorescence types determine the appearance of the fertile area of the plant to potential pollinators and therefore may be as important as floral morphology in certain pollination strategies. These types are defined traditionally as being either determinate or indeterminate (closed and open types, respectively) based on the rapidity with which the floral apex disappears and is used up and whether the stem forms a terminal flower. Determinate inflorescences may terminate more quickly resulting in an immediate and showy display, whereas indeterminate inflorescences may bloom for weeks, presenting flowers at all stages of development at a given time.

A. **Determinate types**

These end in the formation of a flower and are classified as closed types. The main types of determinate inflorescences are classified as *solitary*, *clusters* or *cymes*.

B. **Indeterminate types**

These do not terminate in flowers and are classified as open types. The main types are *racemes*, *spikes*, *catkins*, *heads*, *corymb*, *umbels* and *panicles*. These are terms that are useful for identification of plants, but do not have any implied morphological relationship. Examine available specimens and classify them.
MAJOR INFLORESCENCE TYPES

1. Inflorescence determinate ................................................................................................. 2
   Inflorescence indeterminate .......................................................................................... 6

2. Inflorescence of only one flower (solitary) ................................................................. 3
   Inflorescence of more than one flower ......................................................................... 4

3. Inflorescence terminates a major axis ........................................................................... 5
   Inflorescence terminates a non-major axis .................................................................. cluster

4. Branching in more than one direction .......................................................................... 6
e Branching one-sided ..................................................................................................... scorpioid cyme

5. Secondary axis absent ................................................................................................... 7
   Secondary axis present .............................................................................................. 13

6. Inflorescence forms linear series .................................................................................. 8
   Inflorescence forms circular series ............................................................................... 12

7. Peduncle present ......................................................................................................... raceme
   Peduncle reduced (inflorescence sessile) ...................................................................... 9

8. Axis erect and slender .................................................................................................. 10
   Axis not erect or slender ............................................................................................ 11

9. Flowers not reduced ..................................................................................................... spike
   Flowers reduced ......................................................................................................... spikelet

10. Axis not fleshy ............................................................................................................. catkin
    Axis fleshy ................................................................................................................ spadix

11. Inflorescence sessile .................................................................................................... head
    Inflorescence pedunculate ........................................................................................ corymb

12. Inflorescence whorled on primary axis ........................................................................ 14
    Inflorescence not whorled on primary axis ............................................................... 15

13. Tertiary axis absent .................................................................................................... umbel
    Tertiary axis present ............................................................................................... compound umbel

14. Secondary axis determinate ...................................................................................... paniculate cyme
    Secondary axis indeterminate ................................................................................ 16

15. Branches all on one side ............................................................................................. secondary panicle
    Branches in more than one direction ........................................................................ panicle