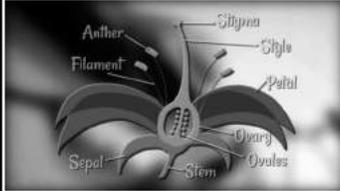


1

Magnoliophyta - Flowering Plants

Introduction to Angiosperms

- "angio-" = vessel; so "**angiosperm**" means "**vessel for the seed**" [seed encased in ovary and later fruit]
- Dominant group of land plants and arose about 140 million years ago – Jurassic/Cretaceous
- 275,000+ species – diverse!
- Co-evolved with animals and fungi



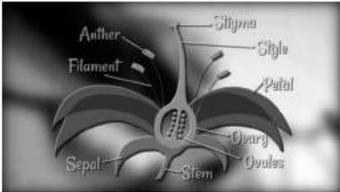

violet flower & fruit

2

Magnoliophyta - Flowering Plants

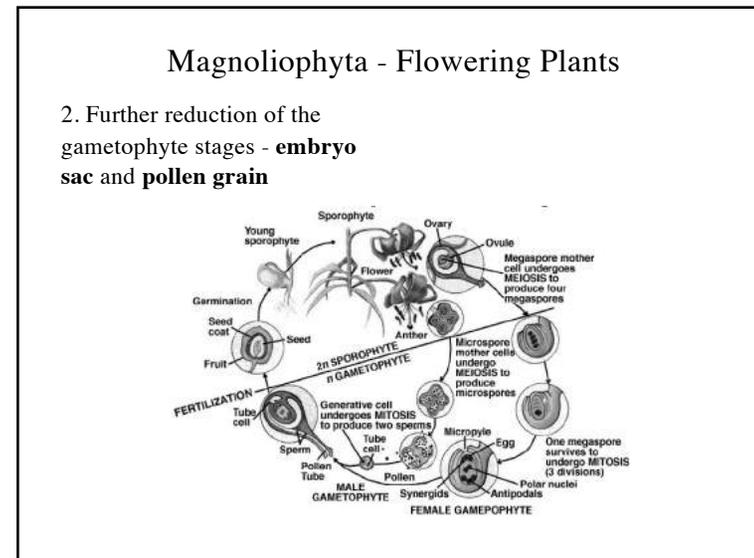
4 Features Define Angiosperms

1. Possession of **flowers** – with stamens and ovaries – ovary(ies) becomes a **fruit**




violet flower & fruit

3



4

Magnoliophyta - Flowering Plants

2. Further reduction of the gametophyte stages - **embryo sac** and **pollen grain**

3. **Double fertilization**: the sperm cell has two nuclei – **zygote** and **endosperm**;

Double Fertilization

Antipodale
Polar nuclei
Egg cell
Synergide
Release of sperm cells
Zygote (2n)
Double fertilization
Endosperm (3n)

corn seed
endosperm

bean seed
cotyledons-
endosperm

pink lady-slipper seeds with NO endosperm

5

Magnoliophyta - Flowering Plants

4. **Vessel elements** in xylem - efficient water conducting cells

Tracheid (functions in both support and water transport)

Vessel elements (specialized for water transport)

Fiber cell (specialized for support)

Cross section of young American basswood

6

Magnoliophyta - Flowering Plants

Classification of Angiosperms

Relationships of flowering plants are now well known based on DNA sequence evidence - **APG** (Angiosperm Phylogeny Group) classification system is standard.

Changes in families (names and genera) have been common in recent years!

Field Manual of Michigan Flora has most up-to-date (generally)

Basal Angiosperm Phylogeny
APGIII - 2009

Euroids
Ceratophylales
Mimosocots
Magnoliales
Laurales
Caneliales
Piperales
Chloranthales
Austrobaileyales
Nymphaeales
Amborellales
Gymnosperms

7

The Flower

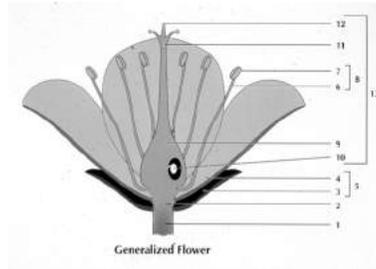
- The outstanding and most significant feature of the flowering plants is the **flower**
- Understanding floral structure and names of the parts is important in recognizing, keying, and classifying species, genera, families.

Flower: highly **specialized shoot = stem + leaves**

from Schleiden 1855

8

The Flower



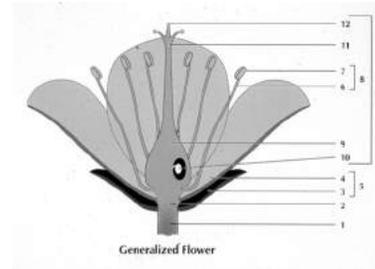
1. **Peduncle:** floral stalk, the stem supporting the flower; sometimes referred to as the **pedicel**

2. **Receptacle:** modified floral stem or axis from which arise the floral appendages or modified leaves

3. **Sepal:** the outer most whorl of leaves, typically green and protect the inner floral parts in buds; collectively all sepals are called the **calyx [CA]**

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The Flower

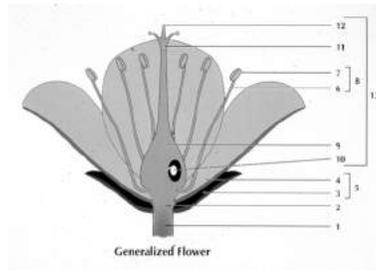


4. **Petal:** the second whorl of leaves, typically brightly colored and assist in attracting pollinators, collectively called the **corolla [CO]**

5. **Perianth:** collective term for sepals and petals [**P**]; if perianth parts cannot be differentiated into sepals and petals, that is, they look so much alike, then they are called **tepals**

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The Flower



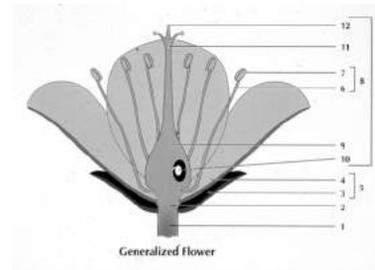
6. **Filament:** slender stalk of the stamen supporting the anther; permits exsertion of pollen out of flower

7. **Anther:** fertile portion of stamen that dehisces to release **pollen grains**; composed of **anther sacs**

8. **Stamen:** the male structure of flower comprising filament and anther; collectively, all the stamens are referred to as the **androecium** (= 'house of males') [**A**]

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The Flower



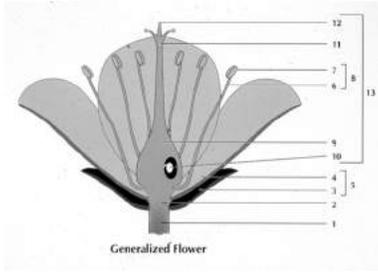
9. **Ovary:** basal portion of pistil that contains ovules; at maturity becomes fruit with seeds

10. **Ovules:** fertile portions of pistil that contain female gametophyte (embryo sac); develop into seeds after fertilization

13. **Pistil:** flask-shaped, female structure comprising three main parts; often referred to as **carpel(s)**; all pistils (1 or more) are referred to as the **gynoecium** (= 'house of females') [**G**]

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The Flower



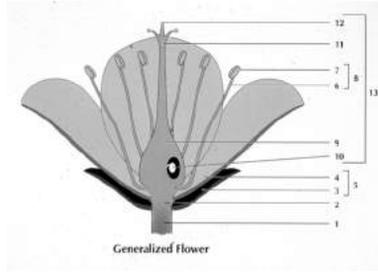
11. **Style:** slender stalk of pistil above ovary that the pollen tubes must pass through to reach eggs in ovules

12. **Stigma:** receptive portion at top of style that receives and recognizes pollen

13. **Pistil:** flask-shaped, female structure comprising three main parts; often referred to as **carpel(s)**; all pistils (1 or more) are referred to as the **gynoecium** (= 'house of females') [G]

13

The Flower

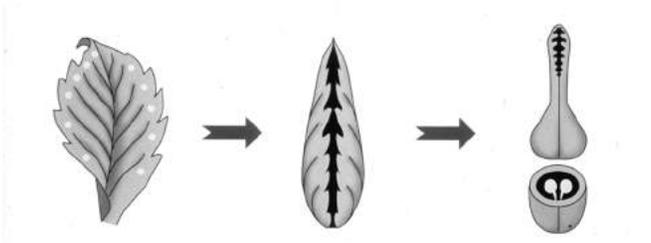


What is the difference between the pistil and the carpel?

13. **Pistil:** flask-shaped, female structure comprising three main parts; often referred to as **carpel(s)**; all pistils (1 or more) are referred to as the **gynoecium** (= 'house of females') [G]

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The Flower



1 floral 'leaf' in gynoecium Folded 'leaf' 1 carpel = 1 pistil

This gynoecium is **monocarpic** (one carpel)

15

The Flower

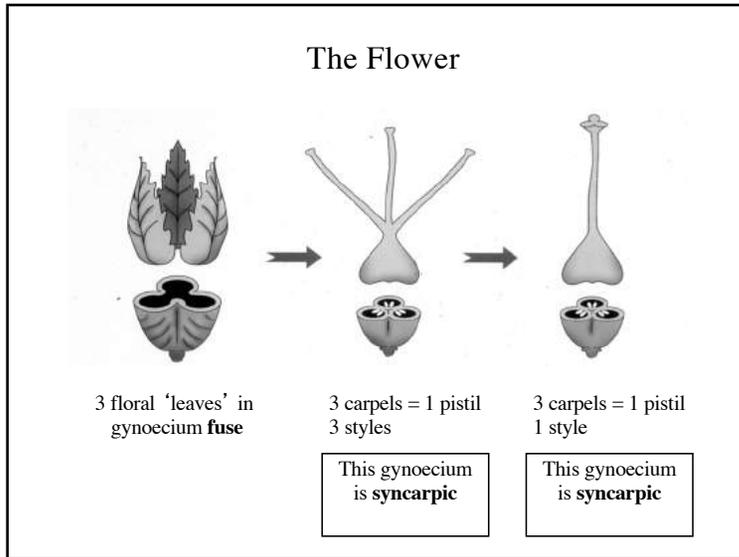
- If 2 'leaves' in one flower each **separately** form carpels,
- then the flower has 2 carpels and 2 pistils,
- gynoecium is **apocarpic (separate carpels)**



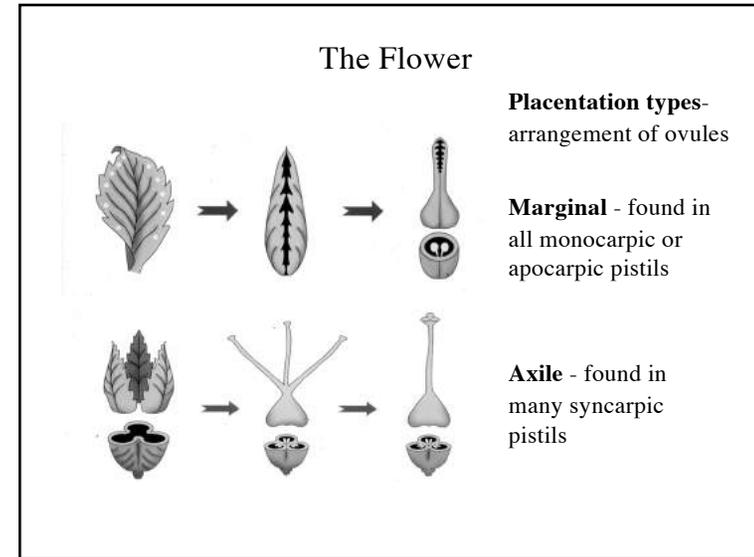
Caltha palustris - Marsh marigold

9 fruits (pistils) from 1 flower
Gynoecium is **apocarpic** with 9 carpels or 9 pistils

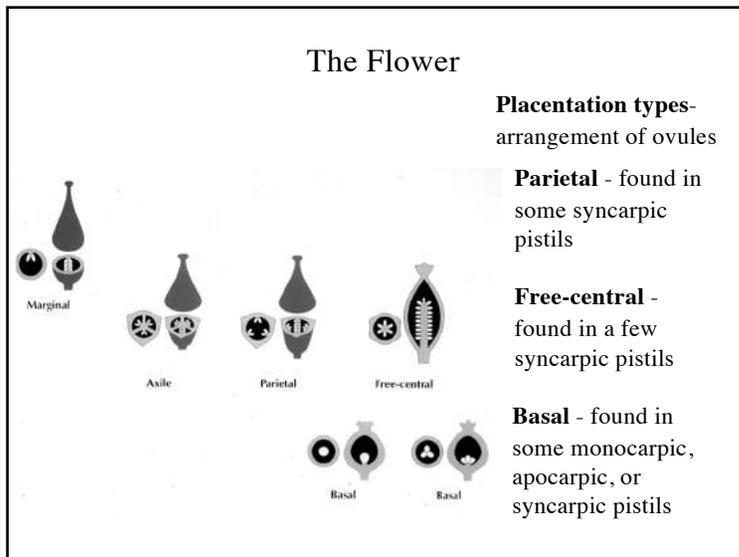
16



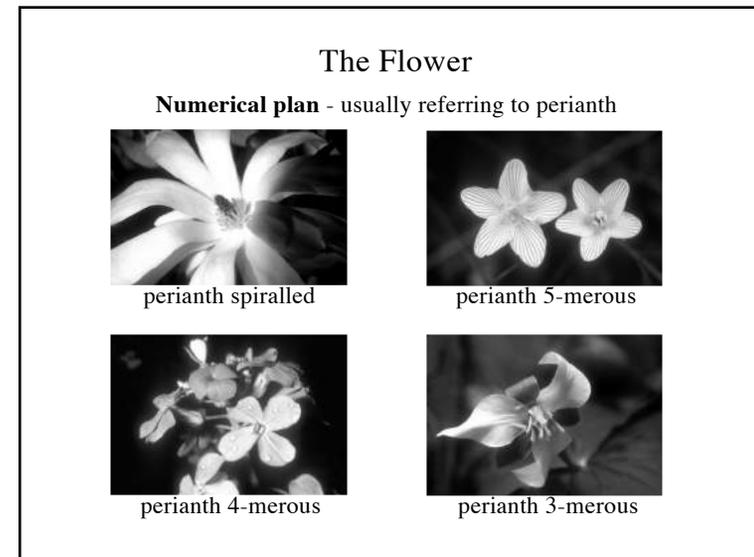
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18



19



20

The Flower



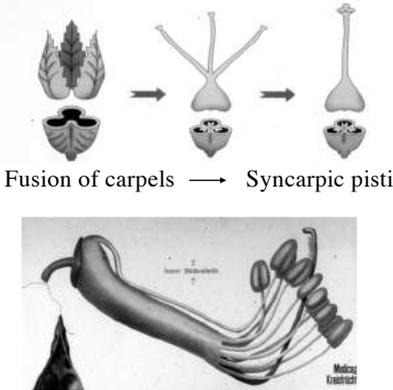
Symmetry

Flowers radially symmetrical
Flowers **actinomorphic**

Flowers bilaterally symmetrical
Flowers **zygomorphic**

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The Flower



Fusion of carpels → Syncarpic pistil

Fusion of stamens → Staminal tube

Fusion

1. Connation: fusion of floral parts from the same whorl



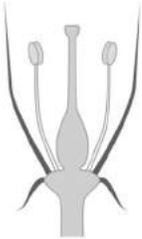
Fusion of petals → Corolla tube petals

22

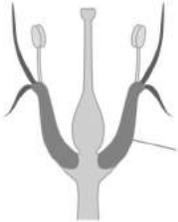
The Flower

2. Adnation: fusion of floral parts from different whorls

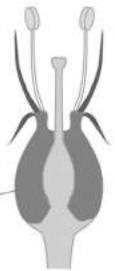
Fusion



Ovary superior
Flower hypogynous
No hypanthium



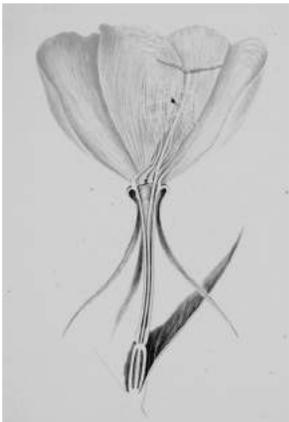
Ovary superior
Flower perigynous
Hypanthium present



Ovary inferior
Flower epigynous
Hypanthium present

23

The Flower



Floral formulas

$$CA^4 \quad CO^4 \quad A^8 \quad G^4$$

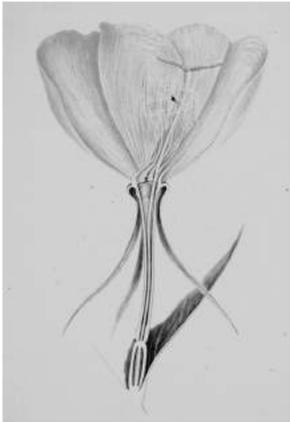
4 sepals (CAlyx)
4 petals (COrolla)
8 stamens (Androecium)
4 carpels (Gynoeecium)

Oenothera biennis
Evening primrose

24

The Flower

Floral formulas



$CA^4 \quad CO^4 \quad A^8 \quad \overset{\circ}{G}^4$ ←

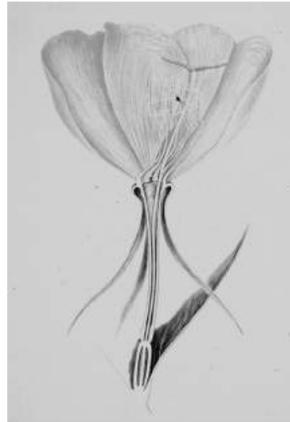
4 sepals (**CA**lyx)
 4 petals (**CO**rolla)
 8 stamens (**Androecium**)
 4 carpels (**Gynoecium**)
 Carpels fused = 1 pistil

Oenothera biennis
Evening primrose

25

The Flower

Floral formulas



$CA^4 \quad CO^4 \quad A^8 \quad \overset{\downarrow}{\overset{\circ}{G}}^4$

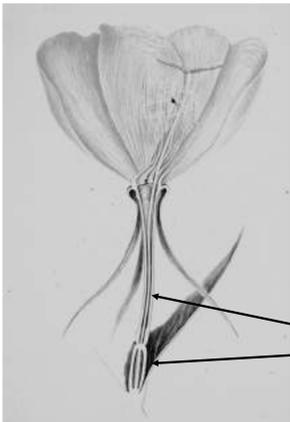
4 sepals (**CA**lyx)
 4 petals (**CO**rolla)
 8 stamens (**Androecium**)
 4 carpels (**Gynoecium**)
 Carpels fused = 1 pistil
 Ovary inferior

Oenothera biennis
Evening primrose

26

The Flower

Floral formulas



$CA^4 \quad CO^4 \quad A^8 \quad \overset{\circ}{G}^4$

4 sepals (**CA**lyx)
 4 petals (**CO**rolla)
 8 stamens (**Androecium**)
 4 carpels (**Gynoecium**)
 Carpels fused = 1 pistil
 Ovary inferior
 Hypanthium
 (+ hypanthium tube)

Oenothera biennis
Evening primrose

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