

Morfologi Tumbuhan: Struktur dan Perkembangan Bunga dan Perbungaan

@santridj





BUNGA

- Merupakan alat perkembangbiakan generatif
- Terdapat pada sebagian tumbuhan berpembuluh → Antophyta
- Tumbuhan
 - Berbunga tunggal → *Zephyranthus roseus*
 - Berbunga banyak → umumnya tbhn



Flower terminology

- A characteristic feature of the angiosperms, the flowering plants, is the grouping of reproductive structures with sterile auxillary ones into a single unit known as the flower.

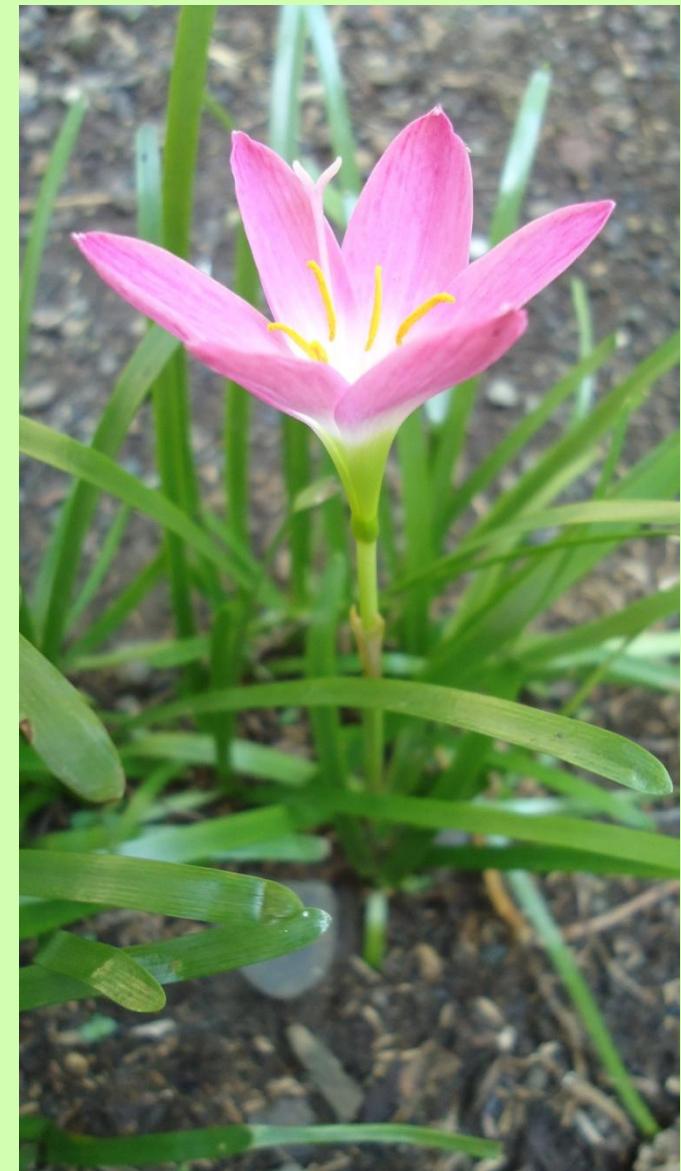


Why Do Plants Have Flowers?

- Flowers are the reproductive structures of plants
- Flowers become fruits
- Fruits contain seeds
- Seeds grow to produce the next generation

Jenis tumbuhan berdasarkan Jumlah Bunga

- Tumbuhan berbunga satu (planta uniflora)
 - *Zephyranthus rosea* Lindl.)





Jenis tumbuhan berdasarkan Jumlah Bunga

- Tumbuhan berbunga banyak (planta multiflora)
 - Umumnya tumbuhan

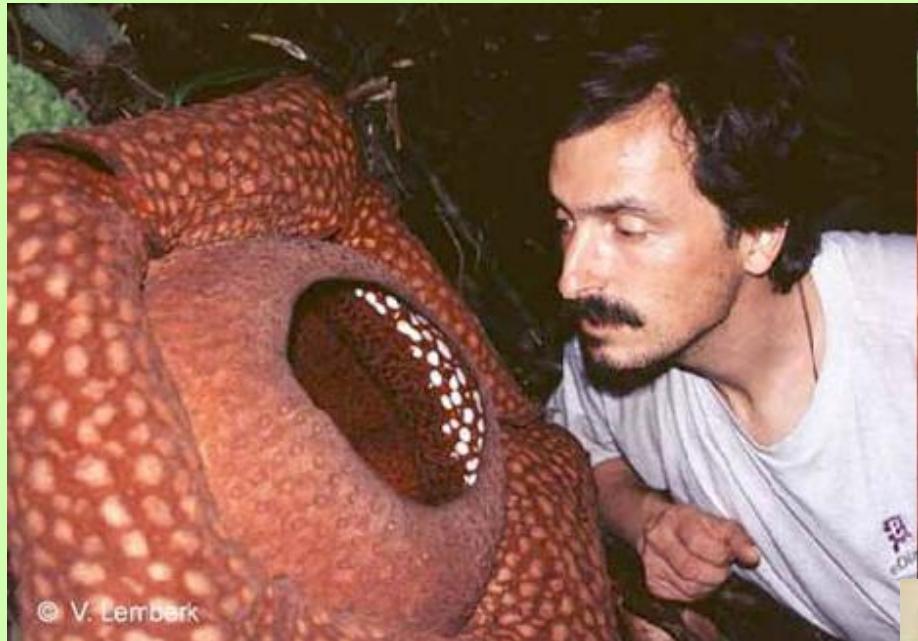


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Does Size Matter?

- The world's largest flower is *Rafflesia arnoldii*, which can be a meter in diameter (over 3 feet) and weigh 11 kg (24 pounds). - [NOTE: Some web sources list the Titan Arum, *Amorphophallus titanum*, as the world's largest flower, but the structure is an inflorescence, not an individual flower.]
- The world's smallest flower is probably *Wolffia globosa*, and the entire plant is less than 1 mm long.



The world's largest flower
is *Rafflesia arnoldii*

The world's smallest flower
is *Wolffia globosa*



Leta Bunga pd Tumbuhan



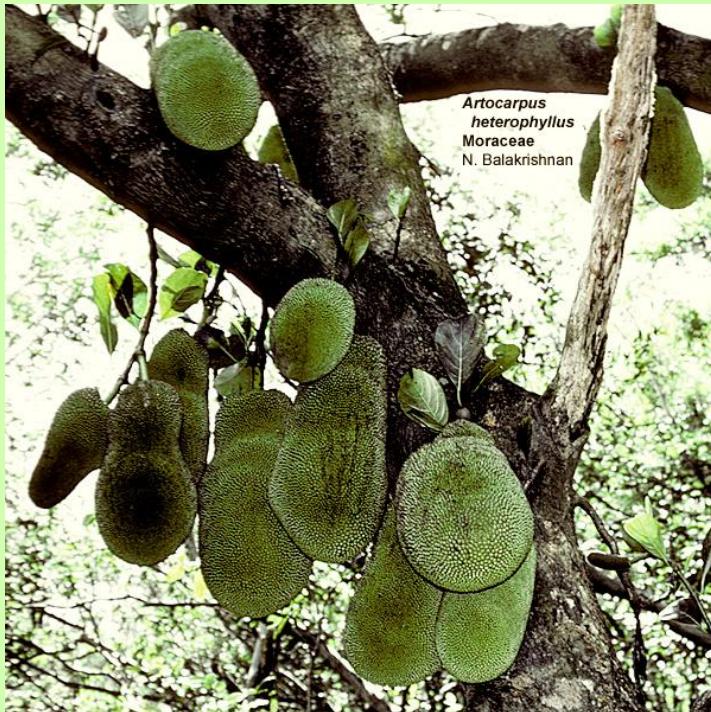
Terminalis
Caesalpinia pulcherrima



Aksilaris/lateralis
Ipomoea batatas L
Clitorea ternatea L.



Letak Bunga pd Tumbuhan

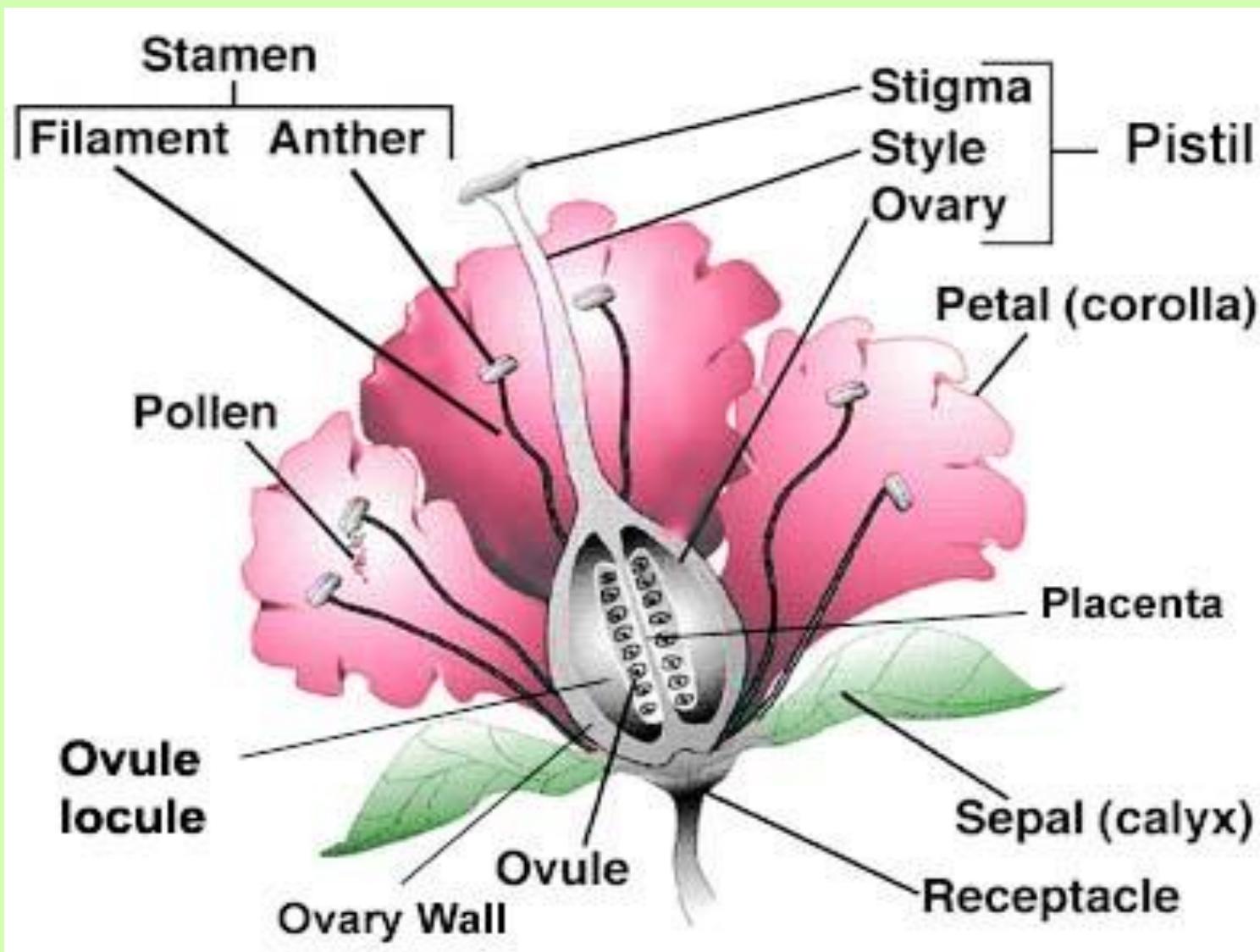


Kauliflorus
Durio zibethinus
Arthocarpus heterophyllus

Epifilus
Epiphyllum hookerii

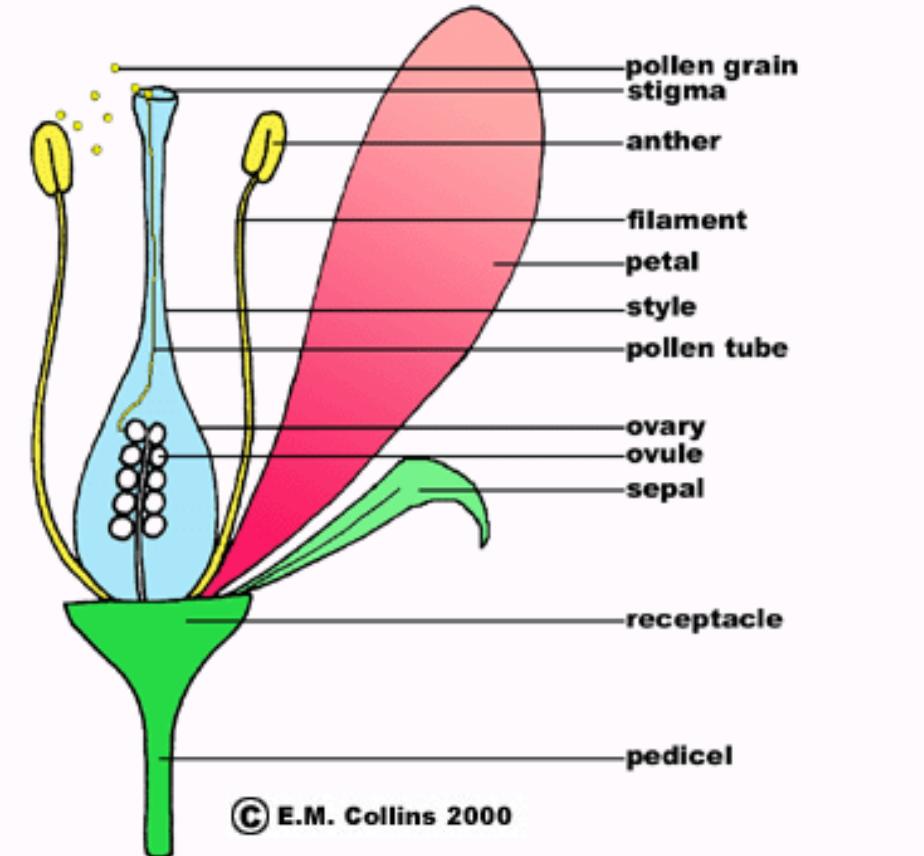
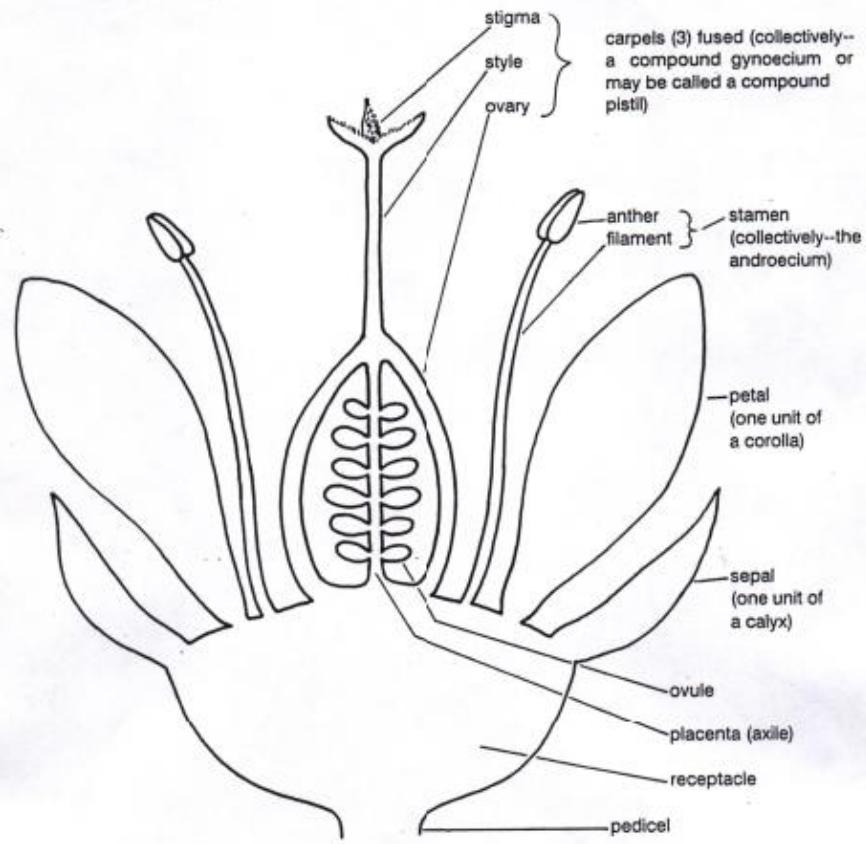


Struktur Bunga (Umum)



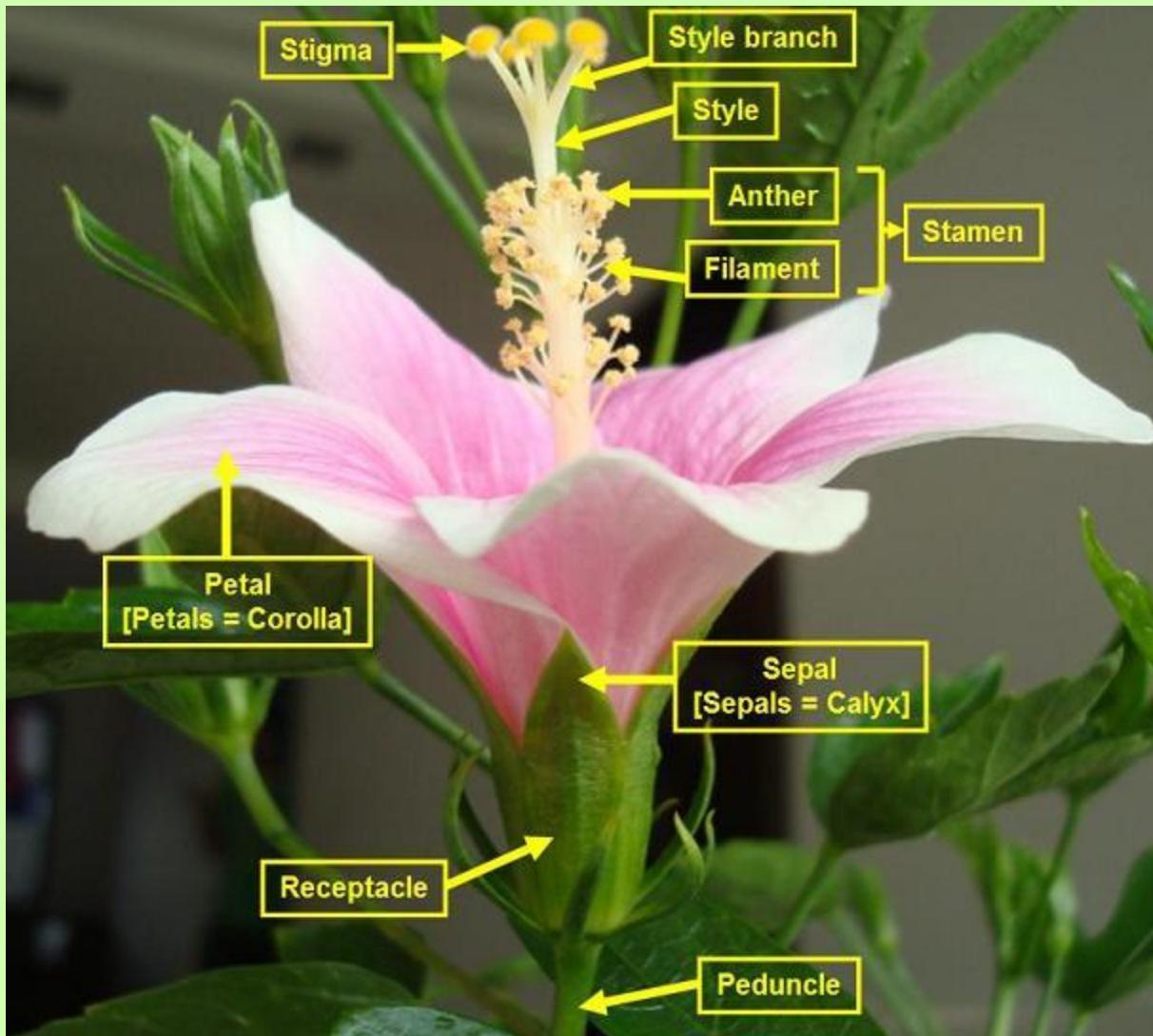


Struktur Bunga (Umum)



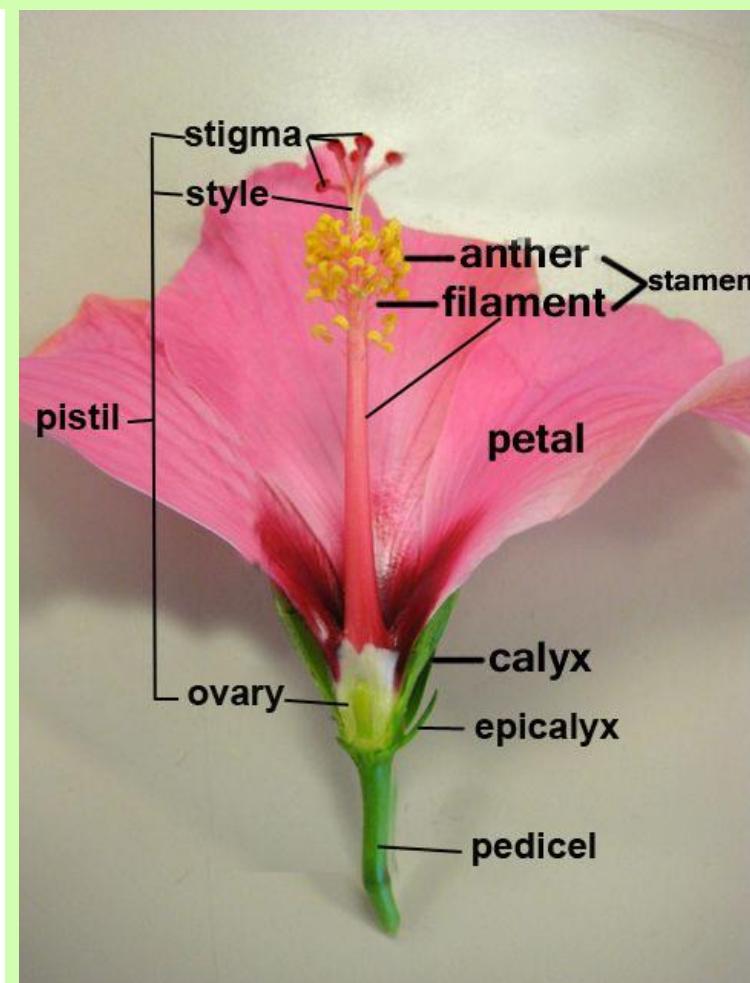
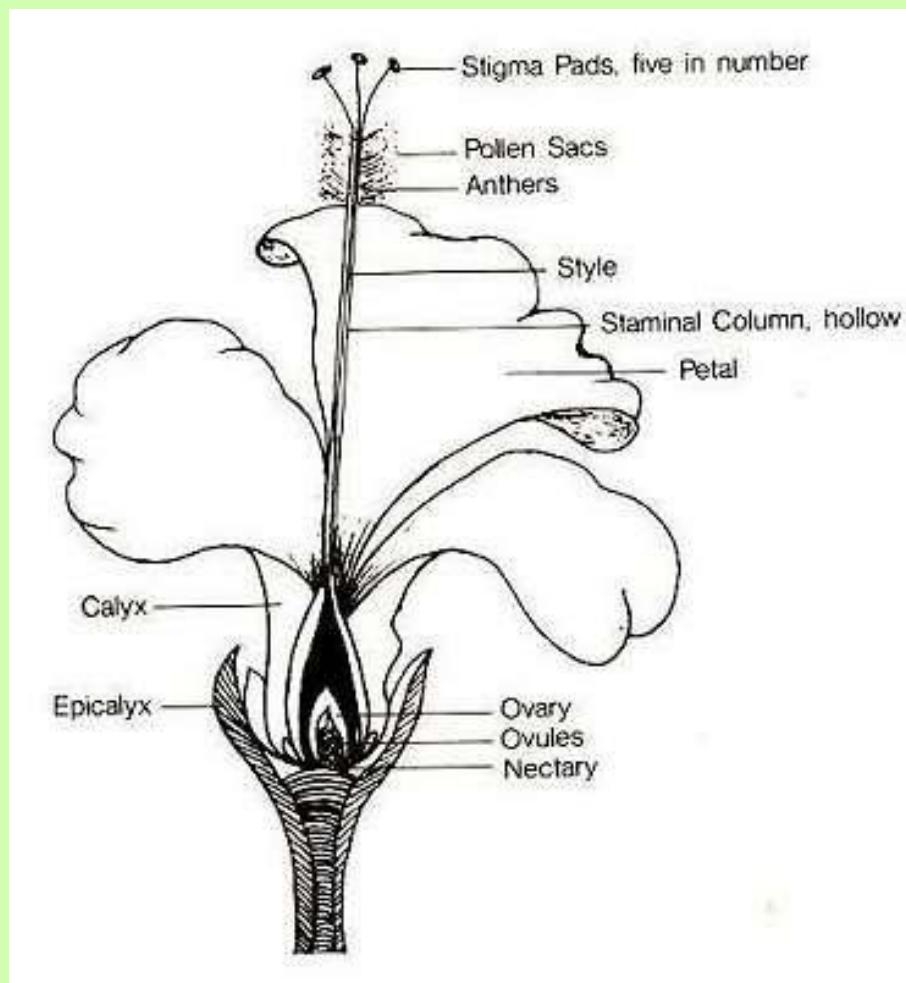


Struktur Bunga Hibiscus





Struktur Bunga Kembang Sepatu (*Hibiscus rosasinensis*)





The Main Part of a Flower Typically has Four Parts



Sepals — often green
protect flower buds
before they open



Petals — often colored,
attract pollinators



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Stamens — “male”
part of flower, produces
pollen

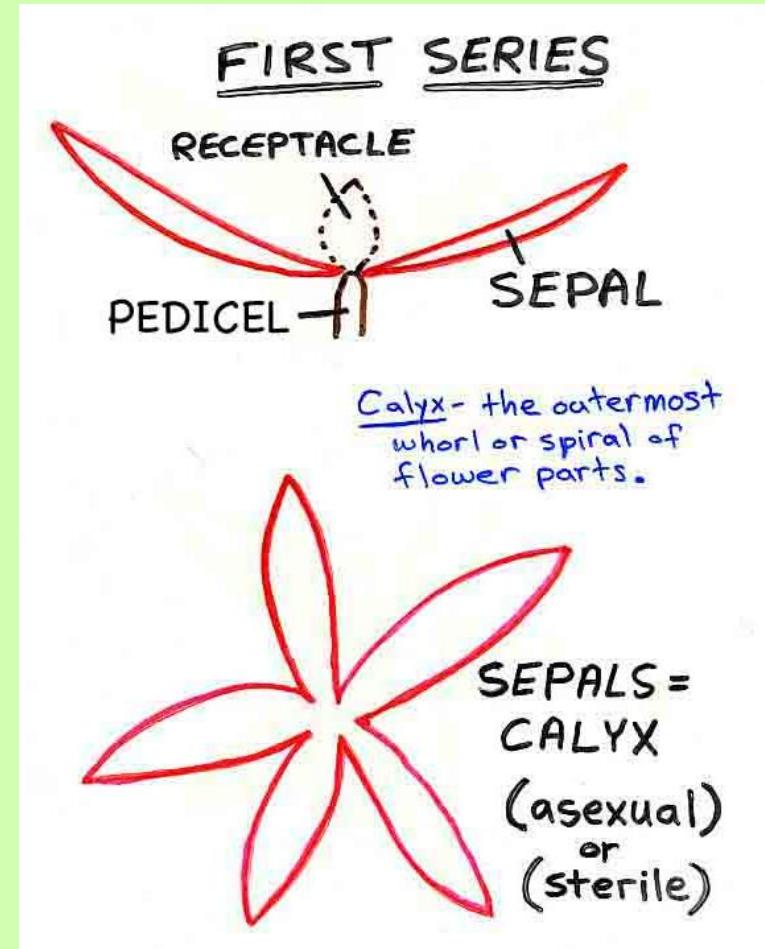


Carpels — “female”
part of flower, contains
ovules



Kelopak Bunga

- First series; the outermost whorl or spiral of a typical flower (asexual/sterile)
- Biasanya gugur pada saat bunga berkembang menjadi buah





- Ada yang persisten seperti pada jambu, terong
- Lobus calyx (sepal) dapat membesar seperti pada *Mussaenda frondosa*
- Pada Malvaceae (*Hibiscus*, *Gossypium*) terdapat epicalyx





12.12.2008



Staminal
column

ovarium

epicalyx

pedicellus

petal

stylus

calyx

ovulum

reseptculum



Tipe Kelopak

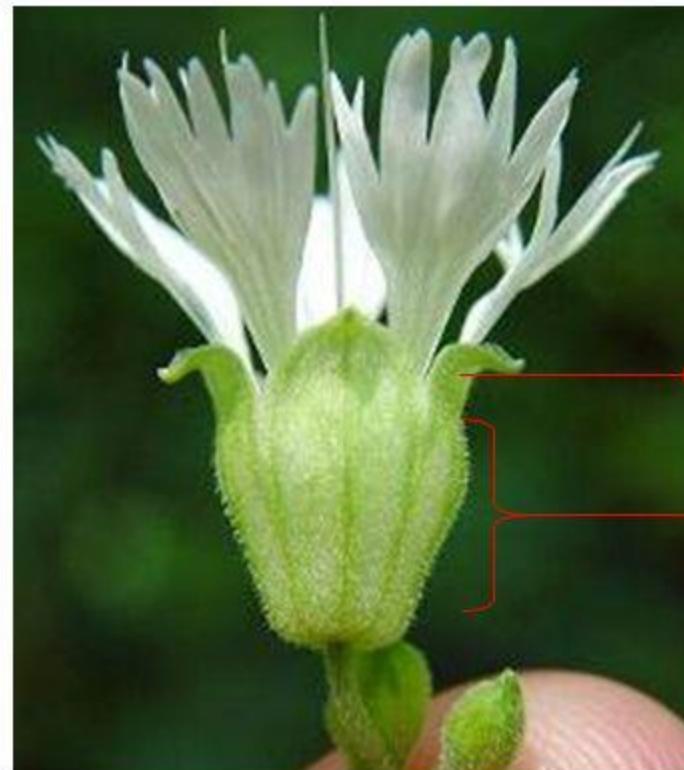
- Berlekatan (gamosepalus)
 - Berbagi, bercangap, berlekuk
- Lepas (polysepalus)

The calyx (K): Totality of sepals in the flower.

Calyx with connate (united) sepals:



Fabaceae flower



Silene spp.

Gamosepalous

Calyx: 1st Whorl of the flower

- It is composed of sepals.
- **Polysepalous:** The sepals are free from each other



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- **Gamosepalous:** The sepals are fused with each other

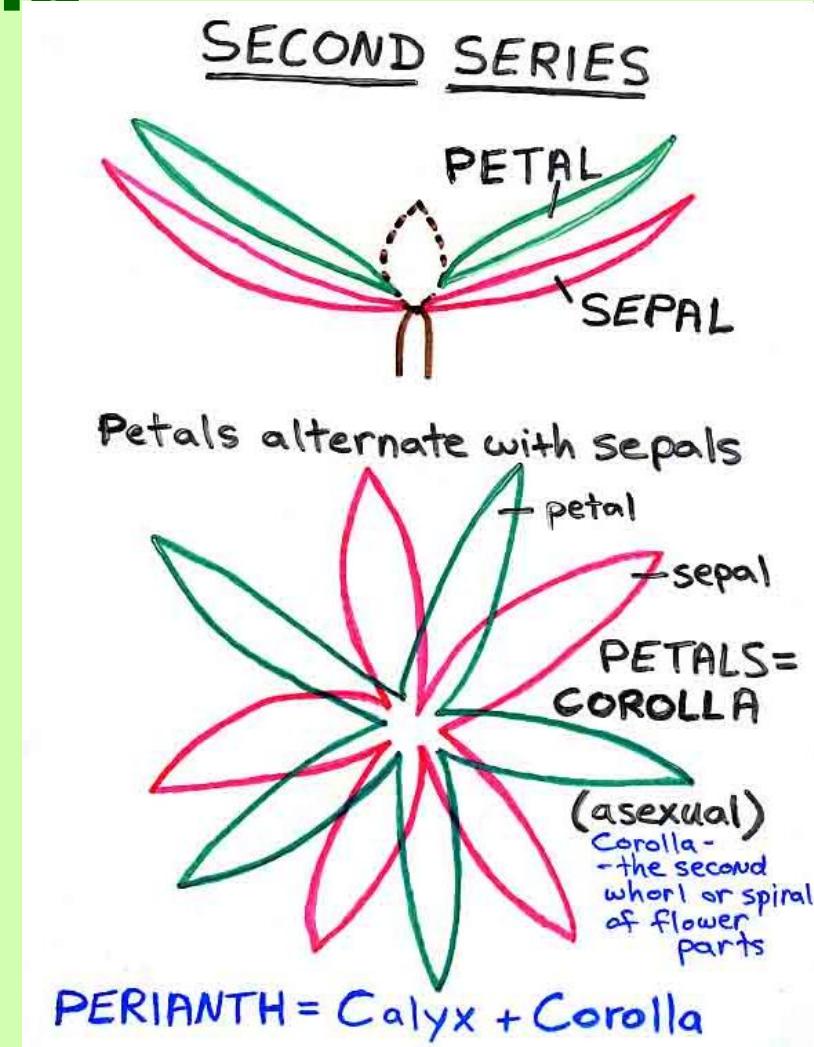


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Corolla

- Petals (corolla) – Second series; the second whorl or spiral of a typical flower (asexual/sterile); petals alternate with sepals
- Perianth – collective term for calyx + corolla





Corolla

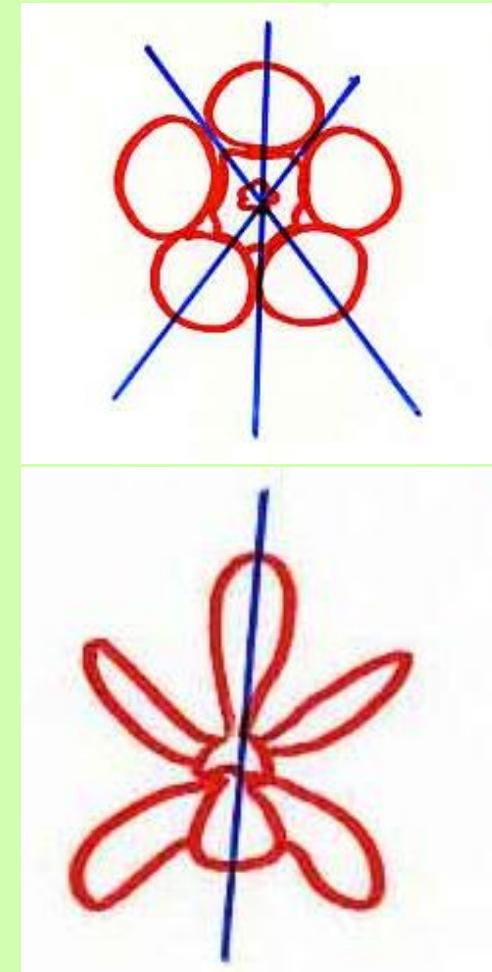
- Terdiri atas petal yang:
 - Berlekatan (Sympetalus, gamopetalus, monopetalus)
 - Limbus
 - Faux
 - tubus
 - Lepas (Choripetalus, dialypetalus, polypetalus)
 - Tidak berpetal (Apetalus)





Tipe corola

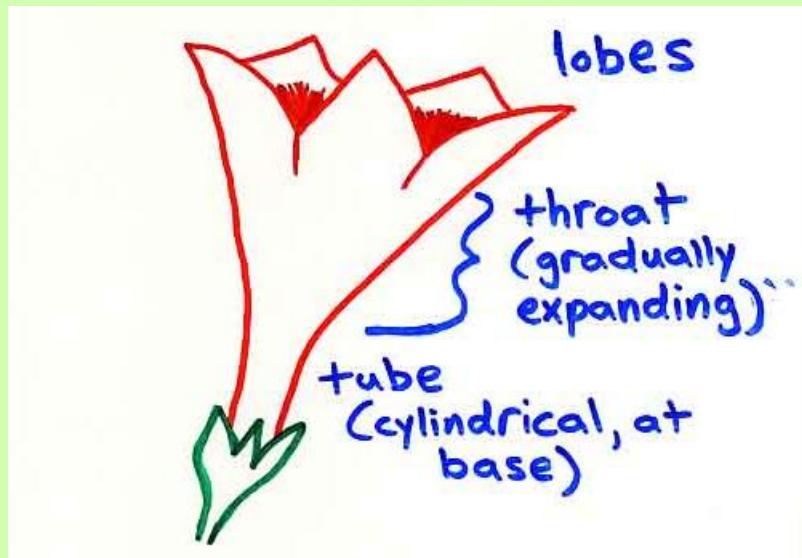
- Simetri Radial (Actinomorphus) *
 - Bintang (rotatus/stellatus)
 - Tabung (tubulosus)
 - Terompet (hypocrateriformis)
 - Mangkuk (urceolatus)
 - Corong (infundibuliformis)
 - L onceng (campanulatus)
- Simetri Bilateral (Zygomorphus) ↑
 - Bertaji (calcaratus)
 - Berbibir (Labiatus)
 - Bentuk kupu-kupu (pappilionaceus)
 - Bertopeng (personatus)
 - Bentuk pita (ligulatus)





Simetri Bunga

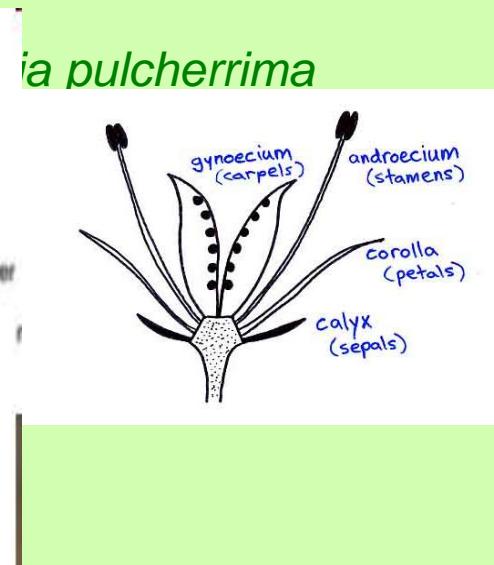
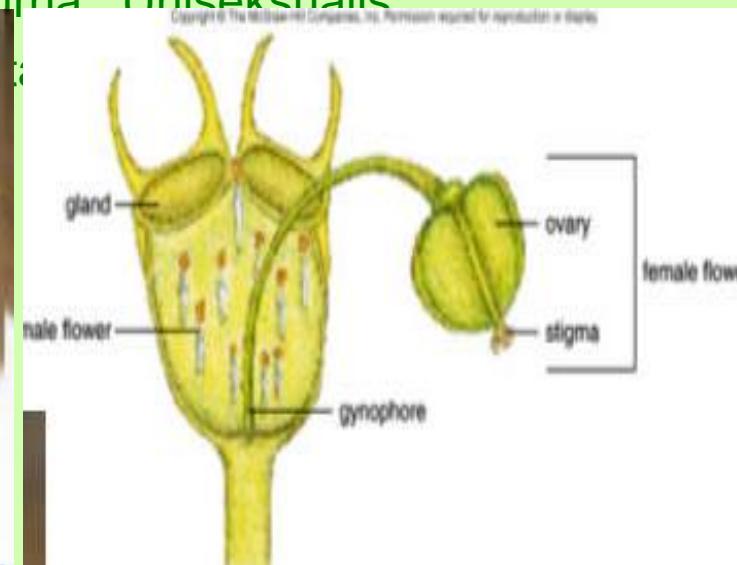
- Asimetris :
 - Canna,
 - Delonix regia
- Zygomorphus / Simetri bilateral (↑)
 - Clitoria ternatea
 - Datura metel
- Actinomorphus / Simetri radial (☀)
 - Solanum torvum





Perhiasan bunga (periantum)

- Bunga Lengkap : Perhiasan bunga lengkap
- Bunga tidak lengkap: salah satu perhiasan bunga tidak ada
- Bunga sempurna : Hermaphrodit
- Bunga tidak sempurna : Uniseksualis
- Bunga sempurna dan tidak lengkap





Tenda bunga (perigonium)

- Tidak bisa dibedakan antara sepal dan petal → tepal
- Contoh :
 - *Michelia champaca* (cempaka)
 - *Gloriosa superba* (Kembang sungsang)





Kelamin Bunga

- Hermaphrodit ♀♂
- Uniseksualis ♀ atau ♂
- Mandul (Steril) jika pada bunga tidak terdapat alat kelamin
 - Bunga tepi pada

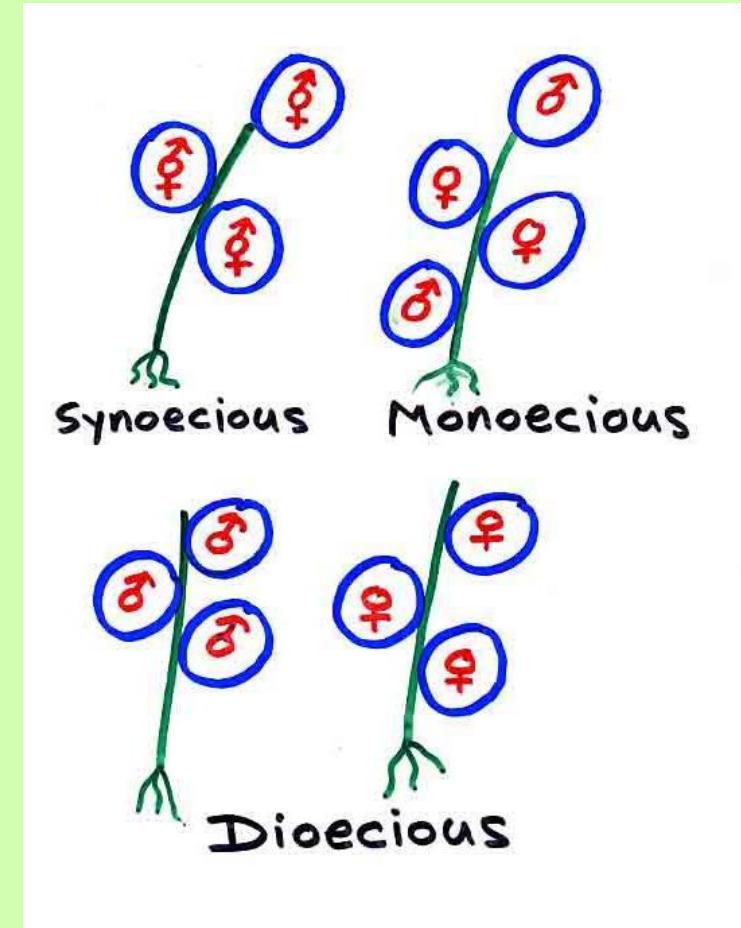


braktea Ovarium bunga tabung Mahkota bunga tabung Ovarium bunga tepi Mahkota bunga tepi



Tipe Tumbuhan Berdasarkan Kelamin Bunga

- Monoecious: Berumah satu (bunga jantan dan betina ada pada satu tumbuhan)
 - Jagung (*Zea mays*)
- Dioecious: Berumah dua (bunga jantan dan betina terpisah pada dua individu tumbuhan)
 - Salak (*Zalacca edulis*)
- Polygamus: Jika pada satu tumbuhan terdapat bunga jantan, bunga betina dan bunga benci sekaligus
 - Pepaya (*Carica papaya*)



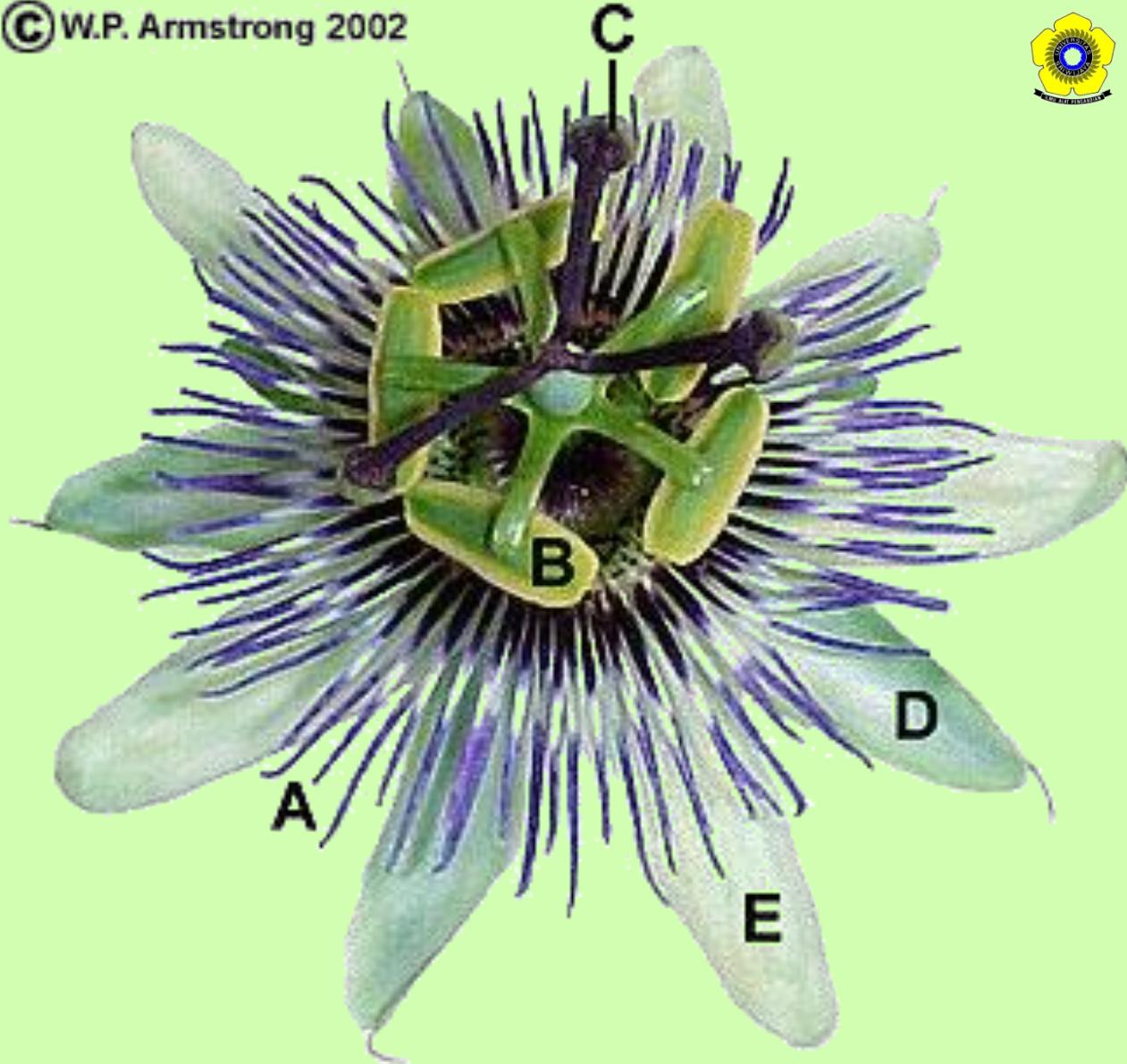


Receptaculum

- Sering termodifikasi menjadi
 - Antofor (*Anyelir / Dianthus caryophyllus*)
 - Androfor (*Gynandropsis pentaphylla*)
 - Ginofor (*Nelumbium nelumbo*)
 - Adroginofor (*Passiflora quadrangularis*)
 - Diskus (*Citrus*)



- Corona
- Anther
- Style
- Sepal
- Petal



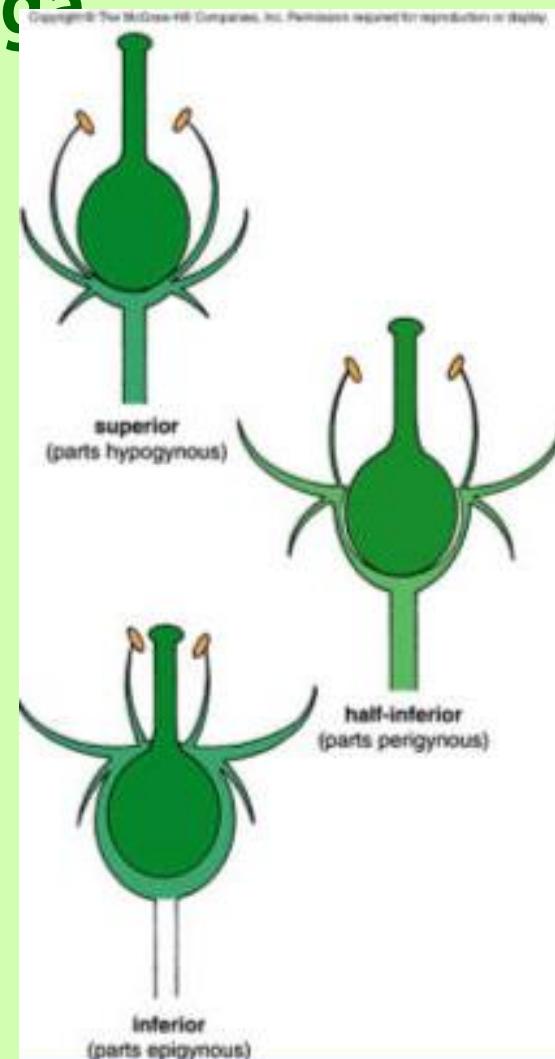


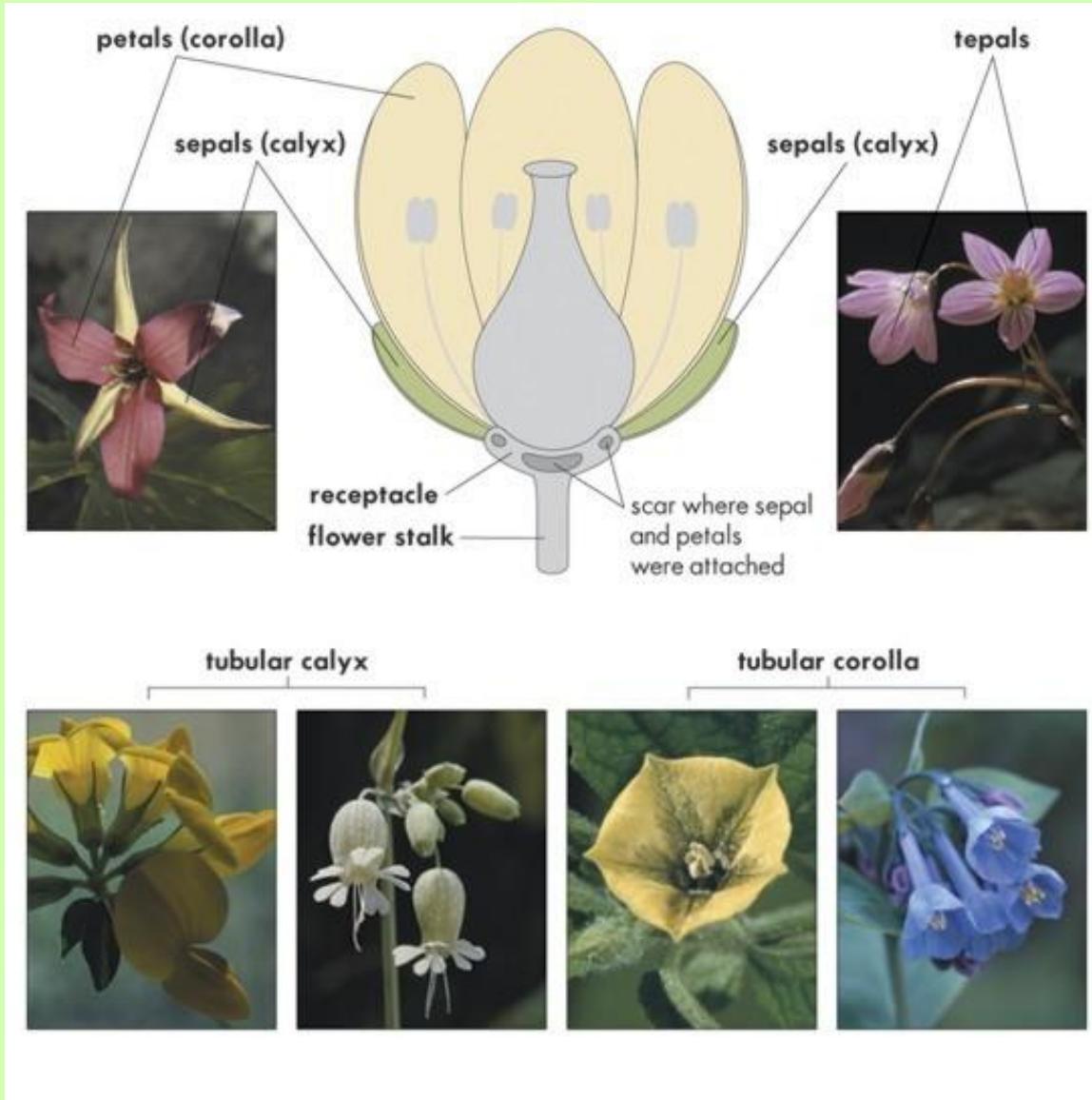
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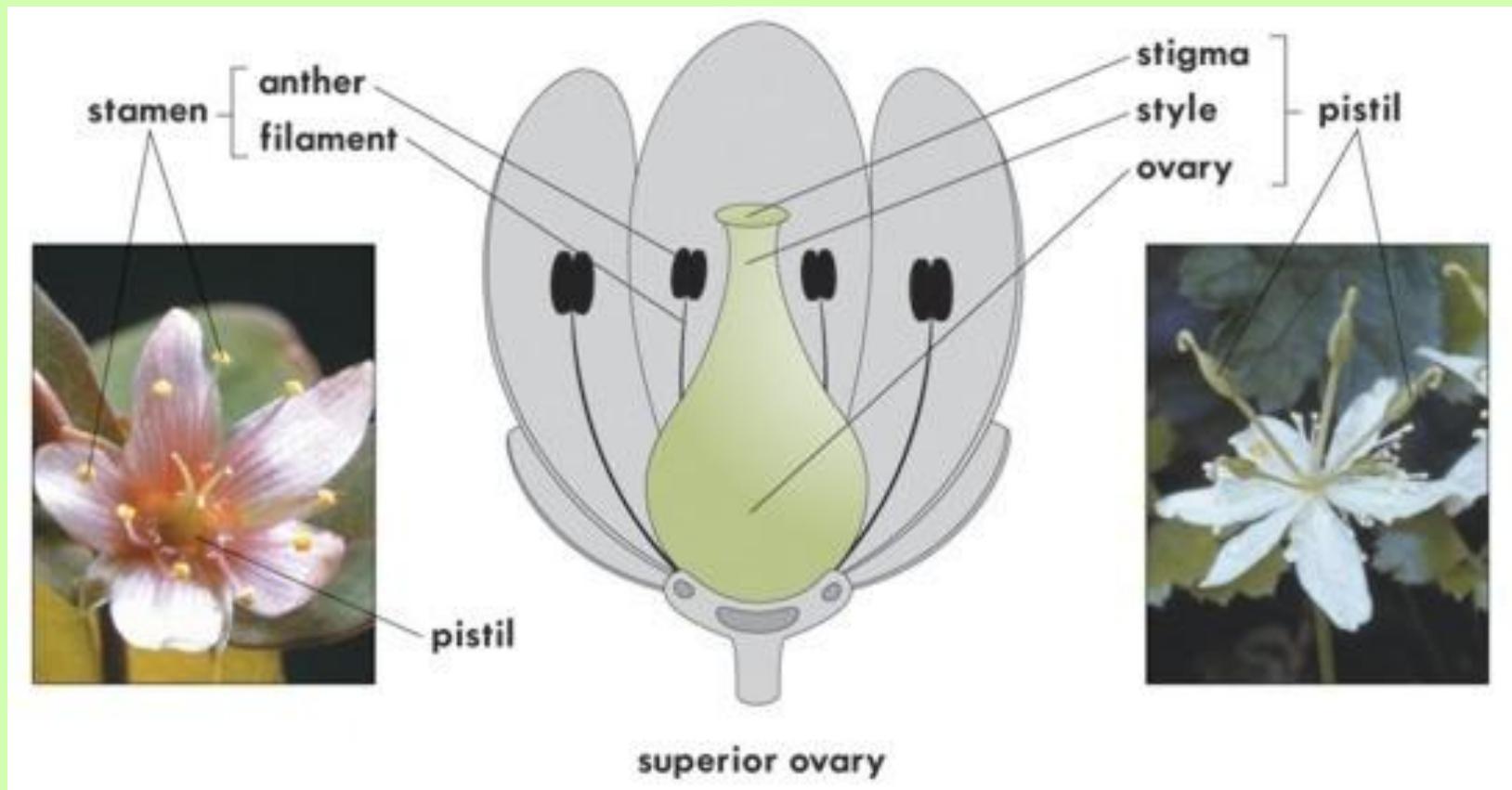


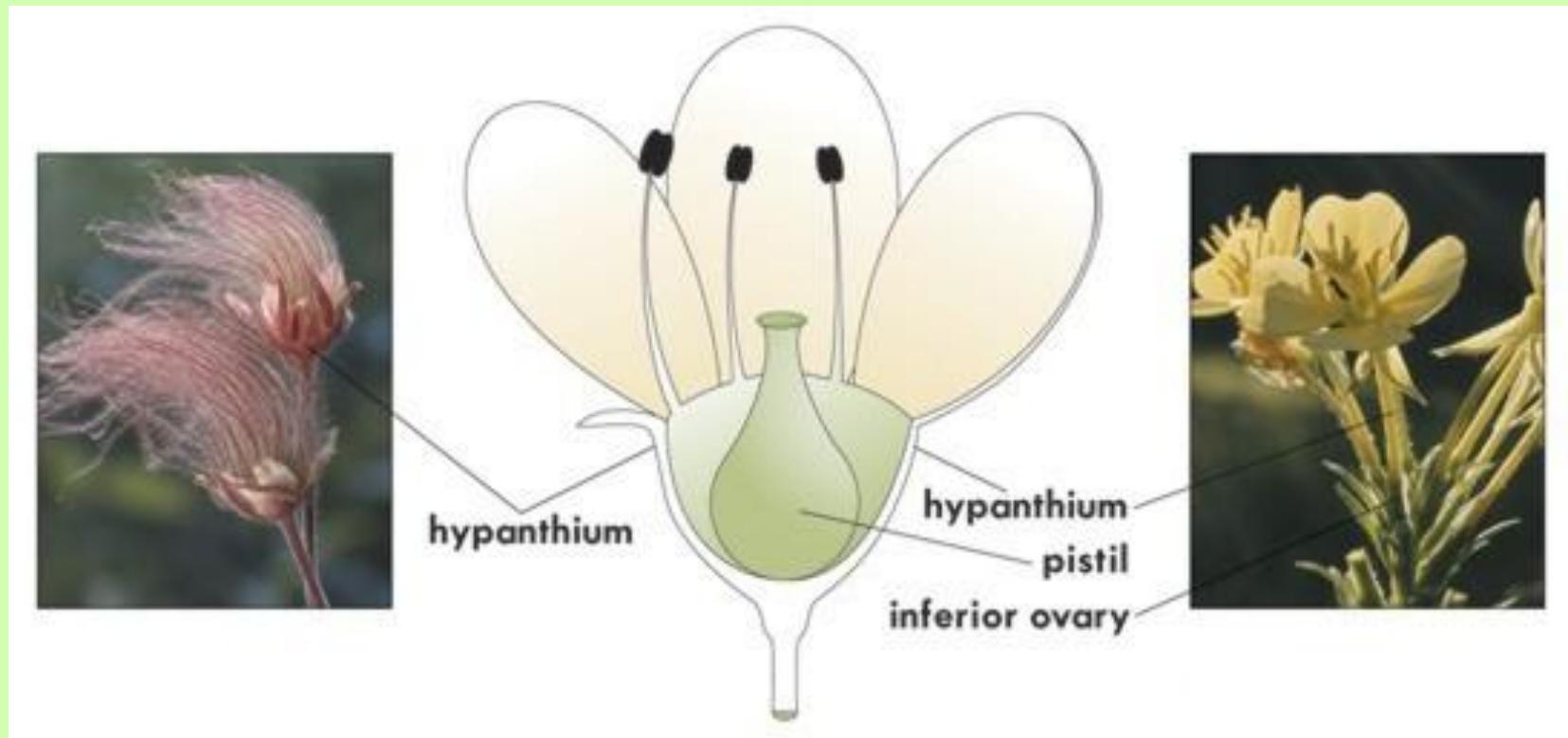
Tipe bunga berdasarkan reseptakulum dan perhiasan bunga

- Hipogynus
 - *Casia siamea*
- Perigynus
 - *Lagerstroemia* sp
- Epigynus
 - *Centela asiatica*





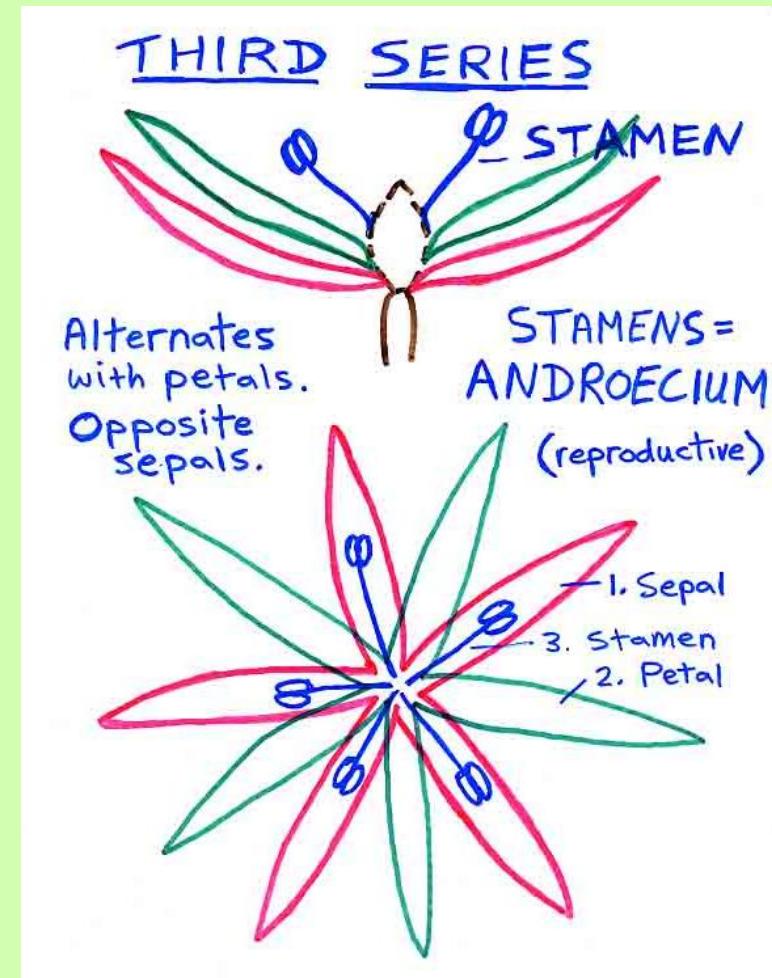






Stamen

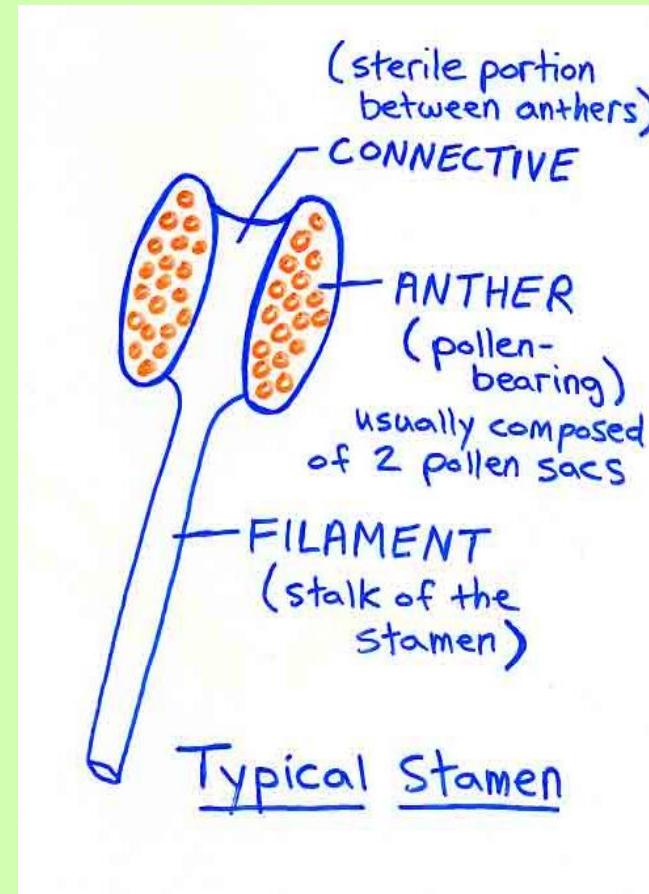
- Stamen(s)
(androecium) –
 - Third series; the third whorl or spiral; the male reproductive unit; stamens alternate with petals and are opposite the sepals





Ada tiga bagian

- Tangkai sari (filamentum)
- Kepala Sari (anthera)
 - Ruang /Kotak sari (theca)
 - Serbuk sari (pollen)
- Penghubung kotak sari (Connectivum)





Letak Stamen pd Bunga

- Pada reseptaculum (jeruk)
- Diatas kelopak (mawar)
- Diatas corolla (*heliotropium indicum*)



Jumlah Benang Sari

- Banyak (Myrtaceae)
- Dlm Dua lingkaran (2x jumlah petal)
- Sama banyak dengan petal
 - Epipetal
 - Episepal
- Didynamus (Labiatae/Lamiaceae)
- Tetradynamus
(Cruciferae/Brassicaceae)



Tangkai Sari / Filamentum

- Monadelphus (satu berkas)
 - *Hibiscus rosasinensis*
- Diadelphus (dua berkas)
 - papilionaceae / fabaceae



Kepala Sari

- Duduk pada tangkai
 - Basifixus
 - Adnatus
 - Versatilis → Graminae



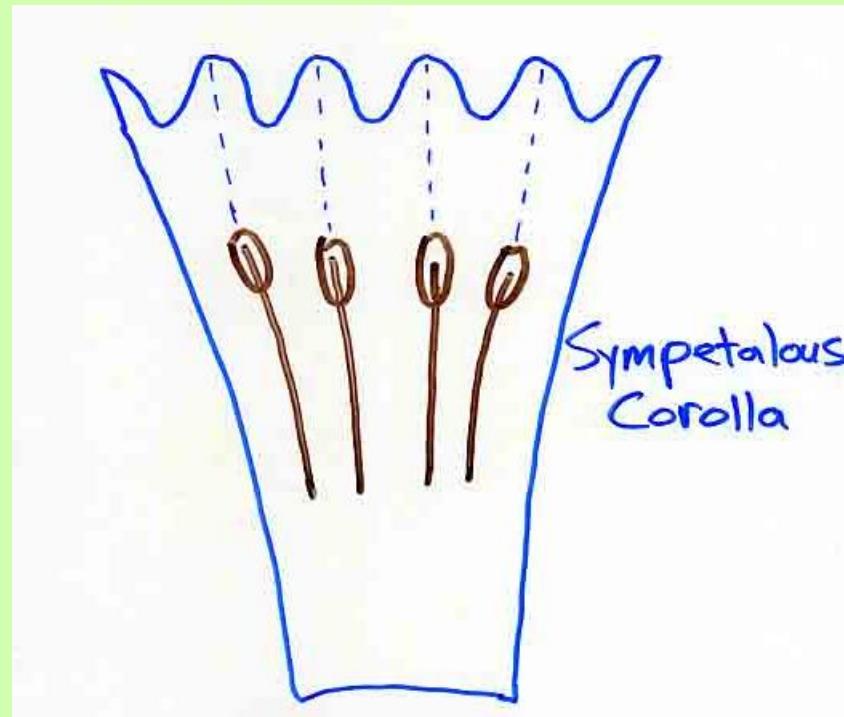
Membukanya kepala sari

- Celah membujur (longitudinal dehiscent); contoh: *Helianthus annuus*, *Begonia* spp.
- Cerah melintang (transversal dehiscent); contoh; Euphorbiaceae
- Lobang pada pangkal (poro dehiscent); Contoh: *Solanum tuberosum* (Solanaceae)
- Katup (valvi dehiscent) contoh: *Citrus* spp., *Rubus* spp.



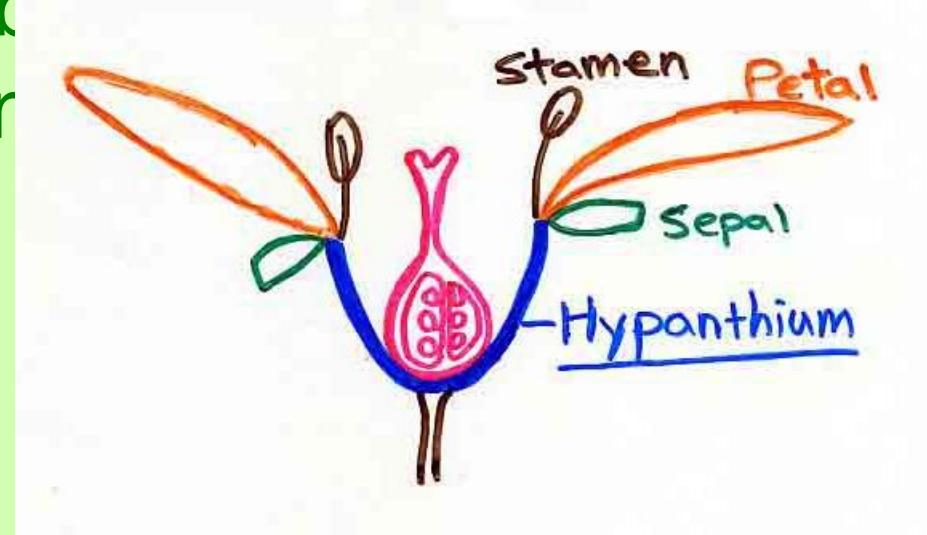
istilah

- Staminodium (benang sari yang steril)
- Staminodium petaloid (benang sari yang termodifikasi menjadi petal)
- Staminal colum (tangkaisari bersatu berbentuk tabung)
- Epipetalous – stamens adnate to corolla (*Alamanda cathartica*).





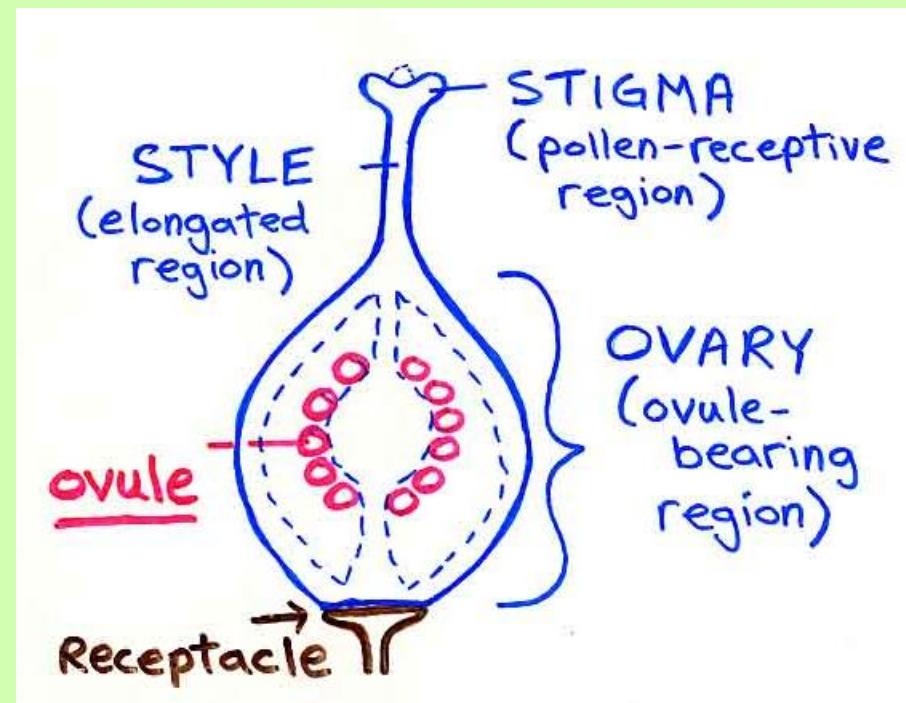
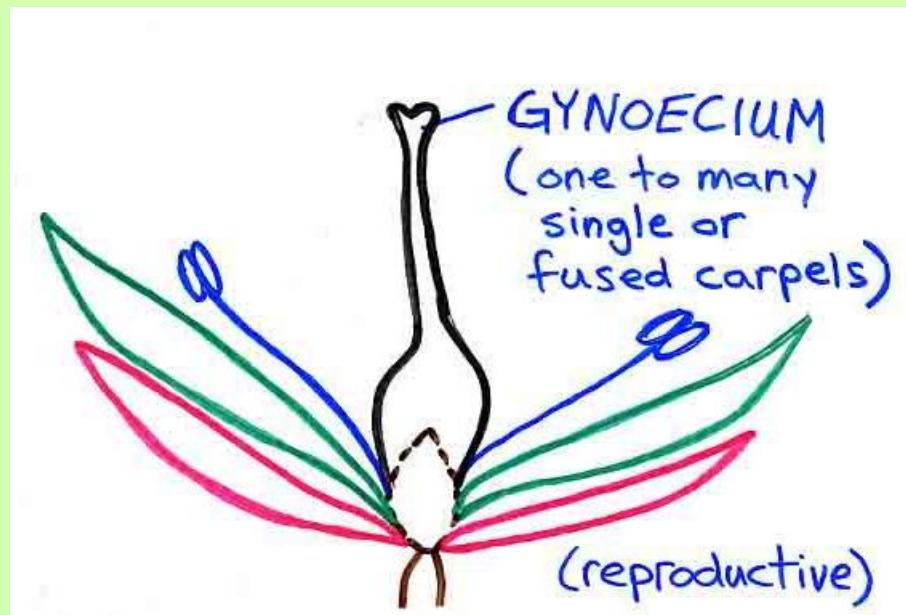
- Hypanthium (floral cup) – a structure derived by the adnation of the perianth bases and shaped.





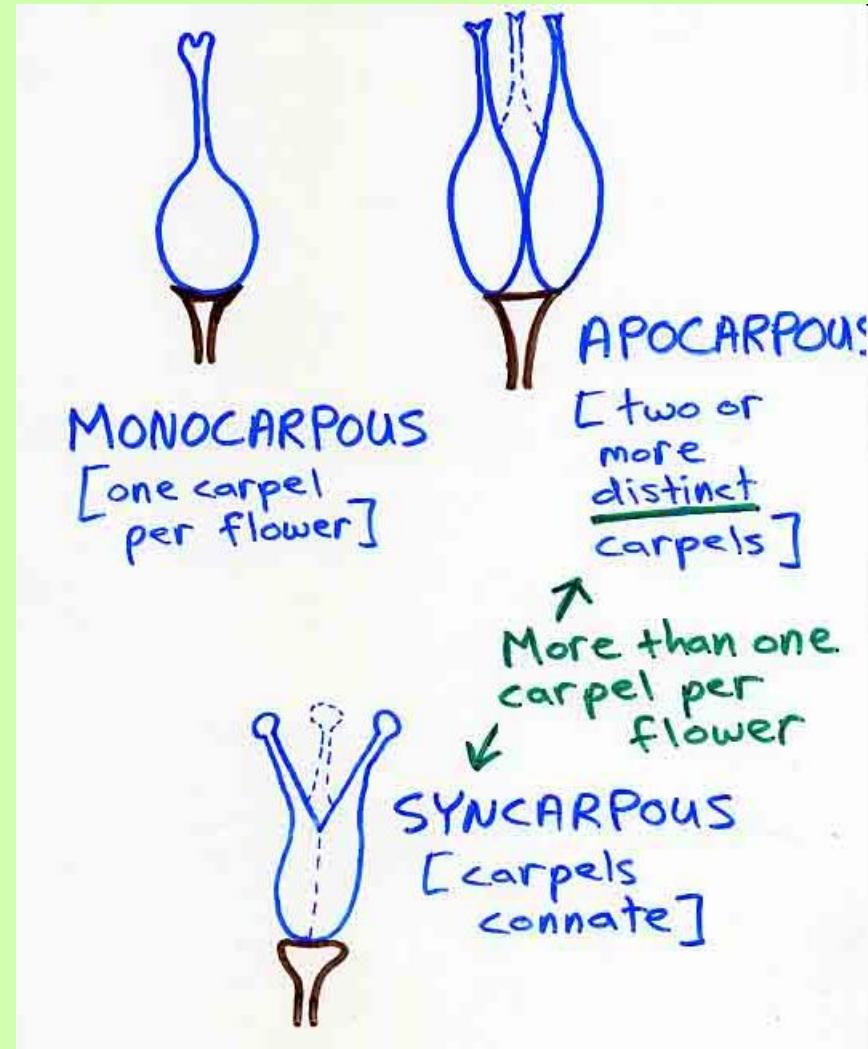
Putik

- Carpel(s) (gynoecium) – Fourth series; the terminal or centermost component; the female reproductive unit; 1 to many separate or fused carpels comprise a gynoecium
 - Kepala Putik (stigma)
 - Tangkai Putik (stilus)
 - Bakal Buah (ovarium)
 - Bakal Biji
 - Plasenta





- Carpels 1 per flower
- Carpels more than 1 per flower:
 - carpels distinct (apocarpous gynoecium)
 - carpels connate (syncarpous gynoecium)
- Pistil – equivalent to gynoecium; formed from one or more carpels
- Simple pistil – a gynoecium with one carpel
- Compound pistil – a gynoecium with two to many separate or fused carpels (it combines both apocarpous and syncarpous gynoecia)





Kepala Putik

- Berbagai bentuk:
 - Benang : jagung
 - Bulu ayam : padi
 - Bulat : jeruk
- Gynostegium: Kepala Putik bersatu dengan stamen → *Callotrophis gigantea*



Bakal Buah

- Berdasarkan letak bakal buah terhadap dasar bunga
 - Superus
 - Semiinferus
 - Inferus
- Berdasarkan jumlah ruang
 - Beruang satu : pepaya
 - Beruang dua : kubis
 - Beruang tiga : karet
 - Beruang banyak: duren



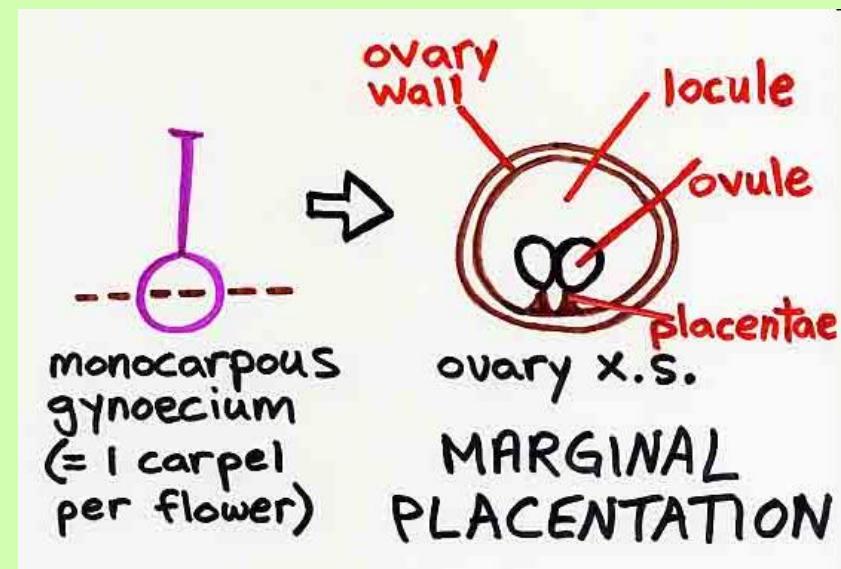
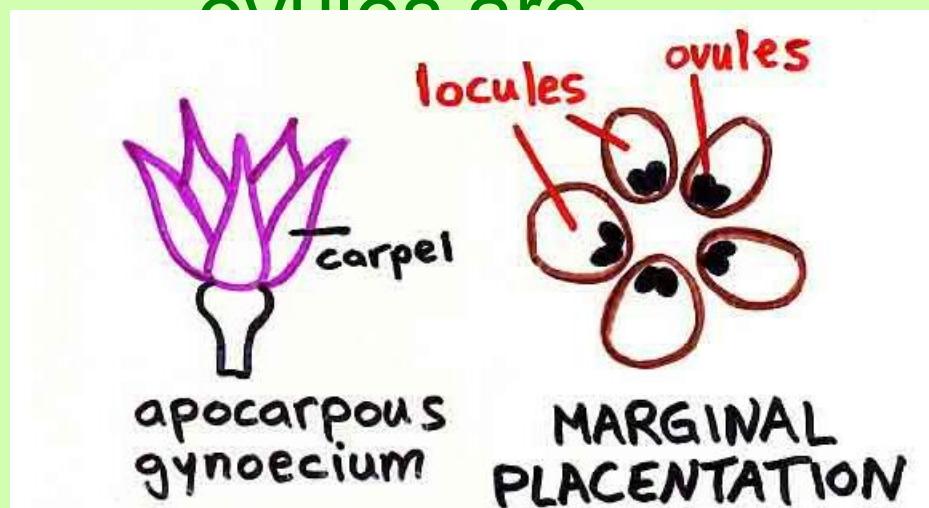
Plasenta

- Placentation – the arrangement of ovules within the ovary → plasenta (tembuni)
- PLACENTATION TYPES:
 - Marginal
 - Axile – only found in a syncarpous gynoecium; the placental area of the ovary is attached to an axis derived from the connate margins of the component carpels – such an ovary is divided into two or more locules by septa. The ovules are borne along the central axis.
 - Parietal – only found in a syncarpous gynoecium; the placental areas are attached to the side walls of the ovary (or extrusions of the wall) – such an ovary usually has one locule (therefore no septa). NOTE: Your textbook considers marginal placentation a type of parietal placentation; we won't in this course.
 - Sentrales
 - Aksilaris



PLACENTATION TYPES

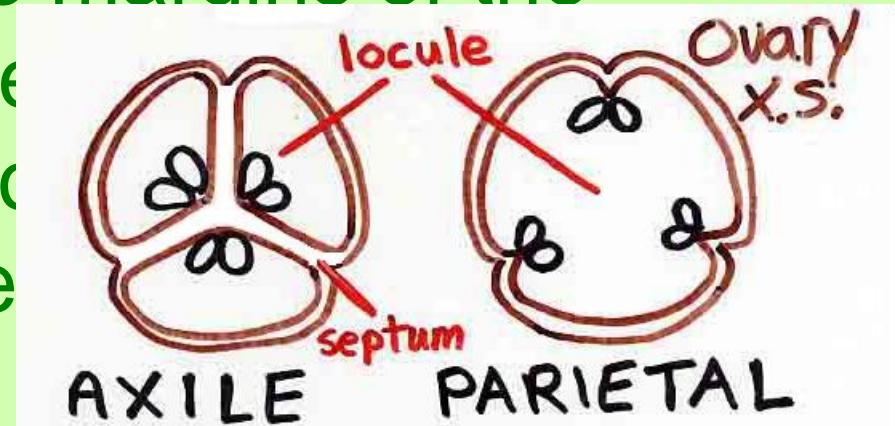
- Marginal – only found in an apocarpous gynoecium; the ovules are





PLACENTATION TYPES

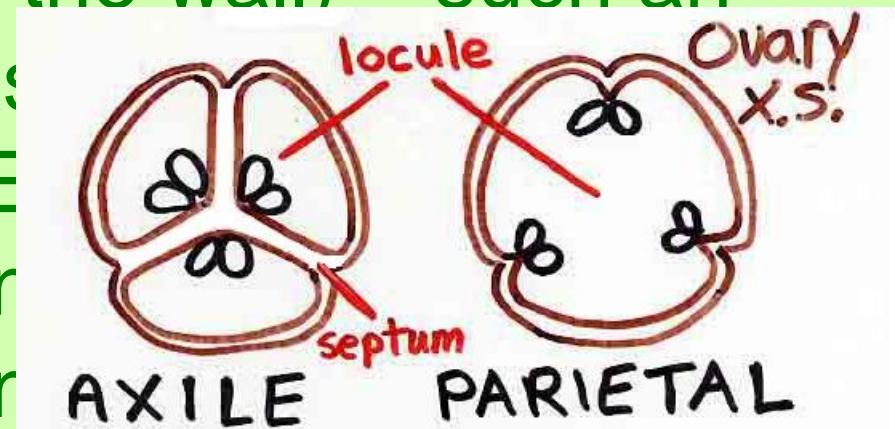
- Axile – only found in a syncarpous gynoecium; the placental area of the ovary is attached to an axis derived from the connate margins of the component carpels divided into two or more septa. The ovules are attached to the central axis.





PLACENTATION TYPES

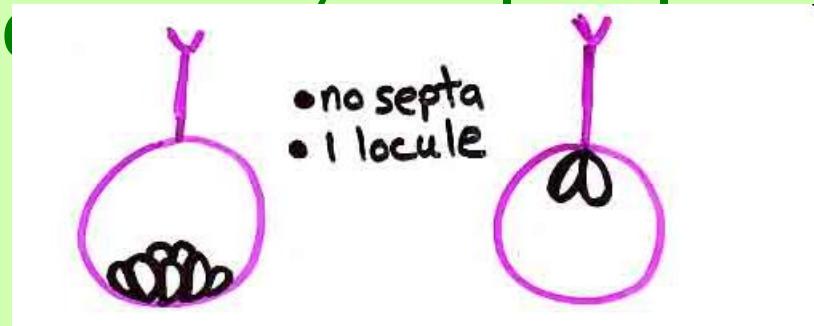
- Parietal – only found in a syncarpous gynoecium; the placental areas are attached to the side walls of the ovary (or extrusions of the wall) – such an ovary usually has no septa). NOTE: considers margin of parietal placenta course.





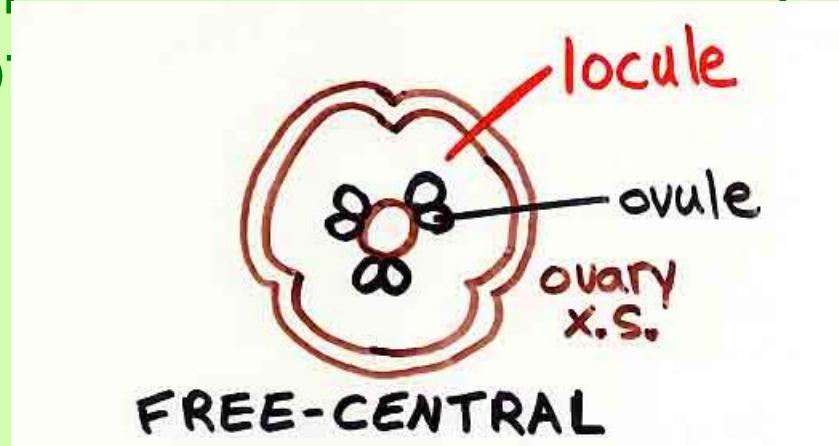
PLACENTATION TYPES

- Apical – attachment of ovules to the top of the ovary (one locule, no septa)
- Basal – attachment of ovules to the bottom of the ovary (multiple locules, multiple septa)





- Free-central – attachment of ovules to a free-standing central column in a syncarpous unilocular ovary (one locule, no septum)





Insertion

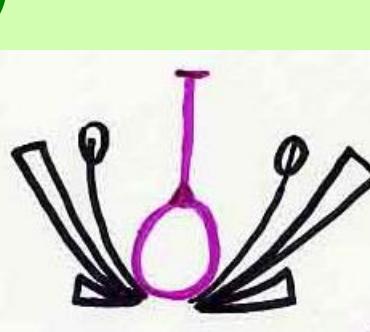
- Insertion (the method of attachment of one structure to another)



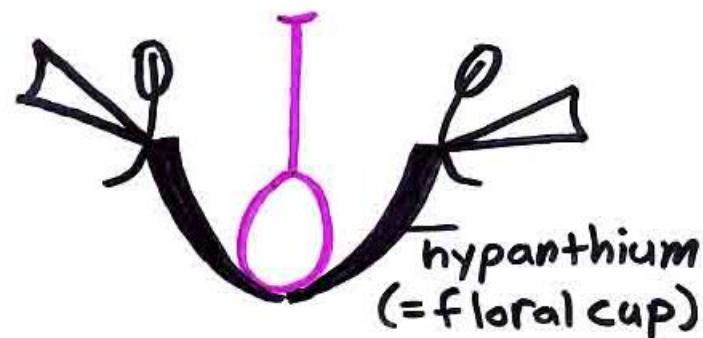
Insertion

- SUPERIOR OVARY – Ovary situated ABOVE the point of attachment of the perianth and androecium and wholly free from them (stamens may be adnate to corolla)

– Hypogynous flower (ovary below perianth and androecium)



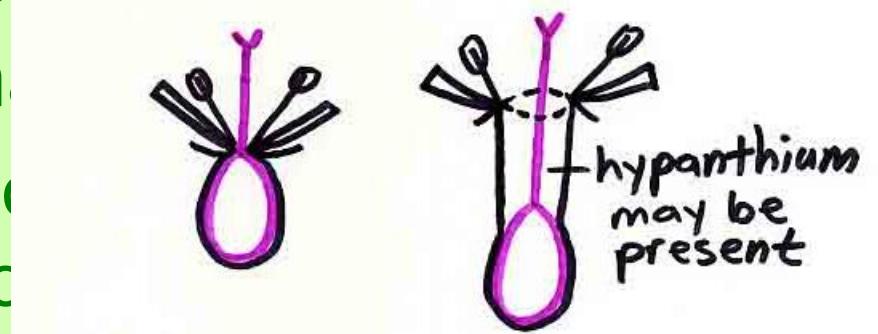
– Perigynous flower (if hypanthium not adnate to ovary) – a flower with perianth





Insertion

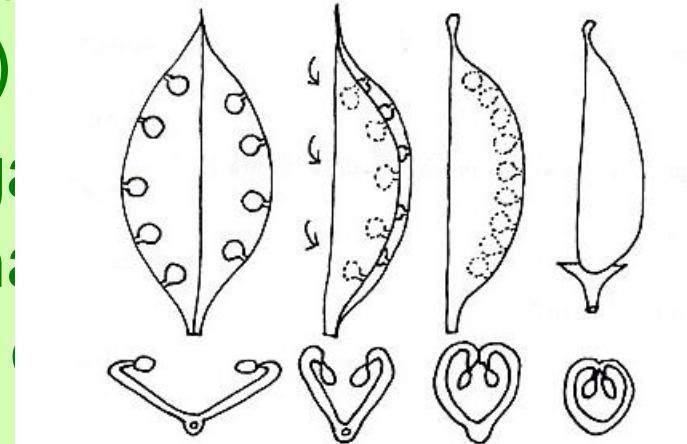
- INFERIOR OVARY – Ovary is **BELOW** the point of attachment of the outer flower parts (perianth and androecium). In other words, the outer floral whorls are adnate to the ovary. A hypanthium (floral cup) may or may not be present.
 - Epigynous flower (adnate to ovary) – a flower in which the perianth and androecium apparently arise upon the ovary (rather than the receptacle).





Evolutionary Development of the Carpel

- What is a carpel?
 - Basic unit of gynoecium
 - The foliar, ovule – bearing unit of a flower that forms either all (apocarpous) or part (syncarpous)
 - Leaflike megasporangia inrolled connivent to form one or more ovules

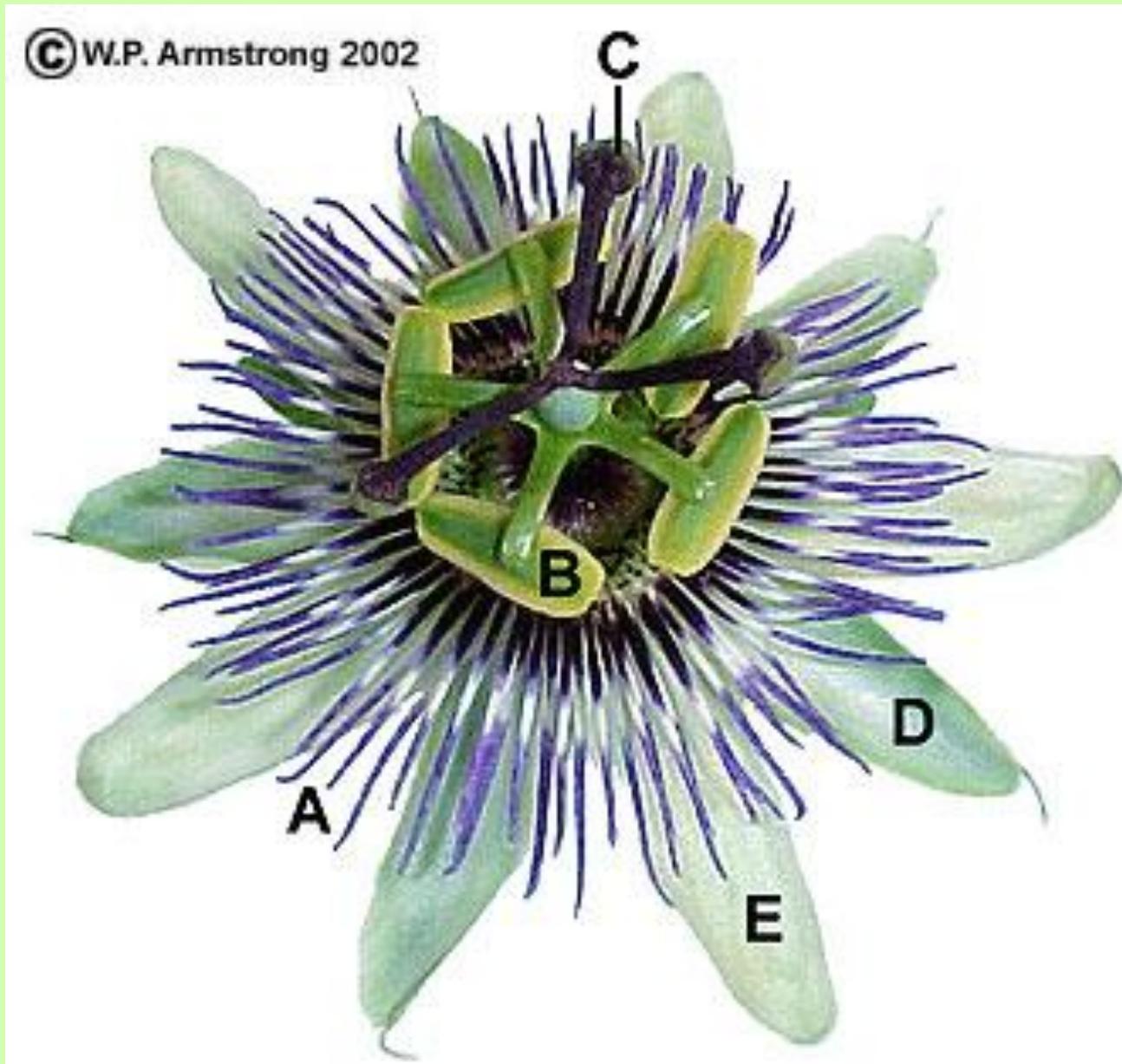




- How can the number of carpels comprising a gynoecium be determined?
 - Count the stigmas
 - Count the styles
 - Count the lobes of the ovary
 - Count the locules in the ovary
 - Count rows of placentae
- Variation in fusion and closure of carpels from Walters and Keil, 1988, Vascular Plant Taxonomy, 3rd ed

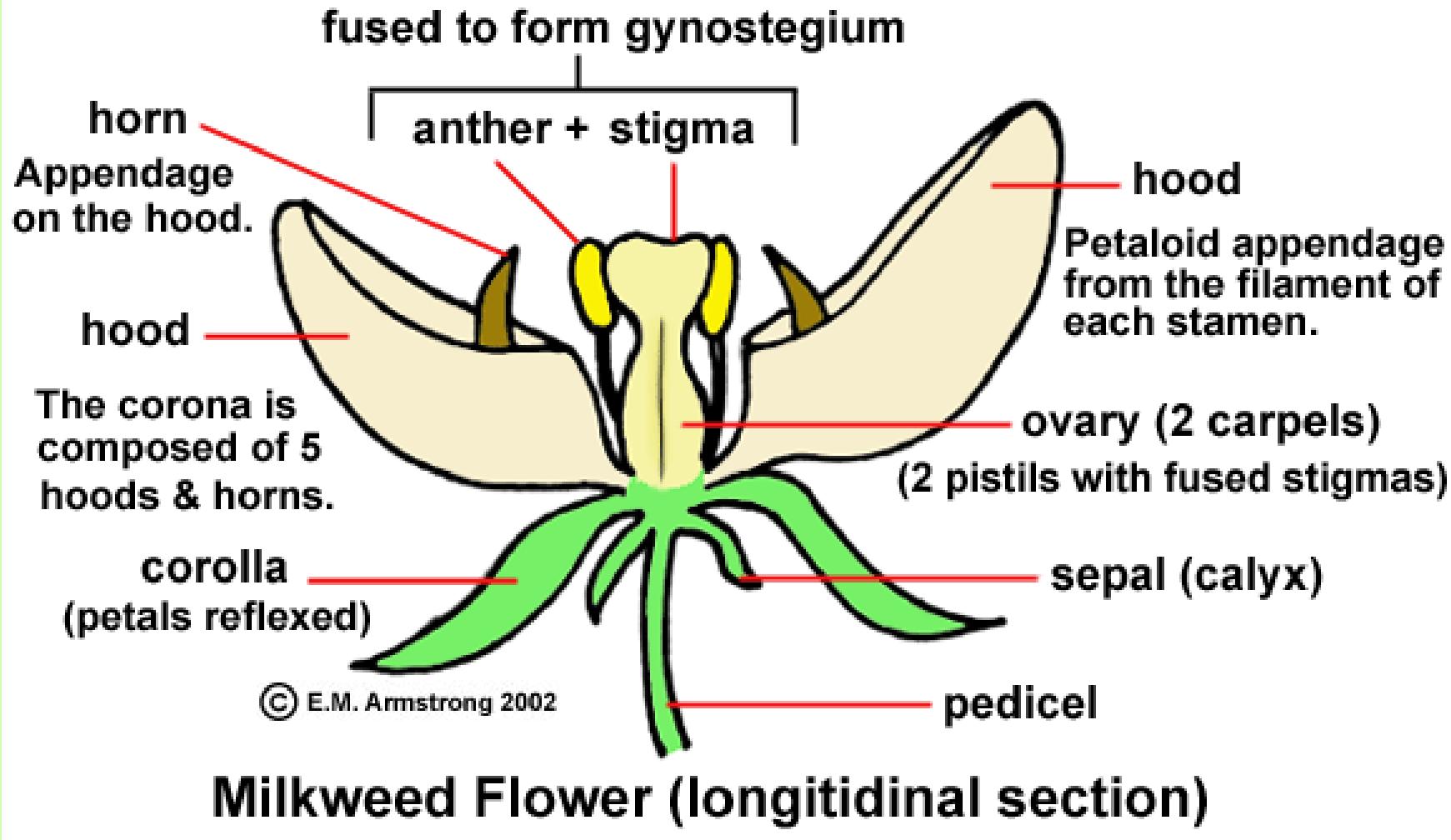


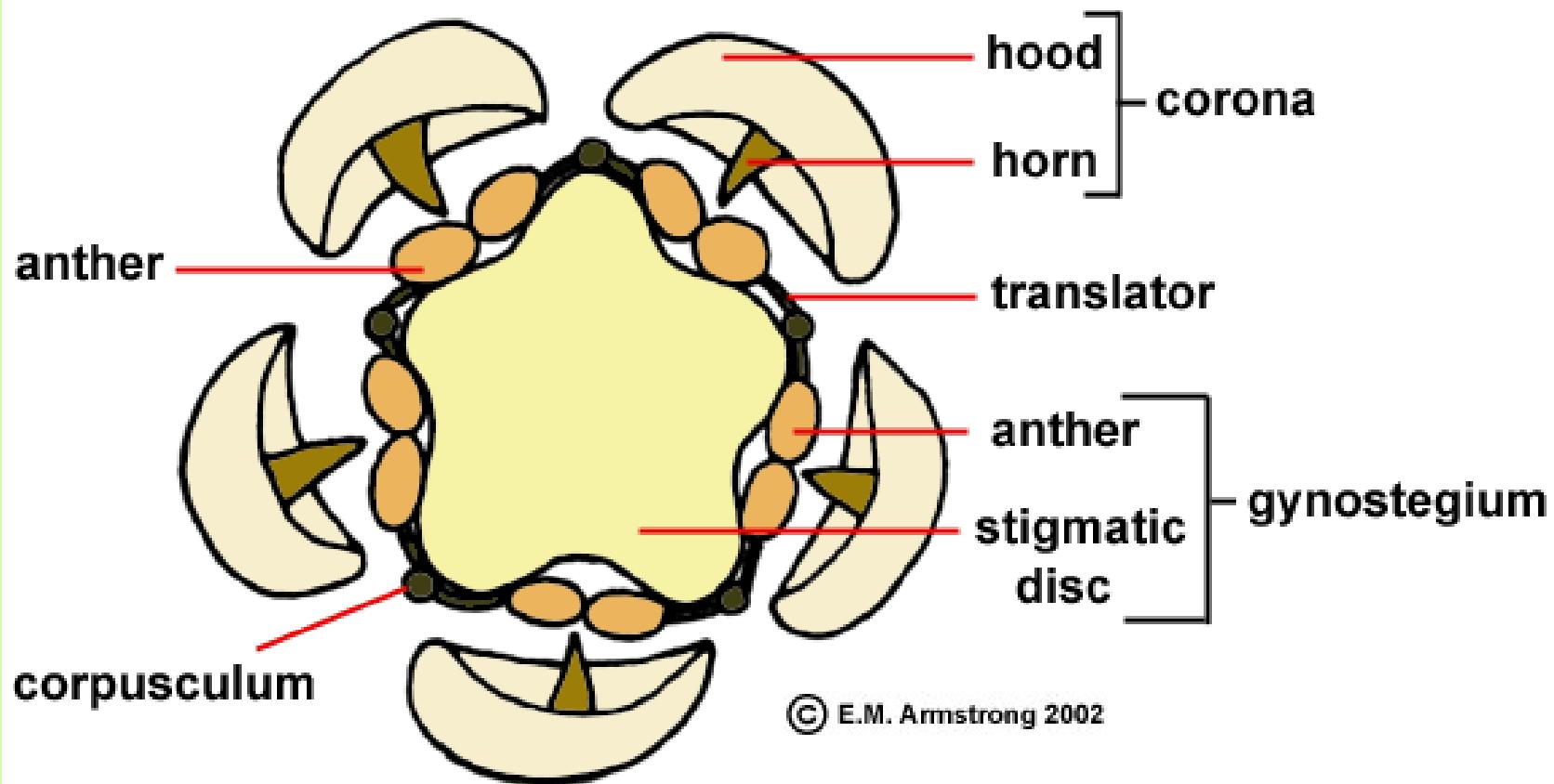
- Corona
- Anther
- Style
- Sepal
- Petal



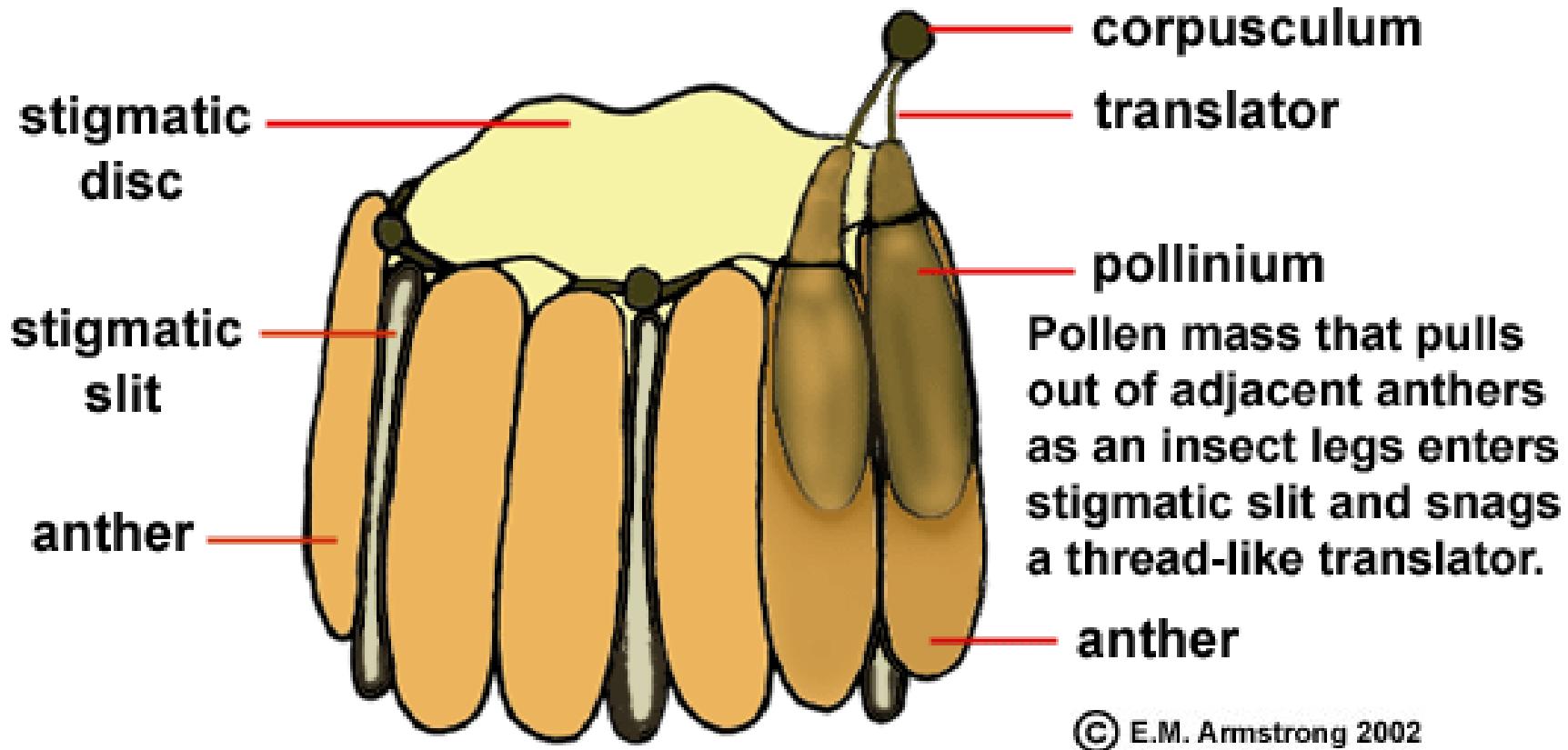


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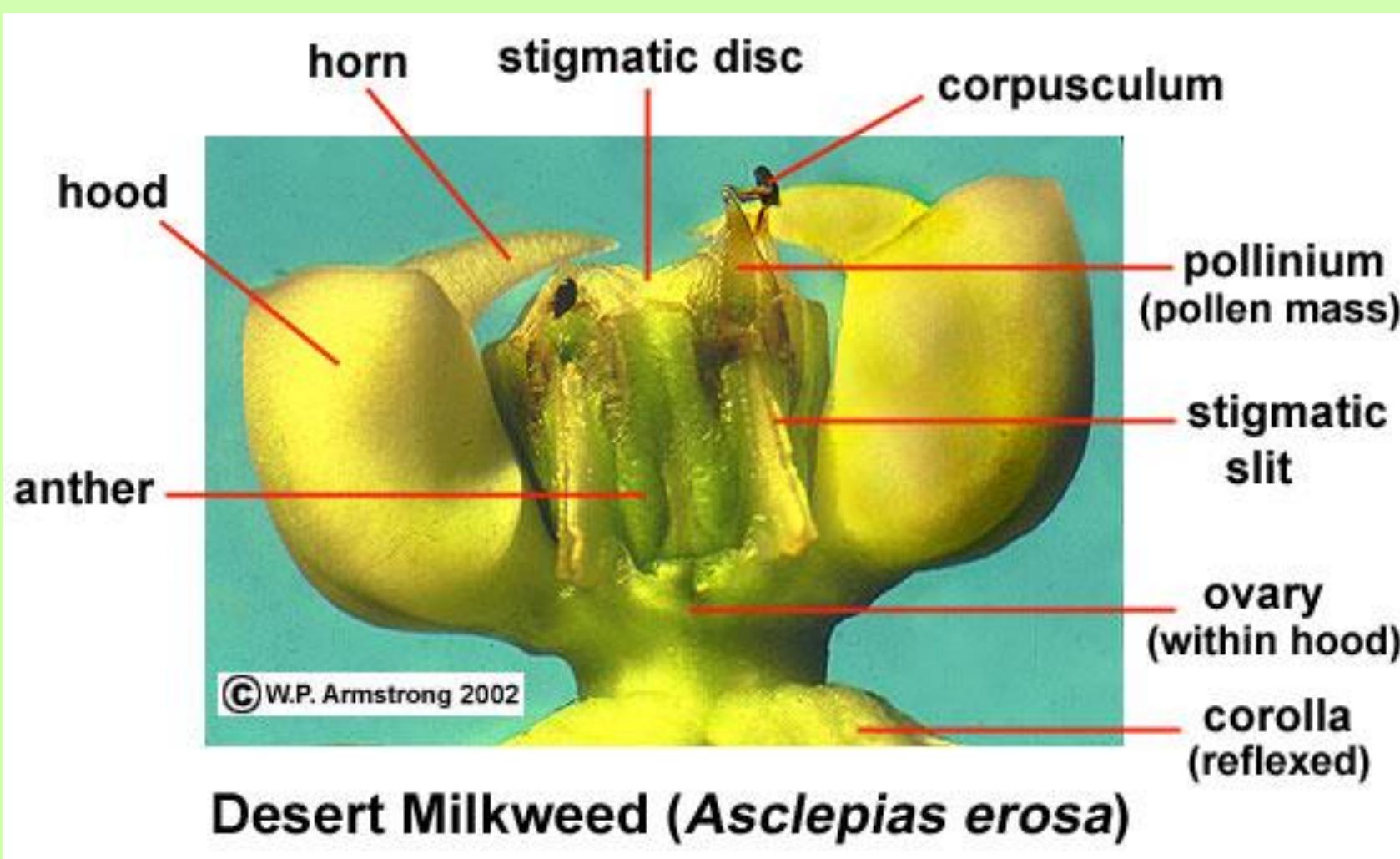


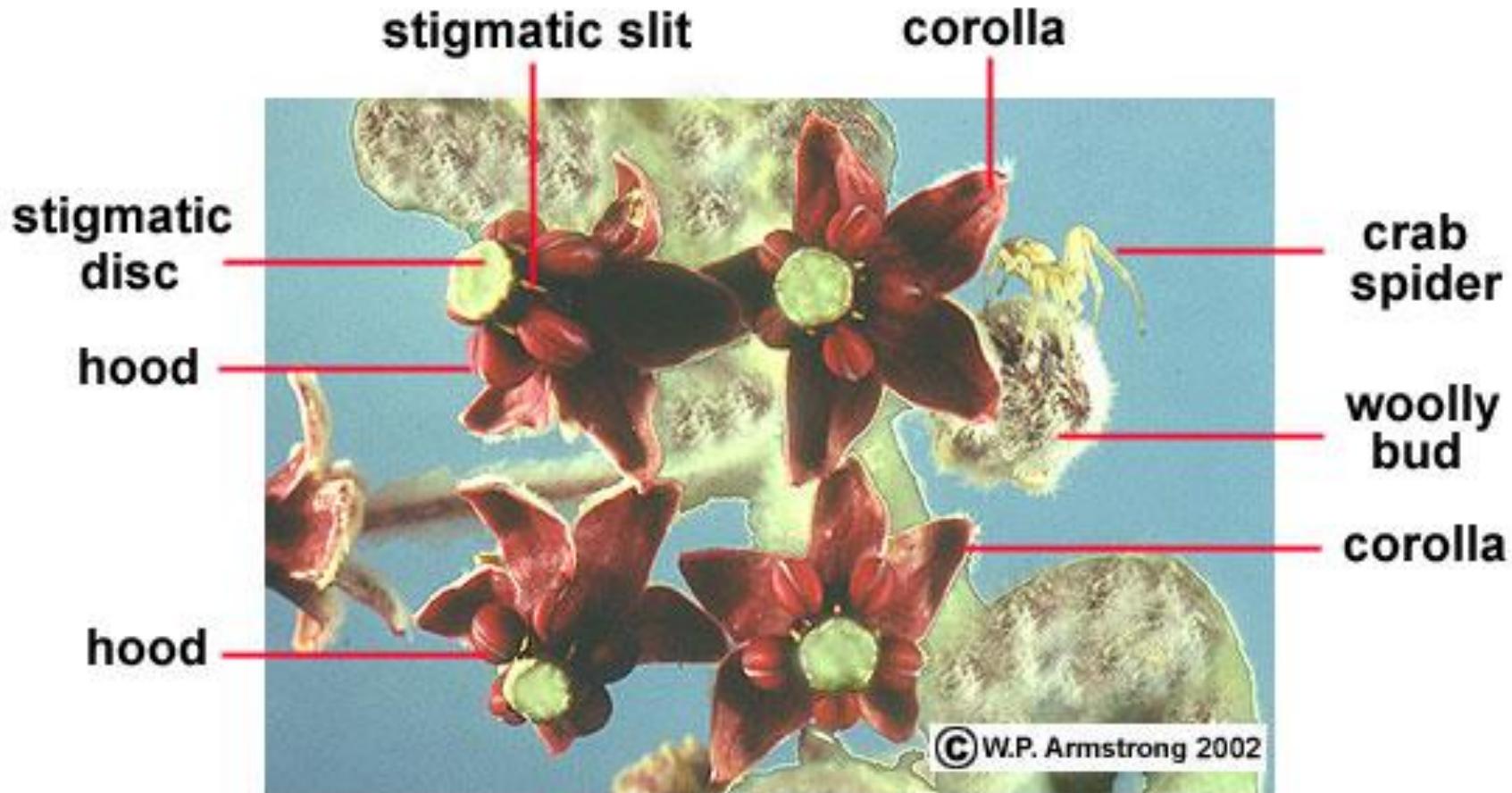


Milkweed Flower (top view of corona & gynostegium)



Milkweed Flower (stigmatic column)

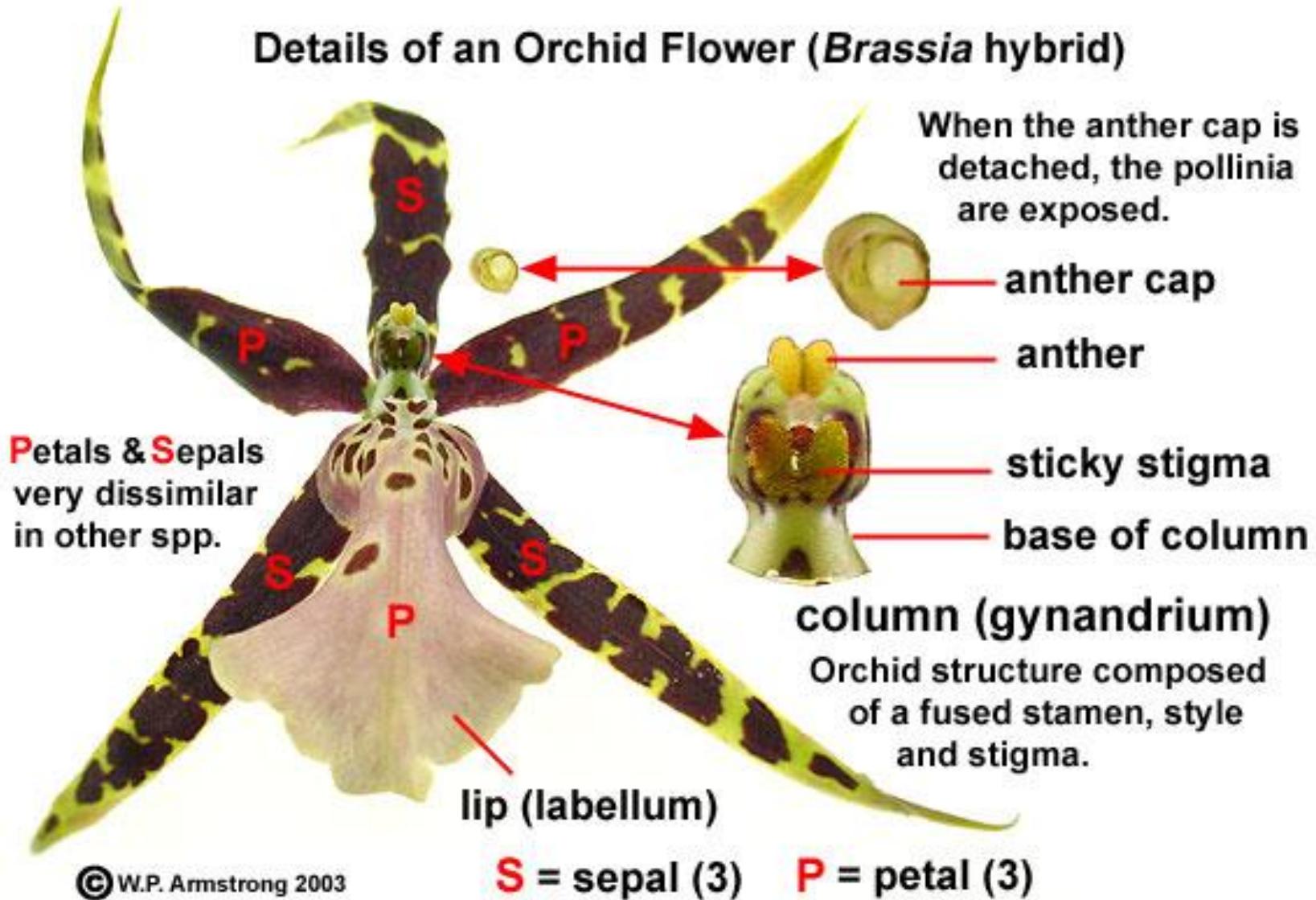


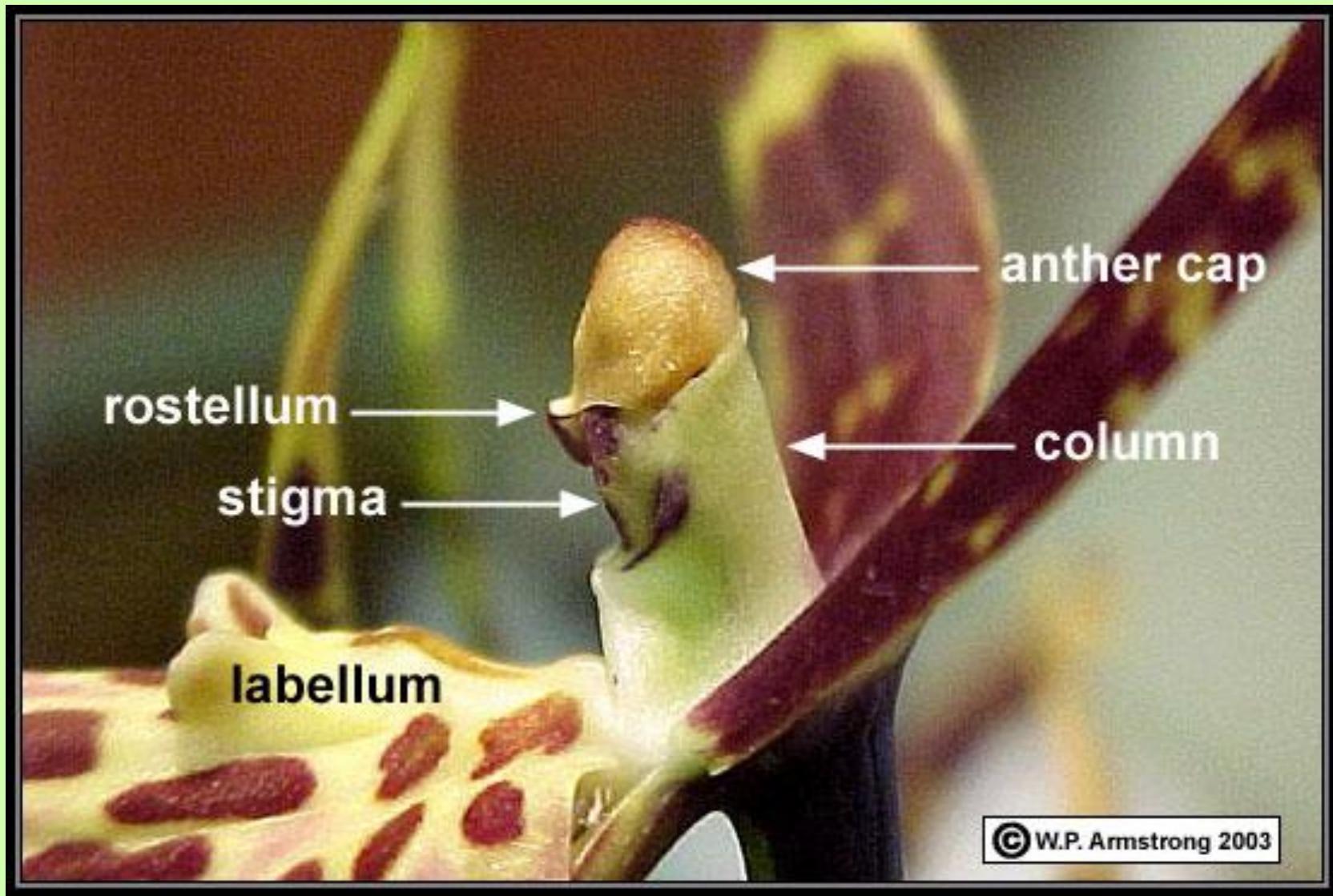


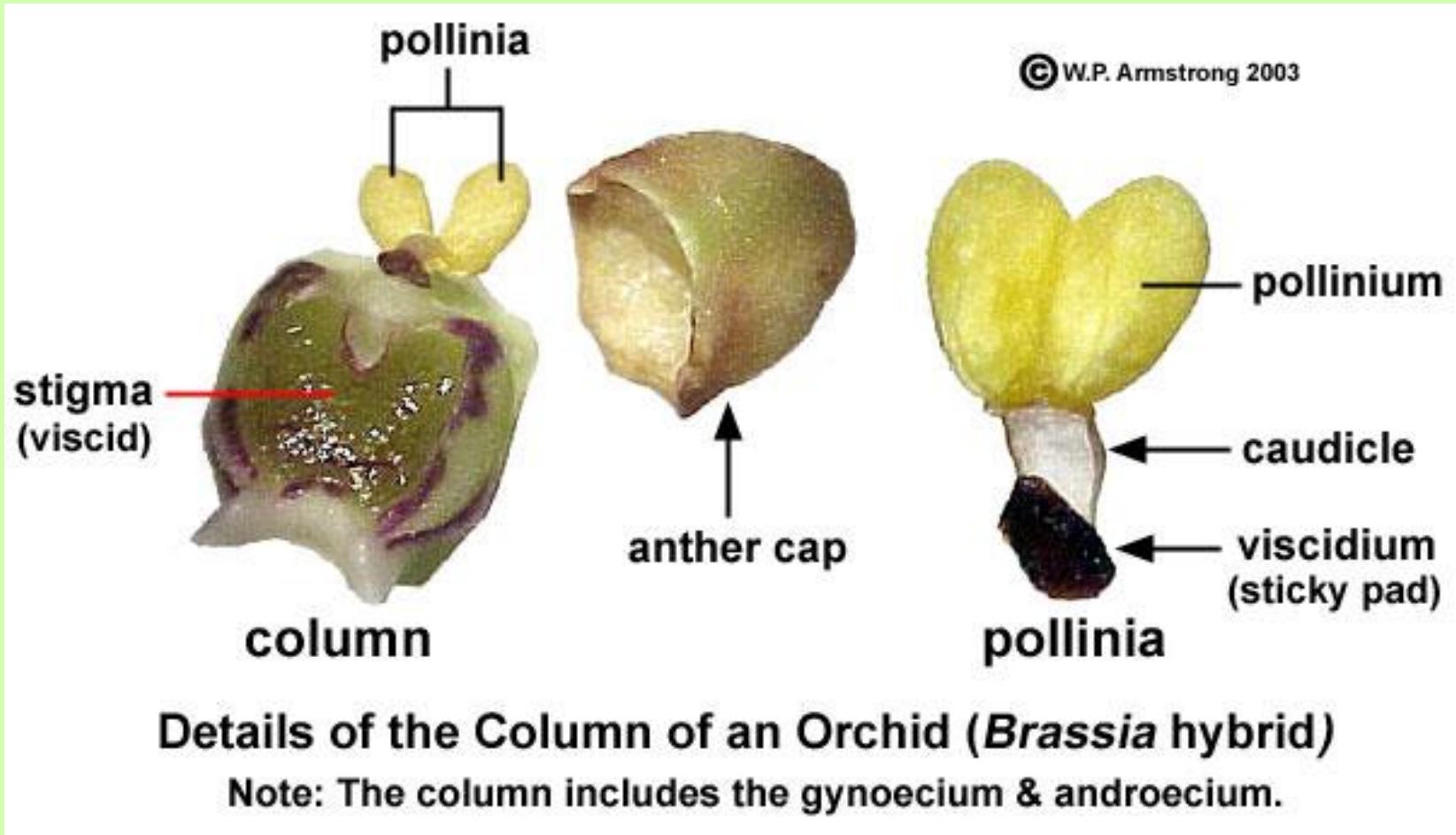
Woolly Milkweed (*Asclepias californica*)

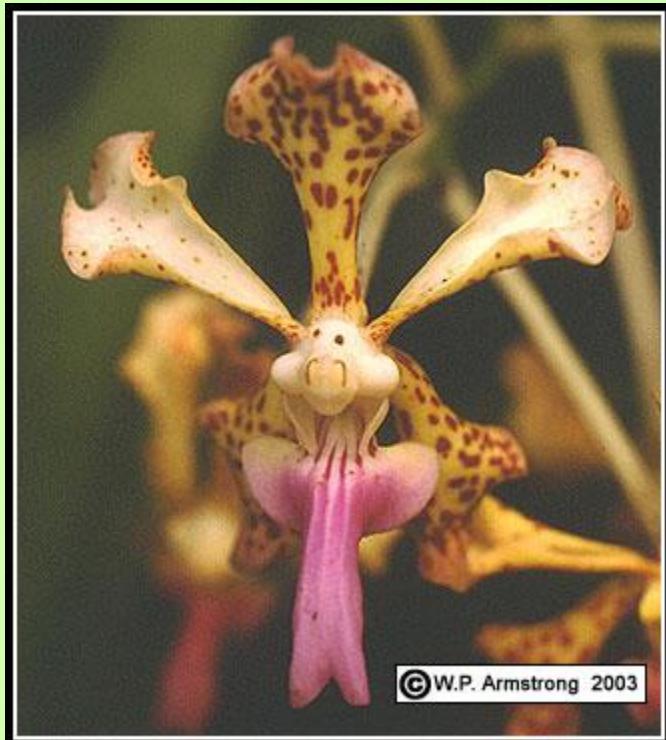


Details of an Orchid Flower (*Brassia* hybrid)









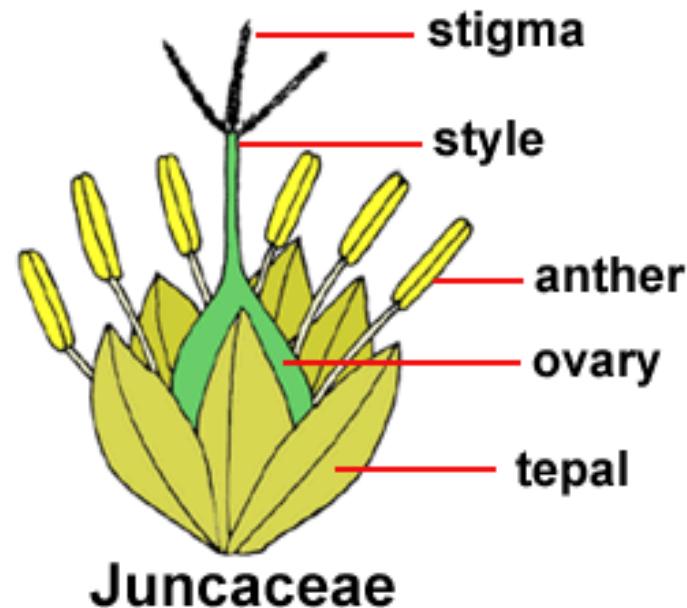
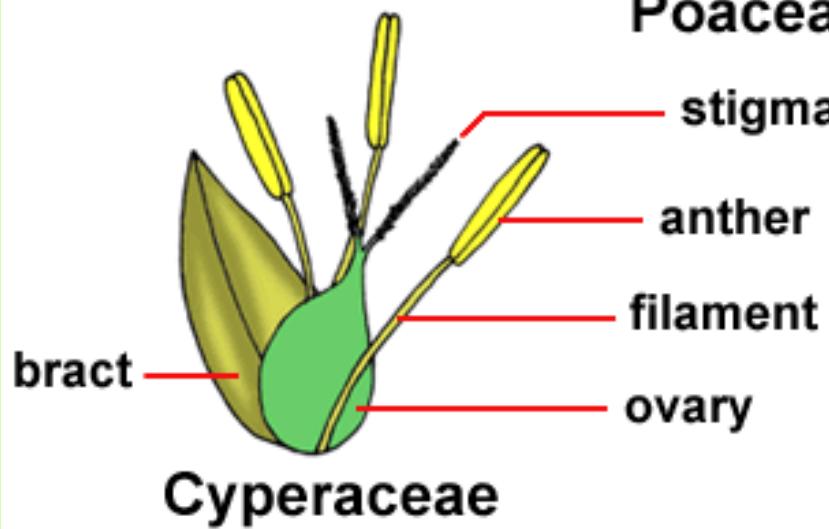
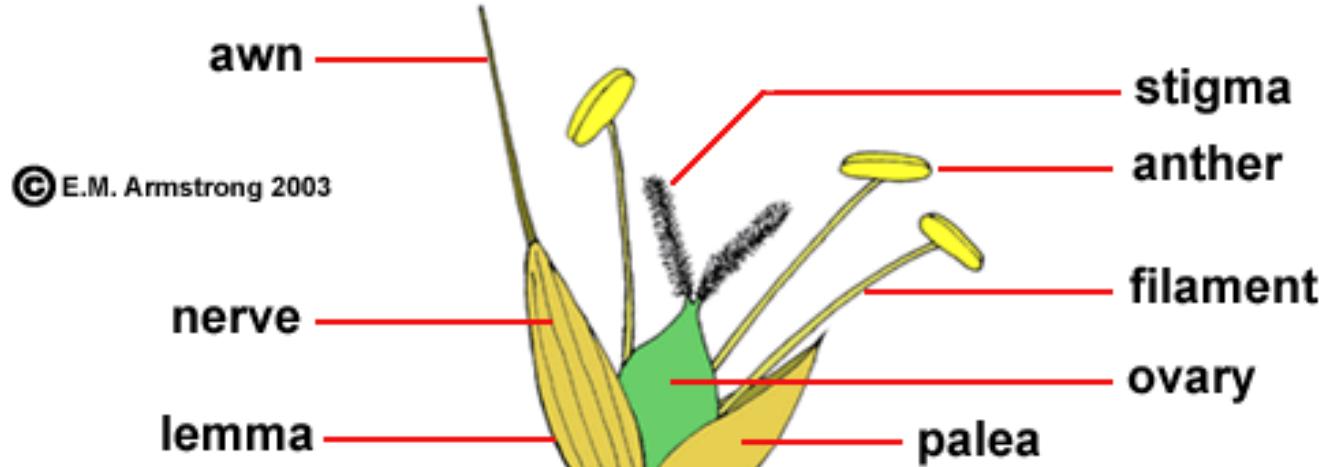
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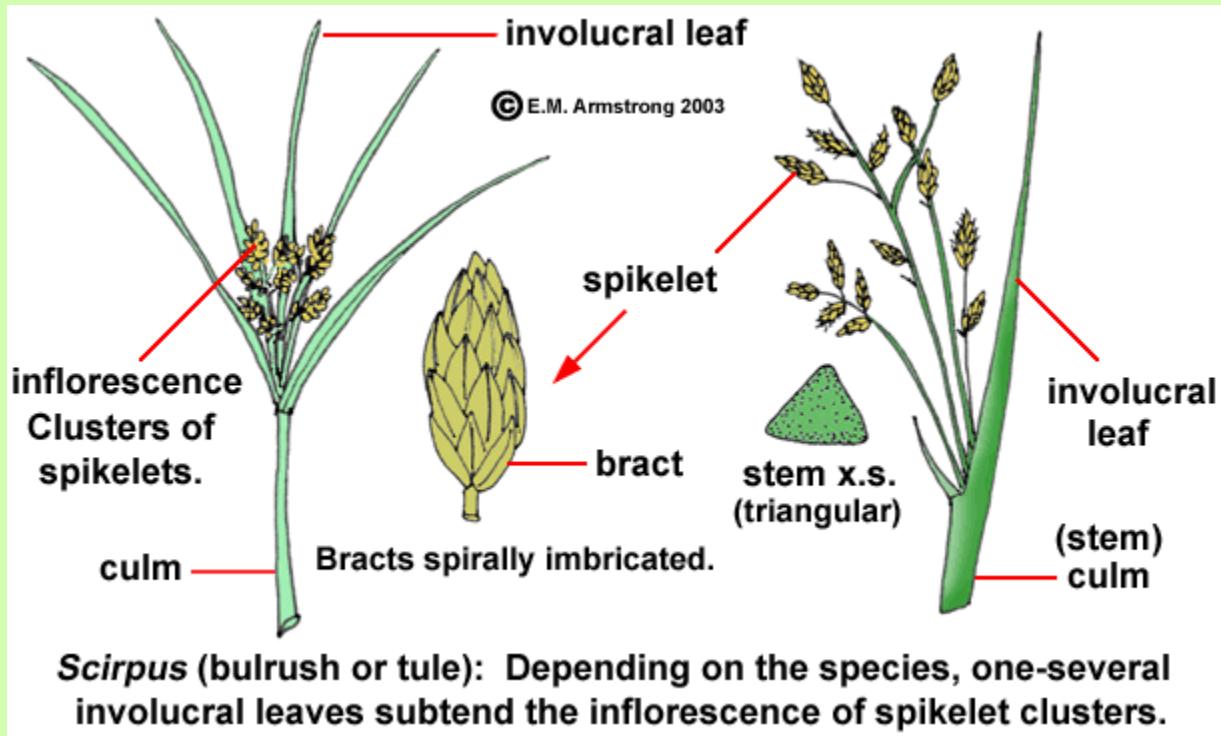


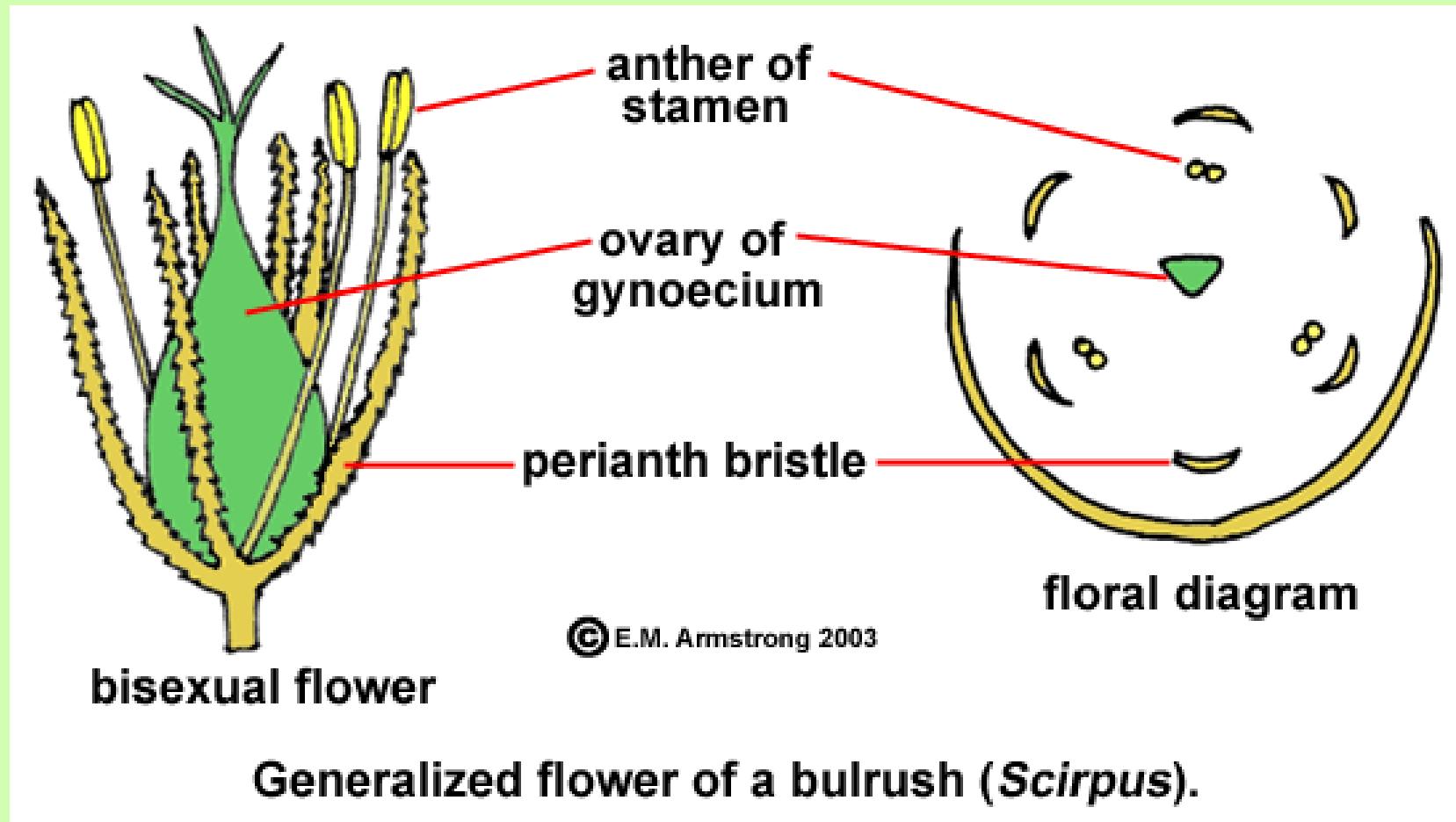
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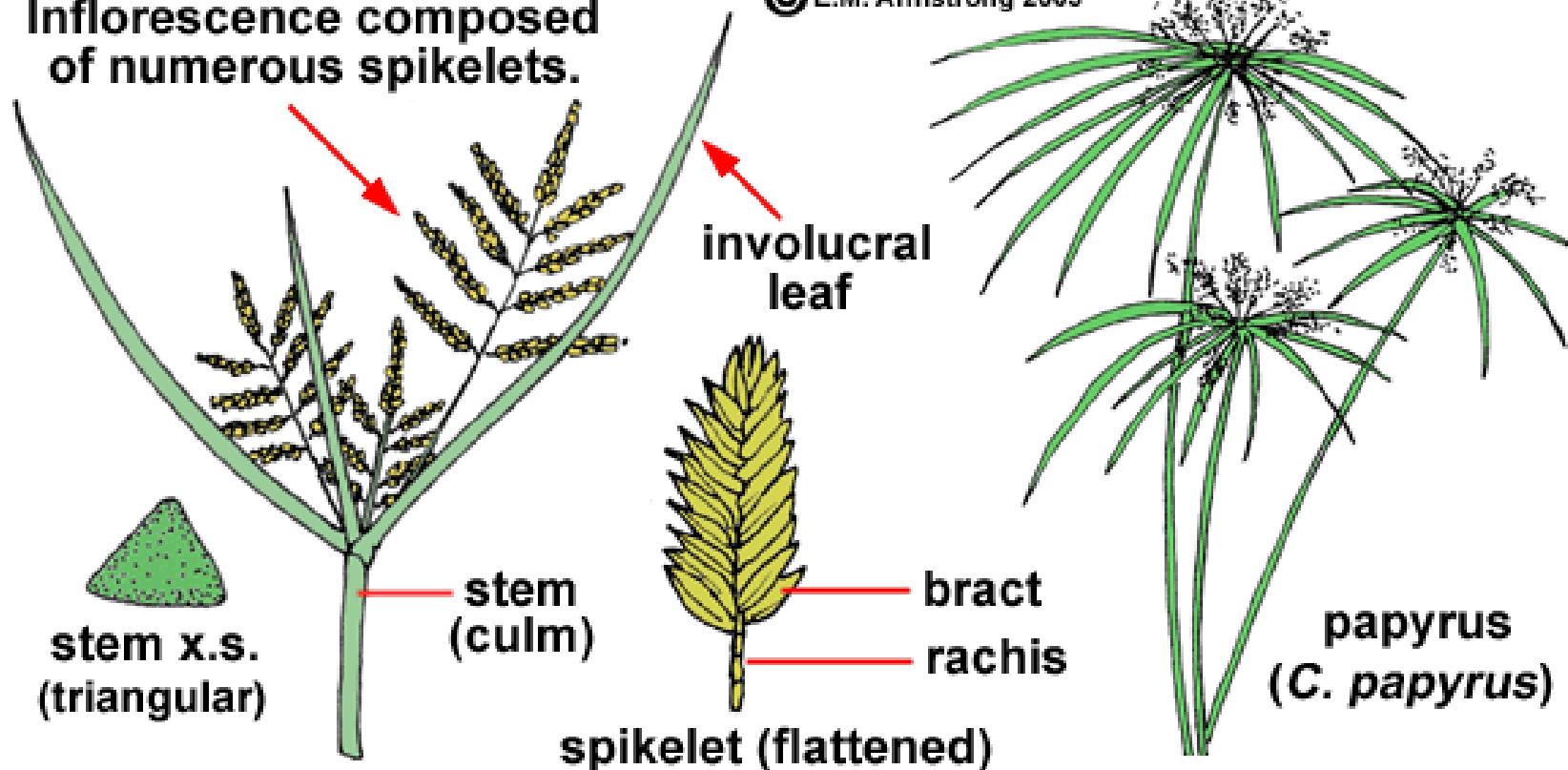




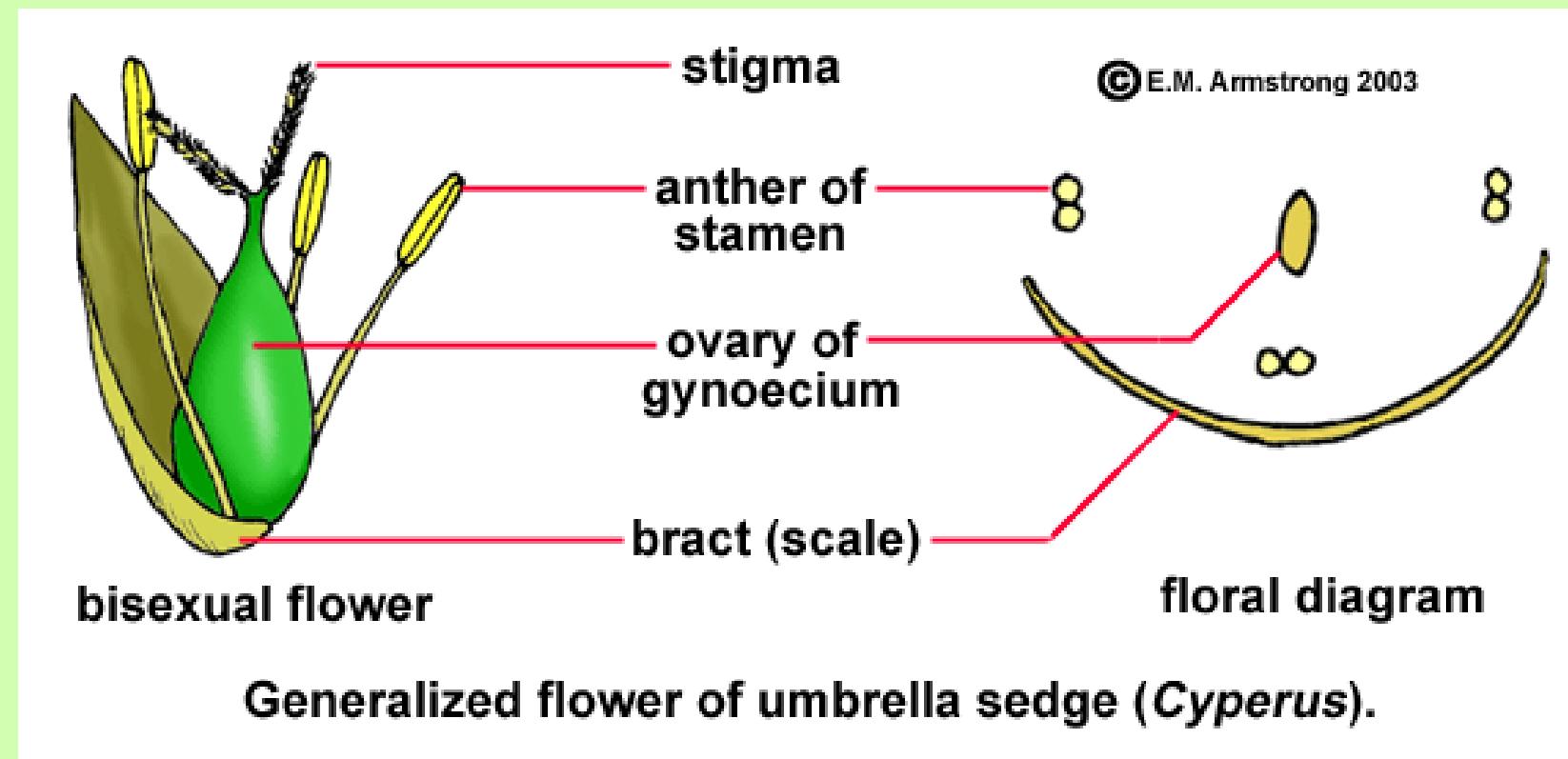


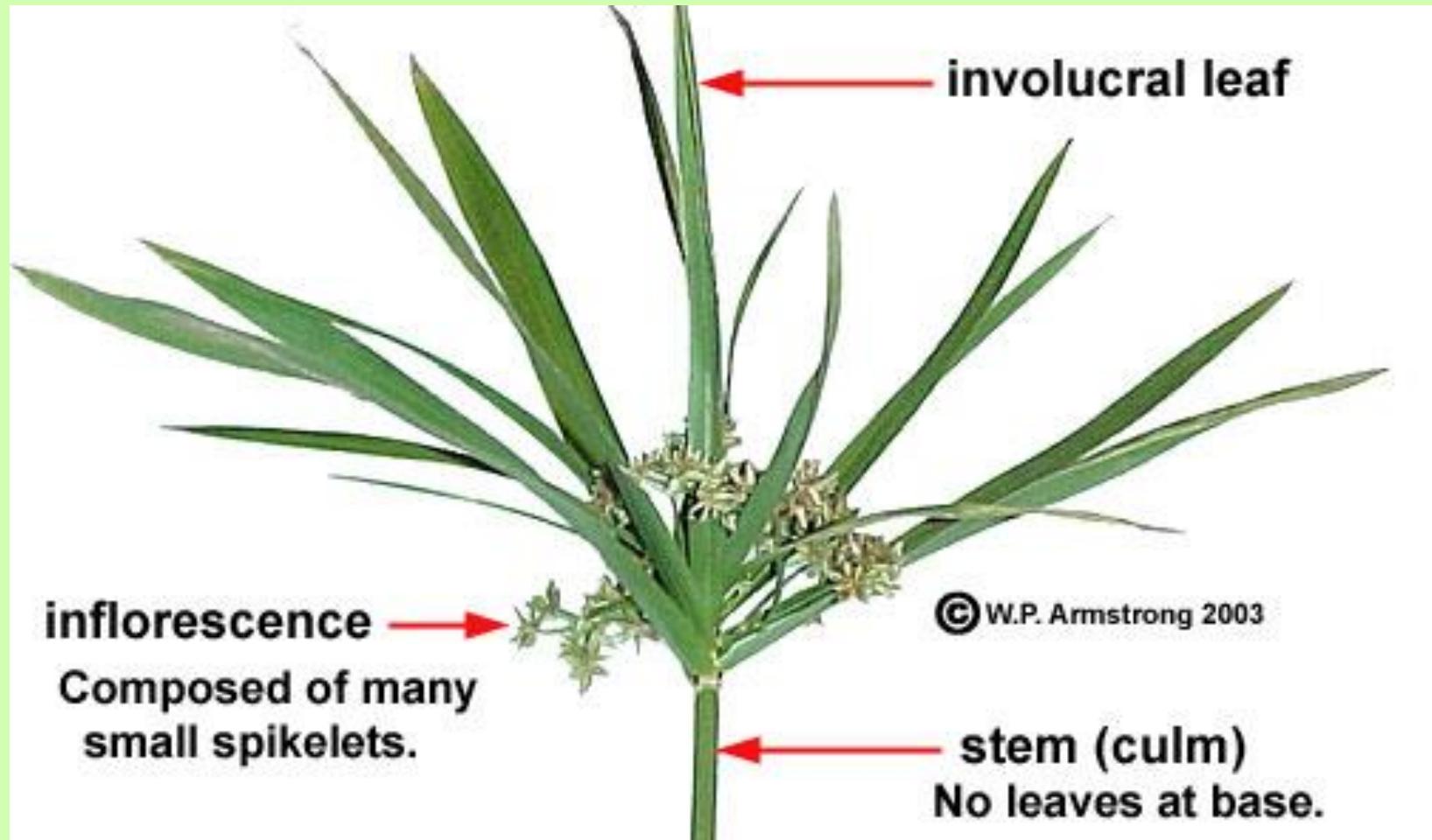


**Inflorescence composed
of numerous spikelets.**



Cyperus: Similar to a bulrush or tule (*Scirpus*), except
the spikelets are flattened with 2-ranked bracts.

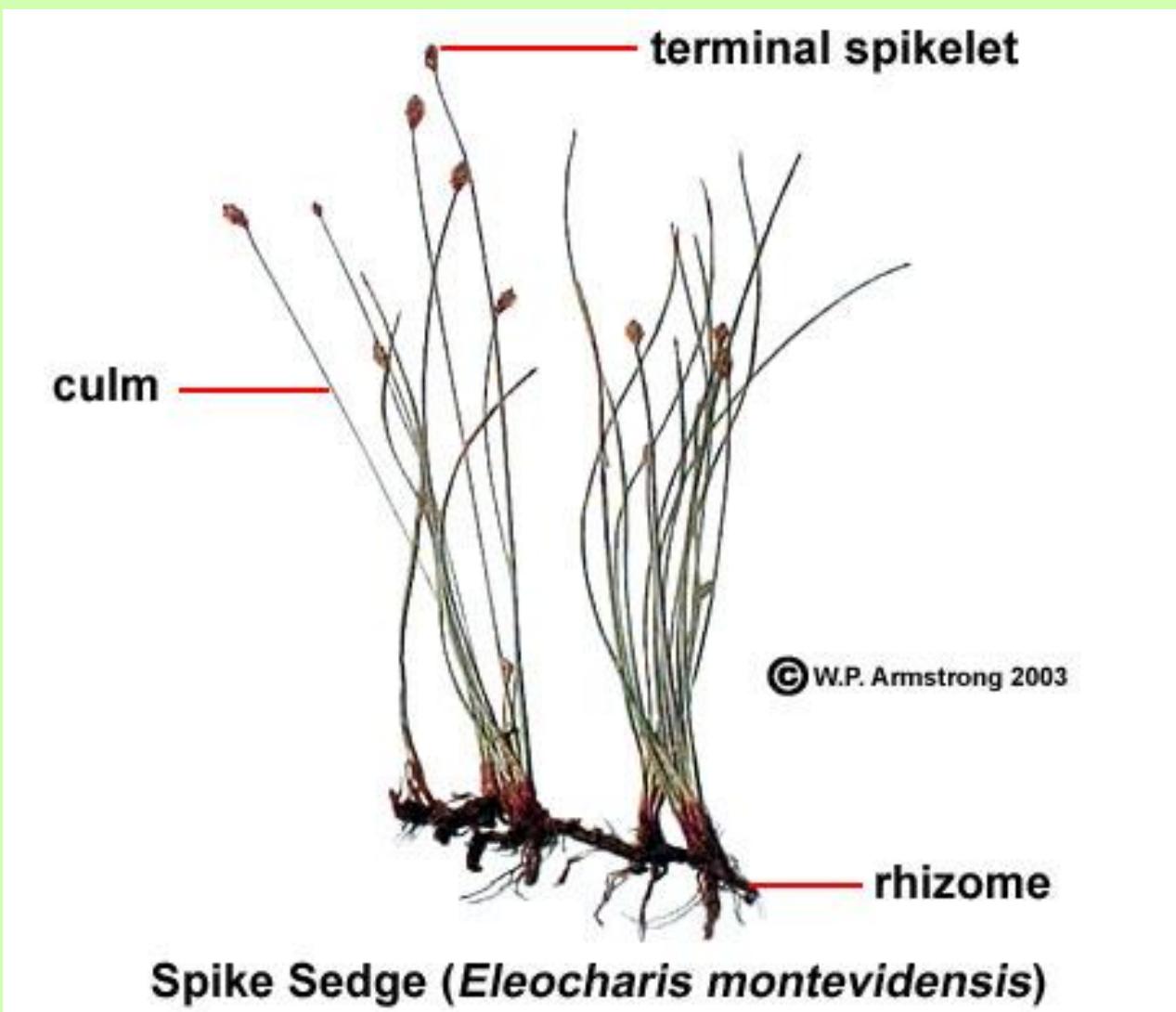


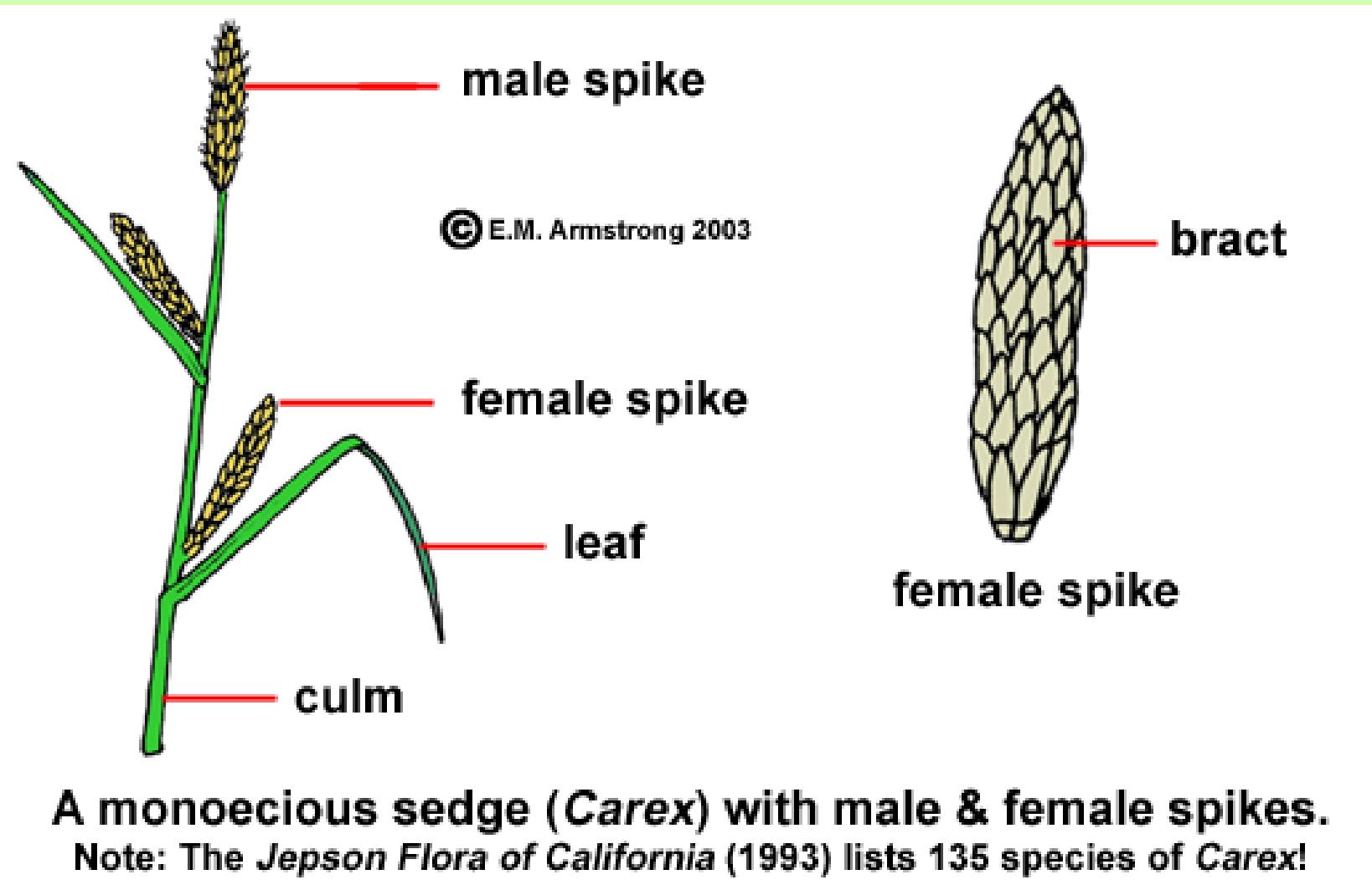




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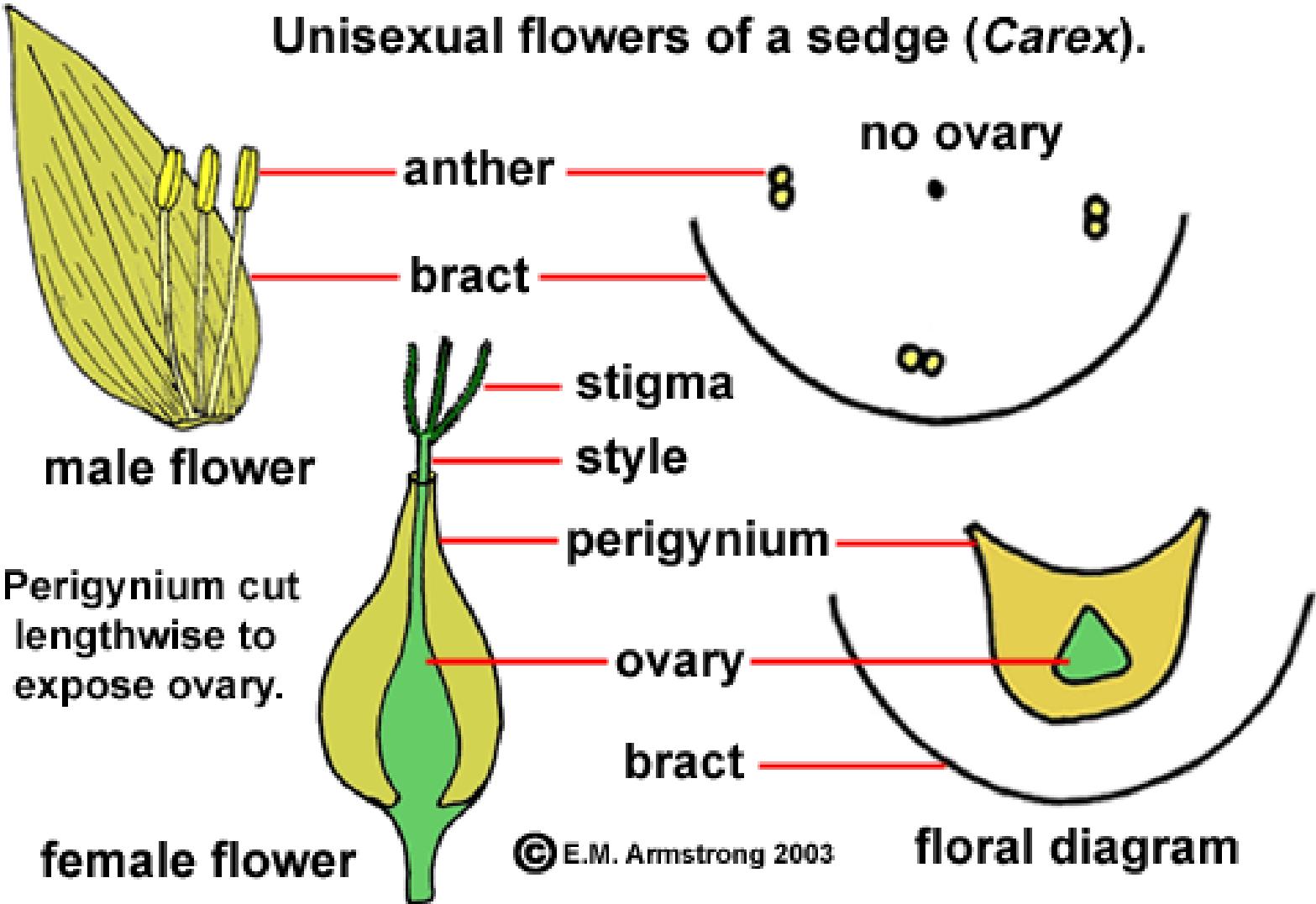
Dwarf Sedge (*Cyperus squarrosus*)

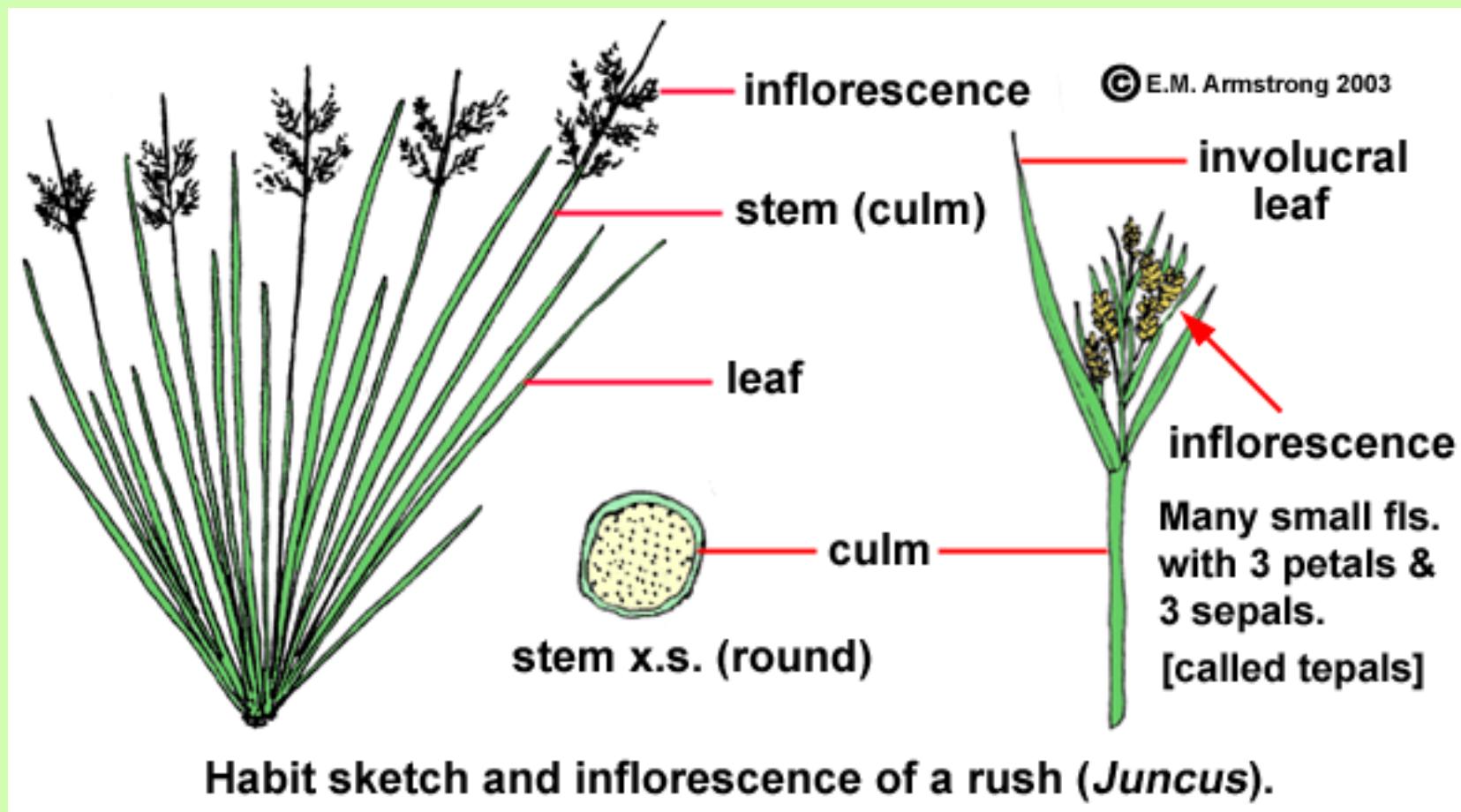


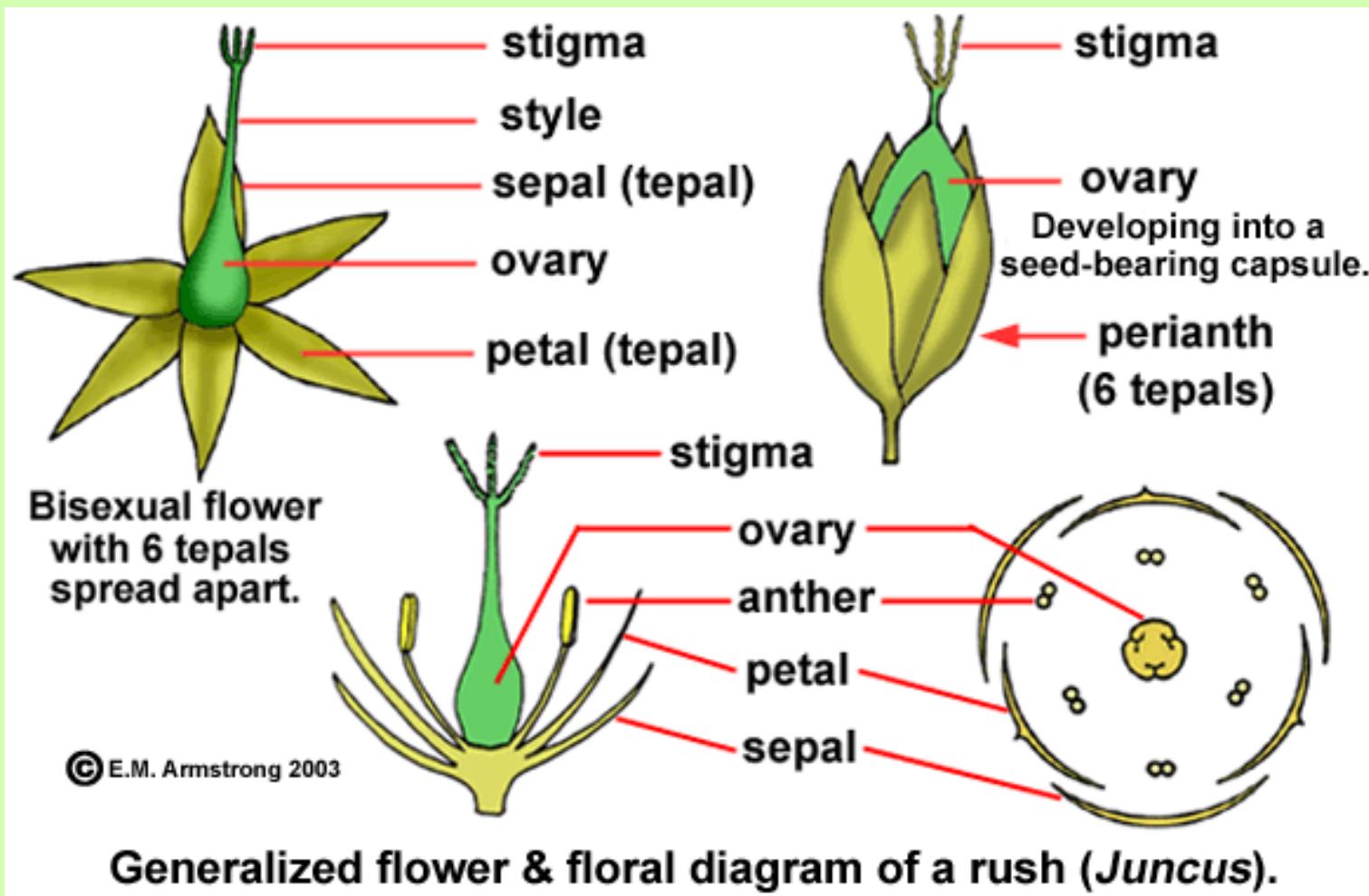


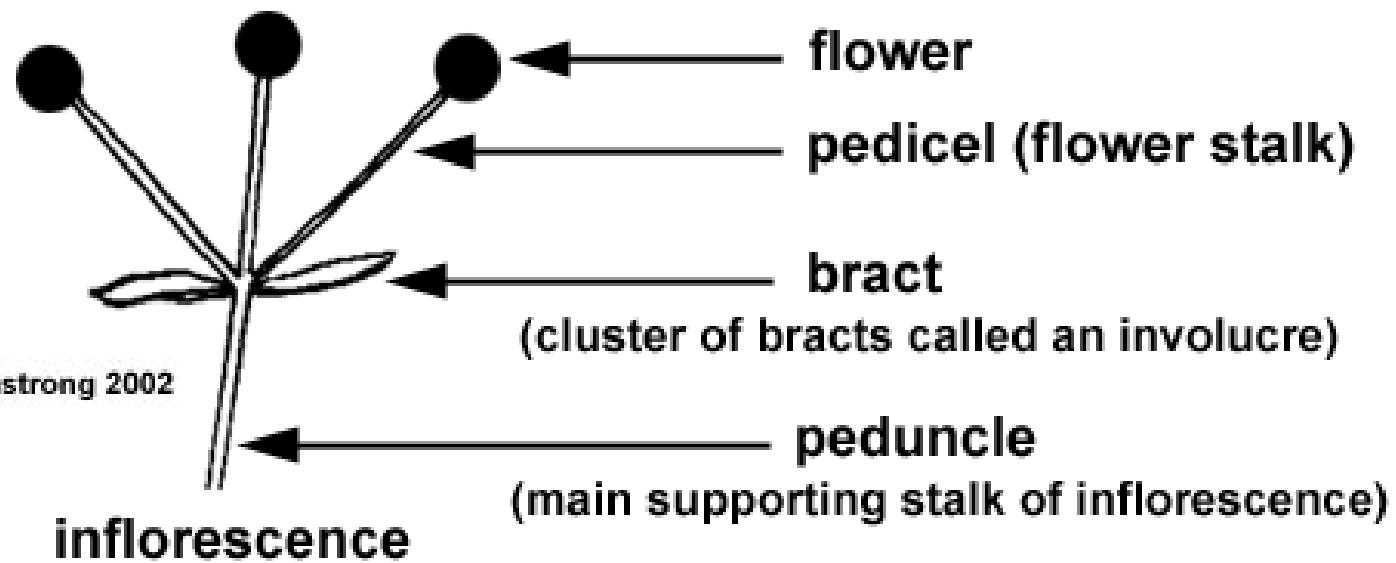


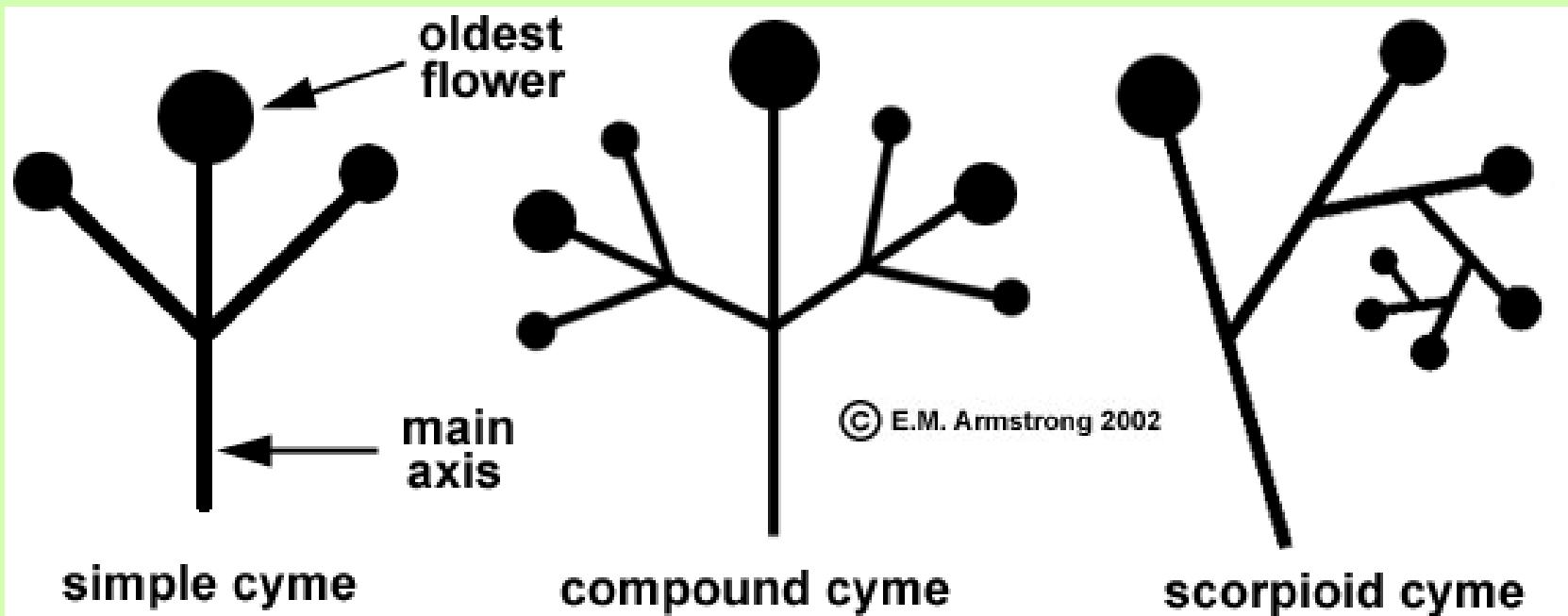
Unisexual flowers of a sedge (*Carex*).



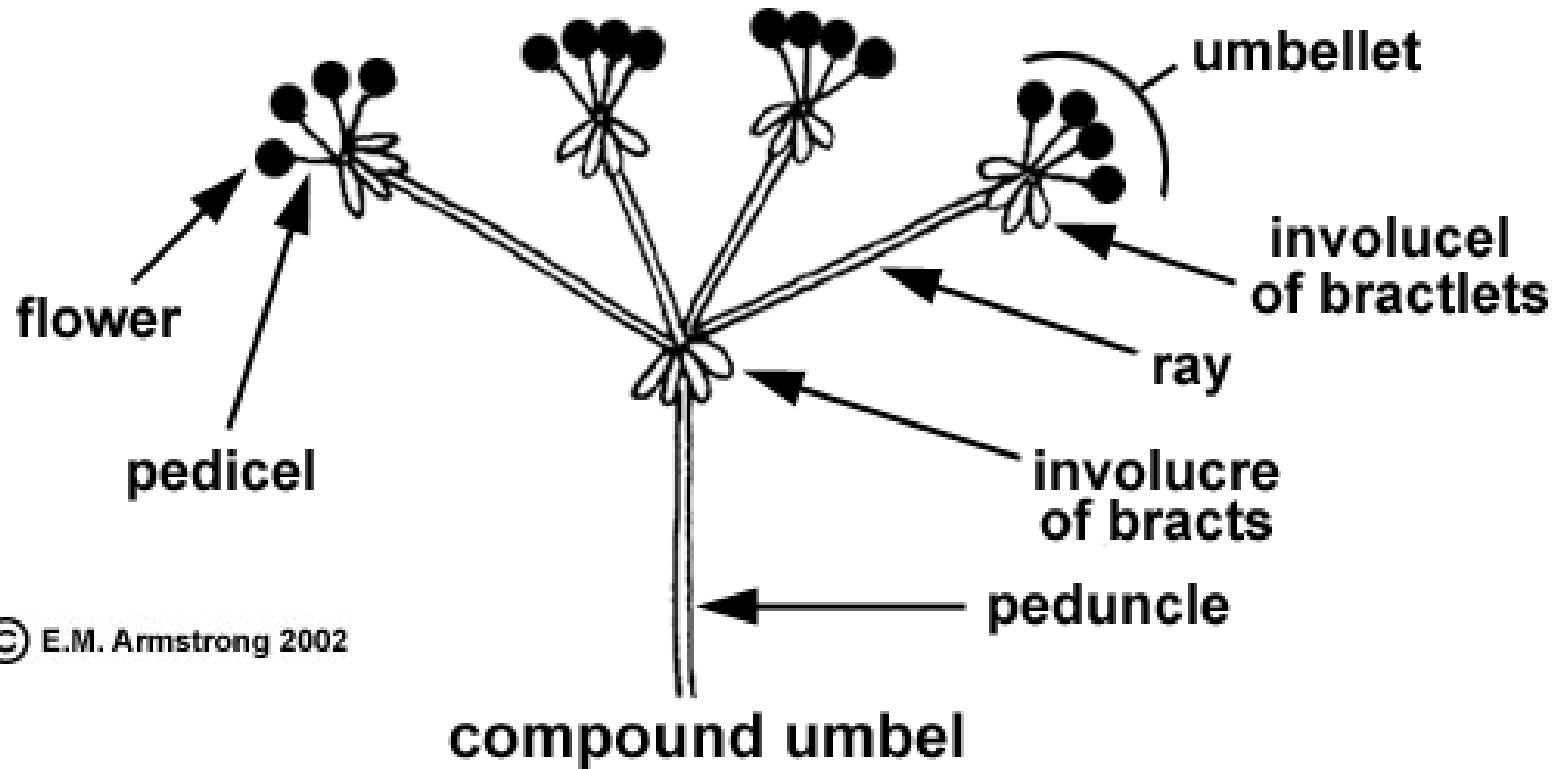








In a cyme, the oldest flower terminates the main axis. Scorpioid cymes have one-sided branching, forming a coiled inflorescence typical of the families Boraginaceae and Hydrophyllaceae.



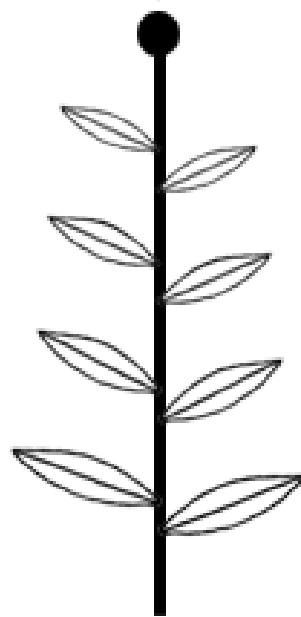
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Typical inflorescence of the carrot family (Apiaceae = Umbelliferae)



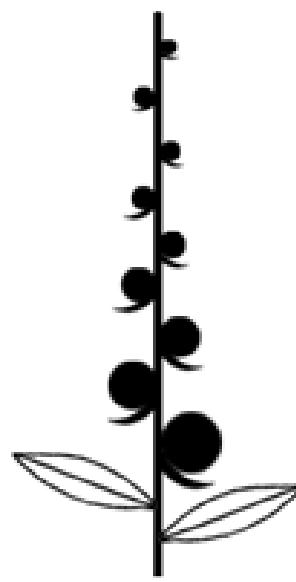
© E.M. Armstrong 2002

**flower
solitary**



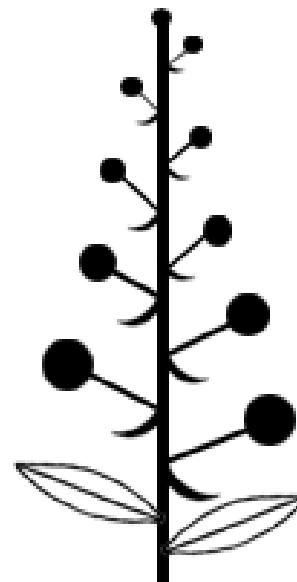
solitary

**flowers
sessile**



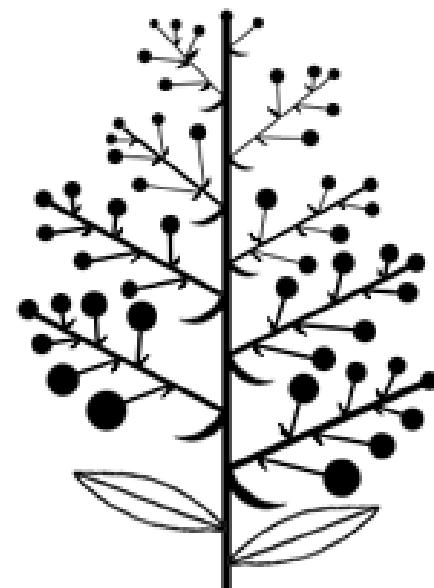
spike

**flowers on
pedicels**



raceme

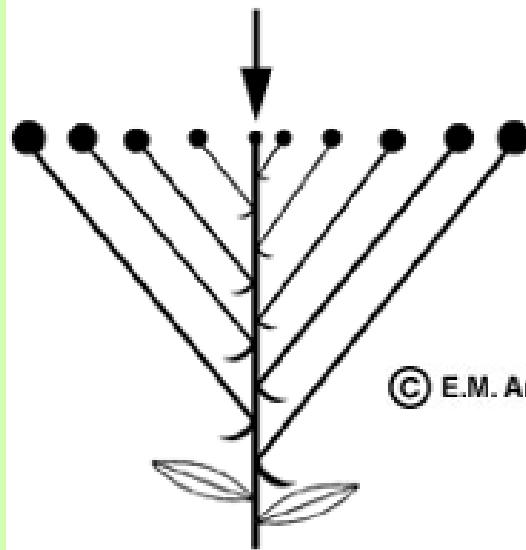
**branched
raceme**



panicle

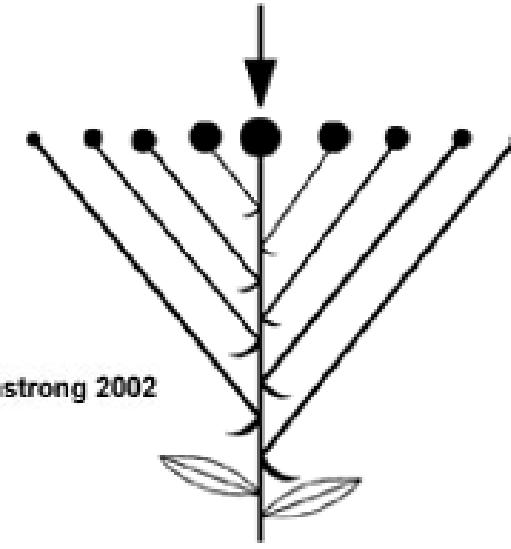


youngest flower



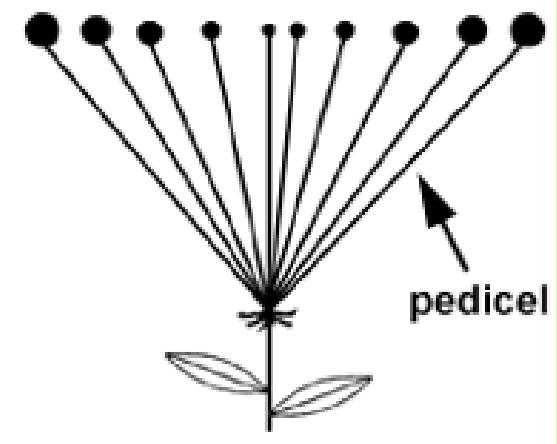
corymb

oldest flower

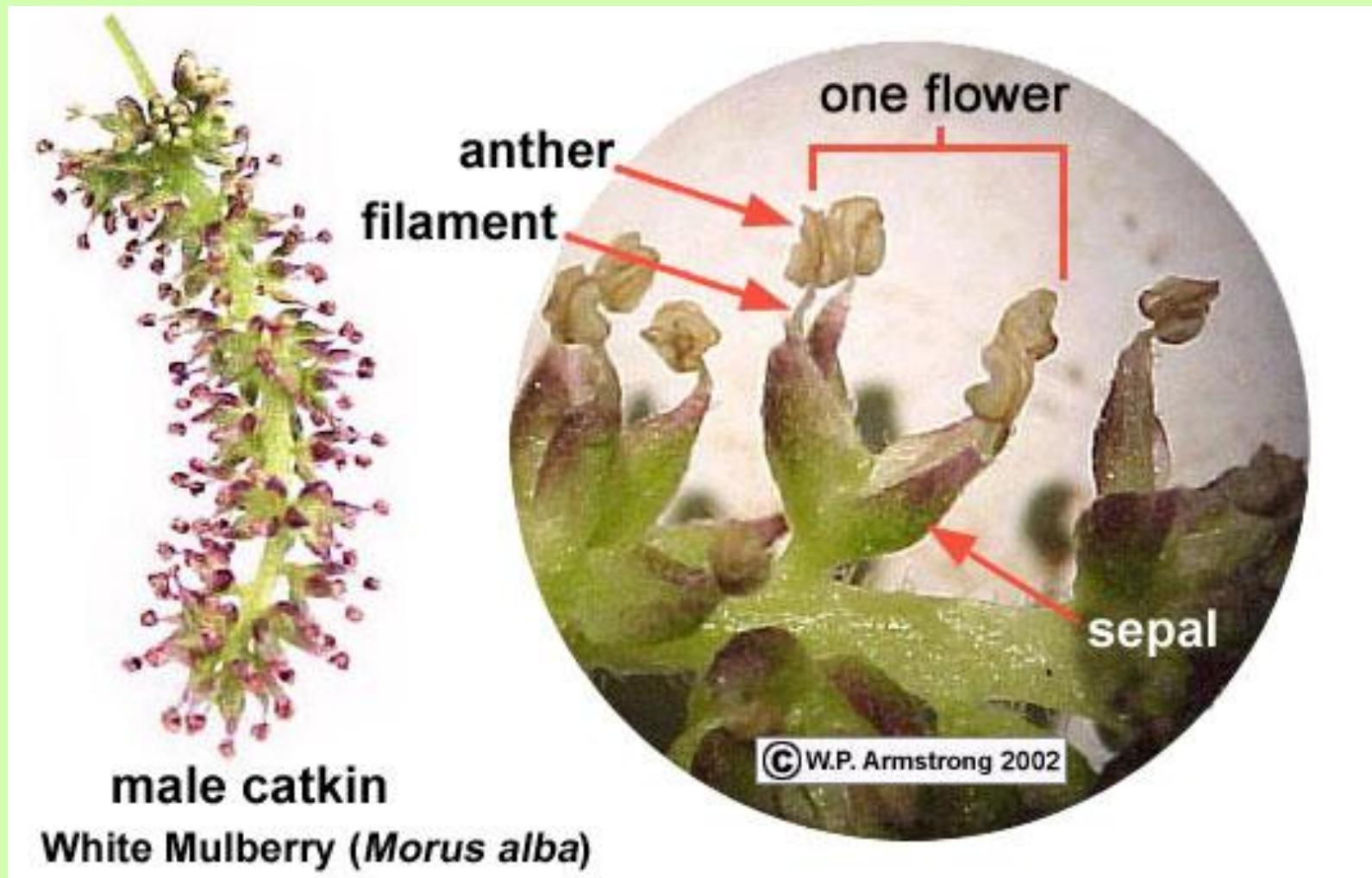


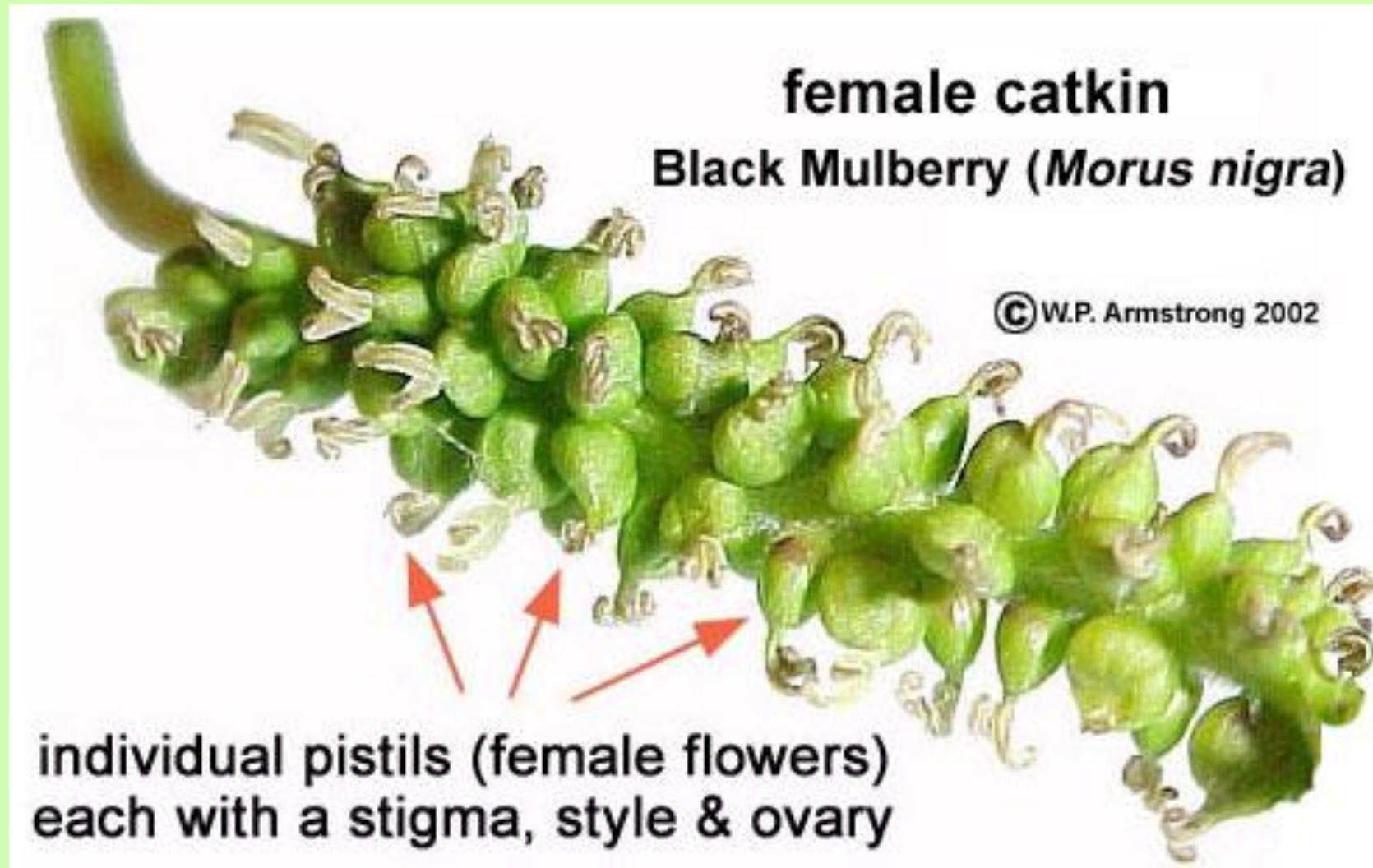
cyme

In an umbel, all the pedicels arise from a common point.



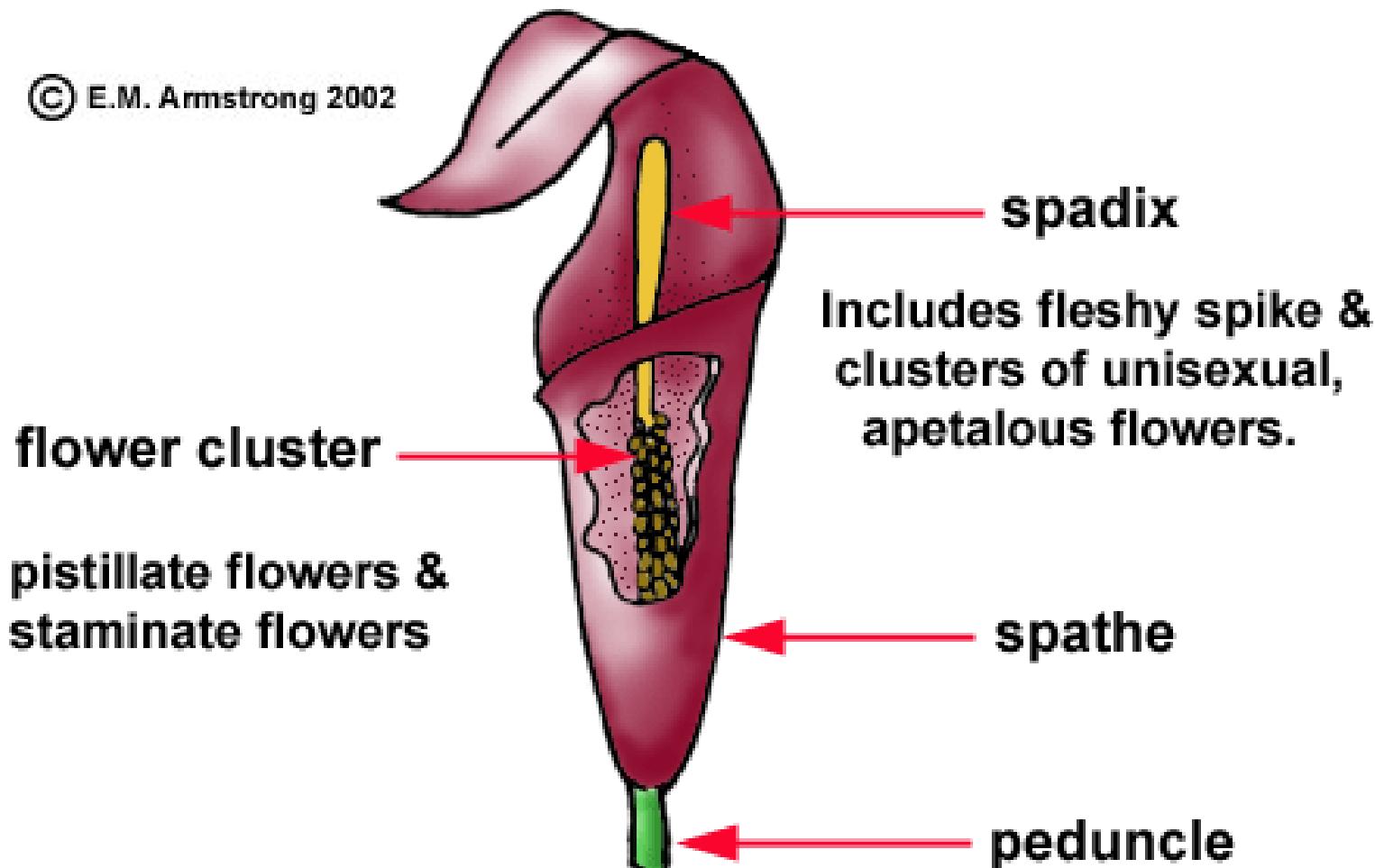
umbel



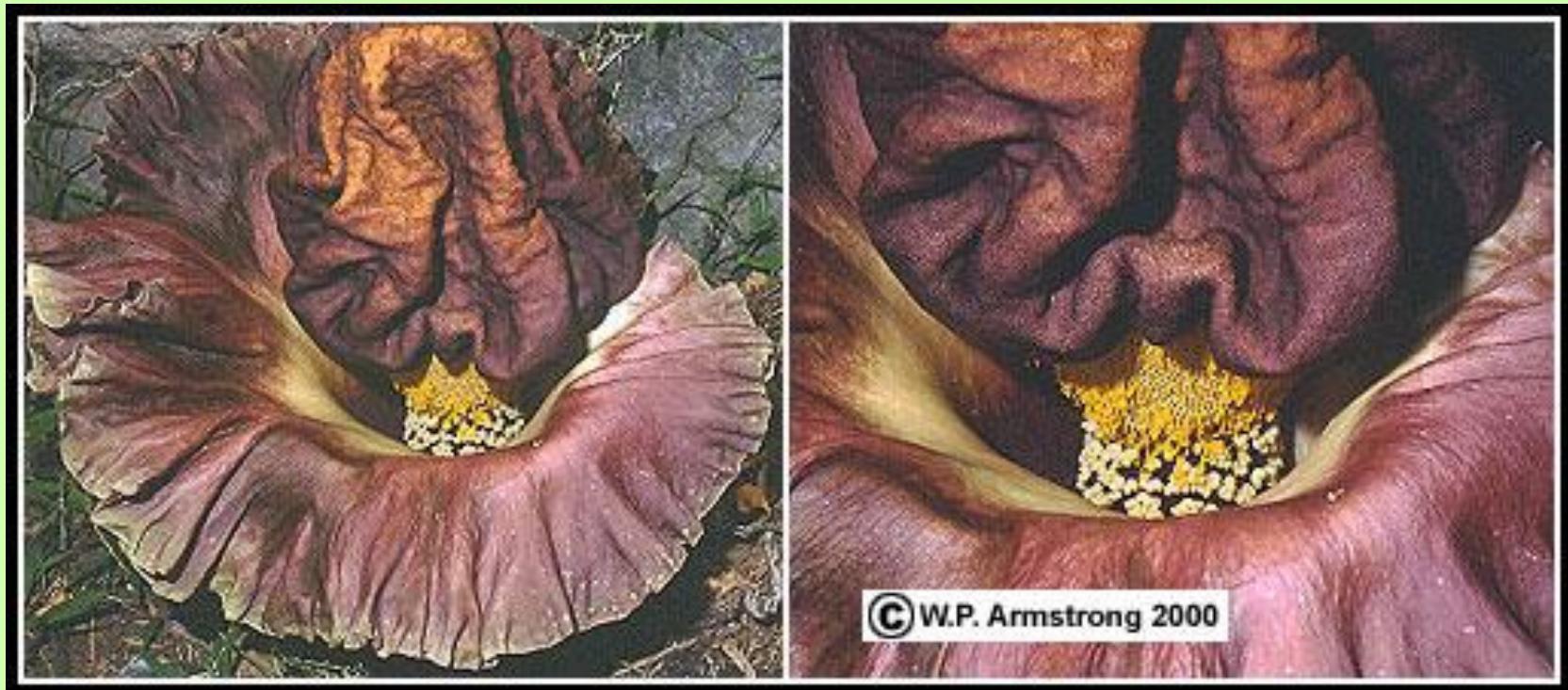


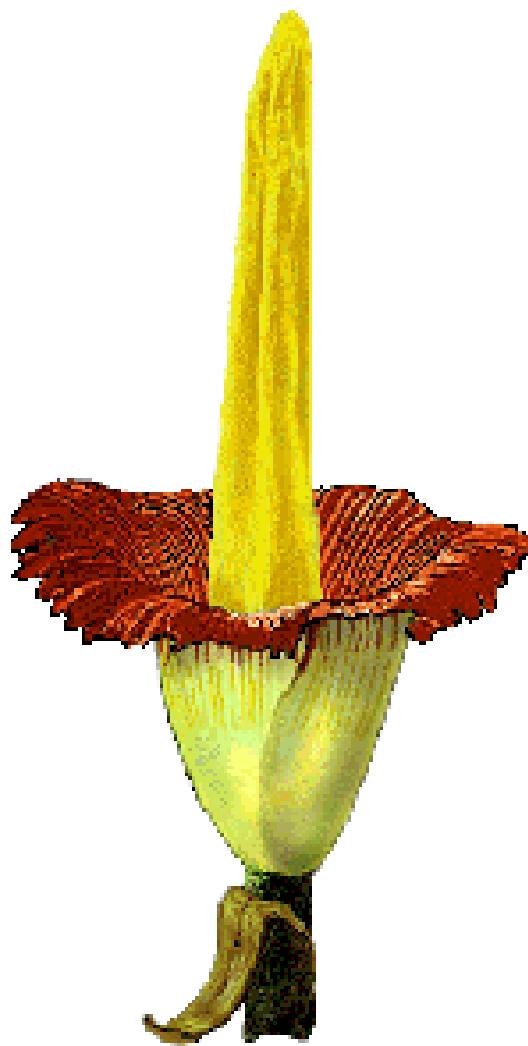


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Spadix of Arum Family





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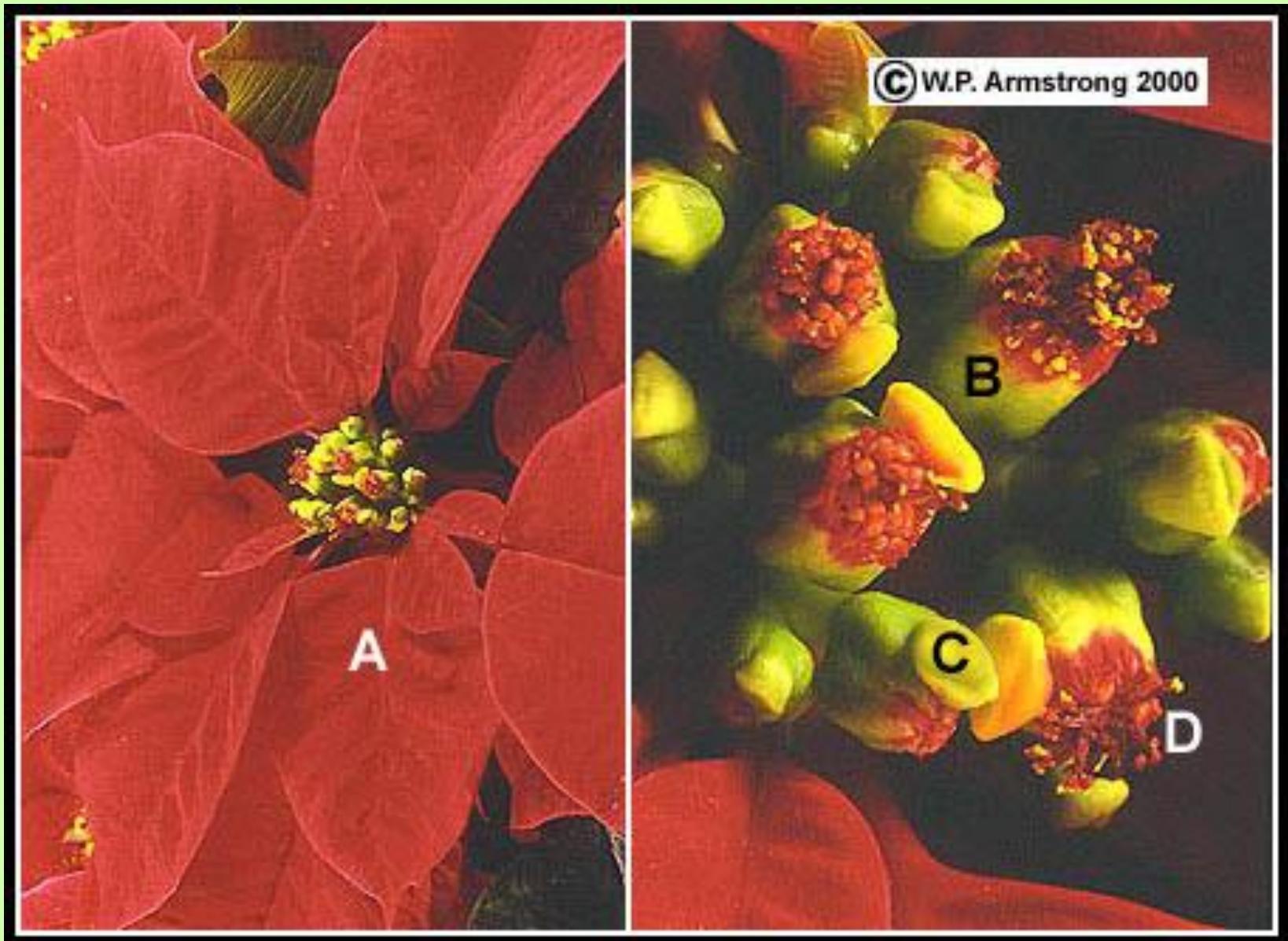
Spathe Bowls

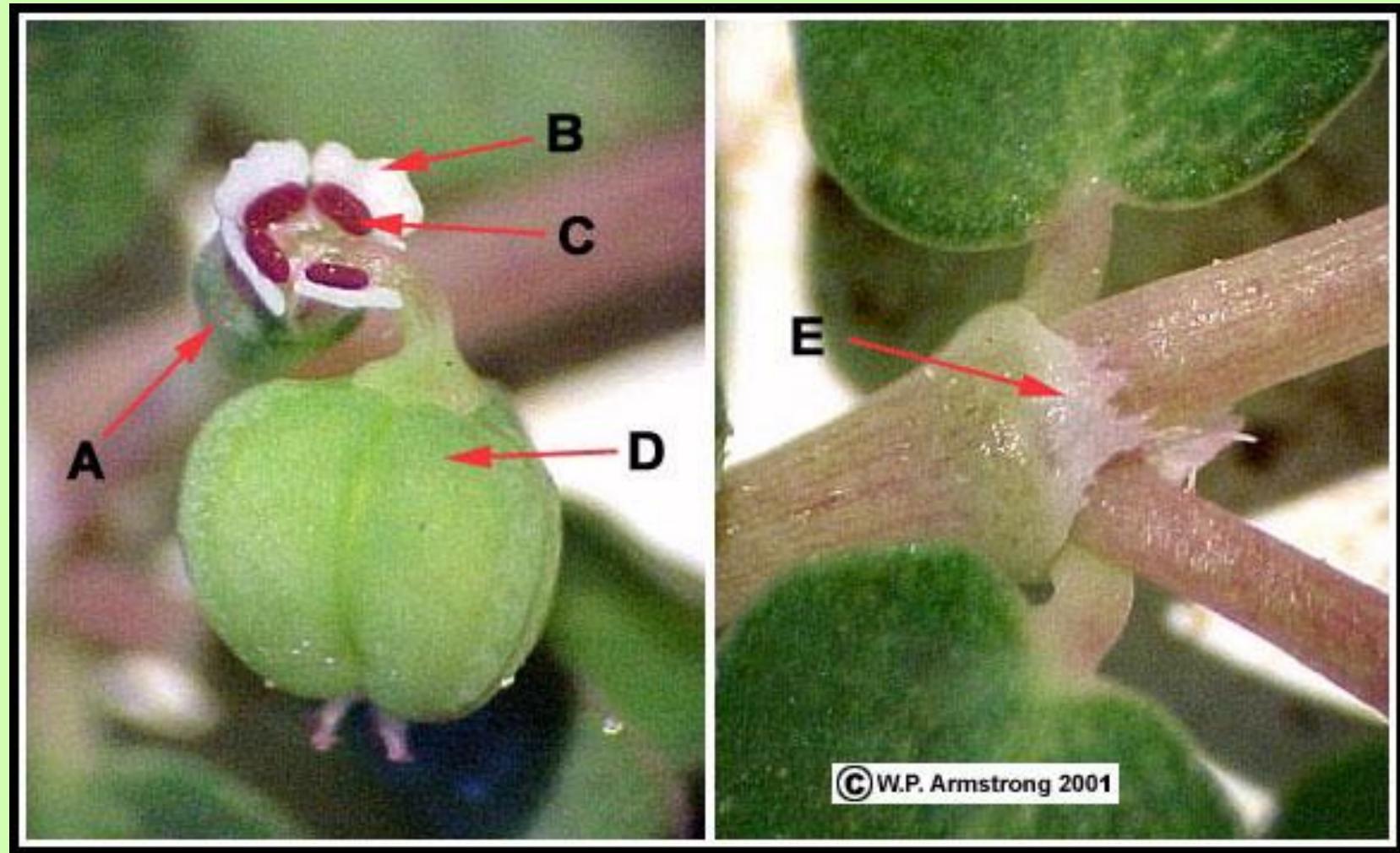
Deciduous bracts that envelop the inflorescence of a coconut palm (*Cocos nucifera*).



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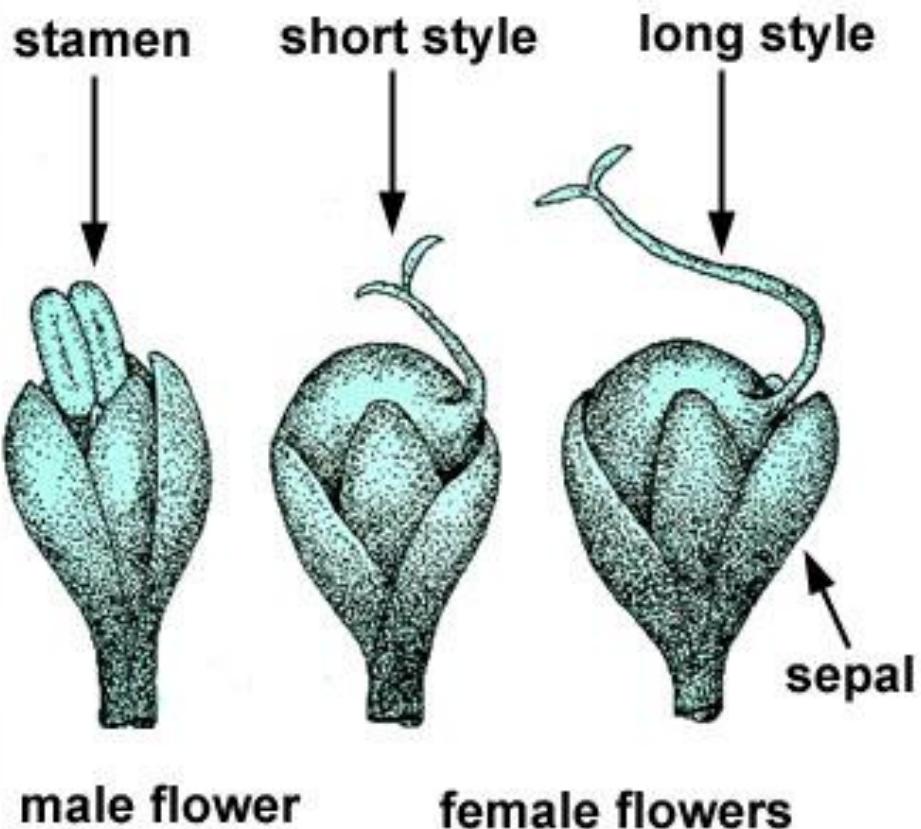
spathe



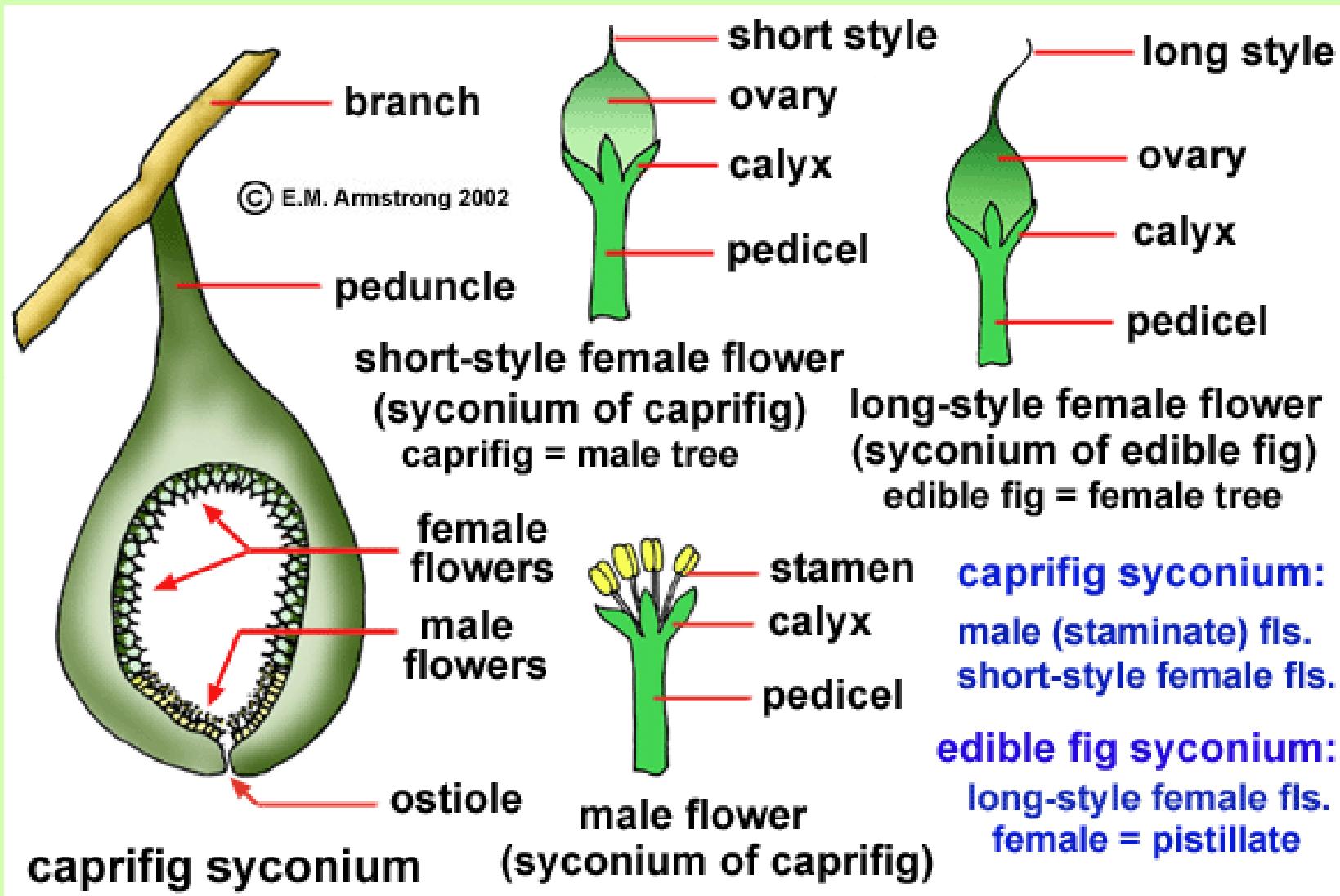




view inside a syconium

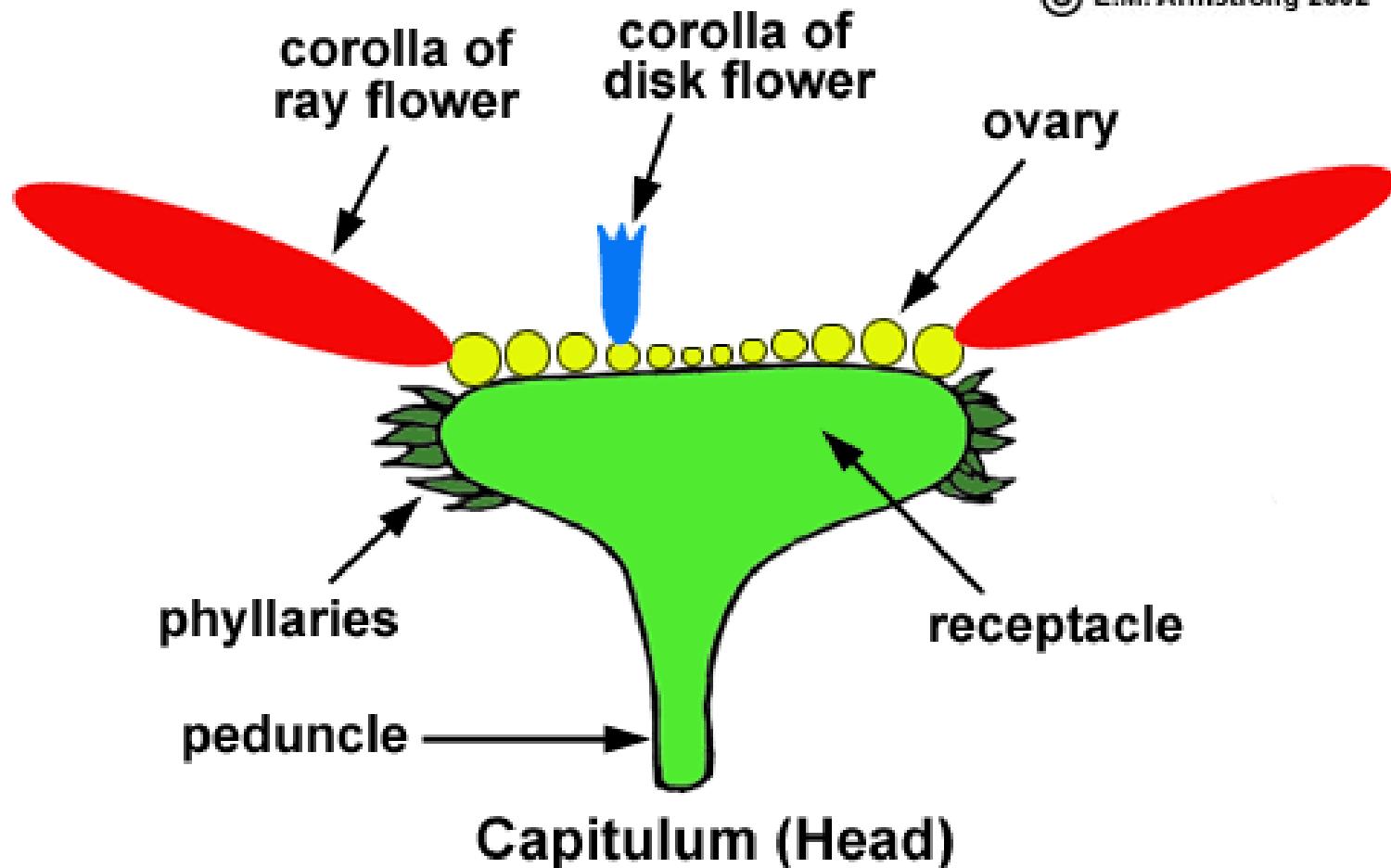


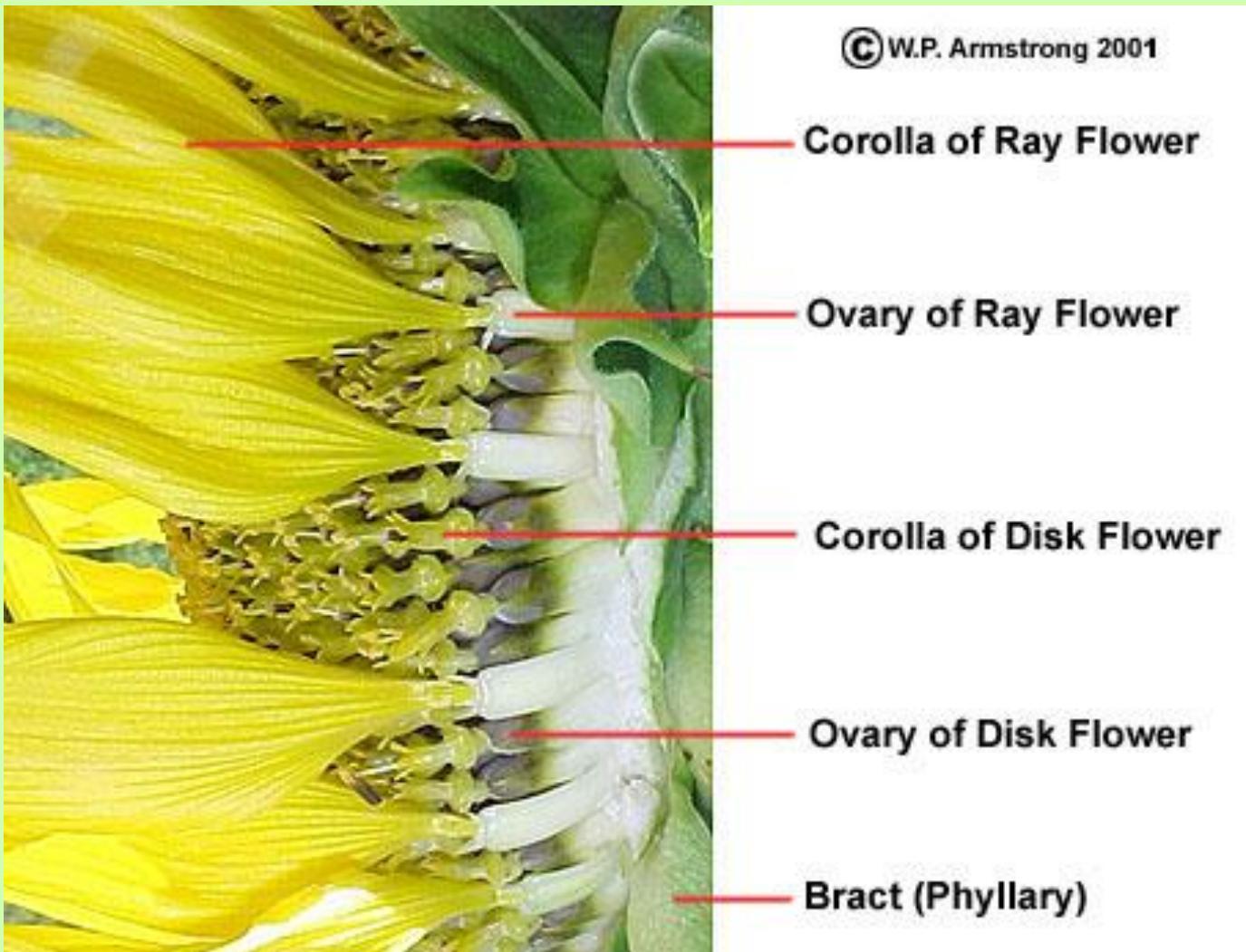
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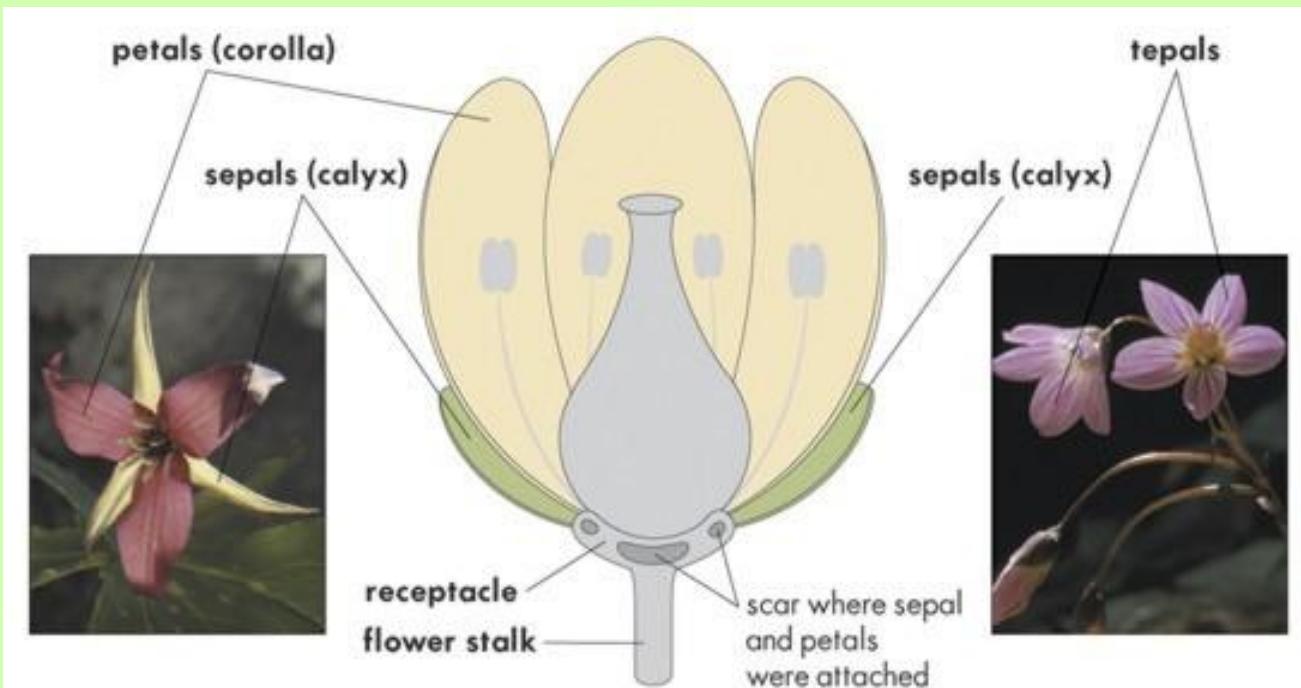


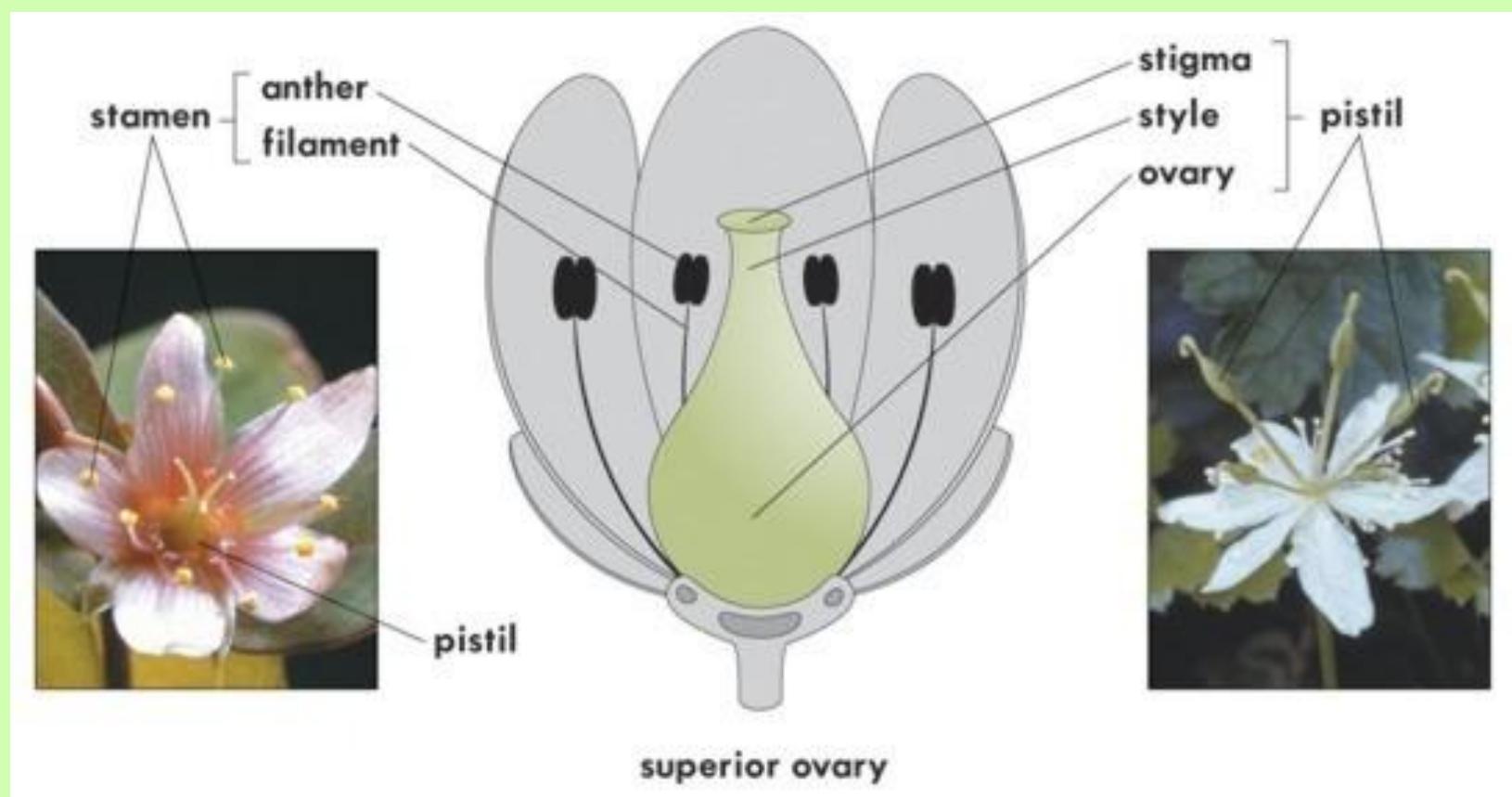


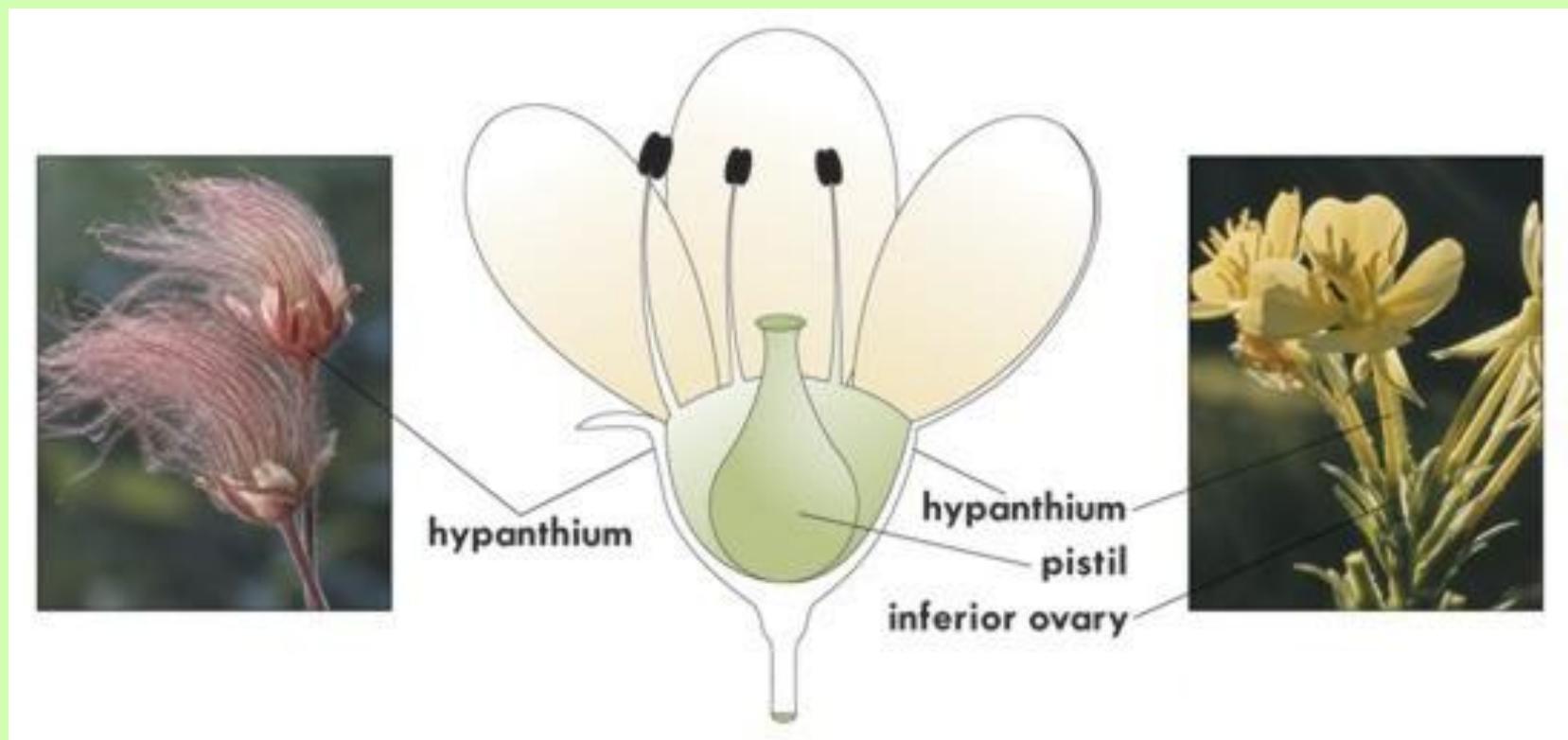
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Correspondence between flower and fruit

