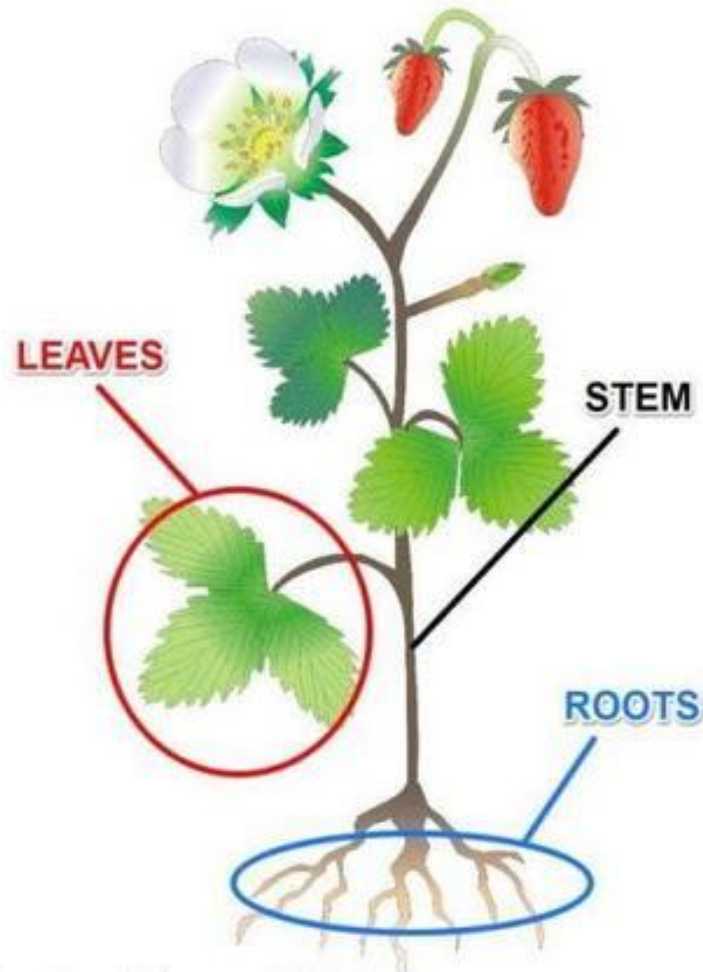


Shoot system (Stem + Associated Leaves)

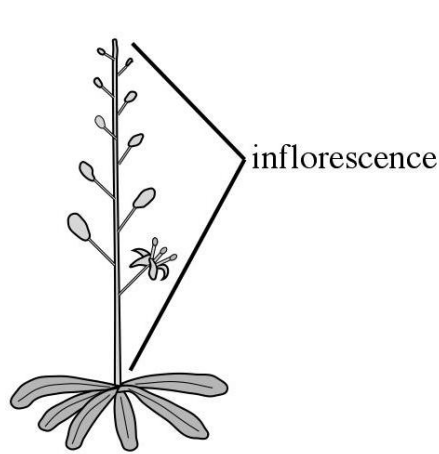


Functions:

- Support for and the elevation of leaves, flowers and fruits.
- The stems keep the leaves in the light and provide a place for the plant to keep its flowers and fruits.
- Transport of fluids between the roots and the shoots in the xylem and phloem

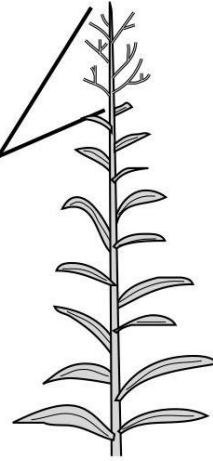
Stem Habit

=relative position of stem (+ growth, structure)



acaulescent

نبات عديم الساق



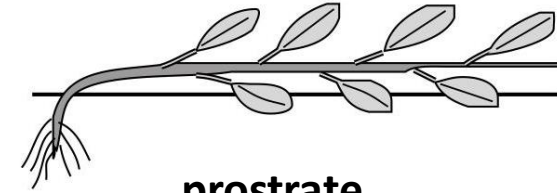
caulescent

نبات ذو ساق



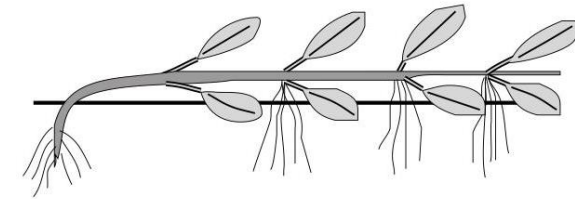
cespitose

نبات ذو ساق خصلي (ذو خصل)



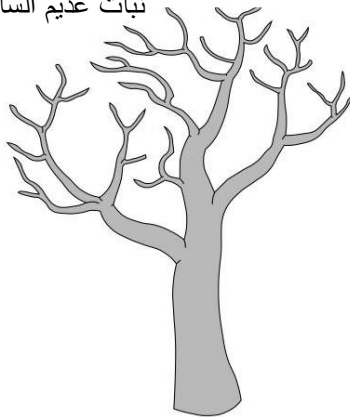
prostrate

نبات ذو ساق زاحف او مفترش



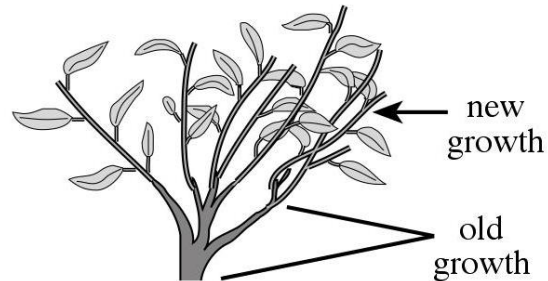
repent

ساق زاحف او مفترش



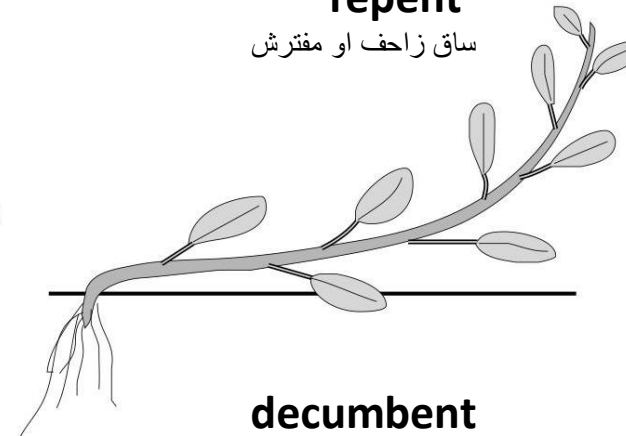
arborescent

ساق شجري



suffrutescent

ساق متخشبة القاعدة



decumbent

ساق منبطح

lateral branching

التفرع الجانبي

Dichotomous Branching

ثنائي التشعب (قمي)

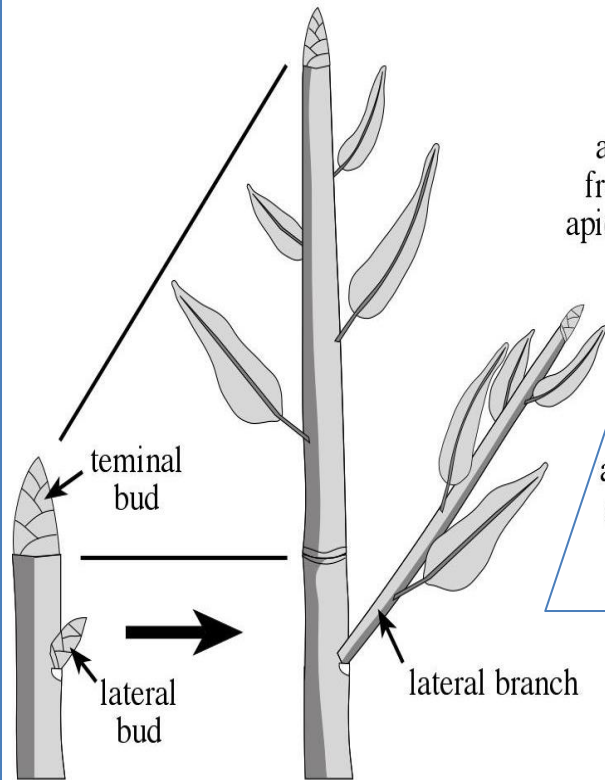
Stem Branching تفرع الساق

lateral branching

التفرع الجانبي

Monopodial Branching

تفرع صادق المحور

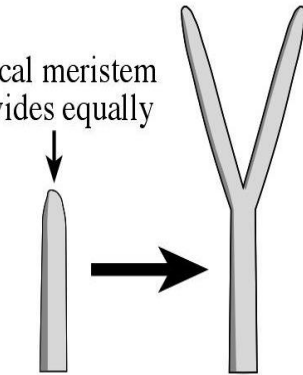


monopodial

axis derived from
single apical meristem

axis derived
from multiple
apical meristems

apical meristem
divides equally

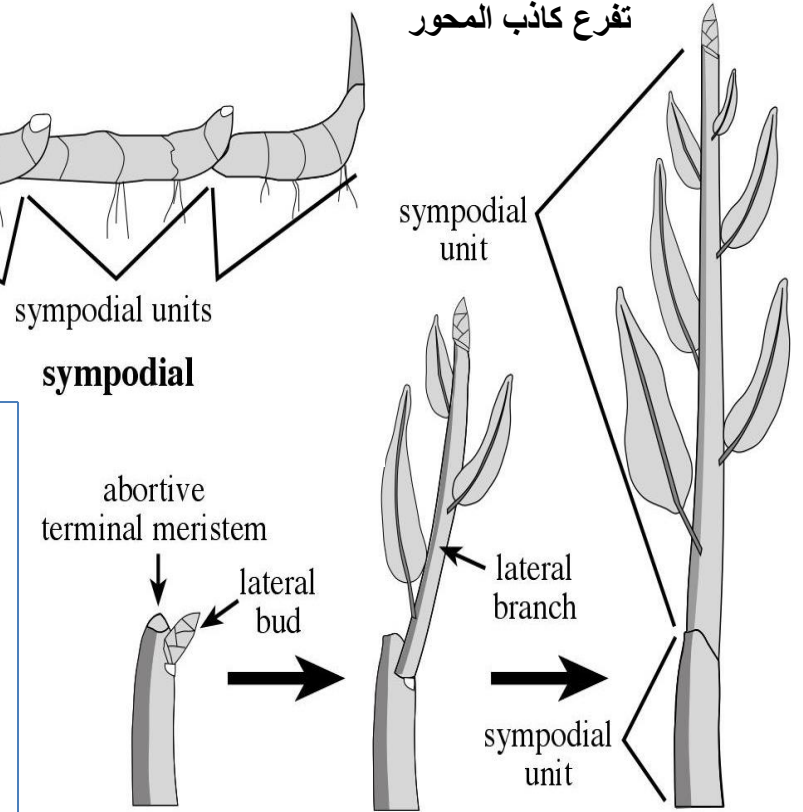


Dichotomous
Branching

ثنائي التشعب (قمي)

Sympodial Branching

تفرع كاذب المحور



sympodial
unit

sympodial

abortive
terminal meristem

lateral
bud

lateral
branch

sympodial
unit

sympodial

axis derived from
multiple apical meristems



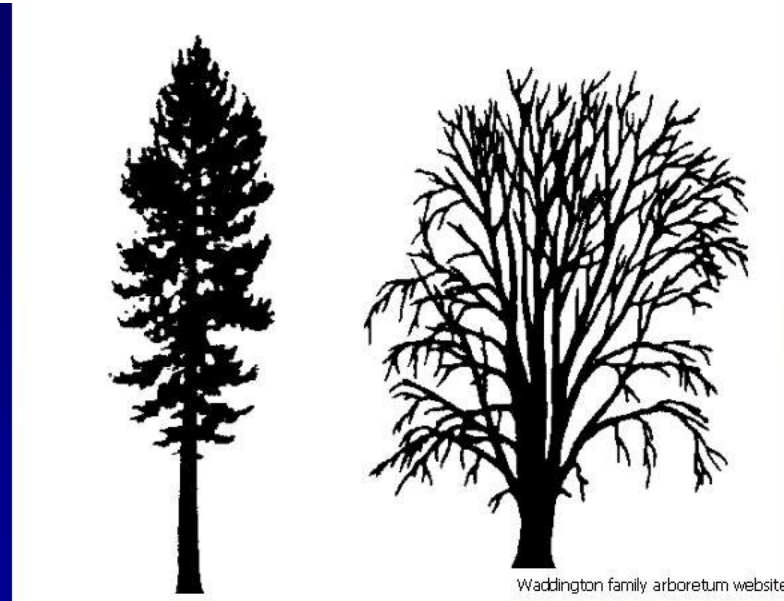
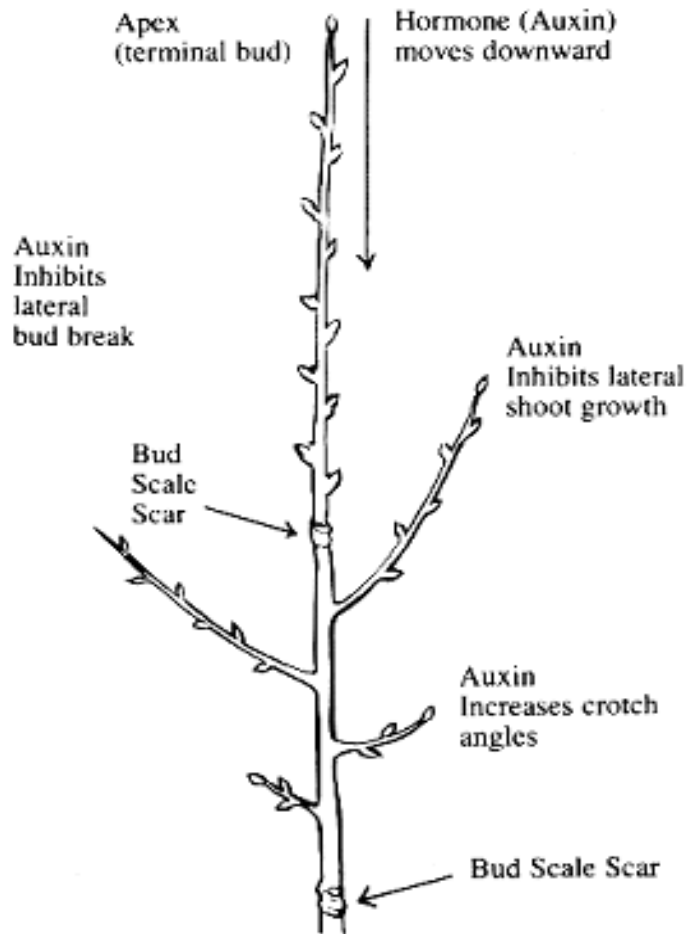
Summary

Type of Branching	How Growth Occurs	Shape of Plant
Monopodial	Main stem keeps growing; side branches arise laterally	Straight / pyramidal
Sympodial	Main stem stops; lateral bud continues growth	Zig-zag / spreading
Dichotomous	Tip splits equally into two	Forked / “Y”-shaped

Apical Dominance السيادة القمية

Usually the growing terminal bud inhibits the development of the lateral buds, a phenomenon known as **apical dominance** – as the influence of the apical meristem lessens the growth of the lateral buds which proceed with their development.

عادة نمو البرعم القمي يثبط نمو وتطور البراعم الجانبية، وتعرف هذه الظاهرة باسم السيادة القمية.



strong apical dominance:
Jeffrey pine

weak apical dominance:
silver maple

Apical Dominance السيادة القمية

Apical dominance is the phenomenon whereby the main, central stem of the plant grows more than other side stems.

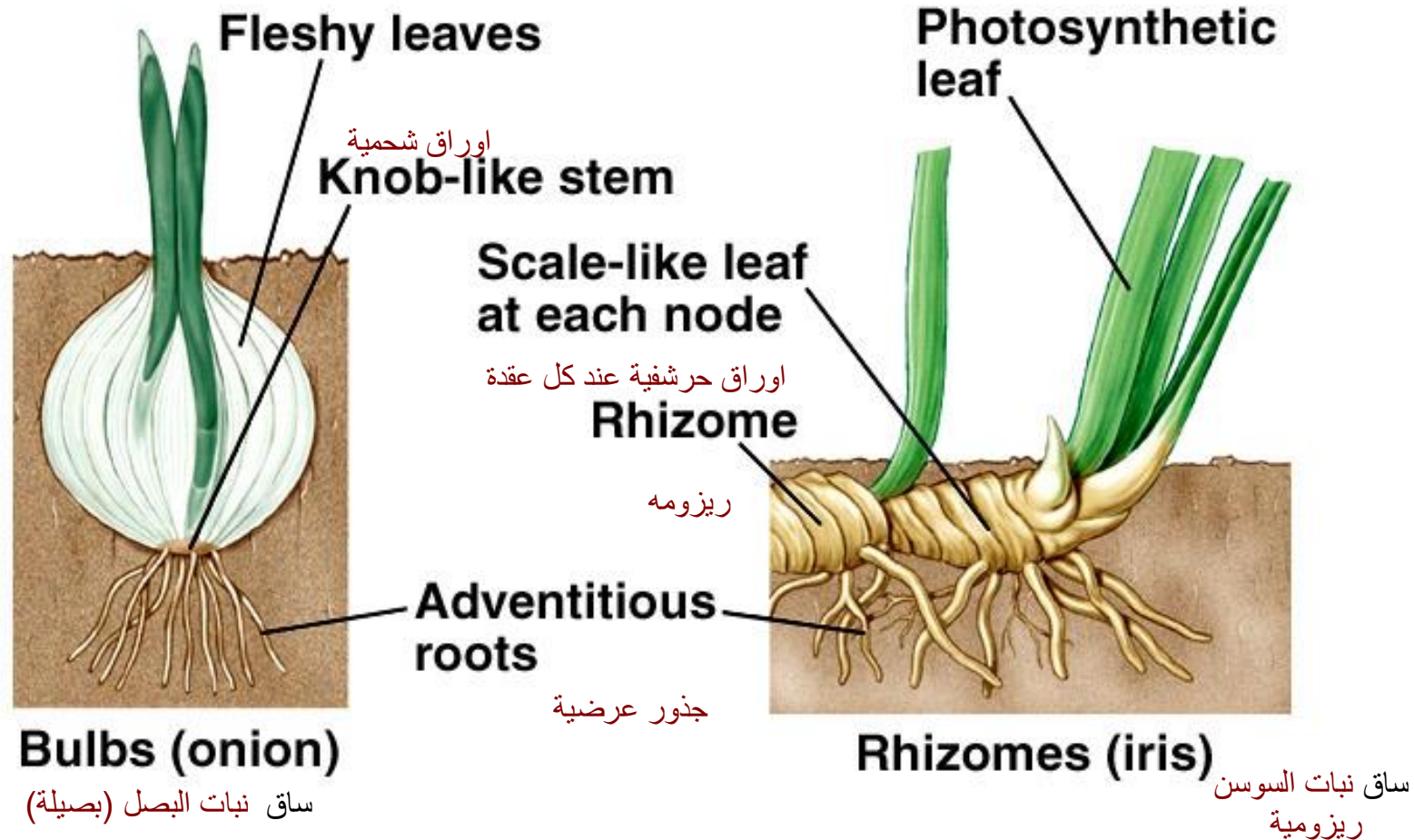


Stem (Shoot) Types & Modifications

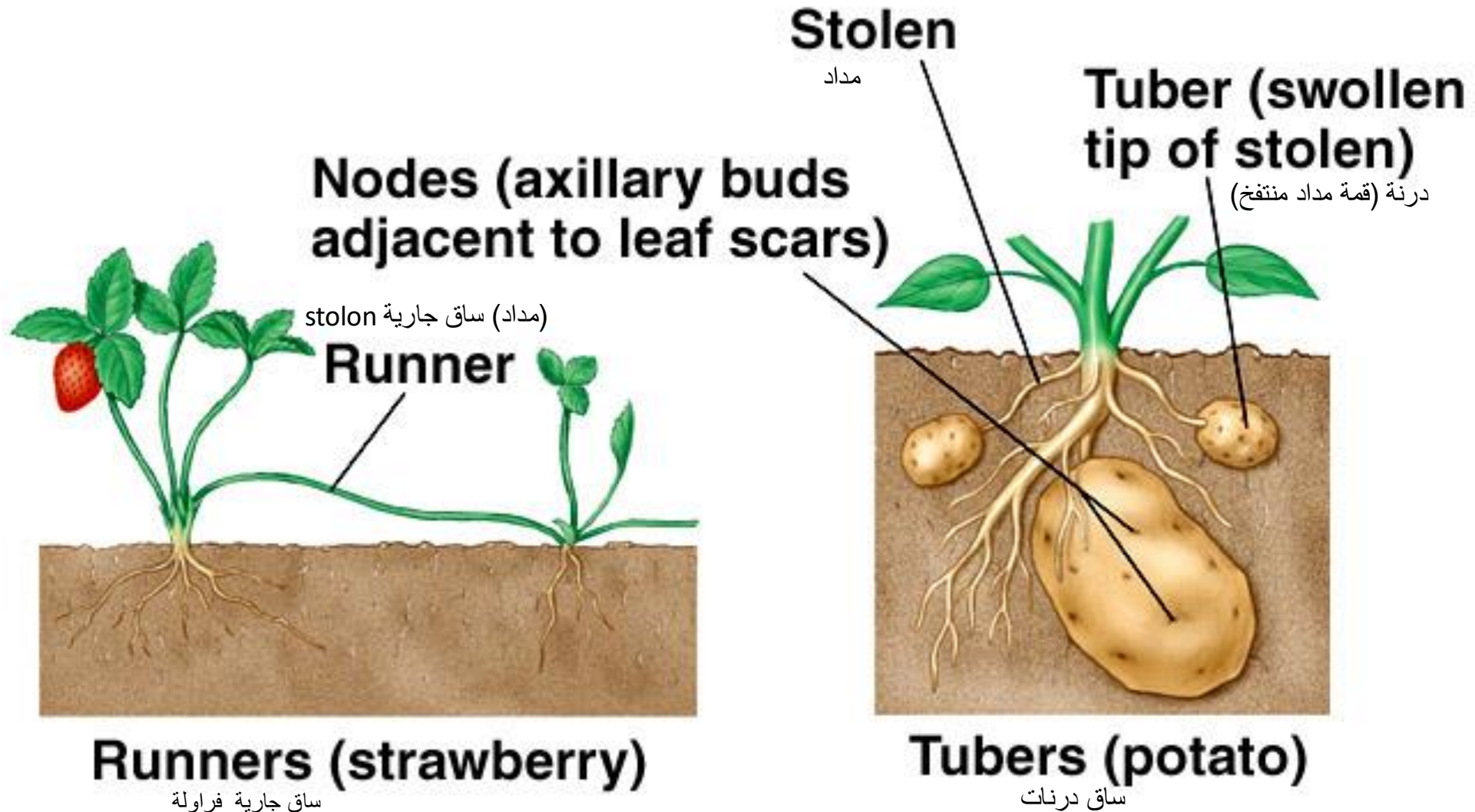
أنواع وتحوير السيقان

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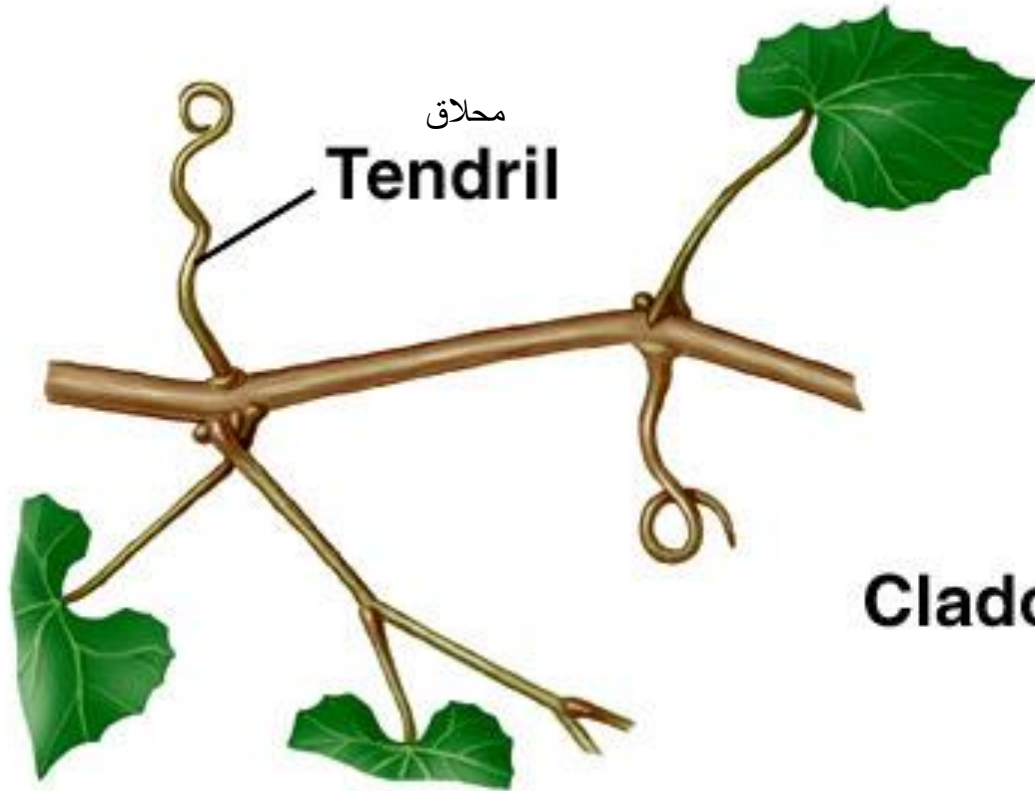
Types of Modified Stems (1)



Types of Modified Stems (2)

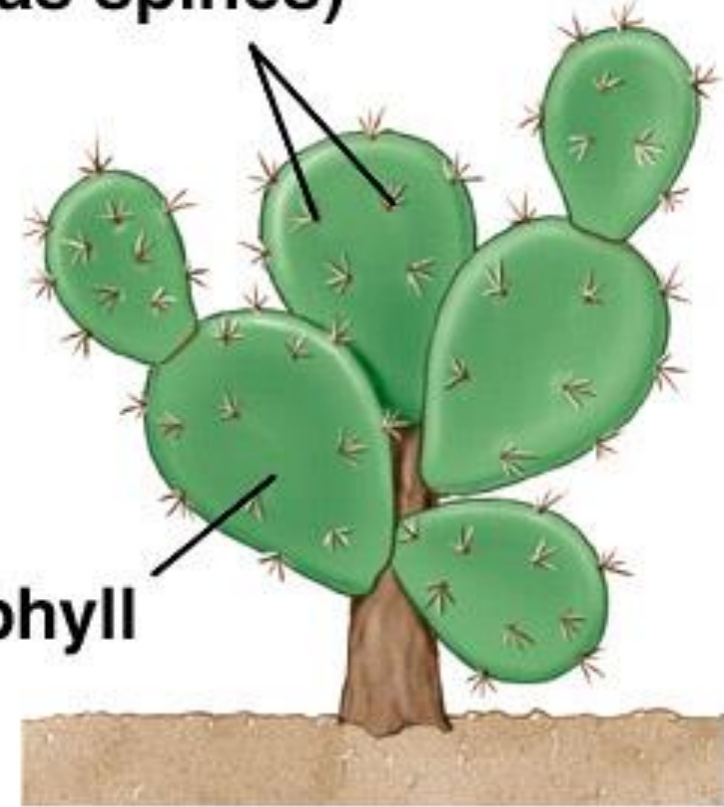


Types of Modified Stems (3)



Tendrils (grape) عنب
ساق محلاقية

Leaves (modified as spines) اوراق متحوّرة لأشواك

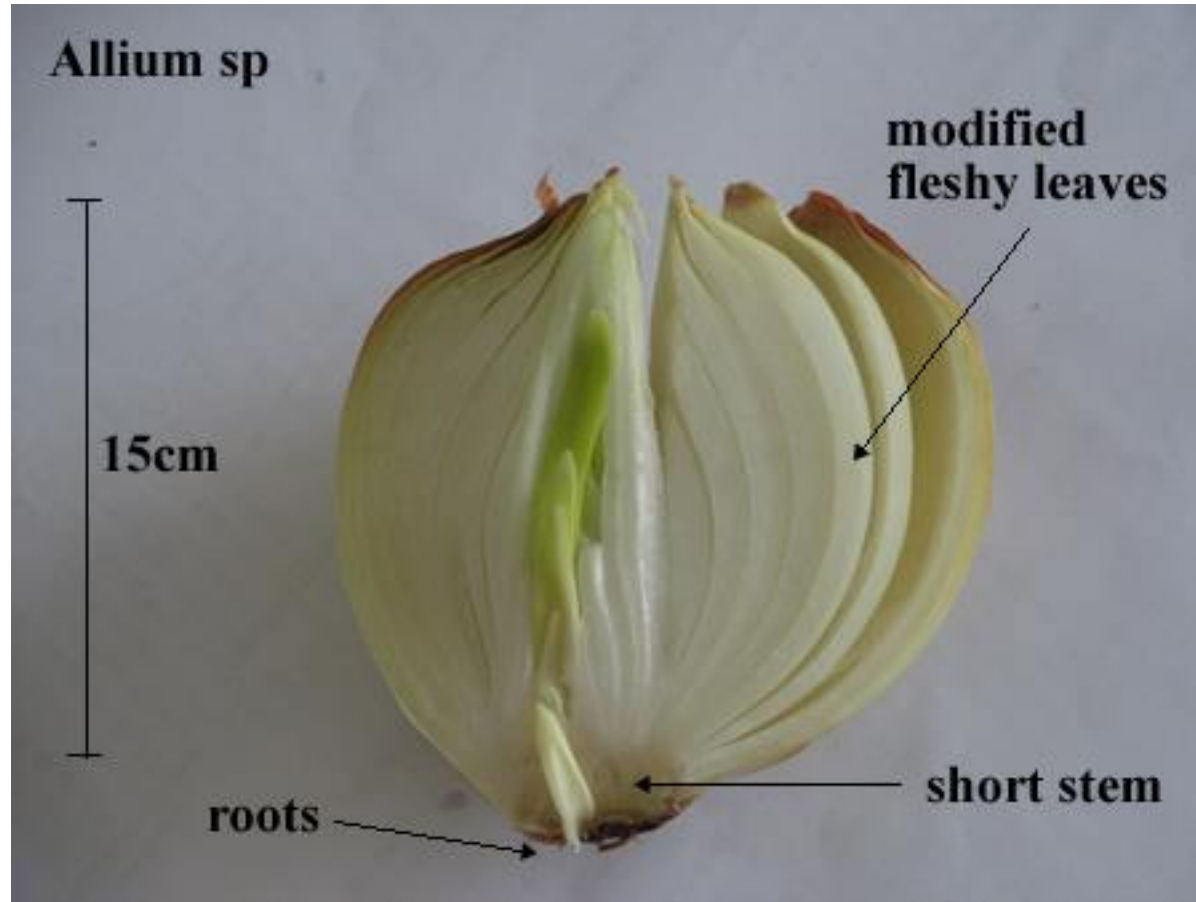


Cladophyll

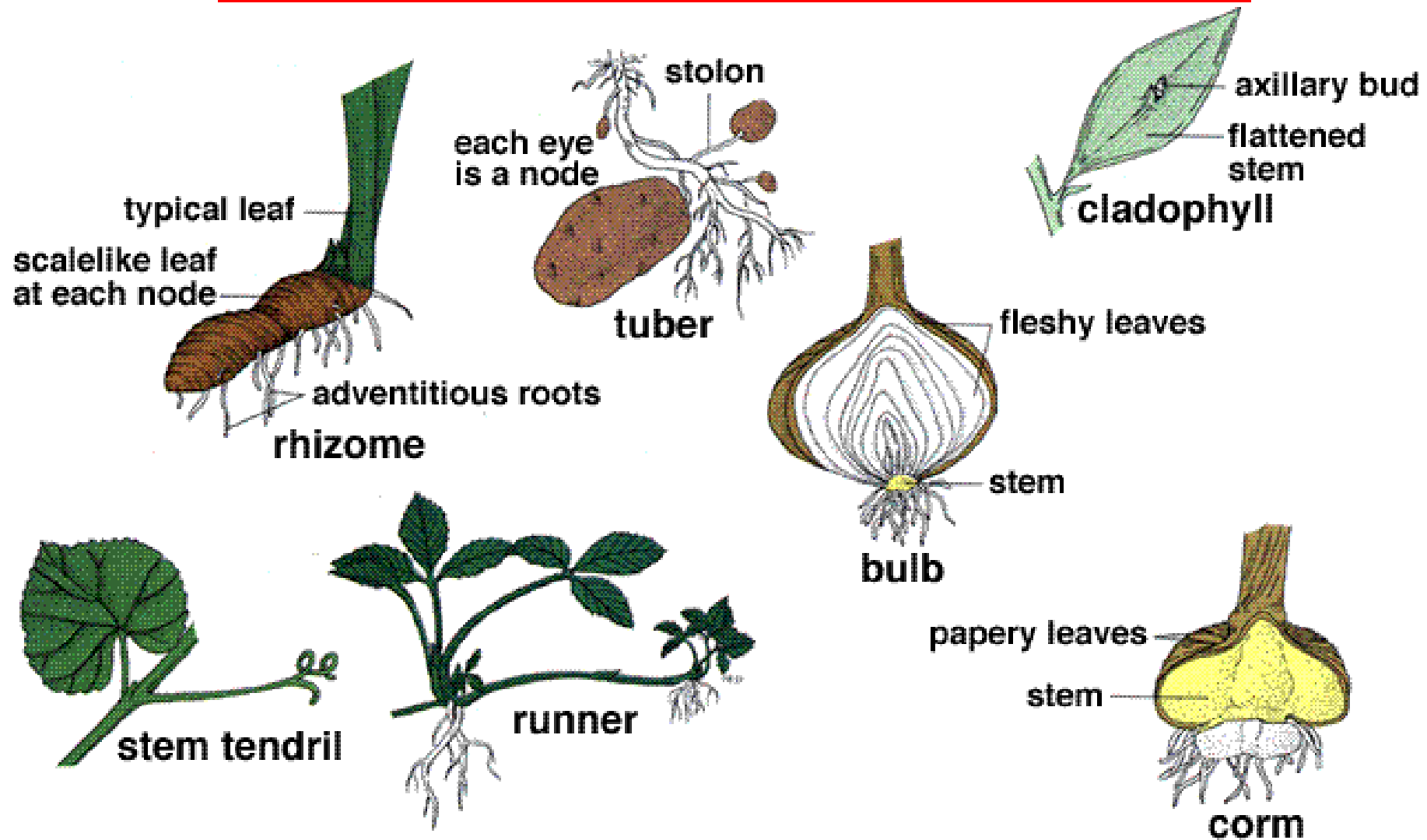
ساق ورقية
التين الشوكي

Cladophylls (prickly pear)

Onion Bulb



Types of Specialized Stems

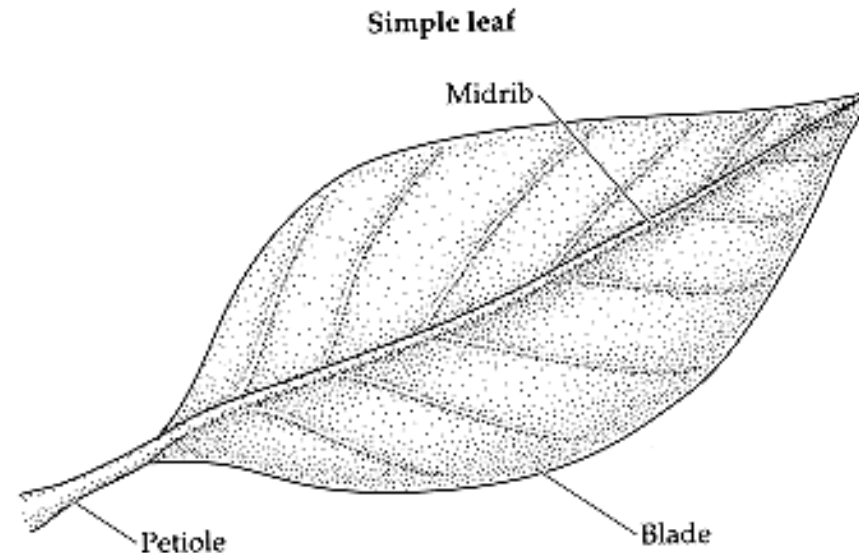


Leaves

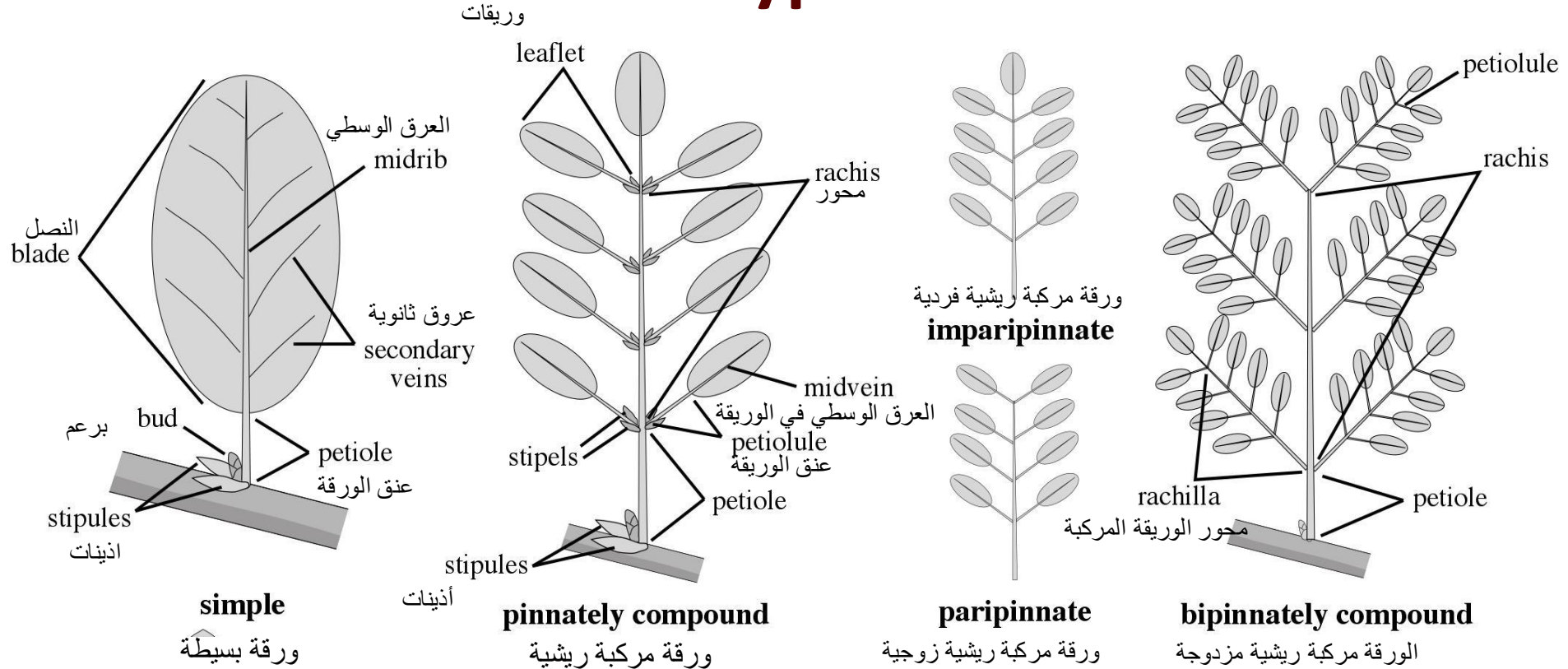
- The leaf- Is the main **photosynthetic organ** of most vascular plants
- Leaves generally consist of a flattened blade and a petiole, which joins the leaf to a node of the stem
- Leaves may appear different based on whether they grow in **shade** or **full sun**
- Some plant species have evolved **modified leaves** that serve various functions
 - Climbing, pollinator attraction, storage, digestion, prevention of water loss, etc.

External Parts of the Leaf:

- **Petiole** عنق
 - Leaf stalk or part that connects the leaf to the stem.
- **Blade** نصل
 - The large, flat part of a leaf.
- **Midrib** عرق وسطي
 - The large center vein.



Leaf Types



(a) Simple leaf.

ورقة بسيطة

A simple leaf is a single, undivided blade.

(b) Compound leaf (Pinnate).

ورقة مركبة ريشية

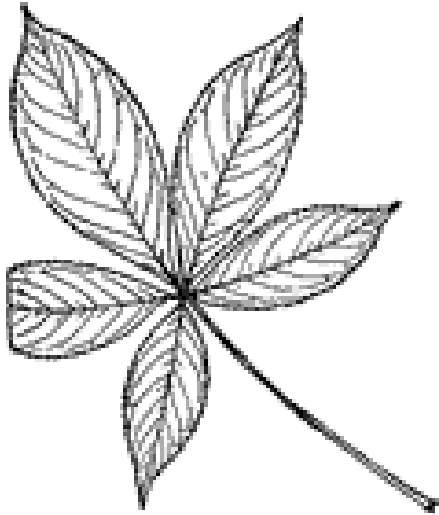
In a compound leaf, the blade consists of multiple leaflets. Note that a leaflet has no axillary bud at its base.

(c) Doubly compound leaf (Bipinnate).

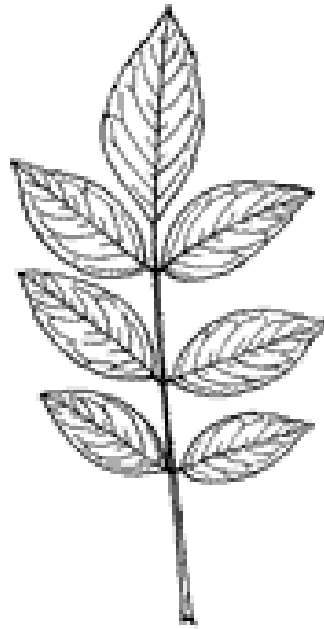
ورقة مركبة ريشية مزدوجة

In a doubly compound leaf, each leaflet is divided into smaller leaflets.

Compound Leaves



palmately
compound
ورقة راحية مركبة



pinnately
compound
ورقة ريشية مركبة



Bi-Pinnately Compound Leaf
ورقة مركبة ريشية مزدوجة

تعرق الورقة Leaf Venation

– تعرق متوازي

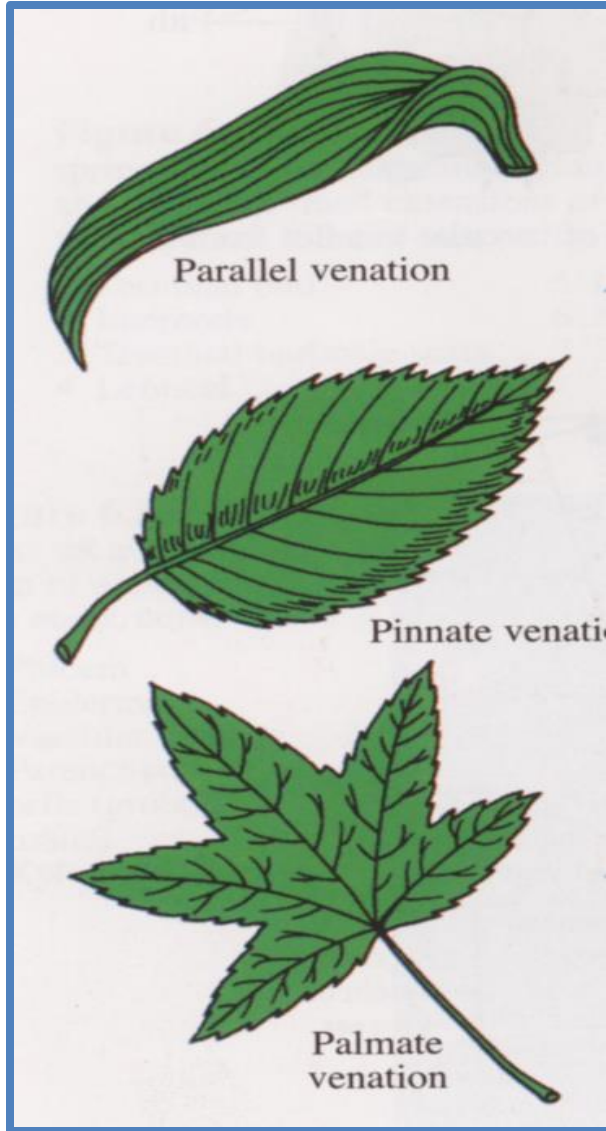
Parallel-veins extend the entire length of the leaf with little or no cross-linking

– تعرق ريشي

Pinnate-leaves have one major vein from which others branch

– تعرق راحي

Palmate-leaves have several veins which branch



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Reticulate
شبكة

Dicot and Monocot Leaves

Parallel
متوازي



Leaf Adaptations/ Modifications

Some plant species have evolved modified leaves to serve various functions.

- (a) **Tendrils.** The tendrils by which this pea plant clings to a support are modified leaves. After it has “lassoed” a support, a tendril forms a coil that brings the plant closer to the support. Tendrils are typically modified leaves, but some tendrils are modified stems, as in grapevines.



- (b) **Spines.** The spines of cacti, such as this prickly pear, are actually leaves, and photosynthesis is carried out mainly by the fleshy green stems.



- (c) **Storage leaves.** Most succulents, such as this ice plant, have leaves modified for storing water.



- (d) **Bracts.** Red parts of the poinsettia are often mistaken for petals but are actually modified leaves called bracts that surround a group of flowers. Such brightly colored leaves attract pollinators.



- (e) **Reproductive leaves.** The leaves of some succulents, such as *Kalanchoe daigremontiana*, produce adventitious plantlets, which fall off the leaf and take root in the soil.





Tendril



Spiny leaf- Cacti spines



Succulent leaves



Brightly-colored leaves- to attract pollinators



Leaf Modifications

(d) Poinsettia leaves attract pollinators.



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(e) Pitcher plant leaves trap insects.



(f) Flowerpot plant leaves collect soil.



Modified into Sharp structure for protection

- **Thorn** – Hard, long, sharp-pointed
- **Spine** - Hard, rigid extensions of leaves
- **Prickle** – Hard, sharp pointed



Prickles

Thorns

Spines

Tentacular Leaf

A leaf bearing numerous, sticky, glandular hairs or bristles that function in capturing and digesting small animals, e.g. *Drosera*



Tentacular Leaf - *Drosera* spp (Droseraceae)

Carnivorous plants

- Insect-Trapping Leaves in areas with low soil Nitrogen
- Insect digested by enzymes to release Nitrogen from proteins



Trap Leaf of *Dionaea muscipula* capturing fly

Leaf modification

(Pitcher plant leaf)



Modification of leaves:

Reproductive Leaves - development of a new plants at tip of the leaf.



Sun and Shade Leaves



Shade Leaves



Sun Leaves

Grown in shade

Grown in sun

