

Introduction to Botany. Lecture 22

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October 27, 2014



1 Questions and answers

2 Leaf

- Repetitive characters
 - Terminal characters
- Leaves in nature
- Modifications of leaf



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2 Leaf

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Previous final question: the answer

How many levels of hierarchy has this leaf?



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3



Leaf

Repetitive characters



Repetitive characters

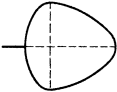
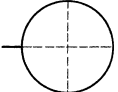
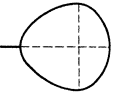
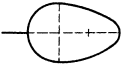
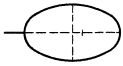
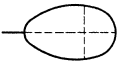

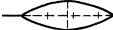
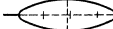

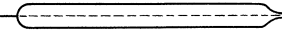
Repetitive characters are the same on each level of leaf hierarchy:

- Shape
- Dissection
- Petiole (stalked/non-stalked etc.)


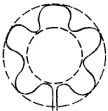







Repetitive characters of same type may combine



Shape

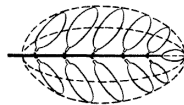
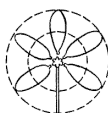
	Maximum width closer to leaf base	Maximum width in the middle	Maximum width closer to the apex
Length = width or slightly more	 Deltate	 Circular	 Cuneate
Length > 1-1.5 x width	 Ovate	 Elliptic	 Obovate
Length > 3-4 x width	 Narrowly ovate	 Lanceolate  Oblong	 Narrowly obovate
Length > 5 x width	 Linear		

Dissection

		Tri-	Palmately	Pinnately
Simple leaves	Lobed (from 1/4 to 3/4)			
				
	Dissected (from 3/4 to midrib)			

Compound leaves

(leaflets stalked, with joints)



Terminal characters

Terminal (leaflet) characters are applicable only to terminal parts (normally, leaflets) of leaves:

- Form of base
- Form of tip
- Type of margin
- Surface
- Venation



Terminal characters: base of leaf blade

- Rounded
- Truncate (straight)
- Cuneate
- Cordate
- Sagittate



Terminal characters: leaf apex

- Rounded
- Mucronate
- Acute
- Obtuse
- Acuminate
- Retuse



Terminal characters: leaf margin

- Without teeth: smooth
- With teeth
 - Dentate
 - Serrate
 - Crenate
- Could be double-dentate, triple-serrate etc.



Terminal characters: leaf venation

Main vein Lateral veins	No	One	Several
	Apodromous	Hypho-	Acro-
Several	...	Ptero-	Actino-



Plan of leaf description

- 1 General characters (leaf as a whole):
 - A. symmetry (symmetrical / asymmetrical);
 - B. stipules (present / absent, deciduous / not);
 - C. base (sheath / no sheath, ligule / no ligule, auricles / no auricles)
- 2 First level of hierarchy: repetitive characters:
 - A. shape;
 - B. dissection;
 - C. petiole (length)
- 3 Second level of hierarchy
- 4 Third level of hierarchy and so on
- 5 Terminal characters (leaflets):
 - A. base [of leaf blade] (rounded, truncate, cuneate, cordate, sagittate);
 - B. apex (rounded, mucronate, acute, obtuse, acuminate, retuse);
 - C. margin (whole, dentate, serrate, crenate; degree of order);
 - D. surface (color, hairs etc.);
 - E. venation (apo-, hypho-, acro-, ptero-, actinodromous)



Leaf

Leaves in nature



Heterophyly

- Juvenile and adult leaves
- Water and air leaves
- Sun leaves and shade leaves



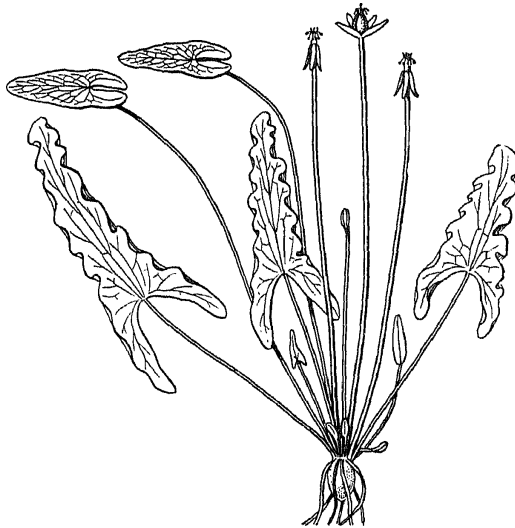
Juvenile leaves of *Juniperus* sp.



Juvenile leaves of *Eucalyptus* sp.



Submerged and floated leaves of *Ondinea*



Leaf mosaic

- Distribution of leaves of plants in a single plane, usually perpendicular to light rays
- Provides the least shading of leaves by one another



Leaf mosaic of red maple (*Acer rubrum*)

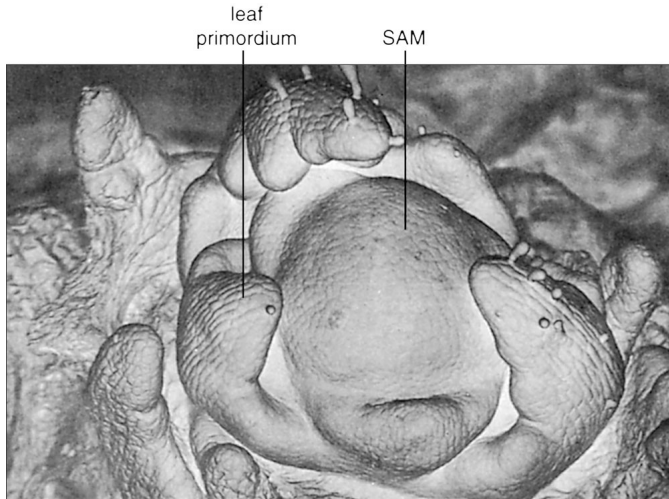


Seasonal life of leaves

- Leaves arise from SAM through leaf primordia
- Old leaves separate from plant in a region called abscission zone



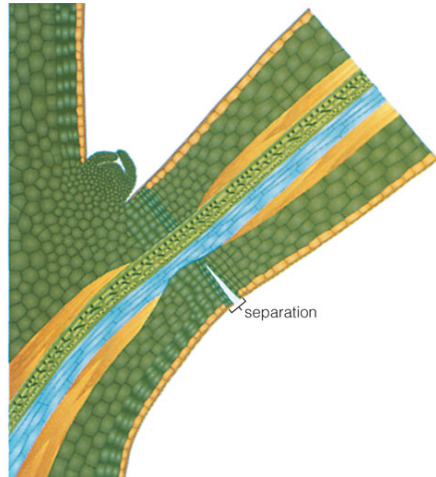
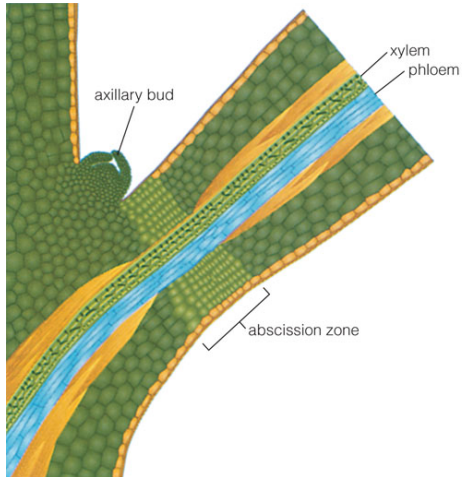
Leaf primordia



© 2006 Brooks/Cole - Thomson



Abscission zone



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Leaf

Modifications of leaf



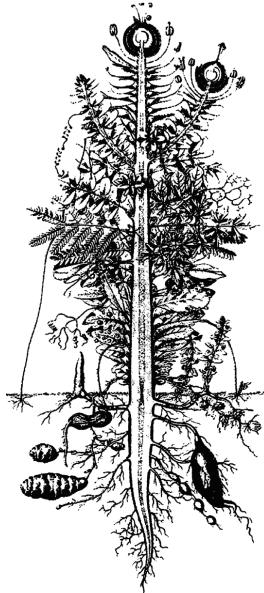
Goethe's theory of modification



Famous German poet and writer Johann Wolfgang Goethe is also a founder of plant morphology. He invented an idea of “primary plant” (“Urpflanze”) where all organs were modifications of one primordial organ.



Urpflanze (another interpretation)



Leaf modifications

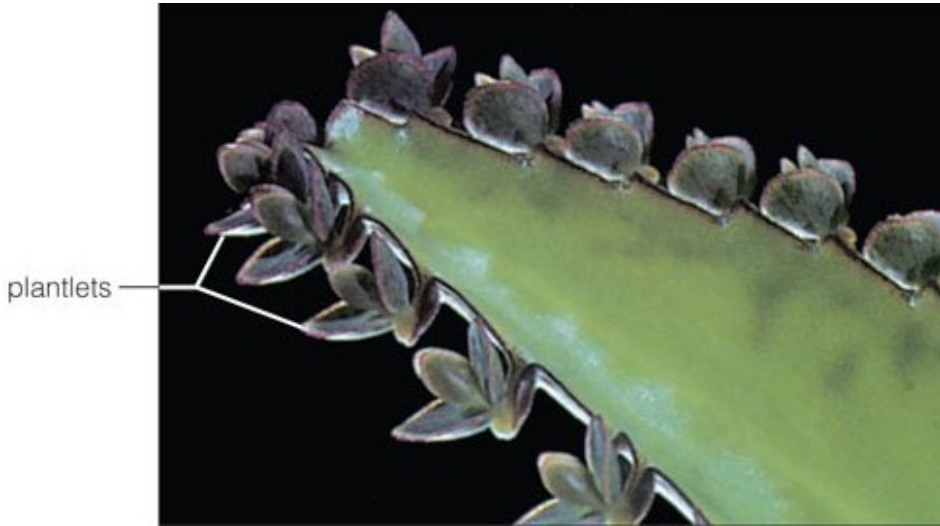
- Spines
- Tendrils
- Succulent leaves
- Traps
- Plantlets



Tendrils of sweet pea (*Lathyrus odoratus*)



Plantlets on the leaf of *Kalanchoe pinnata*



Leaf of Venus flytrap (*Dionaea muscipula*)



Everything is possible when plant needs nitrogen!



Venus flytrap in work



Urn leaf of yellow pitcher plant (*Sarracenia flava*)



Sarracenia flava on Buttercup Fields, Mississippi



Prey in the urn



Urn leaf of purple pitcher plant (*Sarracenia purpurea*)



Hairs prevent insects from climbing out of leaf



“Cobra Lily” (*Darlingtonia californica*)



Sticky tape leaf of butterwort (*Pinguicula* sp.)



Leaf margins are slowly rolling



Sticky tape/trap leaf of sundew (*Drosera intermedia*)



Leaves are constantly open and close and finally digest the glued insects



Table of modifications

<i>Function</i>	Stem / shoot	Leaf	Root
Expansion		Plantlets	
Storage		Succulent leaves	
Photosynthesis		DEFAULT	
Defense		Spines, scales	
Support		Leaf tendrils	
Interactions		Traps, “sticky tapes”, urns	



Final question (3 points)



Final question (3 points)

Please draw the **entire** (not dissected), **ovate** leaf with **acute** apex, **cordate** base, **serrate** margin and **hyphodromous** venation.



Summary

- Leaves have **general**, **repetitive** and **terminal** characters
- **Heterophylly** is a co-existence of different types of leaves on the same plant
- **Abscission zone** helps the separation of leaf at the end of season



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2010—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_154



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.

Plant Biology. 2nd edition.

Thomson Brooks/Cole, 2006.

Chapter 6.

