

# Introduction to Botany. Lecture 15

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# Outline

- 1 Questions and answers
- 2 Morphology of shoot
  - Life forms
- 3 Leaf
  - Leaf morphology

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## Previous final question: the answer

What are tubers?  
(give a short definition)

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(give a short definition)

- Enlarged parts of rhizomes (underground stems), e.g., in potato

# Morphology of shoot

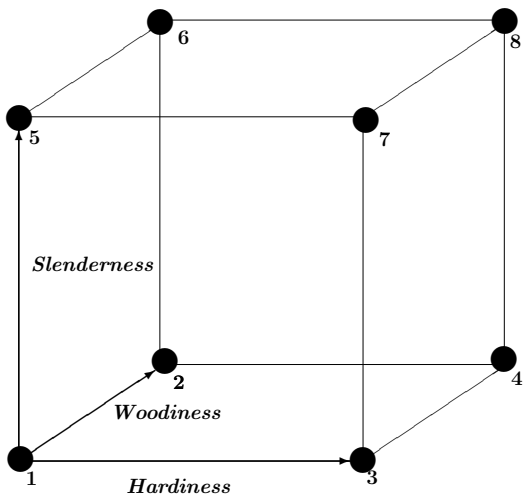
## Life forms

# Life forms: dynamic approach

- **Hardiness:** sensitivity to all negative influence
- **Woodiness:** % of cells with secondary walls
- **Slenderness:** proportion of vertically ordered stems



# Life form cube

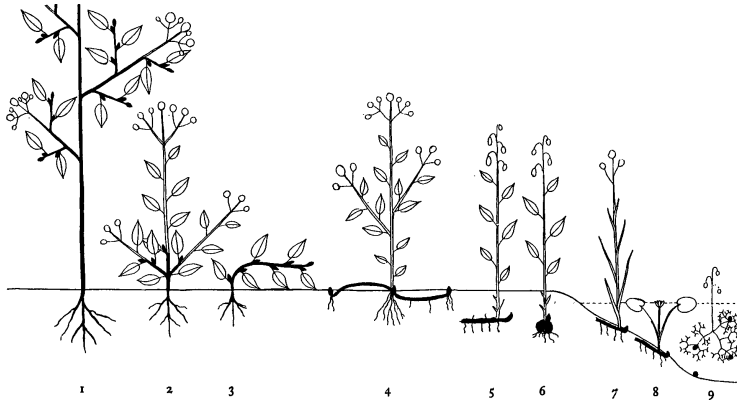


# Life forms: Raunkiaer's approach

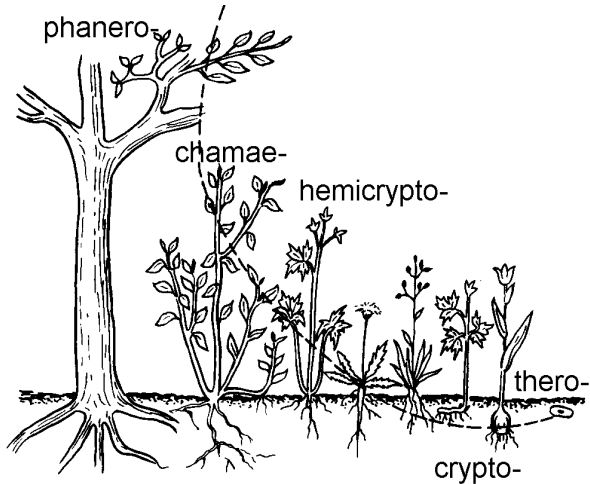
- **Phanerophytes:** winter buds openly exposed
- **Chamaephytes:** winter buds under snow
- **Hemicryptophytes:** winter buds on soil surface
- **Cryptophytes:** winter buds in the soil
- **Therophytes:** no winter buds, only seeds

The Raunkiaer system is very useful to characterize the whole *floras*, especially temperate floras

# Raunkiaer classification (after Raunkiaer, 1937)



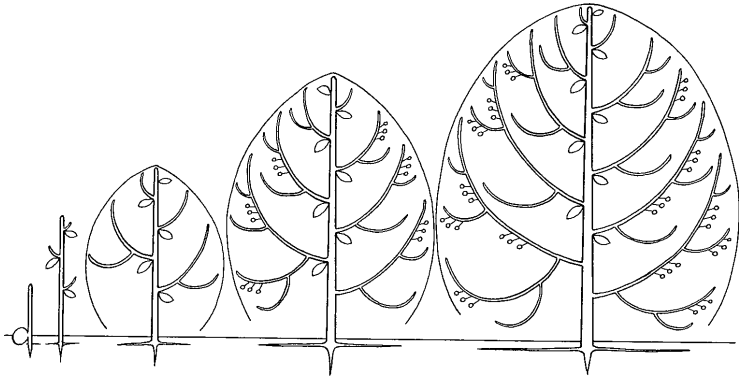
# Raunkiaer classification again



# Life forms: architectural models

- Developed for tropical trees, but also cover temperate forms which are less diverse
- Each model has a name of famous botanist, e.g. Thomlinson, Cook, Attims
- Based on the character of branching, development of generative shoots, directions of growing

## Example of architectural model: Attims



Many temperate trees are growing according to this model

# Leaf

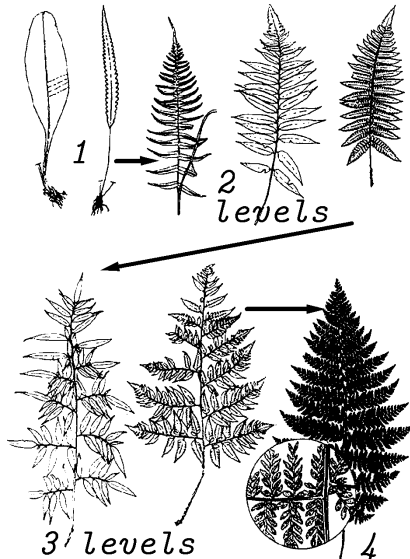
## Leaf morphology

# Definition, functions and features

- Lateral flattened organ of shoot with restricted growth
- Functions:
  - Photosynthesis
  - Respiration
  - Transpiration
  - Synthesis of secondary chemicals
- Features:
  - Have bud in the axil
  - Do not grow by apex
  - Do not produce new leaves
  - Have hierarchical morphology



# Hierarchical levels in leaf morphology



# Types of leaf characters

- General: applicable only to the whole leaf
- Terminal: applicable only to the terminals (e.g., terminal leaflets)
- Repetitive: repeating on each level of hierarchy

# Hierarchy in leaf morphology

- General and terminal characters do not depend on hierarchy
- Repetitive characters may be different on each step of hierarchy
- Therefore, leaf description should state that “on first level of hierarchy, the shape is ..., on the second level, the shape is ...”
- It is possible that each level has different repetitive characters

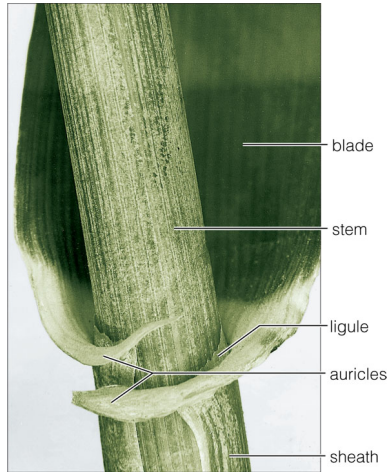
# General characters

- General characters apply to the whole leaf
- Stipules (present or not, how many etc.)
- Other leaf base organs (sheath, ocrea, ligules etc.)

# Stipules



# Leaf base



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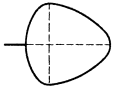
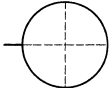
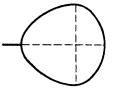
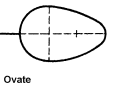
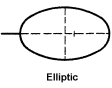
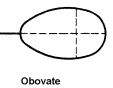
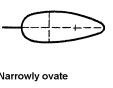
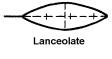
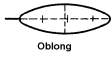
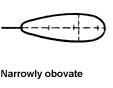
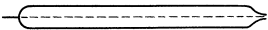
# Repetitive characters

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



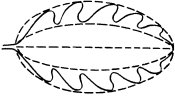


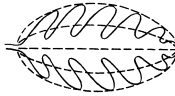


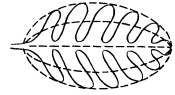
# Shape

	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		

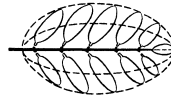
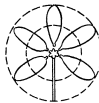




# Dissection

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

Complex leaves  
(leaflets stalked,  
with joints)



# Final question (2 points)

## Final question (2 points)

How many levels of hierarchy has this leaf?



# Summary

- Life forms classifications are based primarily on characteristics of shoot
- Leaves have **general**, **repetitive** and **terminal** characters

## For Further Reading



J. E. Bidlack, Sh. H. Jansky.  
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McGraw-Hill, 2011.  
*Chapter 7.*



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
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*Chapter 6.*