

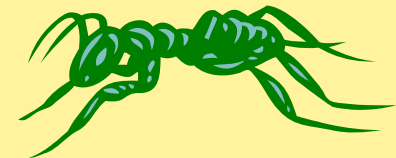
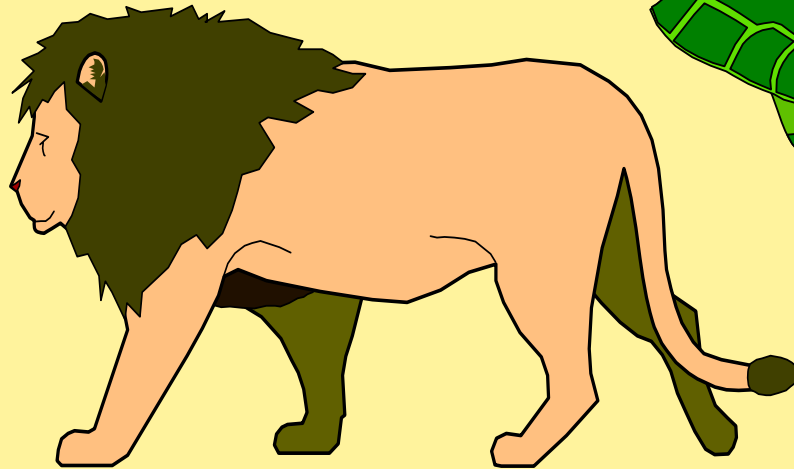
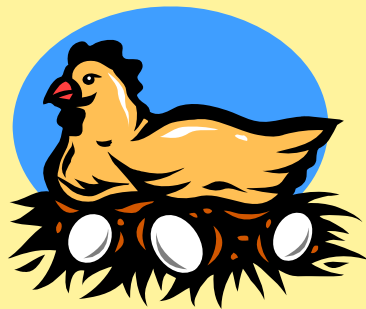
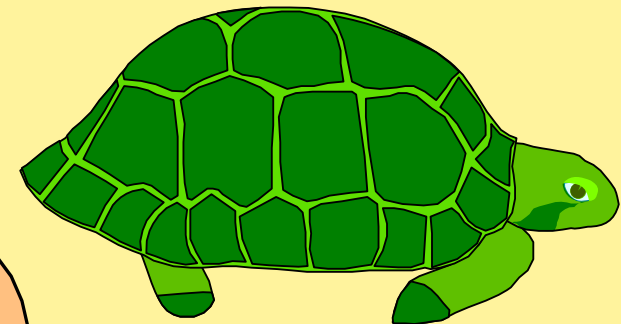
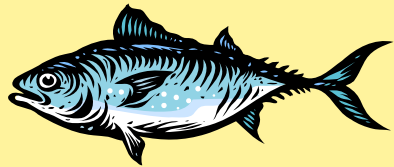
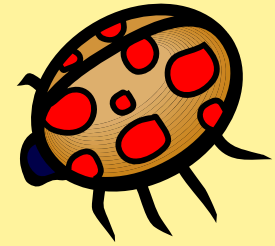
# Bioinformatics CSM17

## Week2: Biological Classification

- Fundamental concepts
- Traditional methods
- Nomenclature (naming)
- Taxonomy & systematics
- Overview of main 'systems'
- Cluster analysis / Numerical Taxonomy

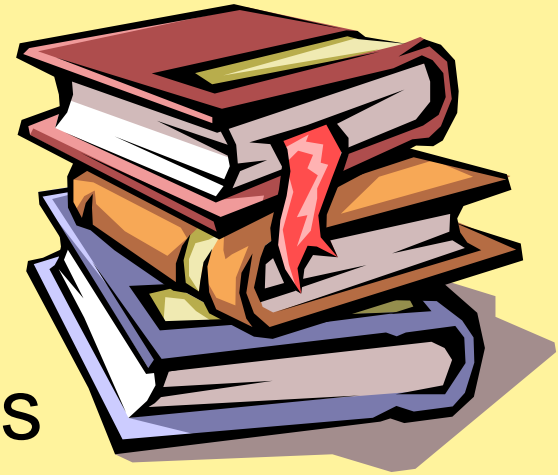
# Fundamental concepts

- the species concept
- classification has its roots in biology
- homology

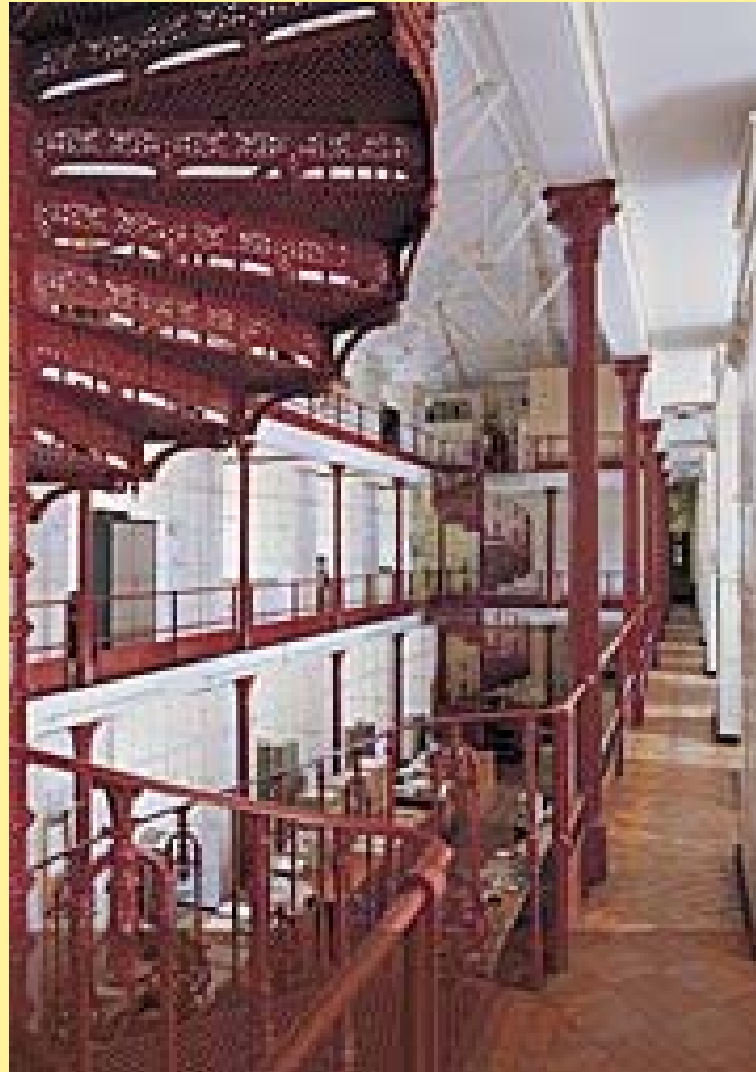


# Traditional/classical methods

- Floras & monographs
- New species
- Herbaria & museums
- Mostly phenotypic characters

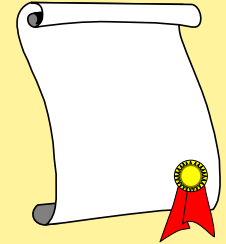


# Herbarium of the Royal Botanic Gardens, Kew (London, UK)



# Nomenclature (Naming)

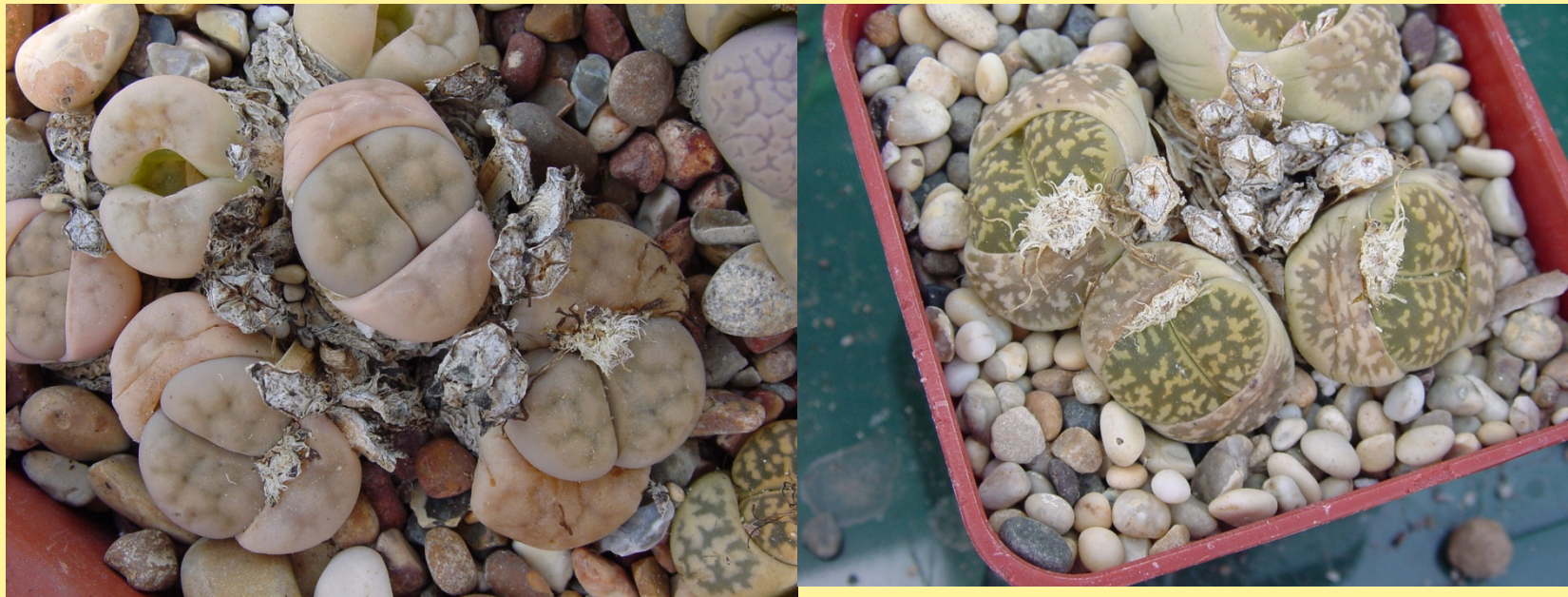
- the *type* concept
- the *binomial* system
  - Carolus Linnaeus, *Species Plantarum* (1753)
- *type descriptions* (Latin) and authorities
- *Index Kewensis*
- IPNI (International Plant Names Index)
- ‘version control’
- ICBN & ICZN



# How to interpret IPNI search

- Aizoaceae *Lithops karasmontana* subsp. *bella* (N.E.Br.) D.T.Cole -- Lithops Flowering Stones: 217 (1988):. (IK)
- Aizoaceae is the FAMILY
- Lithops is the GENUS
- karasmontana is the SPECIES
- bella is the SUBSPECIES (subsp.)
- N.E. Brown is the AUTHOR of  
*Lithops bella* N.E.Brown
- D.T. Cole decided that *L. bella* was a subsp. of *L. karasmontana*

*Lithops karasmontana* subsp. *bella*  
(N.E.Br.) D.T.Cole



JYC: CSM17

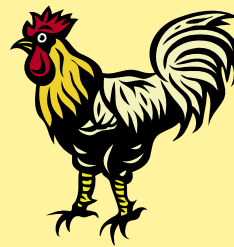
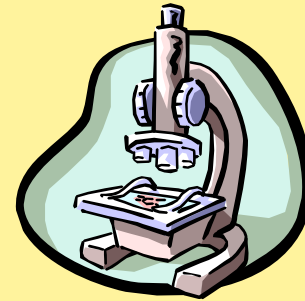
# Taxonomy and systematics

- *Taxonomy*
  - putting things into classes...
  - a ‘taxonomy’ is a classification system
  - ‘taxonomy’ is the theory, principles & practice of classification
- *Systematics*
  - the scientific study of the variation of living organisms and the relationships between them



# Overview of Life

- viruses
- bacteria
- algae
- protista - e.g. *Amoeba*, *Paramecium*
- mosses & liverworts
- higher plants
- animals



# What is a species?

- the biological species concept
- the 'practical' species concept
- about 1.7 million known
  - about 300K green plants
  - about 1.05M animals
- approximately 5-100 million yet to be discovered

# Biological variation

- helps ensure survival
- phenotypic plasticity
  - environmental conditions
- genotypic variation
  - the 'real' (encoded) variation

# *Rosa canina* var. *lutetiana* f. *lasiostylus*

- Kingdom Plantae
- Division (Phylum) Tracheophyta
- Class Angiospermopsida
- Order Rosales
- Family Rosaceae
- Genus *Rosa*
- Species *canina*
- Subspecies *lutetiana*
- Variety (var.) *lasiostylus*
- Form (f.)



# Numerical taxonomy

- Multivariate analysis
- Cluster analysis / clustering
- using a computer...
- Sneath & Sokal 1960s, 1970s



# Distance Measures (Metrics)

- Similarity / Dissimilarity...
- Euclidean distance
  - Standardisation & Normalisation
- Sneath's simple matching coefficient
- Gower's similarity coefficient

# Dendrograms

- Tree diagrams
- Phenograms



# Linkage methods

- Nearest Neighbour (single link)
- Furthest Neighbour
- Group Average Link (complete link e.g. UPGMA)





# DELTA

- DEscriptive Language for TAXonomy
- a suite of programs and tools
- a database format
- uses text-based files

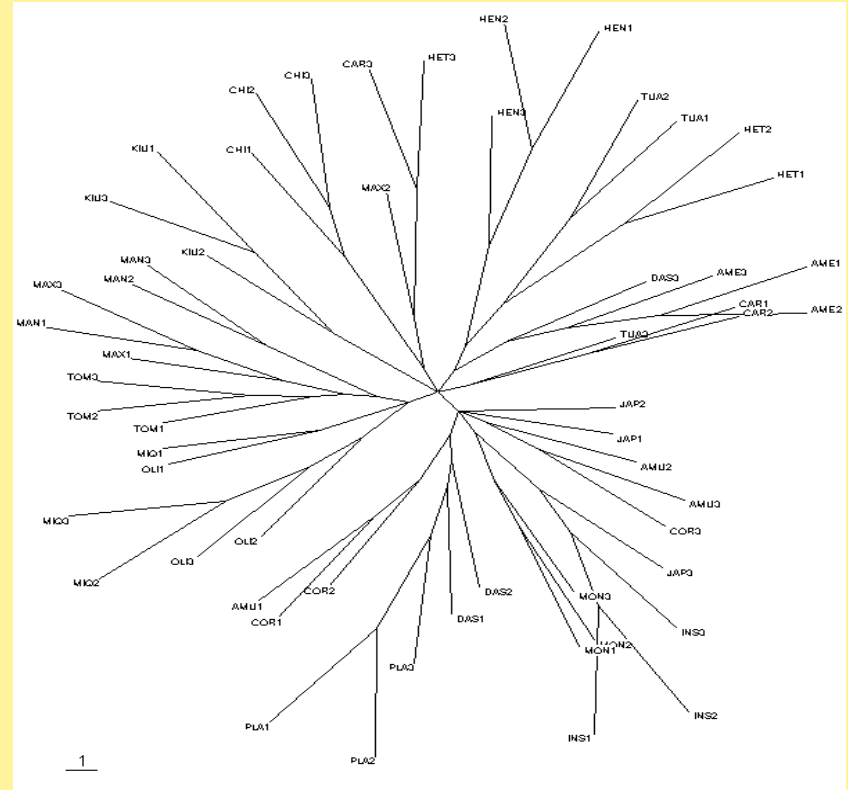
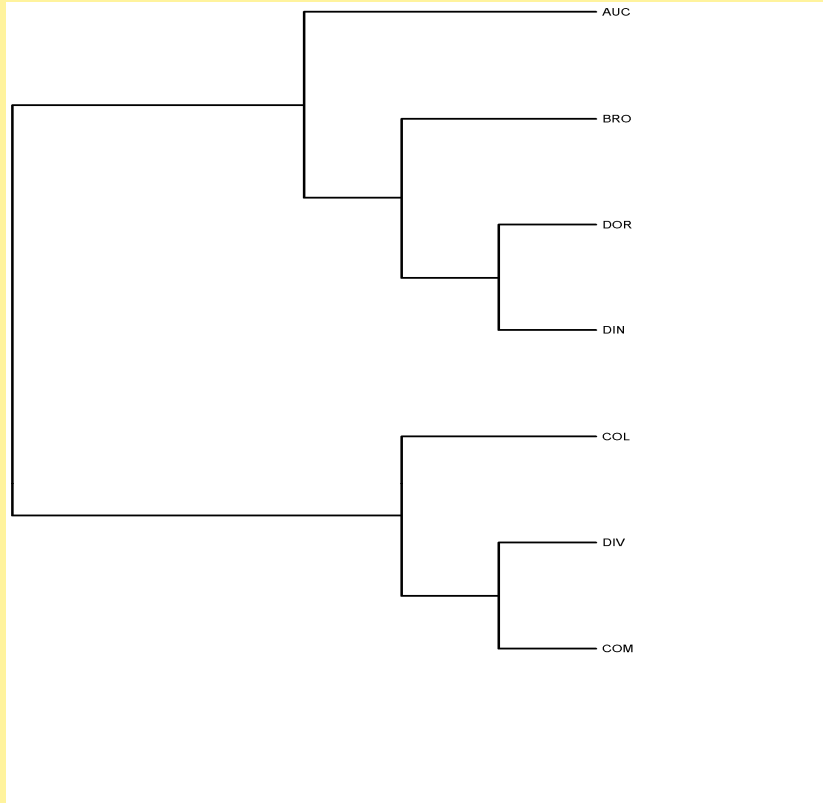
# PCLASS

- a cluster analysis tool bundled with DELTA
- an example treefile...

```
(((((((DAS3:0.07322,AME1:0.07322):0.02505,(AME3:  
0.06559,AME2:0.06559):0.03269):  
0.02093,(HET2:0.08696,HET1:0.08696):0.03225):0.01  
429,(TUA2:0.06325,TUA1:0.06325)
```

# TREEVIEW

- a dendrogram (tree diagram) generator



# Useful Websites & Journals

- *Taxon* - the journal for botanical taxonomists  
[www.botanik.univie.ac.at/iapt/](http://www.botanik.univie.ac.at/iapt/)
- IPNI: [www.ipni.org](http://www.ipni.org)
- Kew Gardens: [www.kew.org](http://www.kew.org)
- TREEVIEW:  
<http://taxonomy.zoology.gla.ac.uk/rod/treeview.html>
- *DELTA*: <http://delta-intkey.com/>

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