

# Orthology Analysis

part of “Graphen und Netzwerke in der Biologie”

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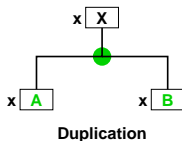
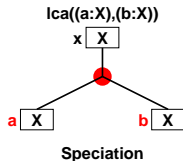
Leipzig, SS 2011

## “A is homologous to B” means...

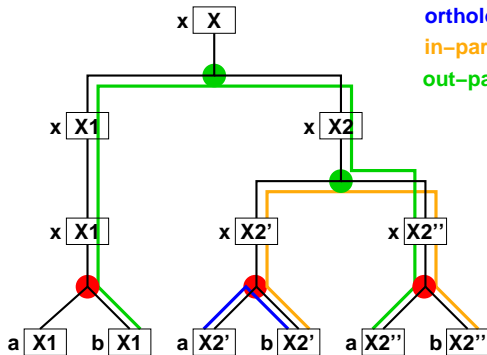
- $A$  and  $B$  are characters (nucleotide sequences, organs,... ) of individual organisms  $I_A$  and  $I_B$ , respectively
- $A$  and  $B$  are derived from a (last) common ancestor  $Ica(A, B)$  by descent
- if  $A$  is a homolog of  $B$ ,  $B$  is a homolog of  $A$  (symmetric relation)
- “homologous” in respect to syntax (structure) or semantics (function)?
- **does NOT just mean “A is similar to B”**
- similarity **might hint** at homology
- similarity **without** common ancestry is called **analogy**

# Orthology – Paralogy

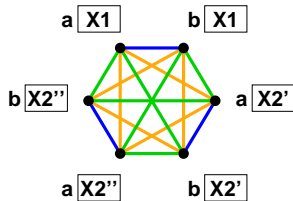
- if  $A$  and  $B$  derived from the  $Ica(A, B)$  by **duplication**,  $A$  and  $B$  are **paralogous**
- if  $A$  and  $B$  are homologs and  $I_A = I_B$  than they are **in-paralogs**
- if  $A$  is paralogous to  $B$  and  $I_A \neq I_B$  than they are **out-paralogs**
- if  $A$  and  $B$  derived from the  $Ica(A, B)$  by **speciation**,  $A$  and  $B$  are **orthologous**



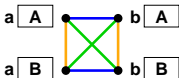
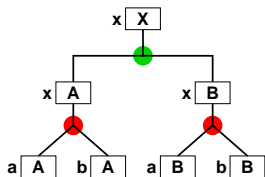
# Orthology – Paralogy



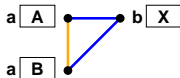
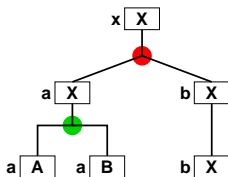
ortholog  
in-paralog  
out-paralog



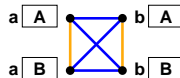
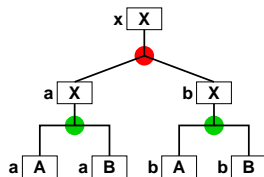
# 1:1, 1:many, many:many orthology



1:1 orthology



many:1 orthology



many:many orthology

# Problem of distinguishing orthologs and paralogs

More information from additional species and about timing of gene duplication and speciation events can change the view.

