ORTHOLOGY PREDICTION

21.11.2014

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Institut für Zellbiologie und Neurowissenschaften

- INTRODUCTION
- ORTHOLOGY PREDICTION METHODS
- EXAMPLE
- EXERCISE

INTRODUCTION

What is orthology?

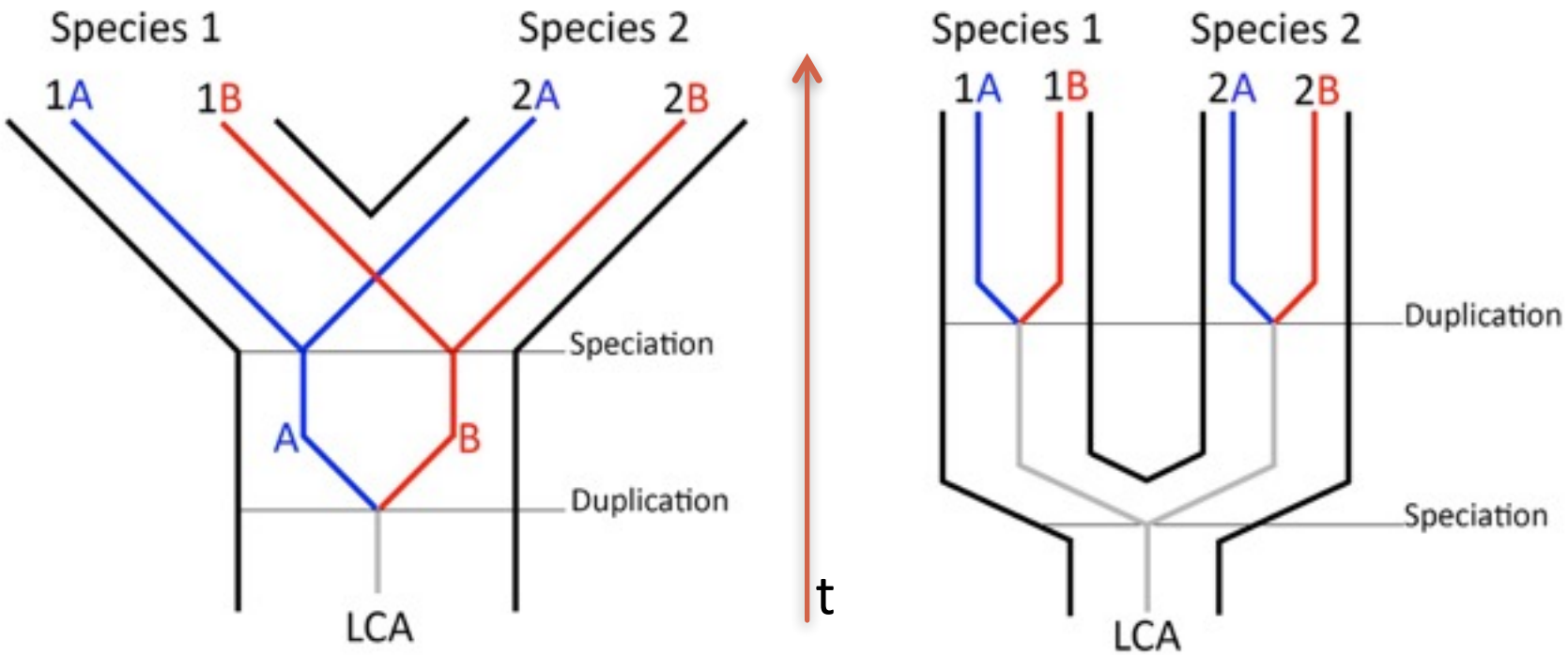
Homology = share ancestry

Ortholog = separated by speciation event

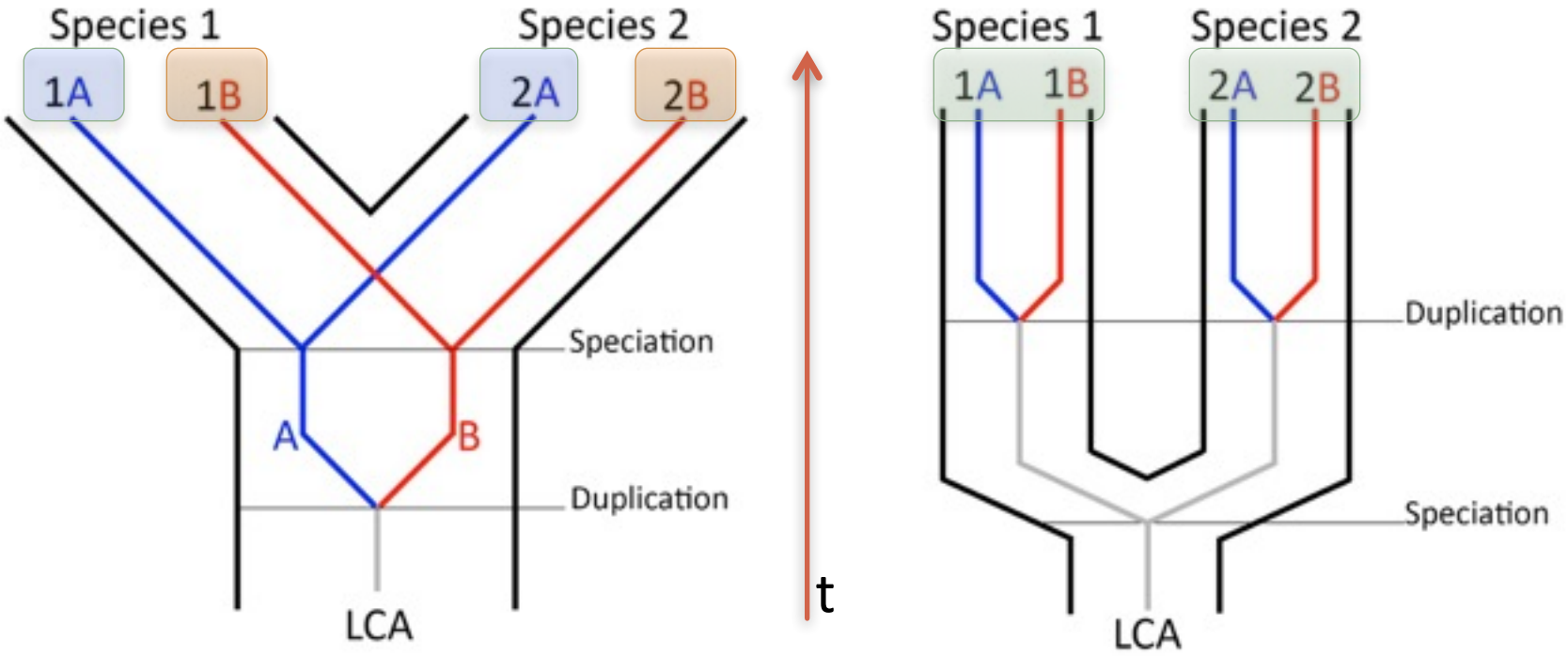
Paralog = separated by duplication event

Fitch W. (1970)

What is orthology?

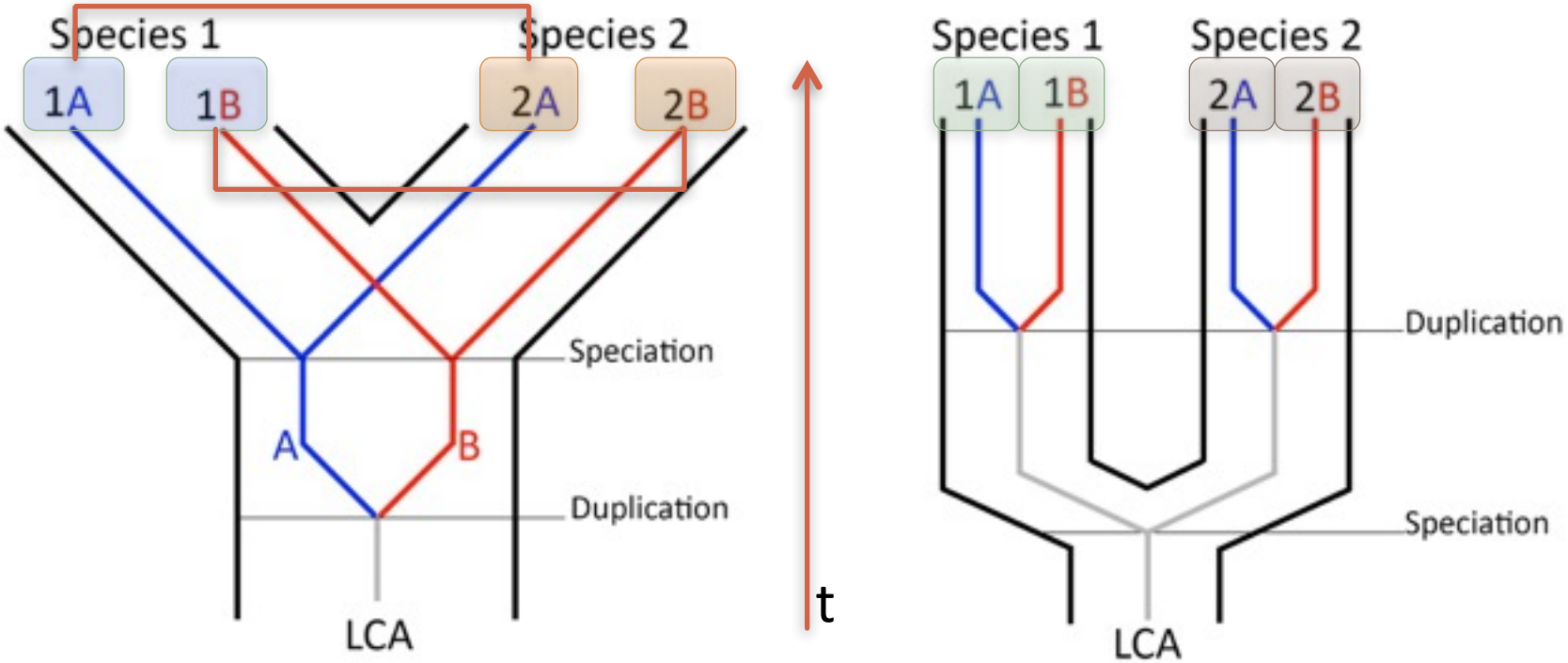


What is orthology?



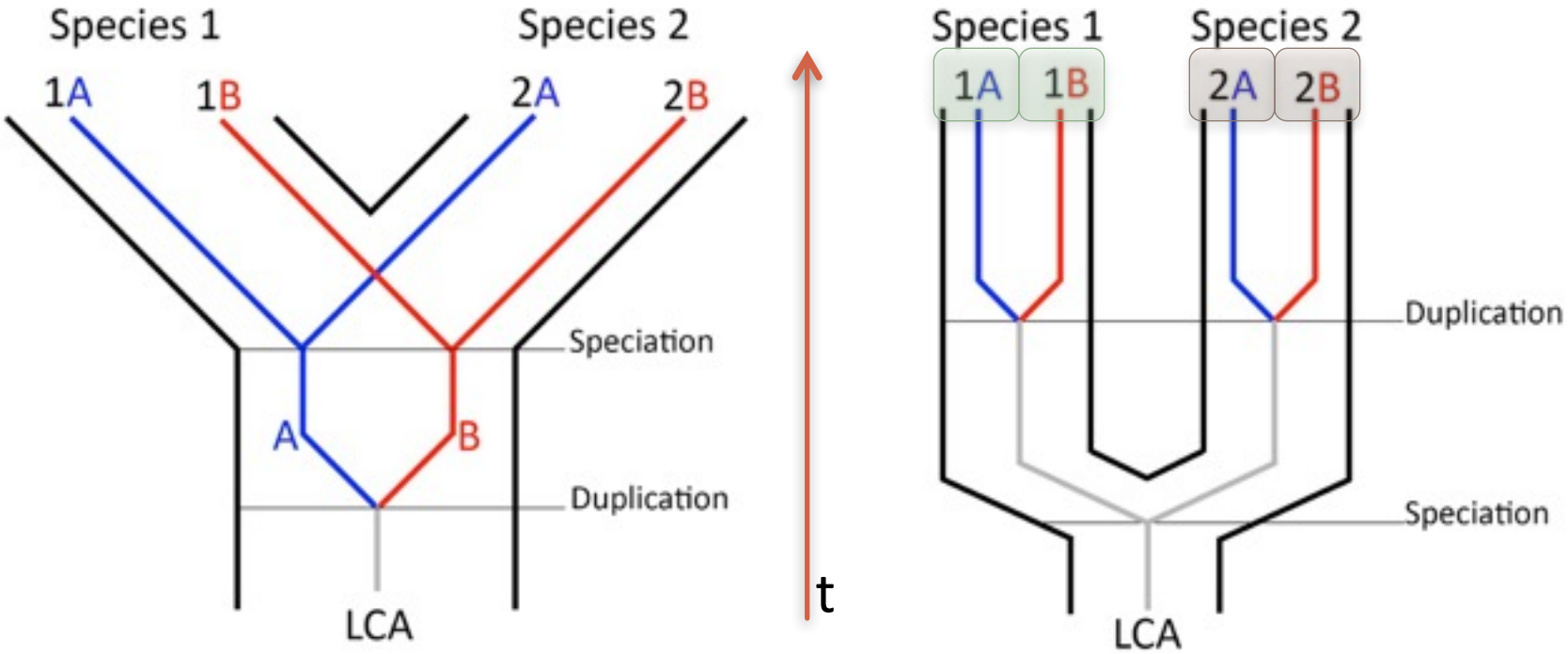
speciation -> ORTHOLOG

What is orthology?



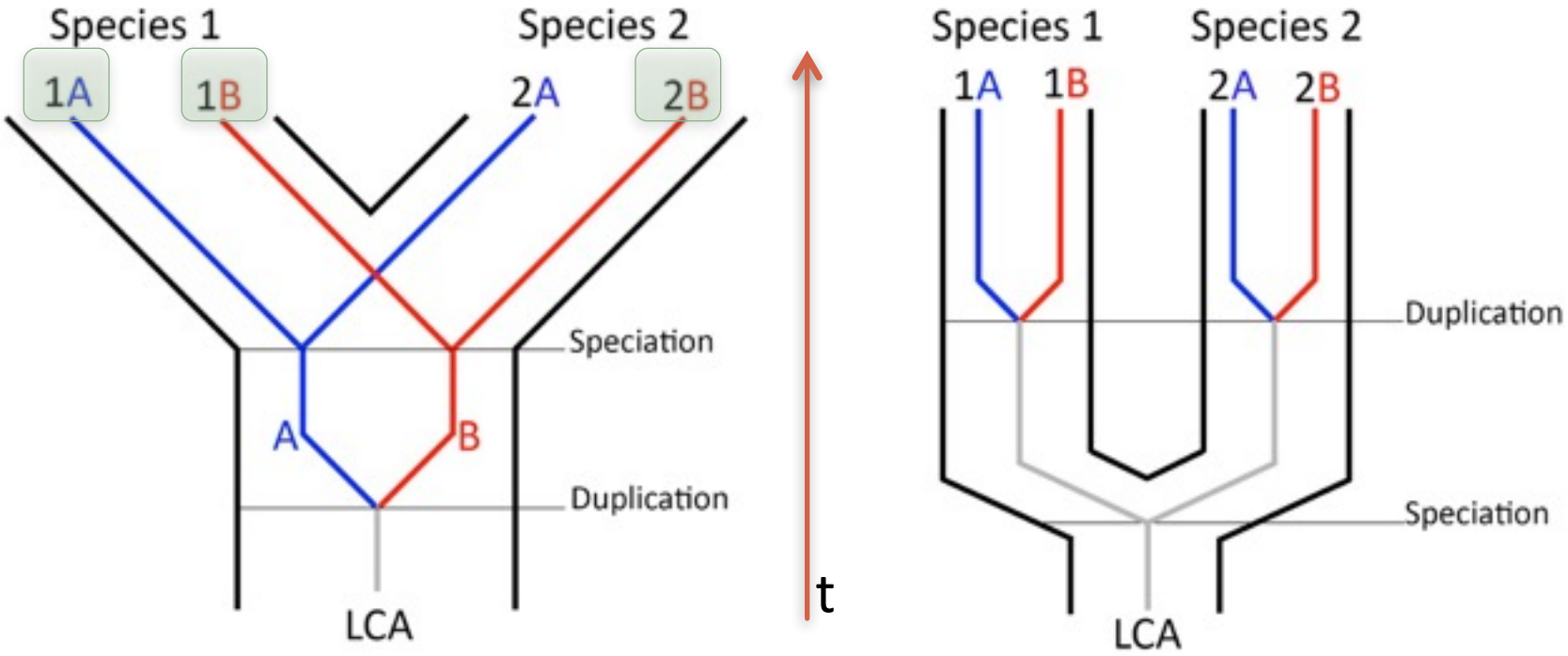
duplication -> PARALOG

What is orthology?



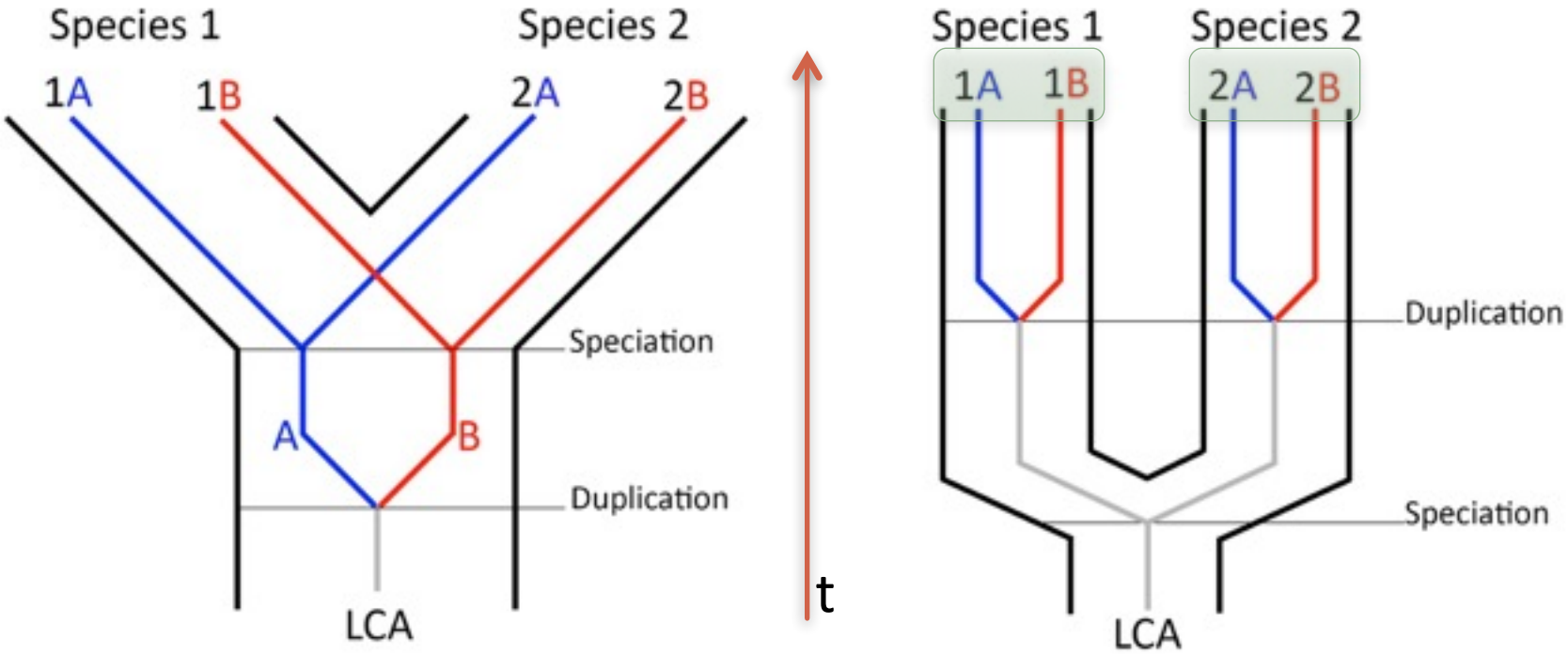
in-paralogs
(duplication occurred after speciation)

What is orthology?



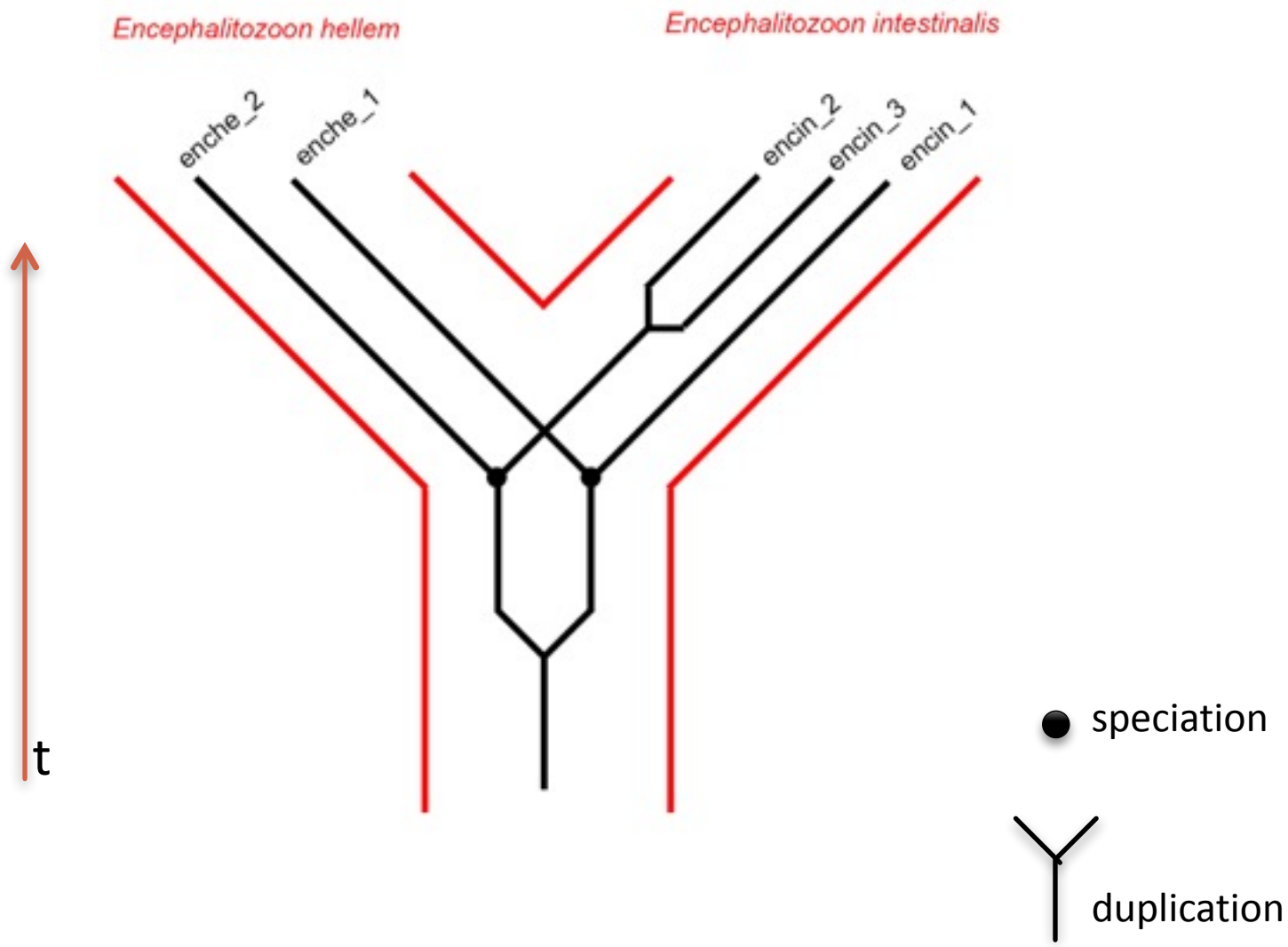
out-paralogs
(duplication occurred before speciation)

What is orthology?

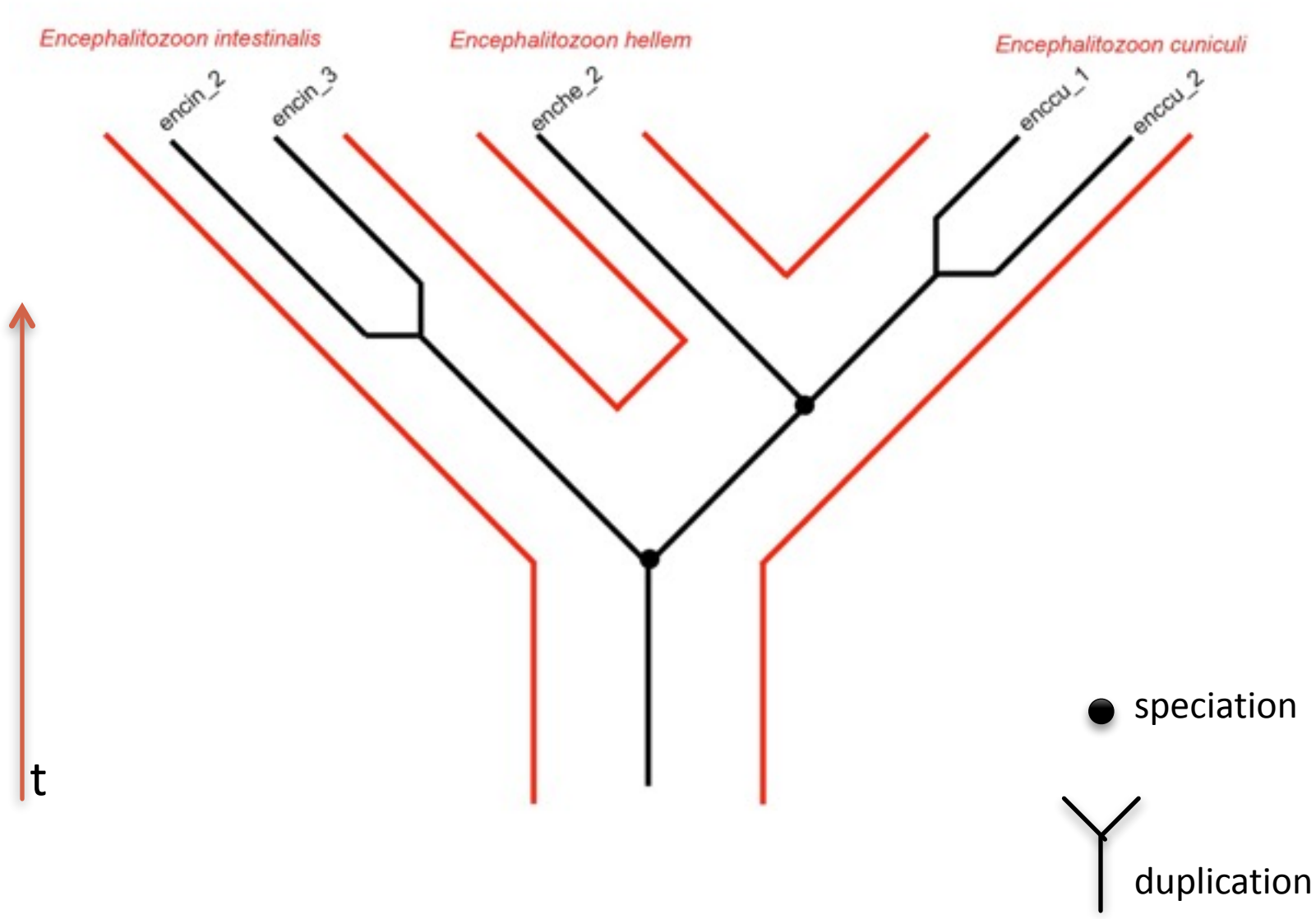


co-orthologs

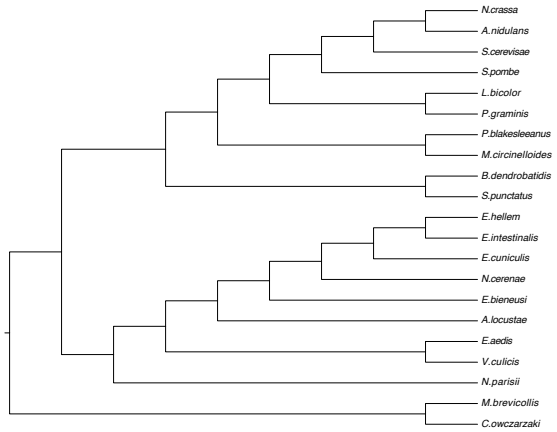
What is orthology?



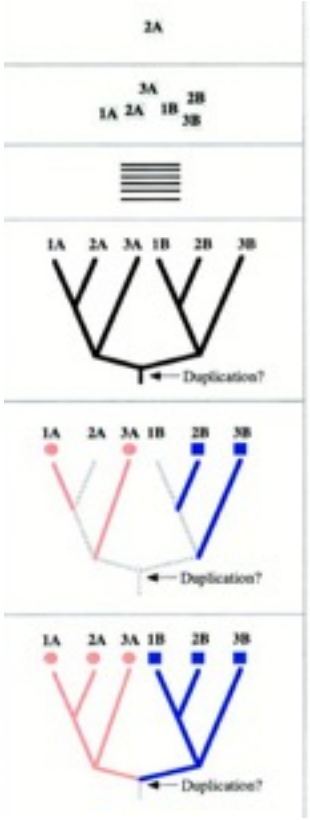
What is orthology?

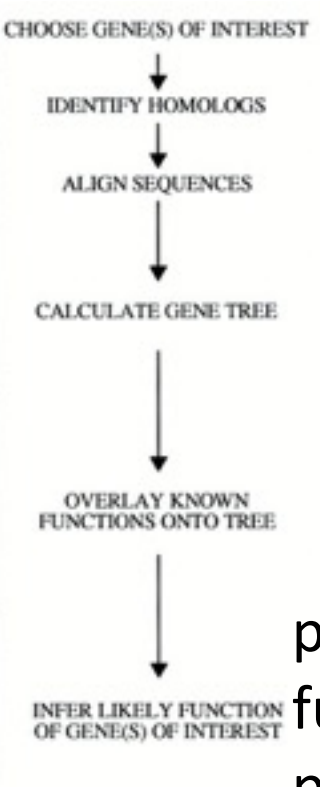


Why orthology important?



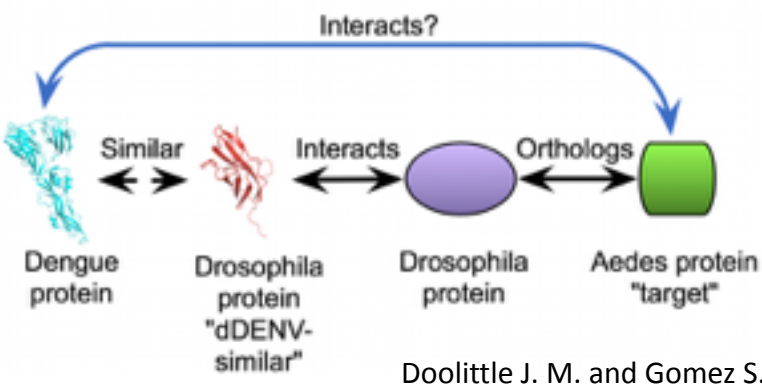
tree reconstruction





protein function prediction

Eisen J. A. (1998)

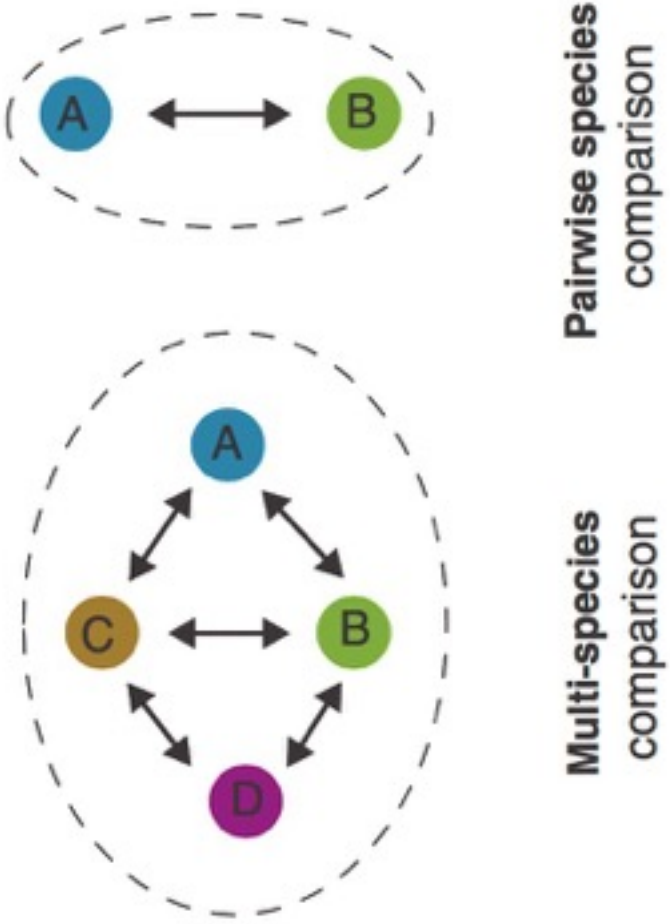


Doolittle J. M. and Gomez S. M. (2011)

protein-protein interaction analysis

OTHOLOGY PREDICTION METHODS

BLAST-based approaches

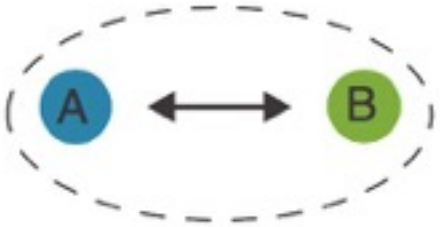


Trachana K. et al. (2011)

Reciprocal Best Hit
InParanoid

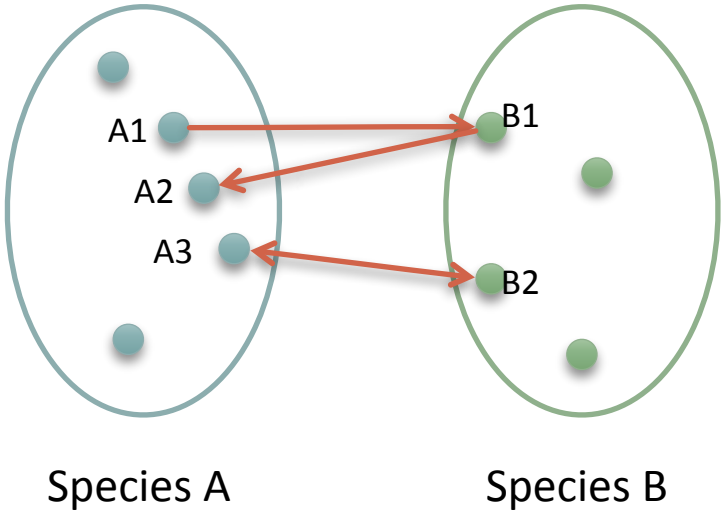
OrthoMCL
COG (Cluster of Orthologous Groups)
eggNOG (evolutionary genealogy of genes: Non-supervised Orthologous Groups)

BLAST-based approaches



Pairwise species comparison

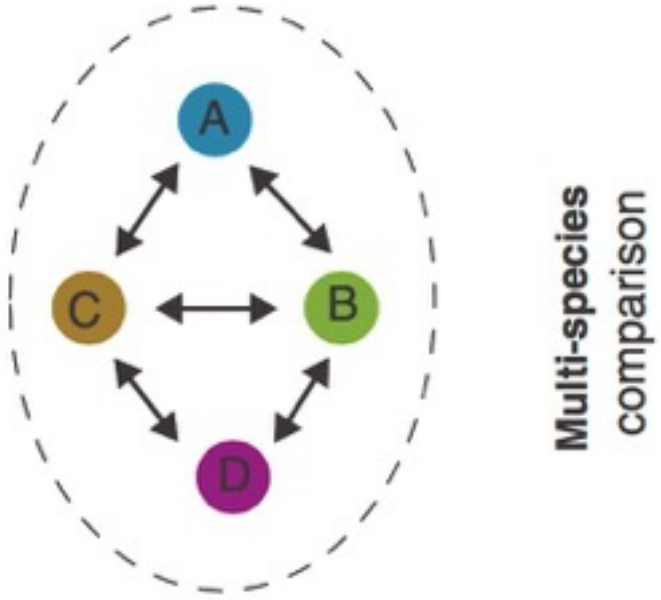
Reciprocal Best Hit



BLAST-based approaches

OrthoMCL: use All-vs-all BLASTp and cluster BBHs using Markov model

COG, eggNOG: identify three-way BBHs in 3 different species and merge triangles that share a common side.

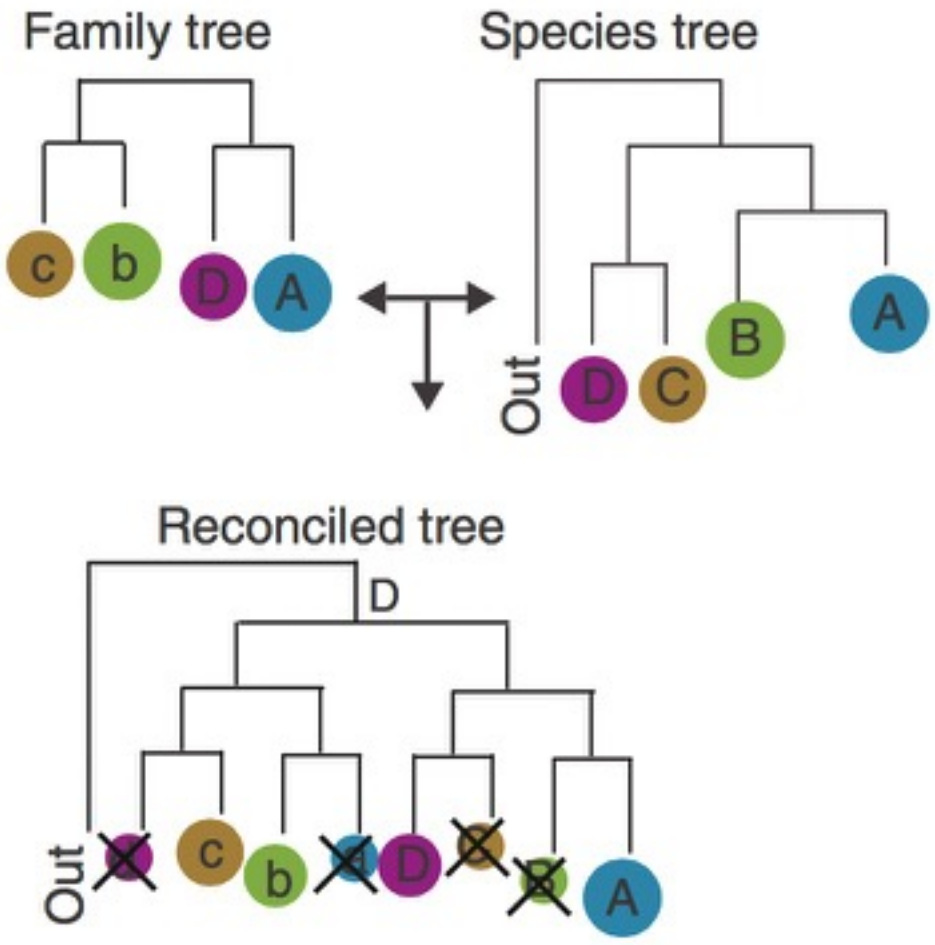


OrthoMCL

COG (Cluster of Orthologous Groups)

eggNOG (evolutionary genealogy of genes: Non-supervised Orthologous Groups)

Tree-based approaches



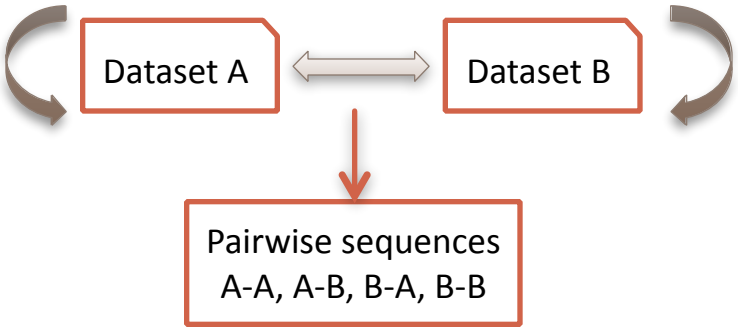
Trachana K. et al. (2011)

TreeFam
PhylomeDB
EnsemblCompara

EXAMPLE

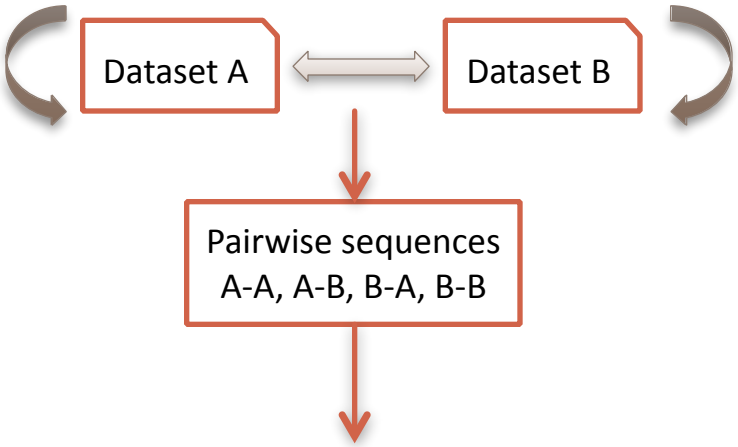
Orthology prediction using InParanoid

Orthology prediction using InParanoid

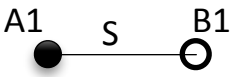


All-vs-all Blast search

Orthology prediction using InParanoid

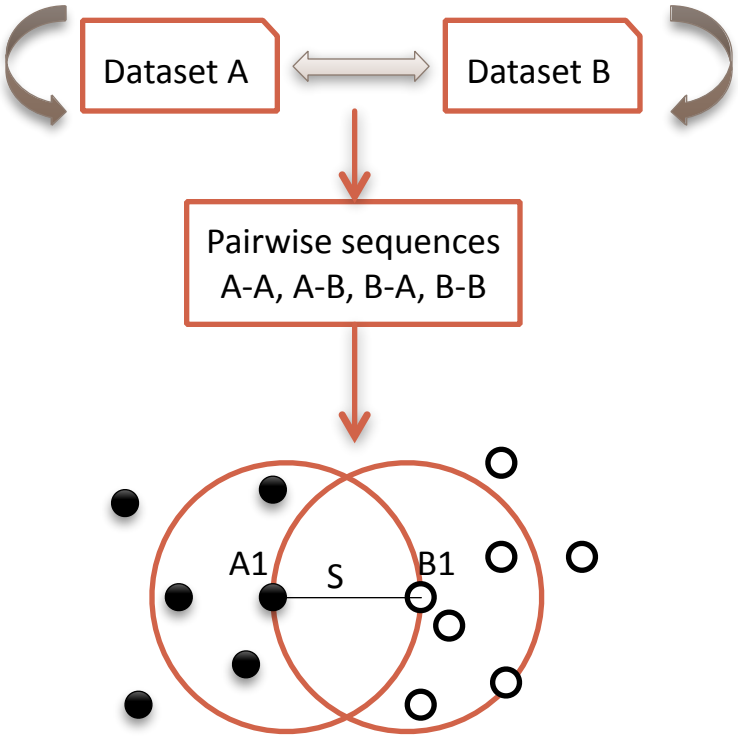


All-vs-all Blast search



Find potential seed orthologs

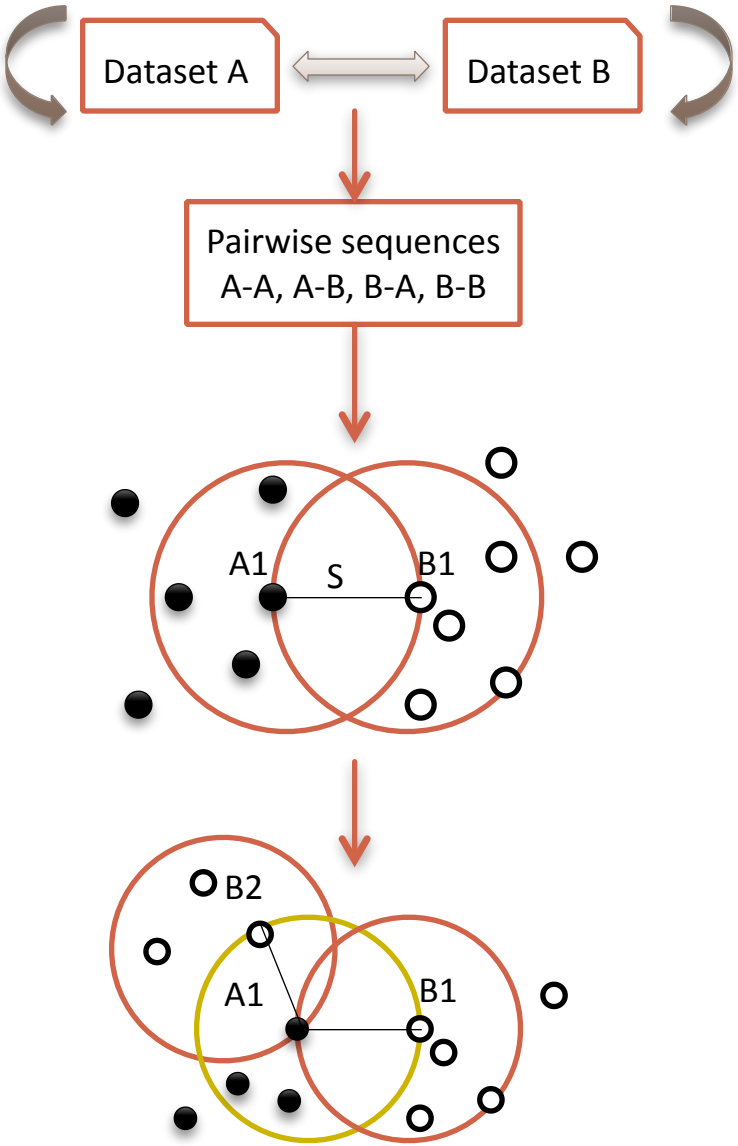
Orthology prediction using InParanoid



All-vs-all Blast search

Find potential seed orthologs
& add in-paralogs

Orthology prediction using InParanoid

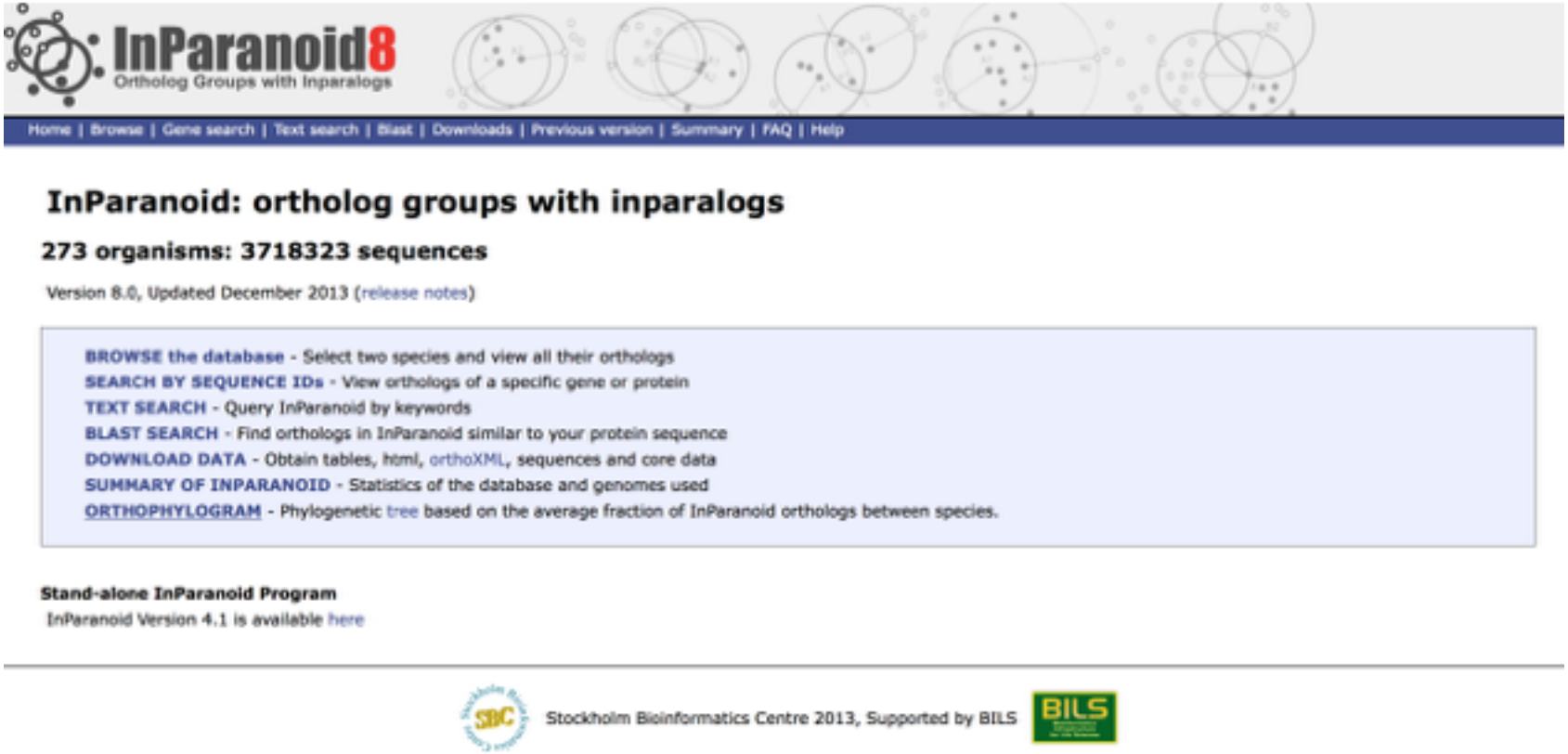


All-vs-all Blast search

Find potential seed orthologs
& add in-paralogs

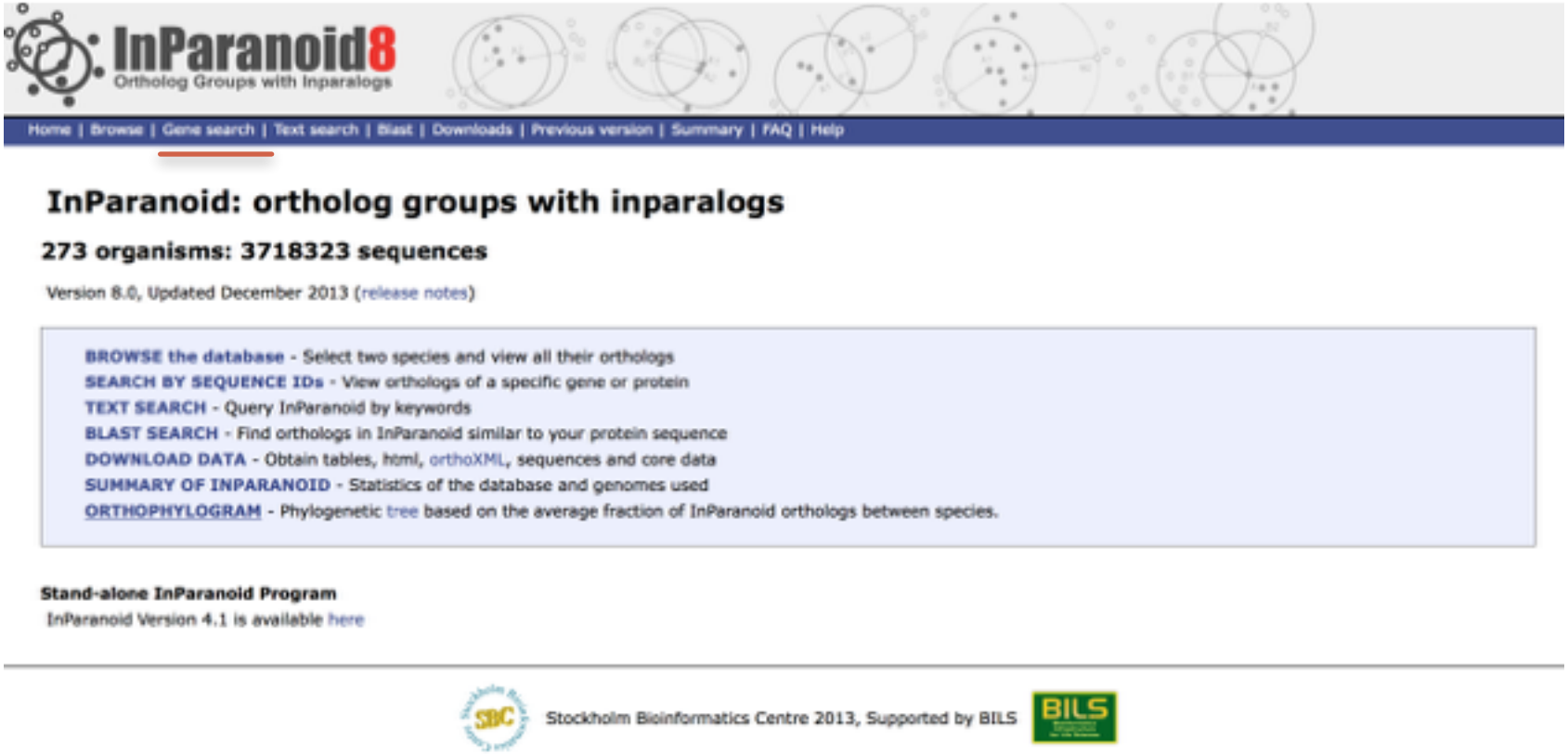
Resolve overlapping groups

Orthology prediction using InParanoid



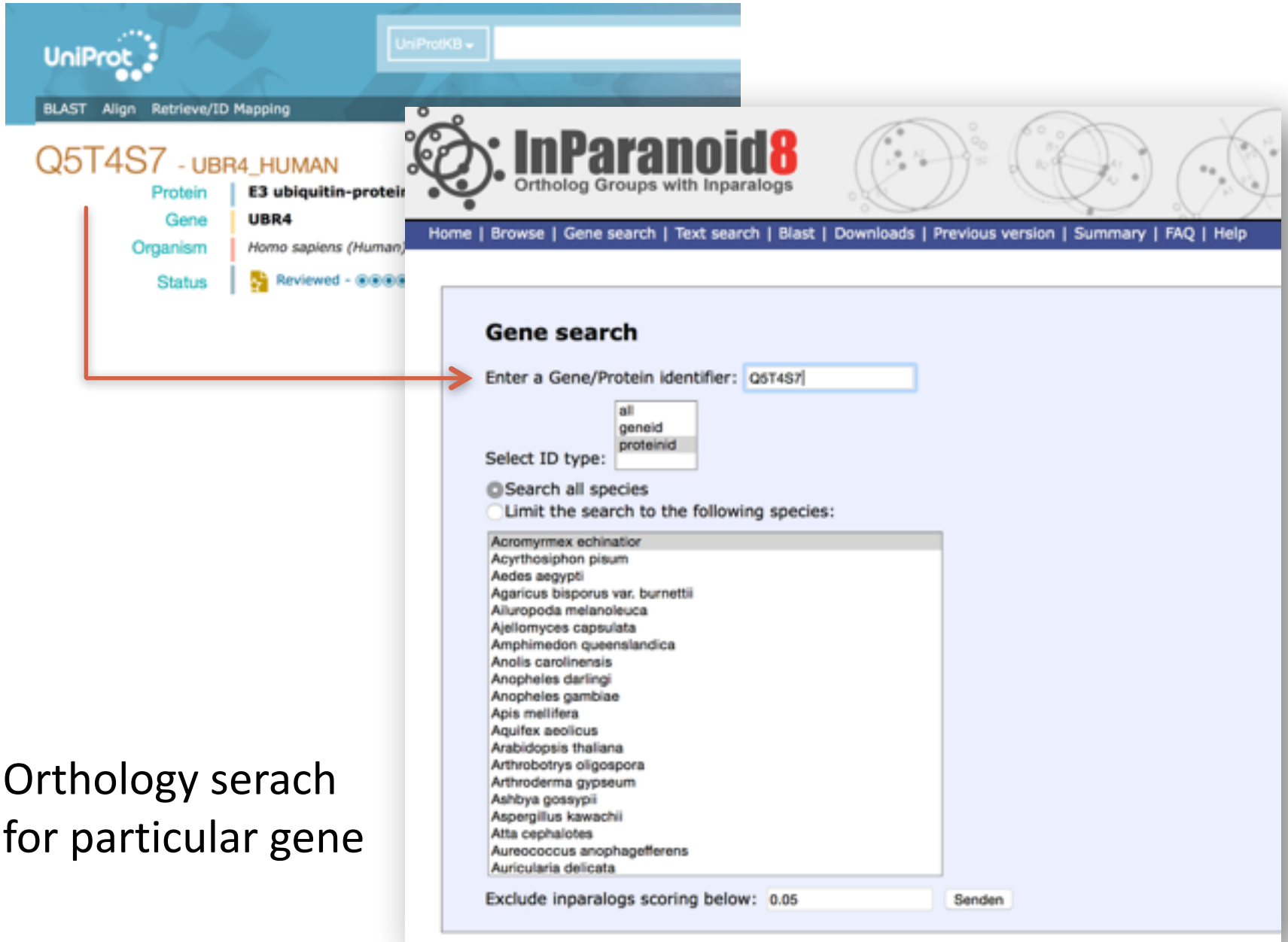
http://inparanoid.sbc.su.se/cgi-bin/index.cgi

Orthology prediction using InParanoid



Orthology serach for particular gene

Orthology prediction using InParanoid



Orthology serach for particular gene

Orthology prediction using InParanoid

Searching all species for the proteinid **Q5T4S7** excluding inparalogs scoring below 0.05

xml

Inparalog and Orthologs cluster for Homo sapiens and Cricetulus griseus

Cluster 11

Protein ID	Species	Score	Bootstrap	Description	Alternative ID
Q5T4S7	Homo sapiens	1	100%	E3 ubiquitin-protein ligase UBR4	UBR4_HUMAN (UniProt)
G3I9O5	Cricetulus griseus	1	100%	E3 ubiquitin-protein ligase UBR4	G3I9O5_CRIGR (UniProt)

Inparalog and Orthologs cluster for Homo sapiens and Heterocephalus glaber

Cluster 4

Protein ID	Species	Score	Bootstrap	Description	Alternative ID
Q5T4S7	Homo sapiens	1	100%	E3 ubiquitin-protein ligase UBR4	UBR4_HUMAN (UniProt)
G5BZM0	Heterocephalus glaber	1	100%	E3 ubiquitin-protein ligase UBR4	G5BZM0_HETGA (UniProt)

Inparalog and Orthologs cluster for Homo sapiens and Acromyrmex echinatior

Cluster 5

Protein ID	Species	Score	Bootstrap	Description	Alternative ID
Q5T4S7	Homo sapiens	1	100%	E3 ubiquitin-protein ligase UBR4	UBR4_HUMAN (UniProt)
F4WKS3	Acromyrmex echinatior	1	100%	Protein purity of essence	F4WKS3_ACREC (UniProt)

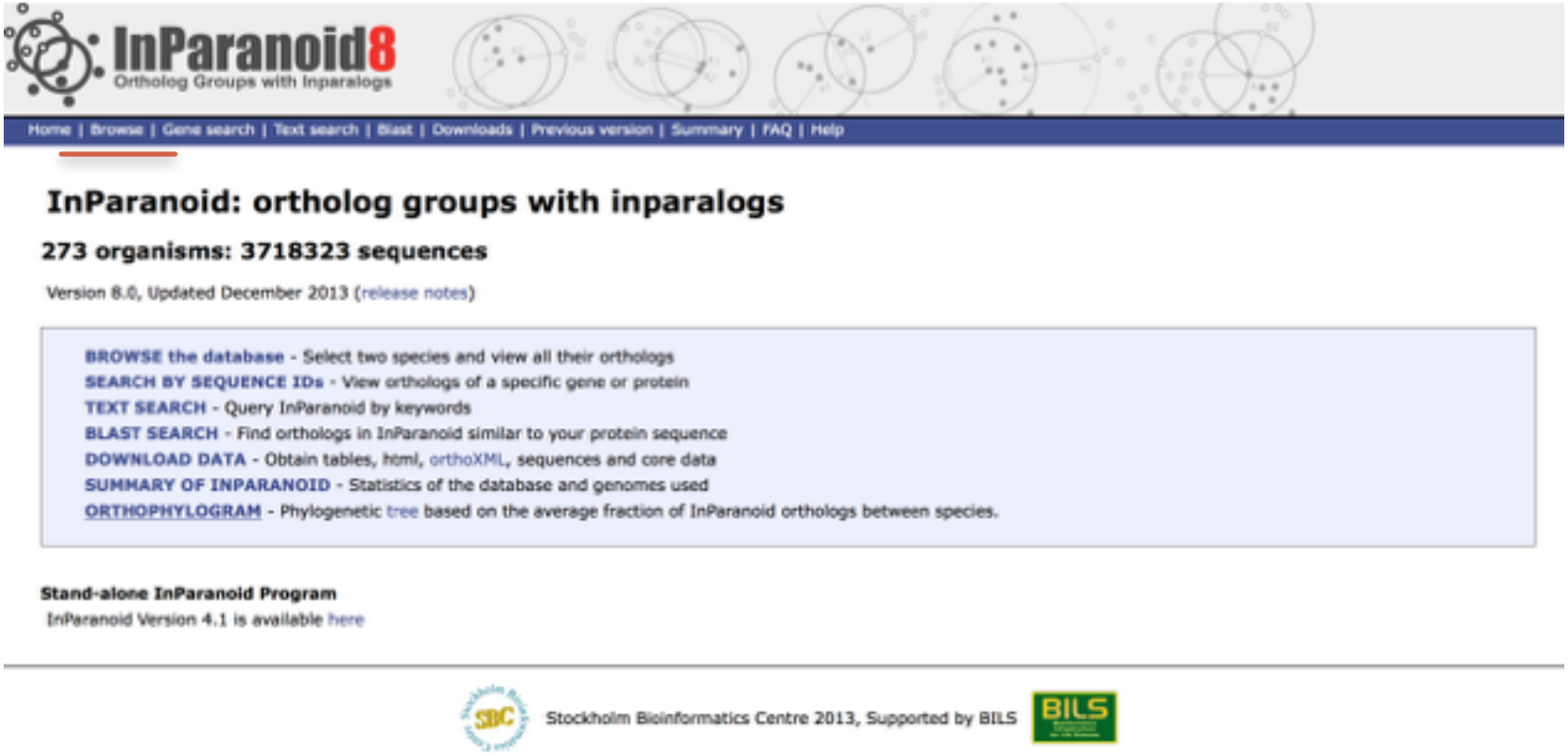
Inparalog and Orthologs cluster for Homo sapiens and Camponotus floridanus

Cluster 7

Protein ID	Species	Score	Bootstrap	Description	Alternative ID
Q5T4S7	Homo sapiens	1	100%	E3 ubiquitin-protein ligase UBR4	UBR4_HUMAN (UniProt)
E2AZ34	Camponotus floridanus	1	100%	Protein purity of essence	E2AZ34_CAMFO (UniProt)

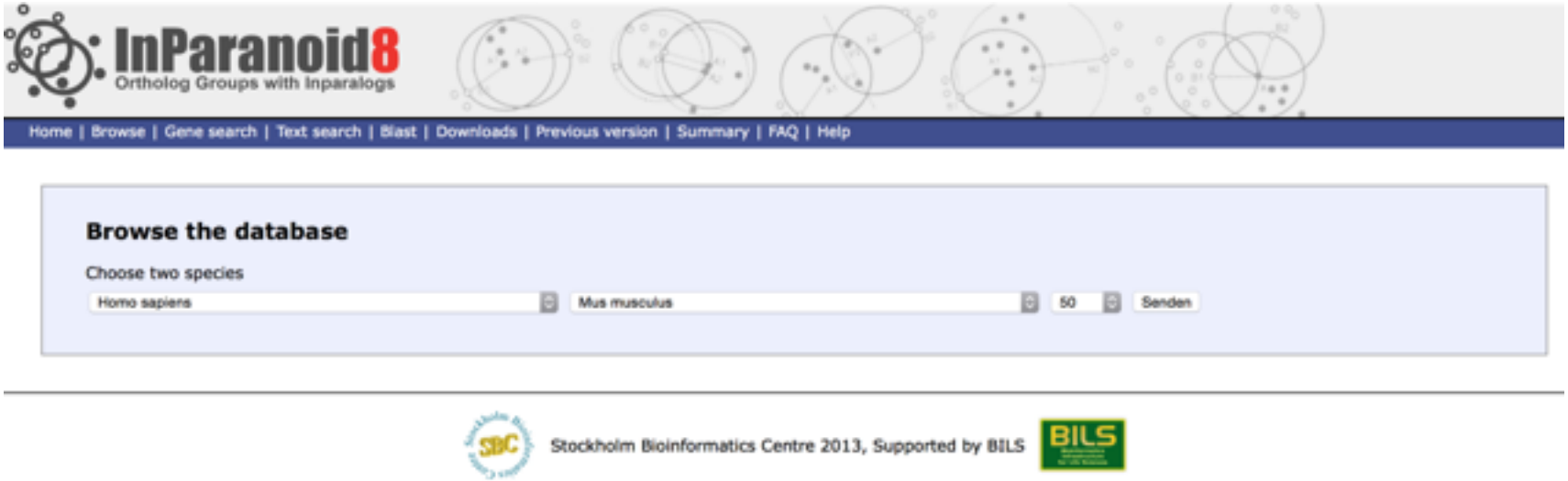
Orthology serach for particular gene

Orthology prediction using InParanoid



Browse for all ortholog groups between 2 species

Orthology prediction using InParanoid



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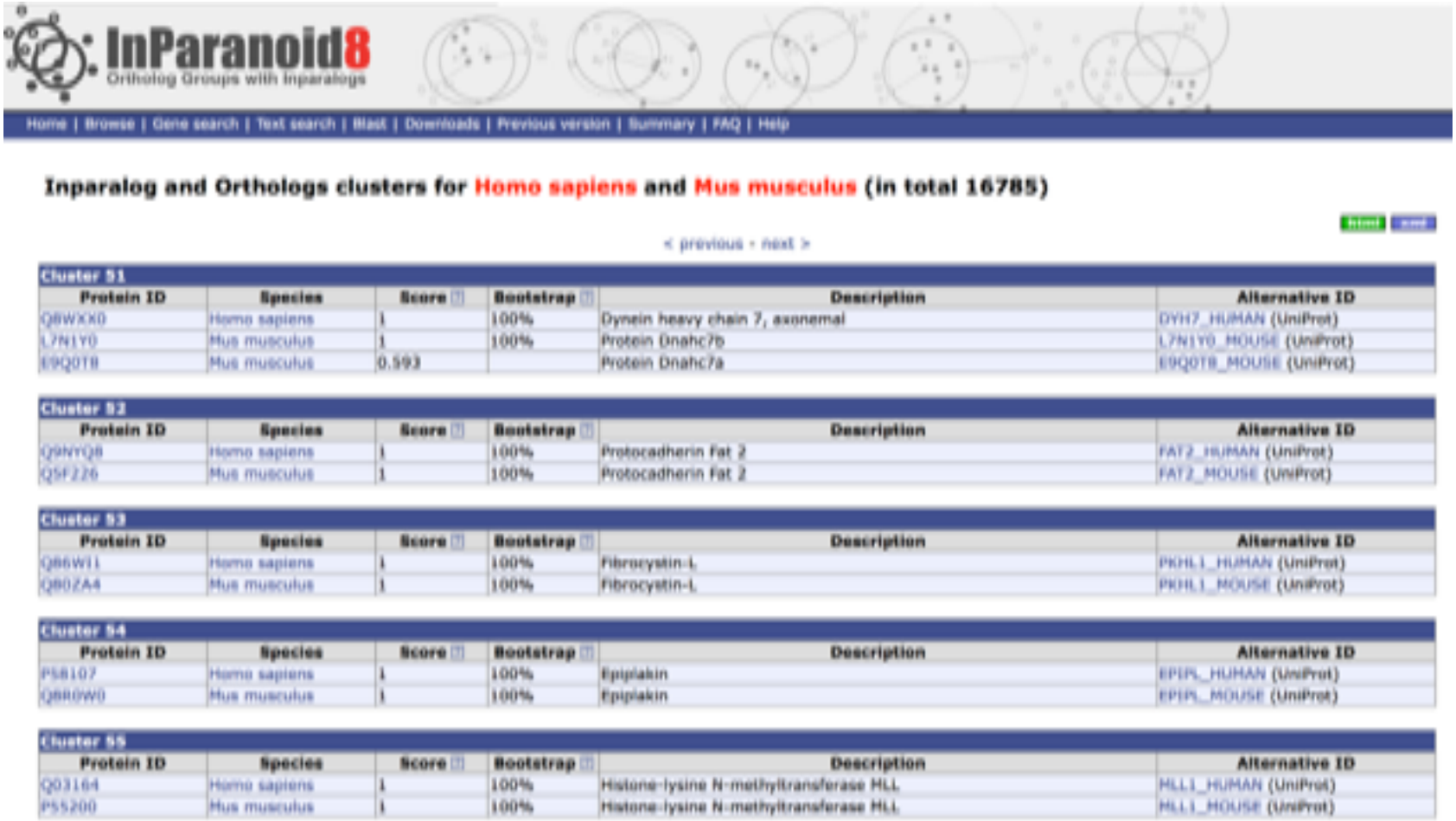

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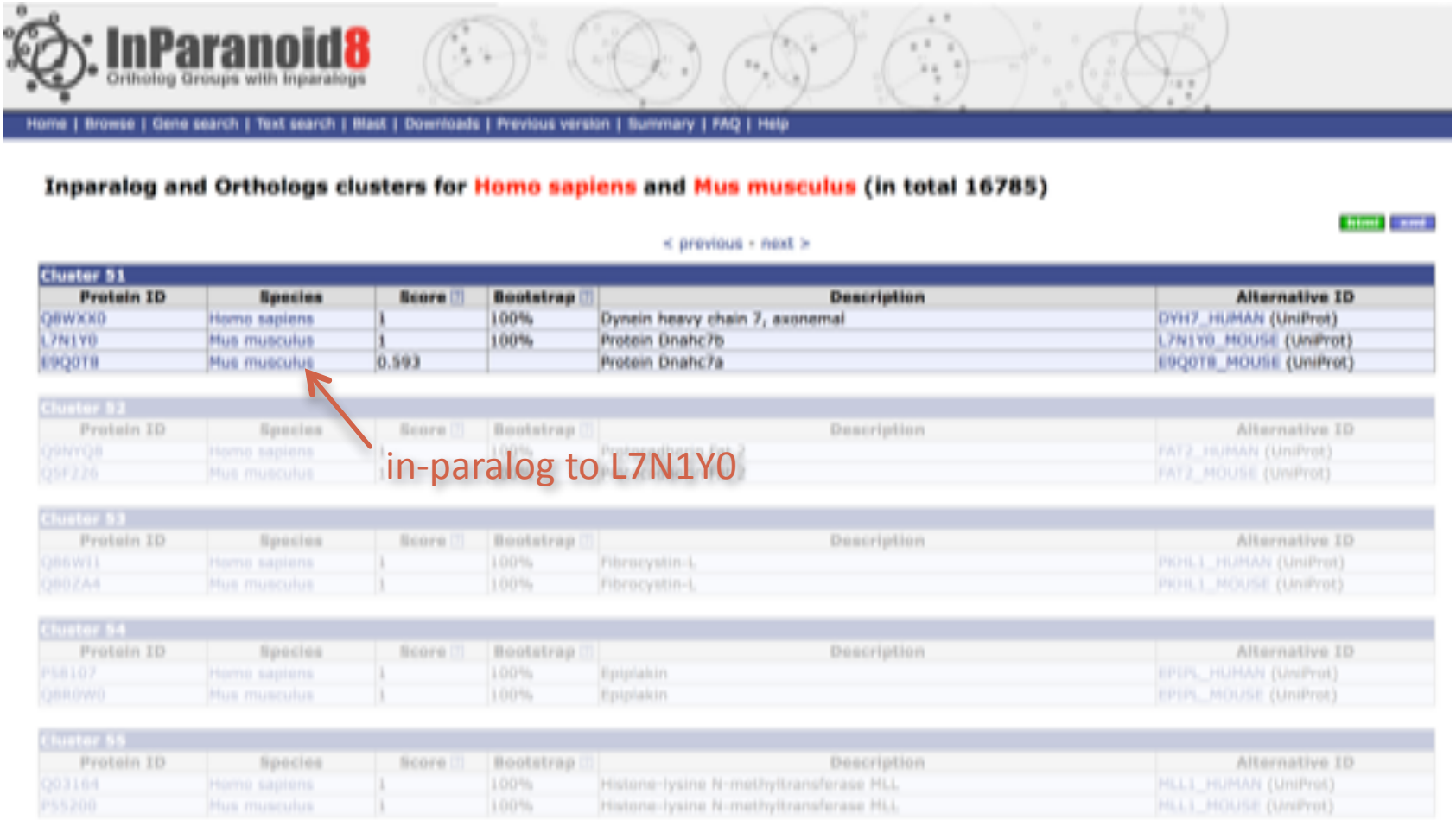

Browse for all ortholog groups between 2 species

EXAMPLE

EXERCISE

Orthology prediction using InParanoid

Cladonia grayi

vs

Saccharomyces cerevisiae