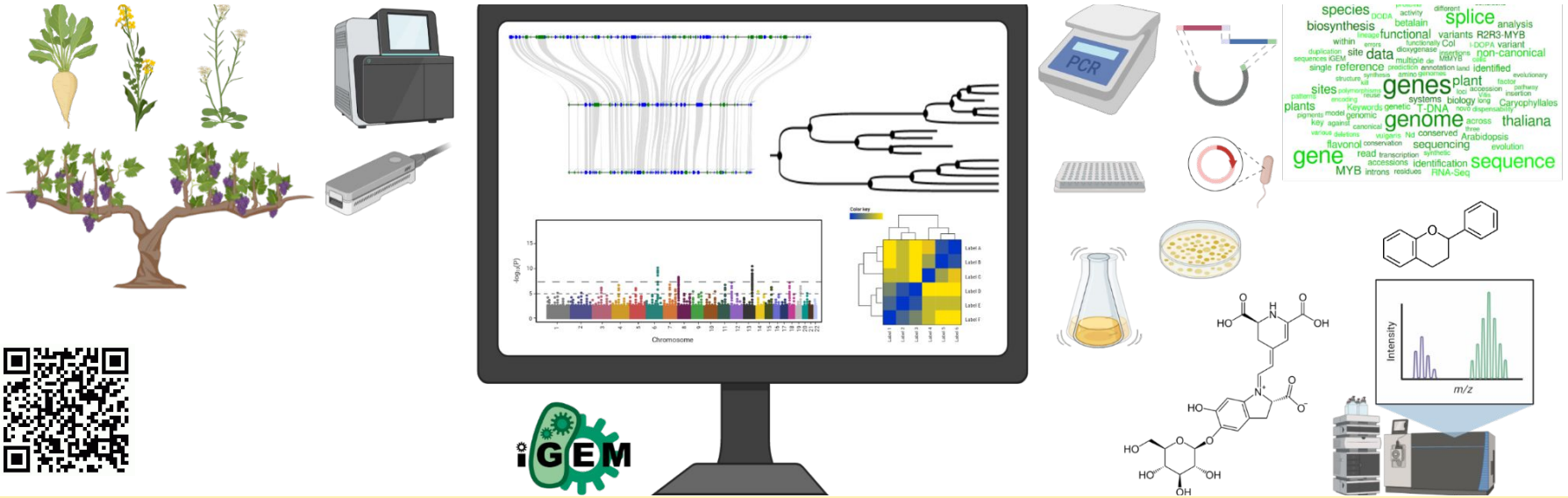
Technische Universität Braunschweig



Genomics Applications

Prof. Dr. Boas Pucker (Plant Biotechnology and Bioinformatics)

Availability of slides

- All materials are freely available (CC BY) - after the lectures:
  - StudIP: **GE31/MM12**
  - GitHub: https://github.com/bpucker/teaching

- Questions: Feel free to ask at any time

- Feedback, comments, or questions: b.pucker[a]tu-braunschweig.de

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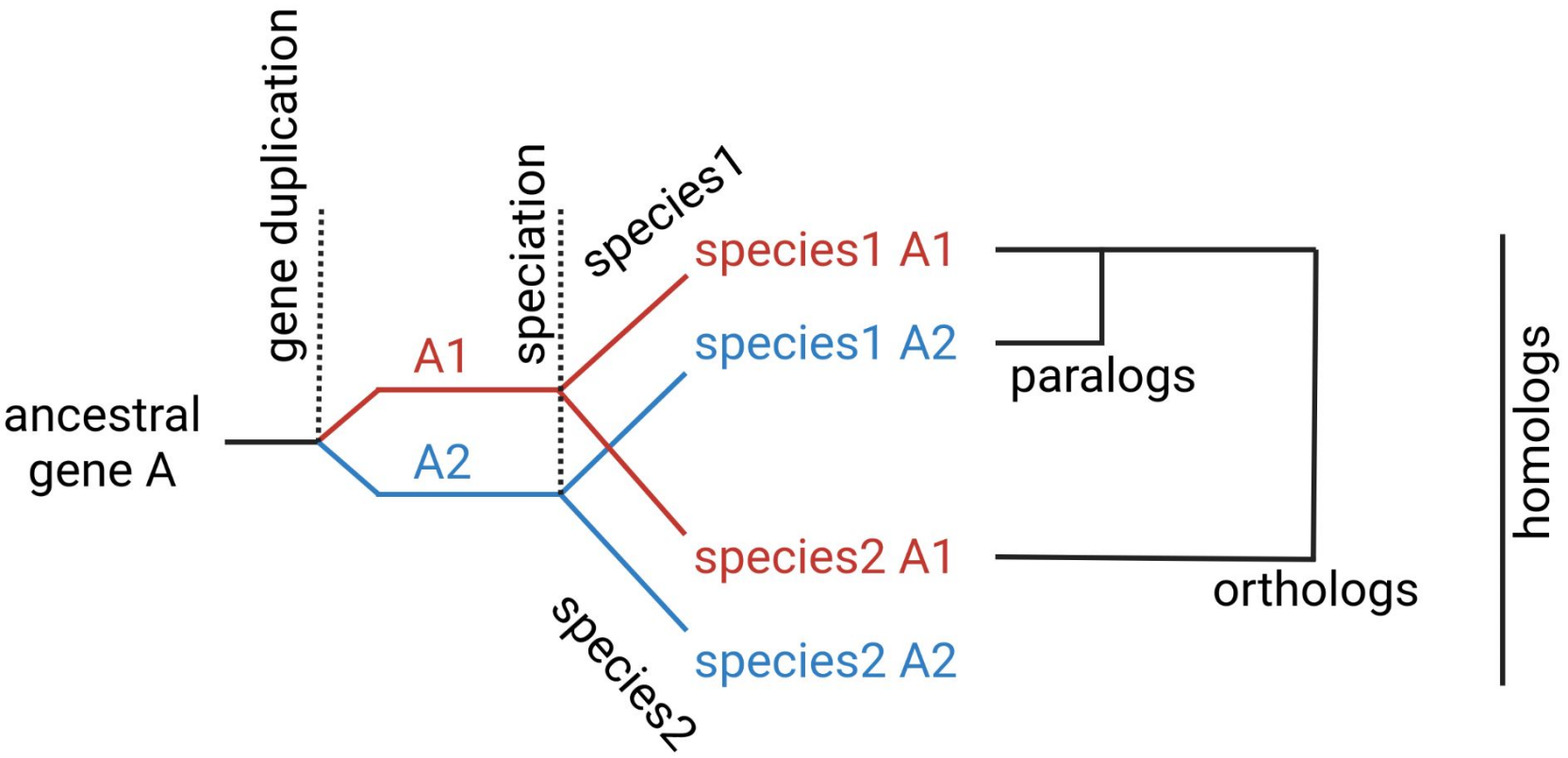
“Nothing in biology makes sense except in the light of evolution”
(who said this?)

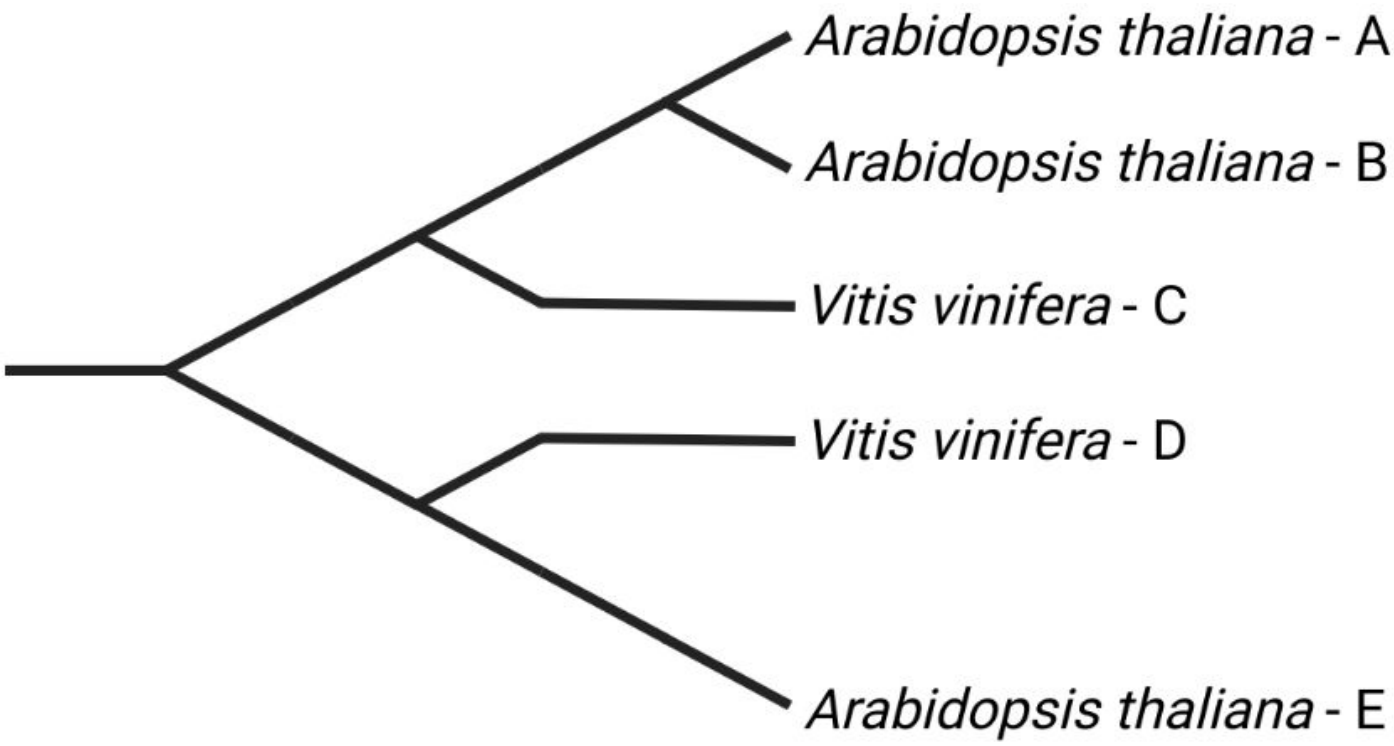
Evolutionary genomics

- Paralogs/orthologs
- OrthoGroup analysis with OrthoFinder (some evolution basics)
- Homeologs

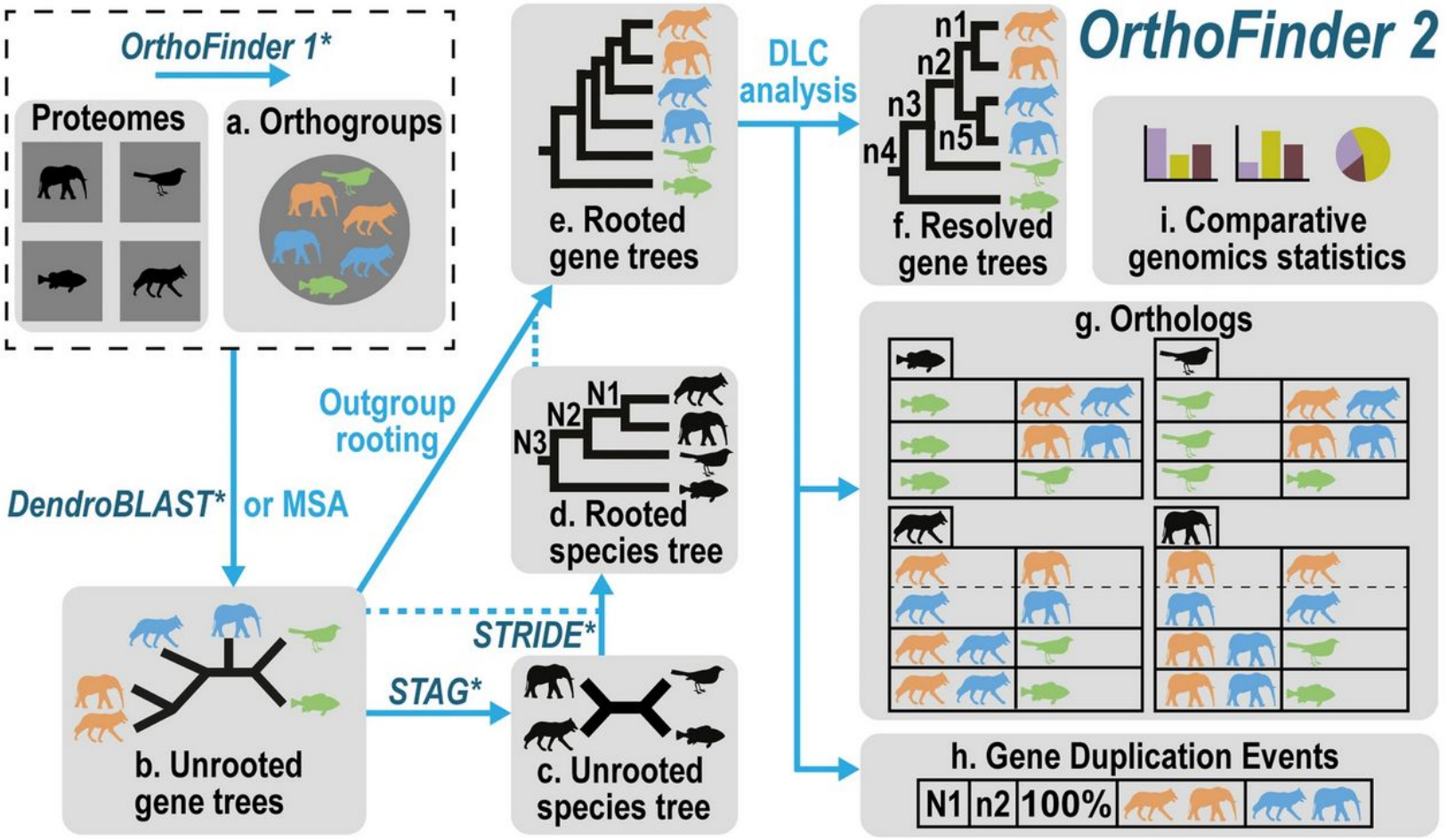
Paralogs & orthologs



Which are orthologs/paralogs?

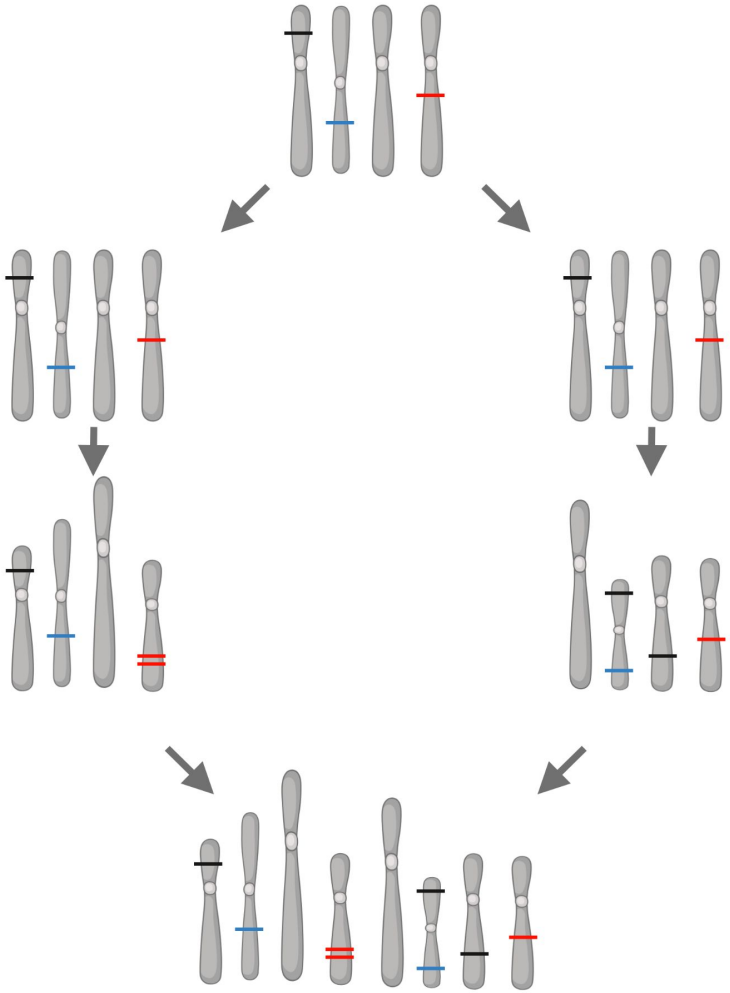


OrthoFinder2



Emms et al., 2019: 10.1186/s13059-019-1832-y

Homeologs



Same color indicates **orthologs**

Same color indicates **homeologs**

Speciation

Gene duplications, translocations, and rearrangements

Hybridization leads to polyploidization

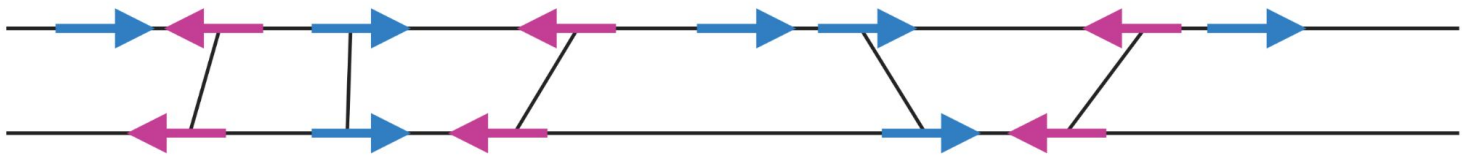
Glover et al., 2016: 10.1016/j.tplants.2016.02.005

Comparative genomics

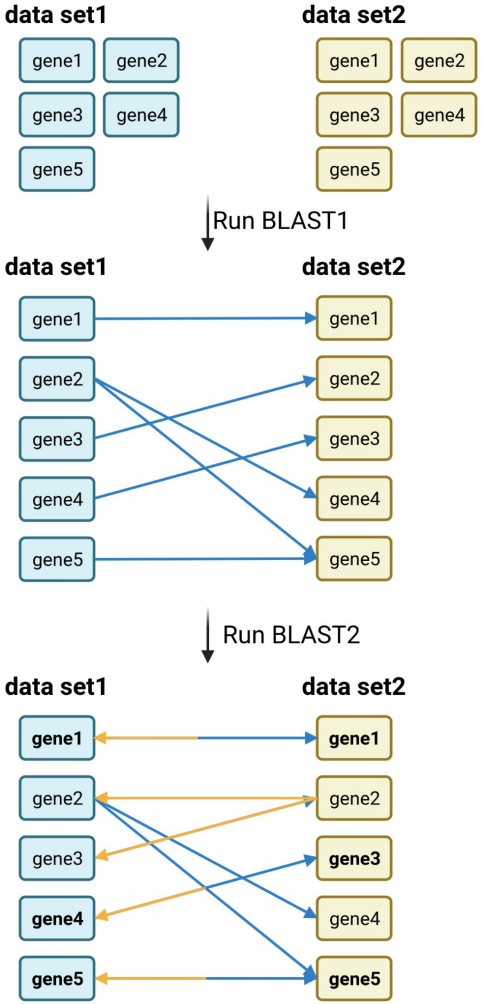
- Compare genome sizes
- Compare chromosome numbers
- Compare gene sets
- Compare gene positions & chromosome structures

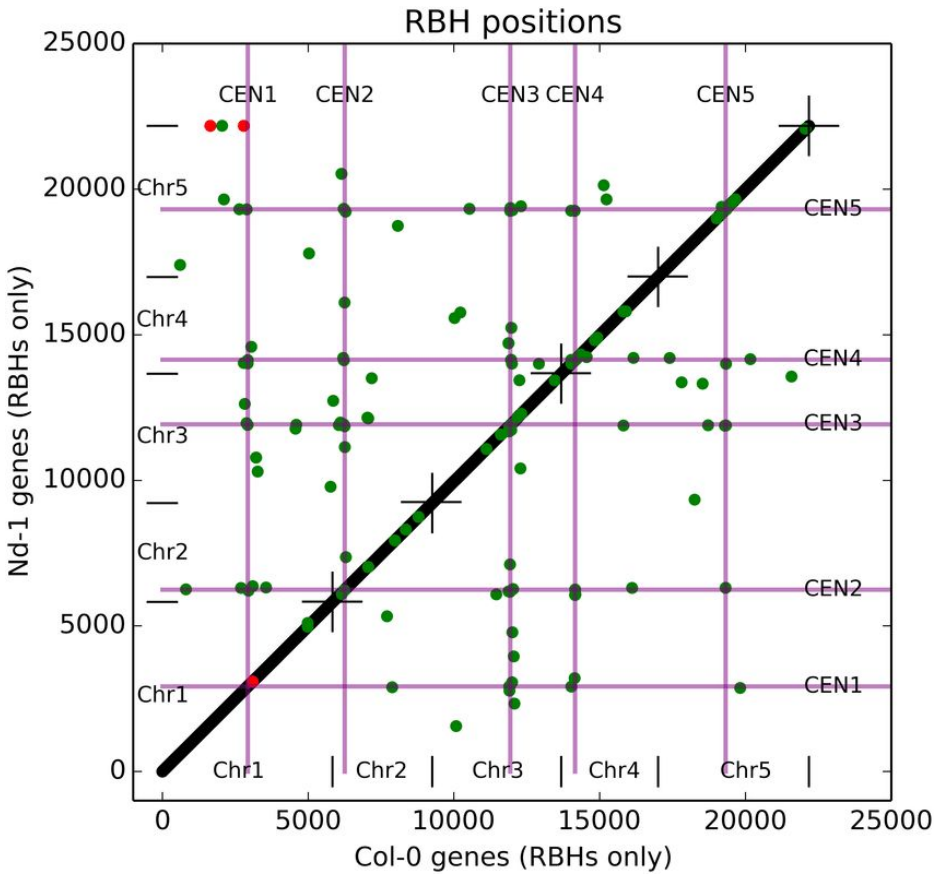
Synteny

Synteny = Same order of genes in different genomes



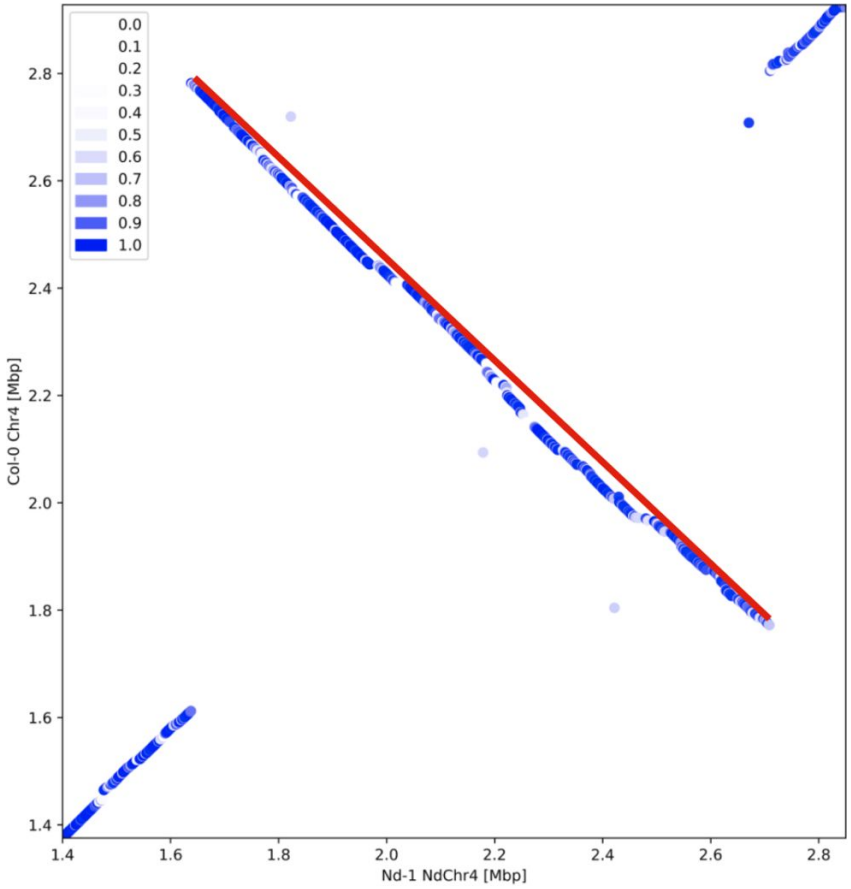
Reciprocal Best BLAST hits (RBHs)

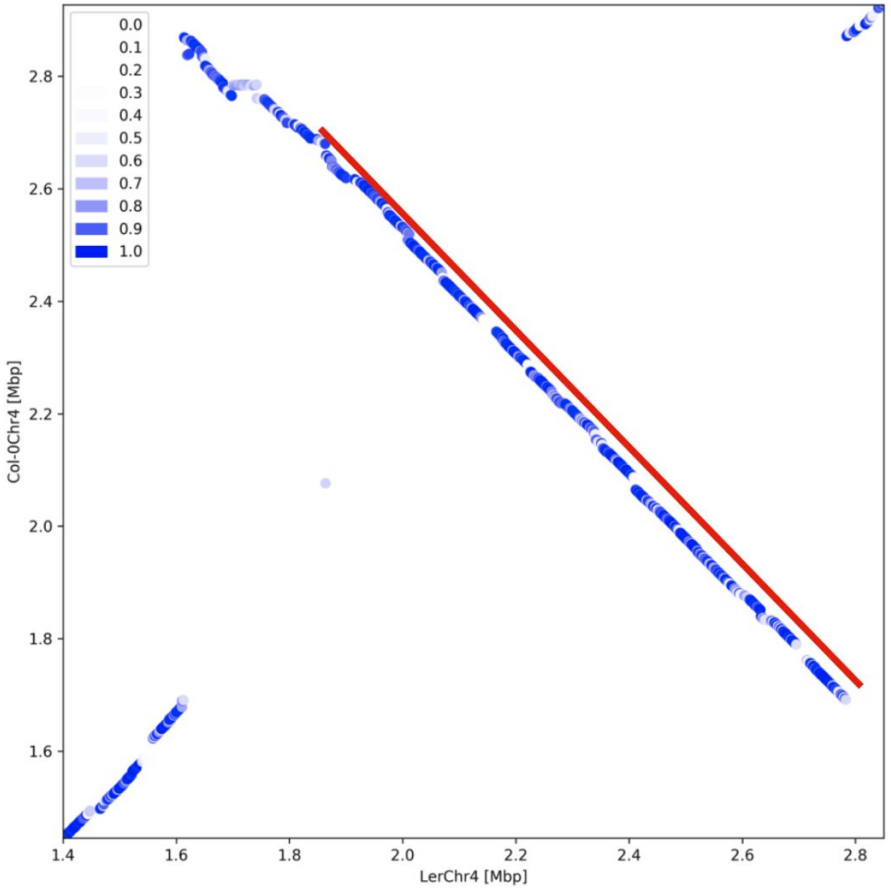




Pucker et al., 2016: 10.1371/journal.pone.0164321

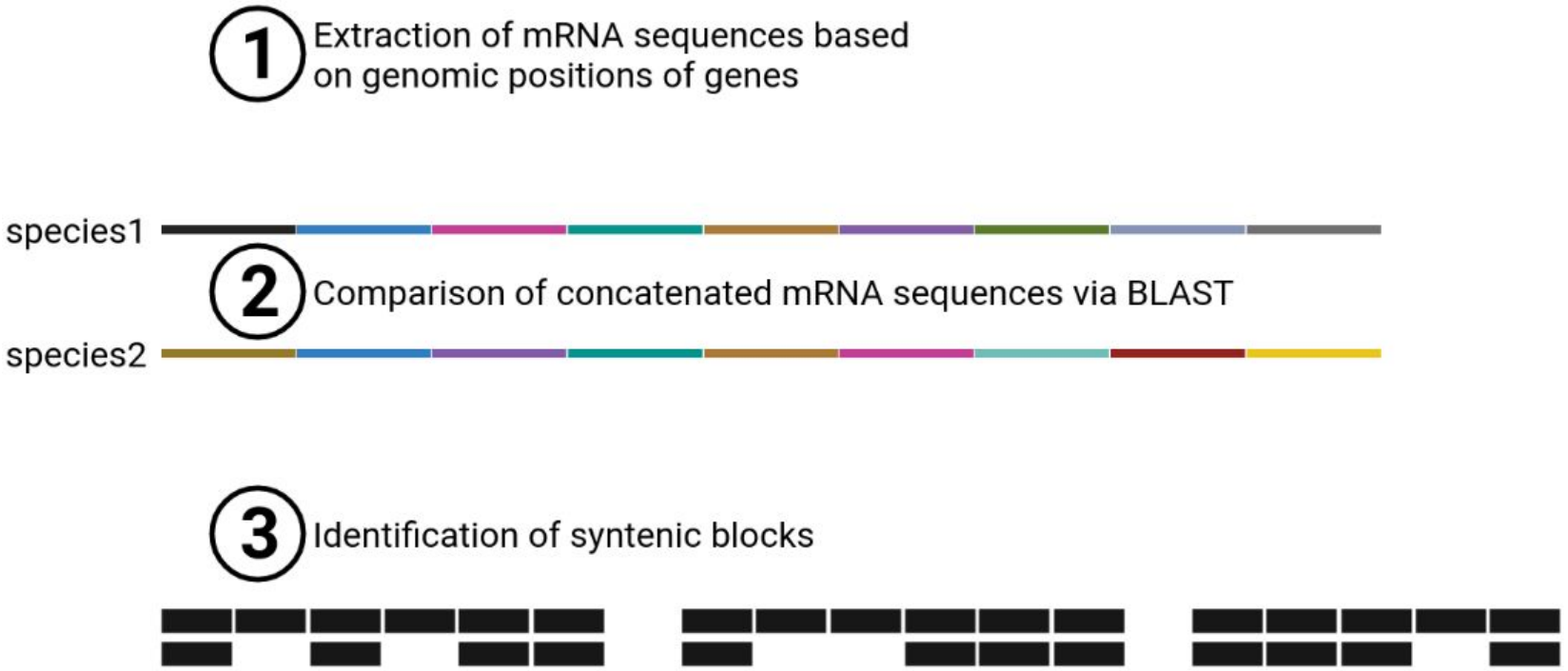
Dot plots





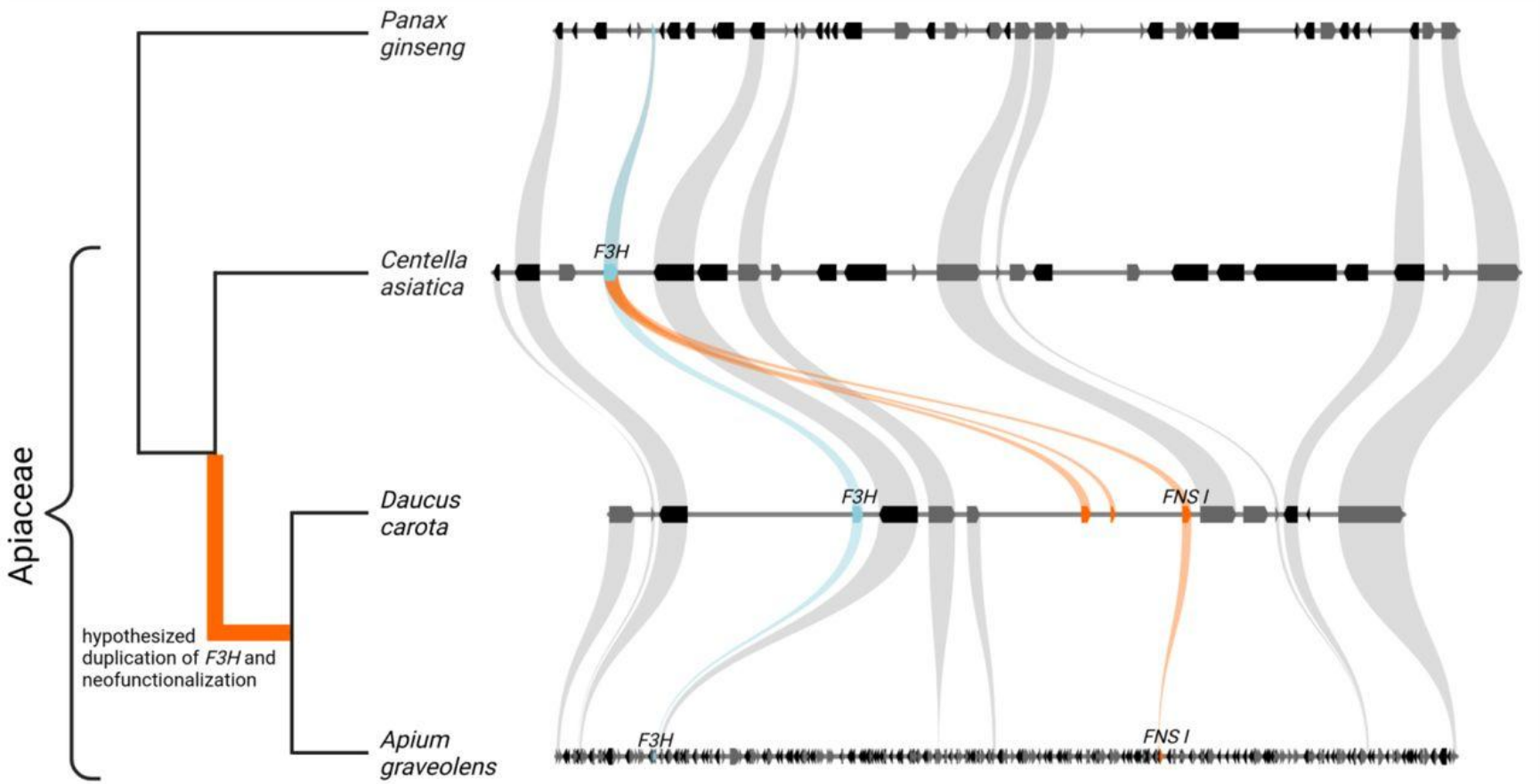
Pucker et al., 2019: 10.1371/journal.pone.0216233

JCVI/MCscan



https://github.com/tanghaibao/jcvi/wiki/MCscan-(Python-version)

Evolution of FNS I in the Apiaceae



Pucker & Iorizzo, 2022: 10.1101/2022.02.16.480750

Time for questions!

Questions

1. What are paralogs/orthologs?
2. What is synteny?
3. Which methods can be used to analyze synteny?
4. Which pattern indicates an inversion in a dot plot?
5.