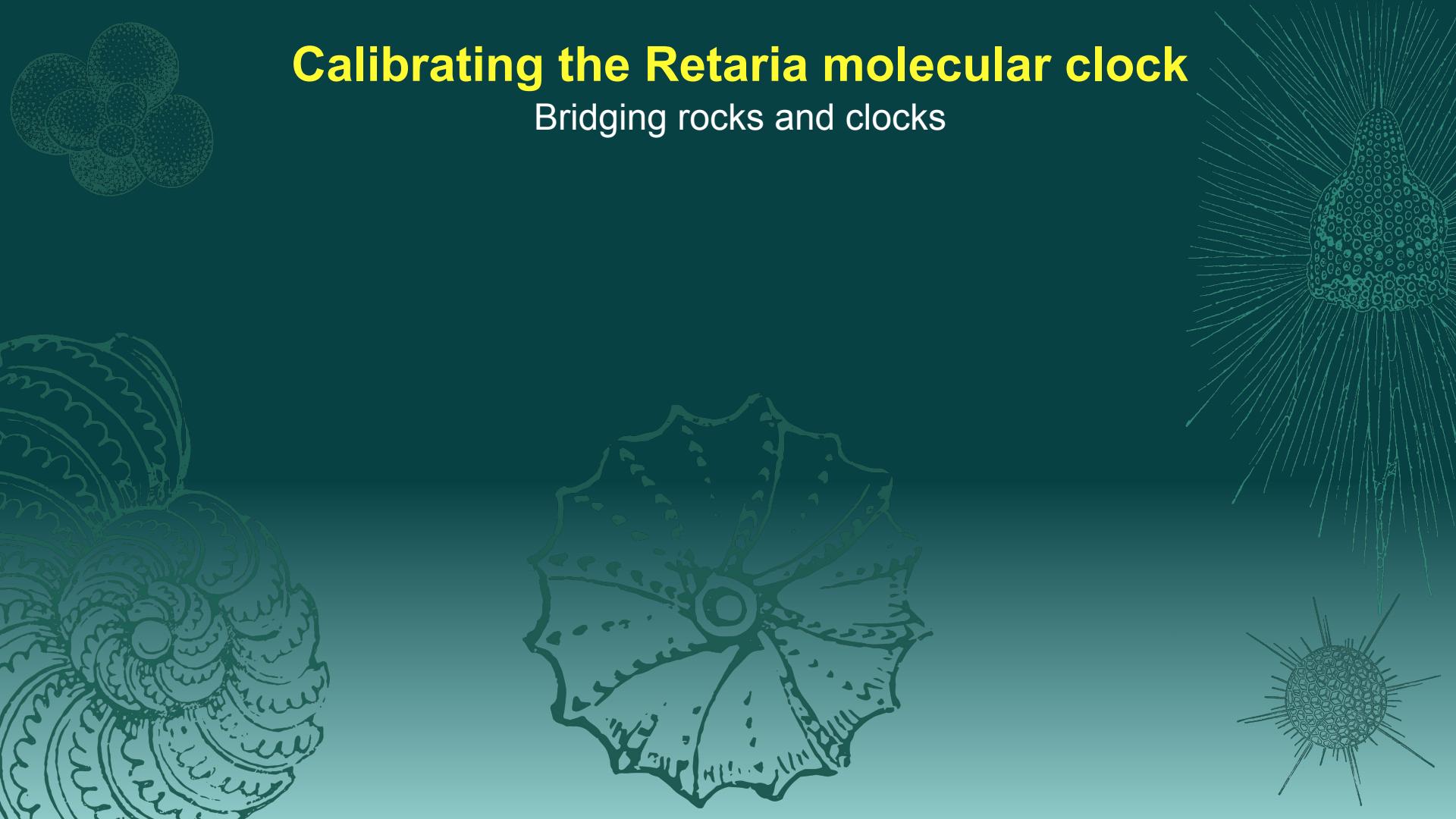


Calibrating the Retaria molecular clock

Bridging rocks and clocks



Calibrating the Retaria molecular clock

Bridging rocks and clocks



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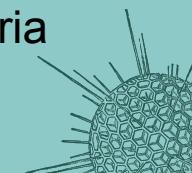


Mattia Greco

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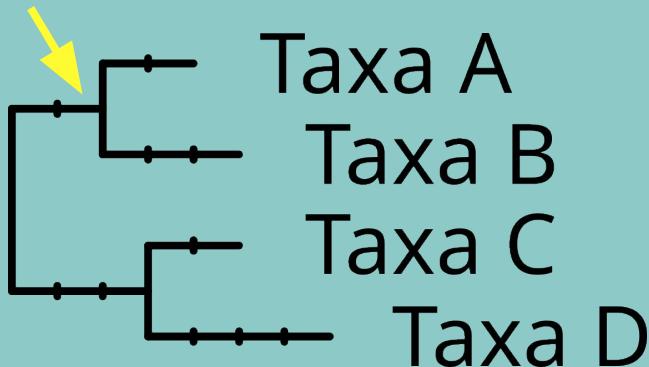
Postdoctoral fellow at the Institute of
Marine Science (CSIC), Barcelona,
Spain

- Introduction to molecular phylogenetics and tree thinking
- Introduction to the molecular clock concept and best practices calibrating Retaria
- Case study: Calibrating *Globigerinoides* (by Mattia)

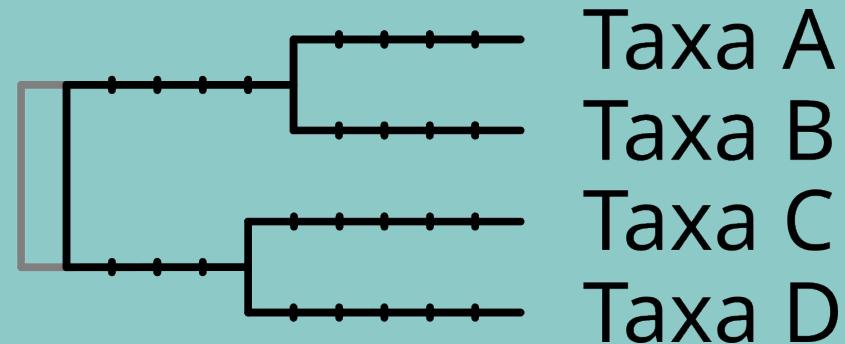


Molecular clock in a nutshell

5 time units



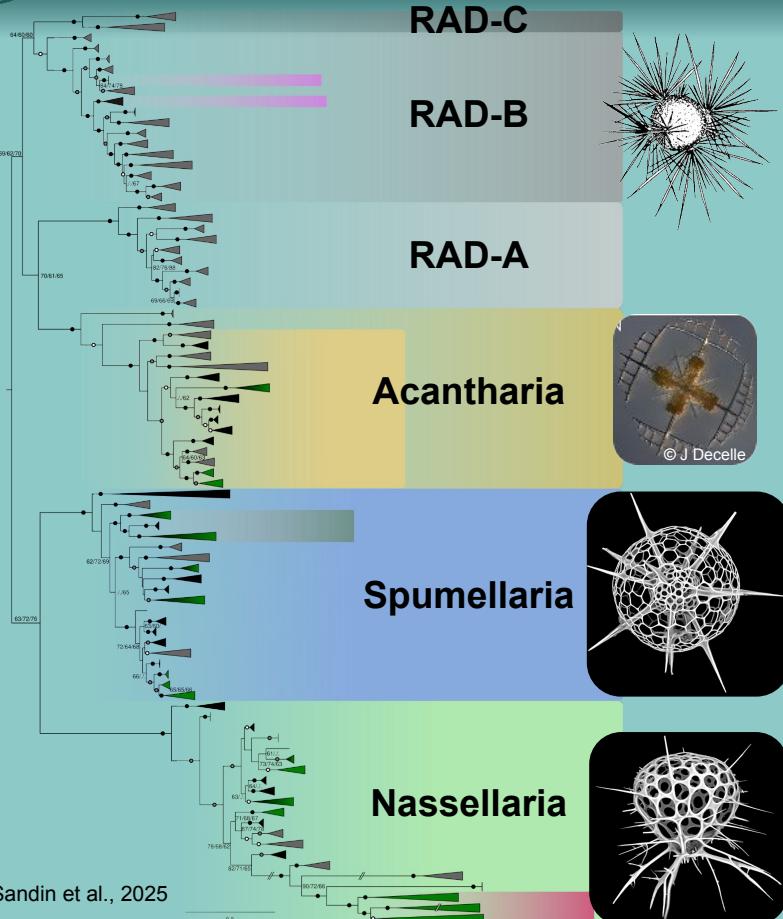
1 mutation unit



1 time unit

Under a **strict clock model**, times are proportional to distances

Molecular clock in a nutshell



A strict clock model is too simplistic at broad taxonomic scales

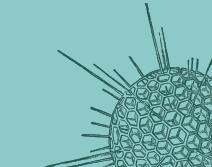
Relaxed clock models allow different rates at different lineages

Choosing the software

Scientific question
and dataset

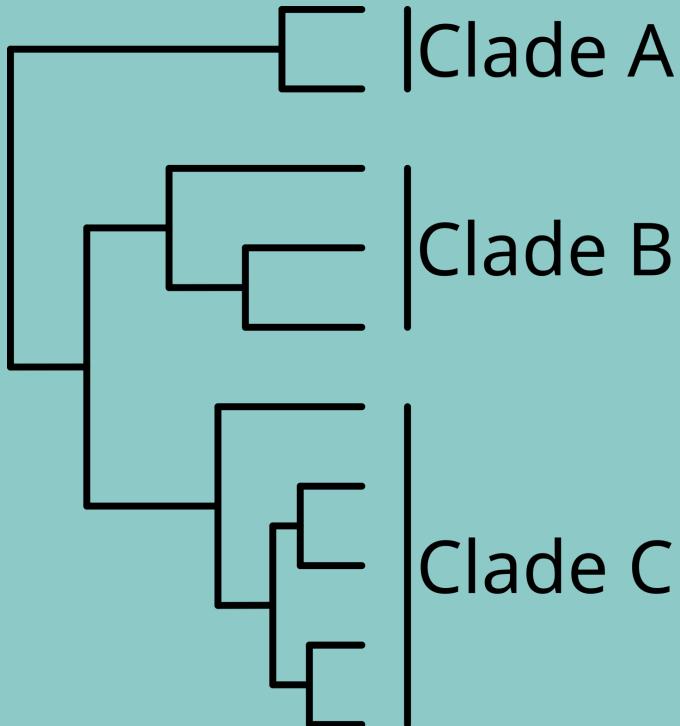
Uncertainty
Priors:
Speciation & fossil calibrations

Bayesian	BEAST/BEAST2	V	Octopus
	MCMCTree		
Penalized likelihood	MrBayes	VI	Octopus
	PhyloBayes		
...	...	VI	Octopus
	r8s		
...	TreePL	VI	Octopus
	...		





Choosing the calibration points

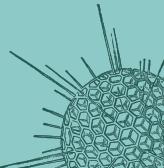


Perform a **relative calibration**
and compare with your
fossil dates

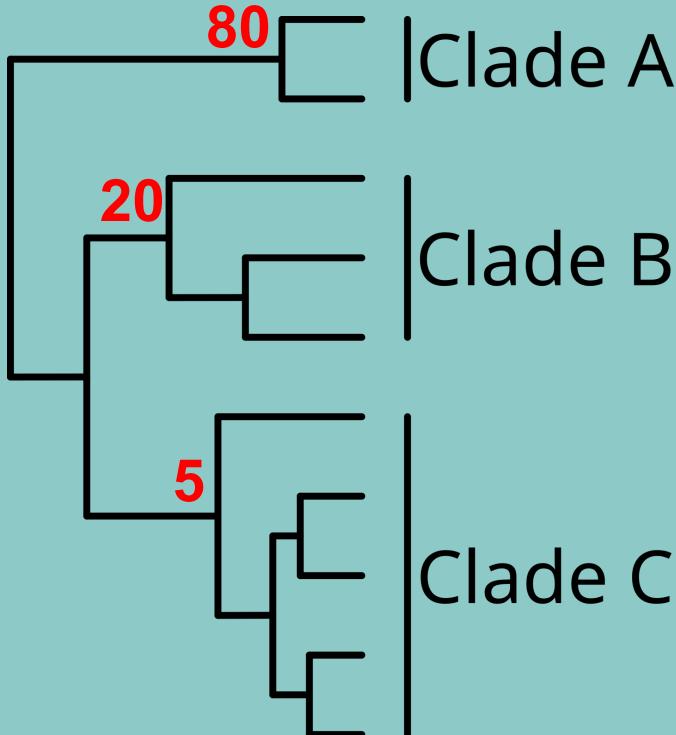
Fossil calibrations



Priors



Choosing the calibration points



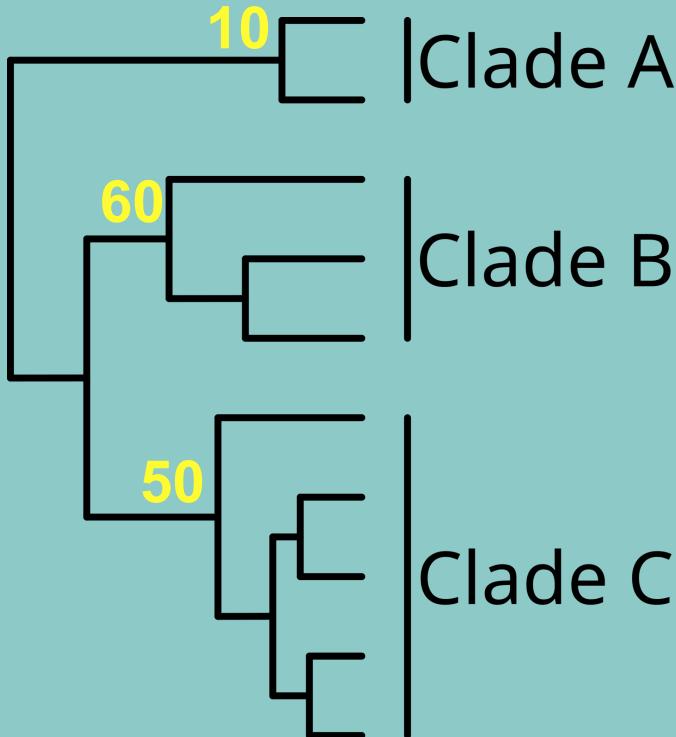
Perform a **relative calibration** and compare with your fossil dates

Fossil calibrations



Priors

Choosing the calibration points



Perform a **relative calibration** and compare with your fossil dates



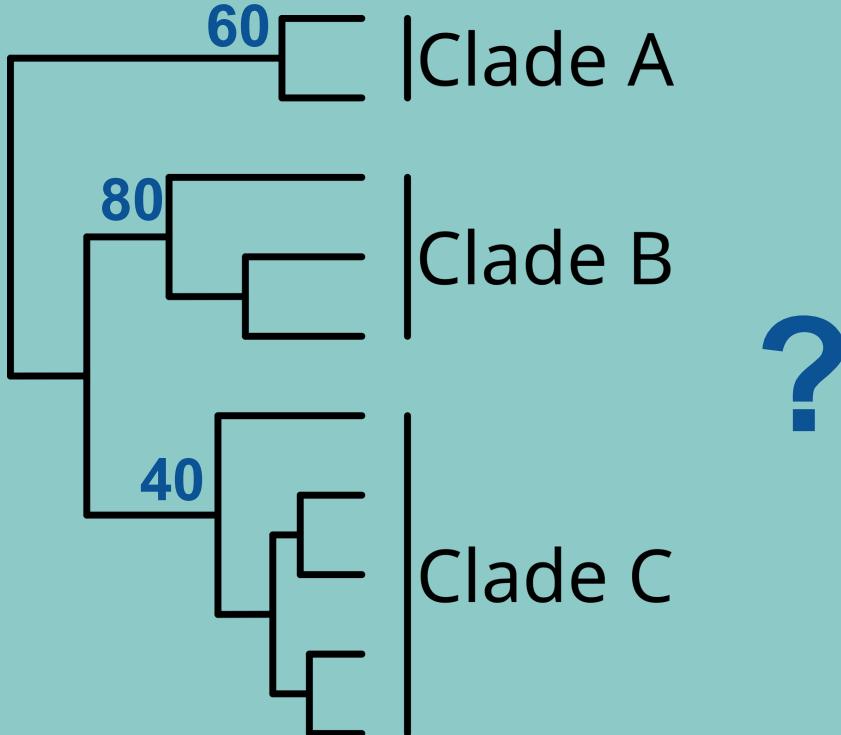
Fossil calibrations



Priors

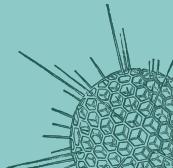


Choosing the calibration points



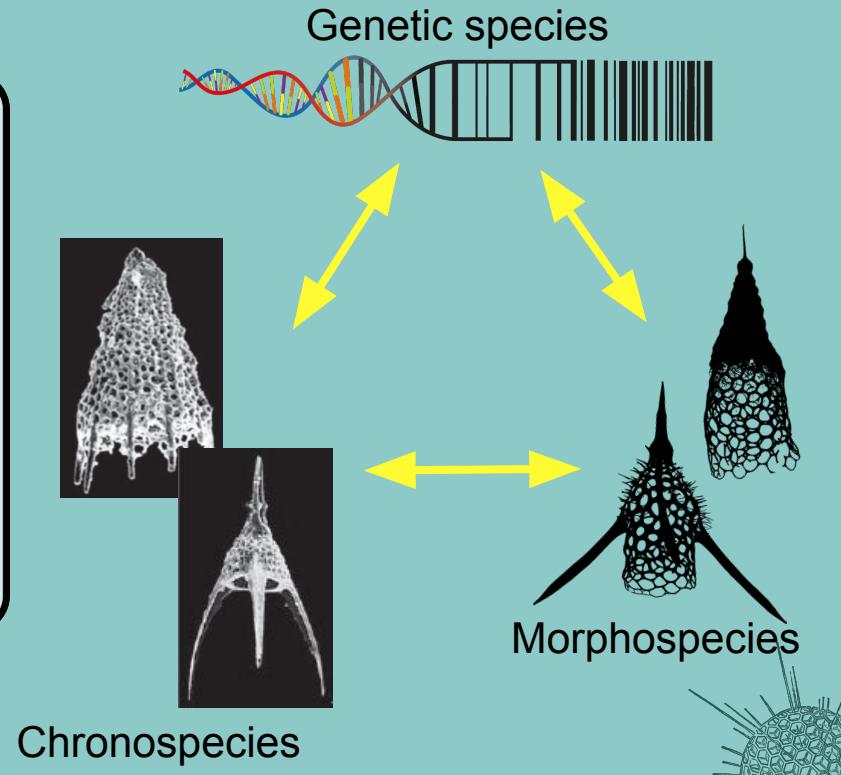
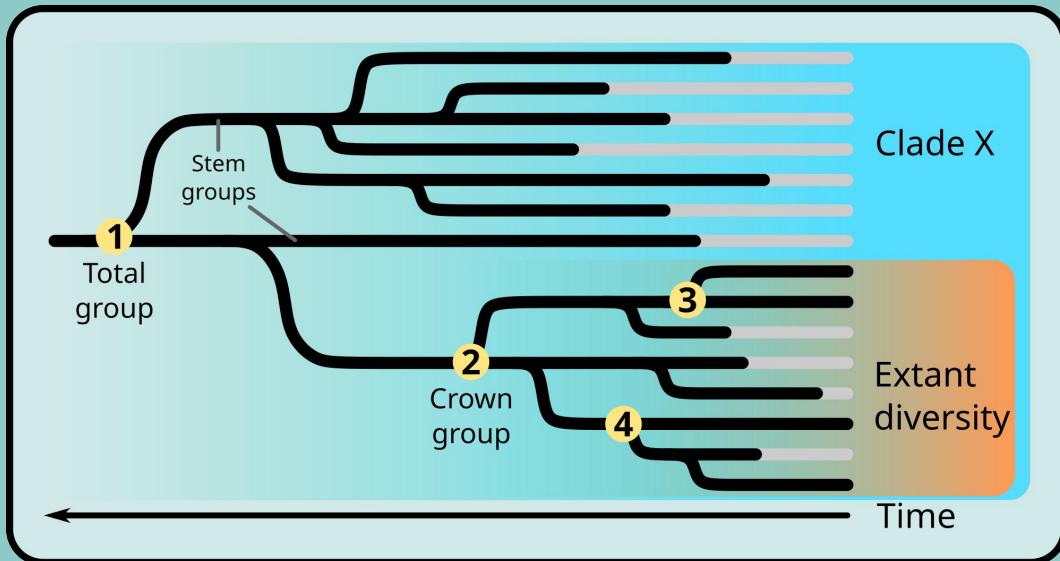
Perform a **relative calibration**
and compare with your
fossil dates

Fossil calibrations
↓
Priors



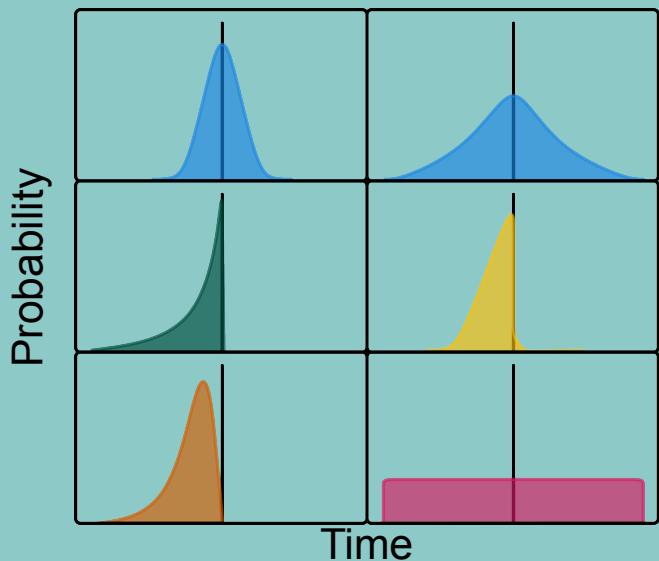
Choosing the calibration points

Understanding diversity



Choosing the prior distributions

Choosing the right distribution

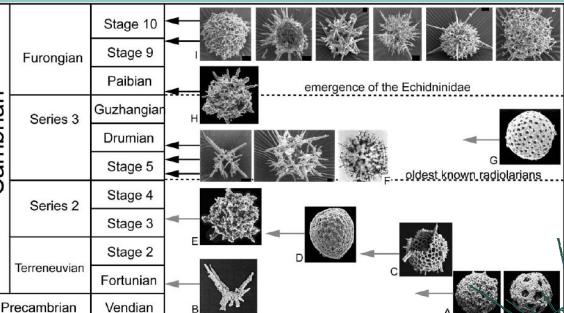
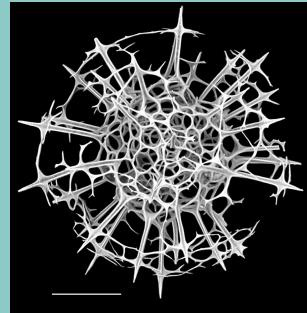


Distributions:

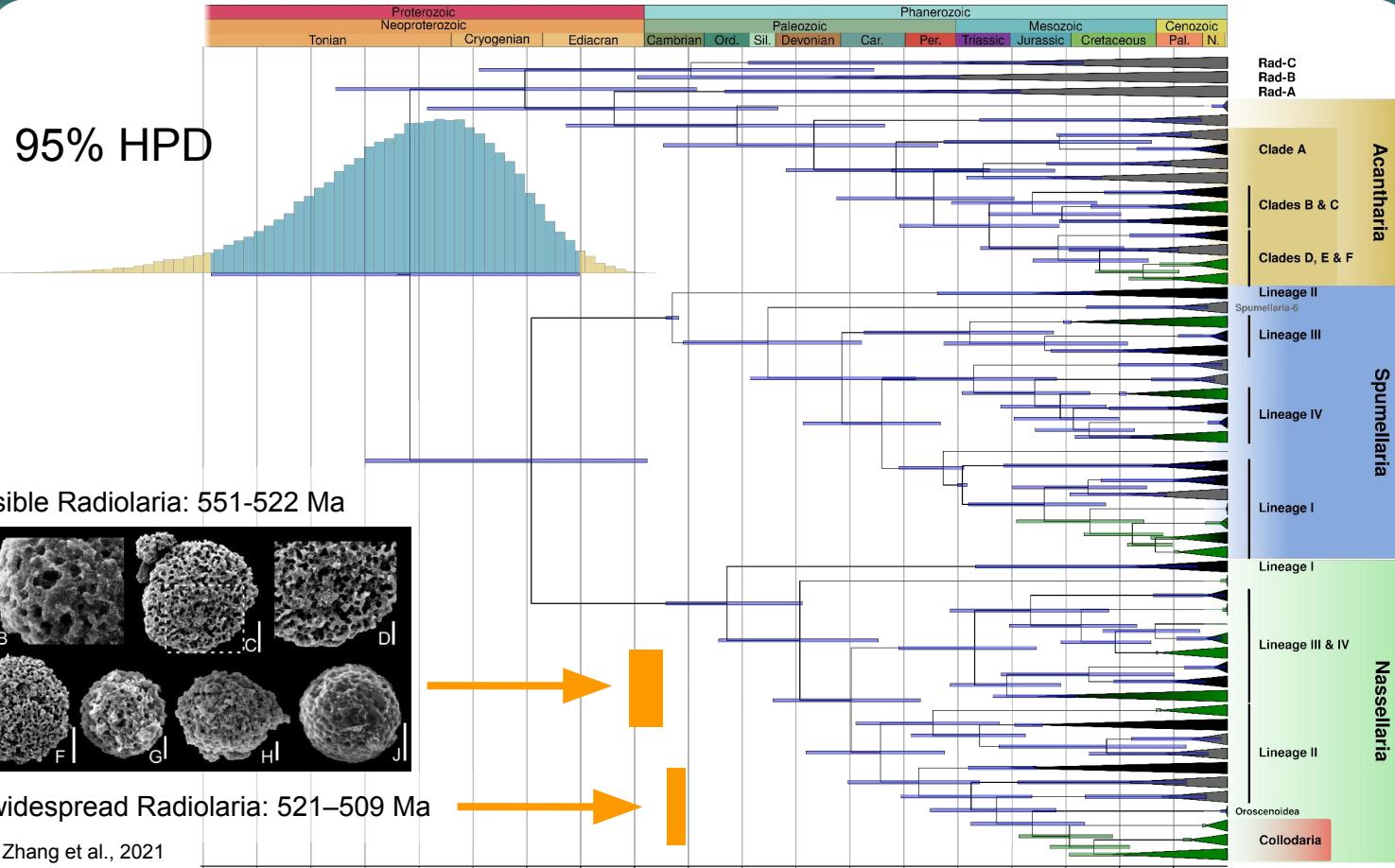
- **Normal:** $N(\mu, \sigma)$
- **Exponential:** $\exp(\lambda)$
- **LogNormal:** $\ln(\mu, \sigma)$
- **Gamma:** $\text{gamma}(\alpha, \theta)$
- **Uniform:** $U(a, b)$
- ...

Depends on:

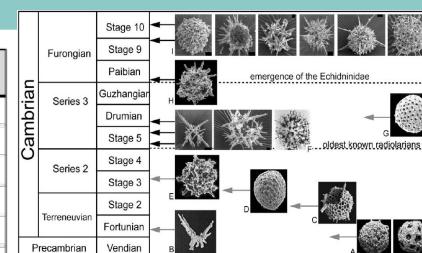
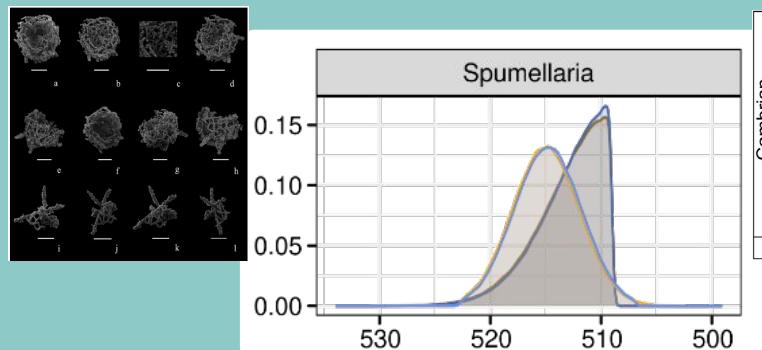
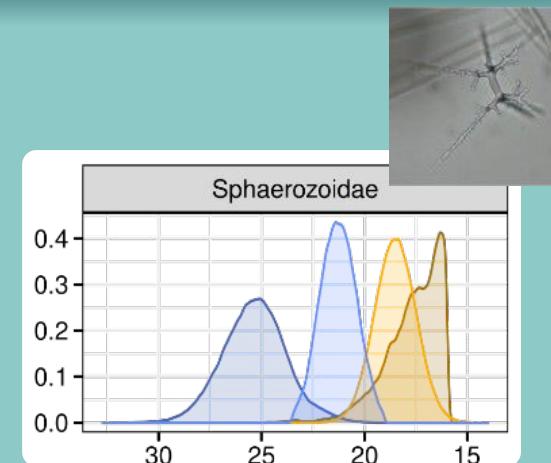
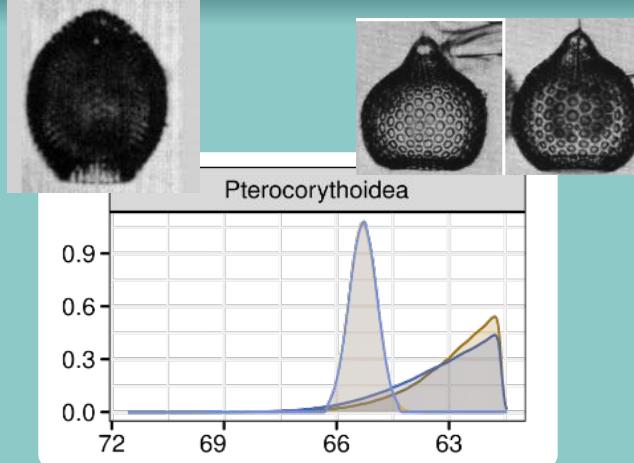
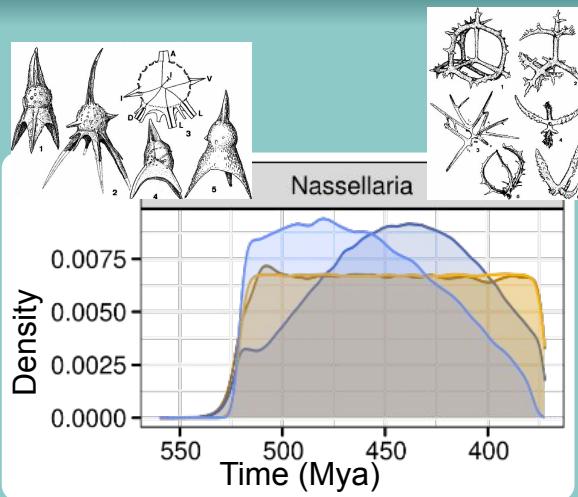
- Fossil interpretation
- Fossil confidence
- Phylogenetic diversity
- ...



Interpreting the molecular clock timing



Assessing the priors



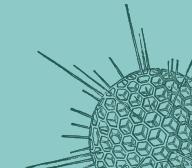
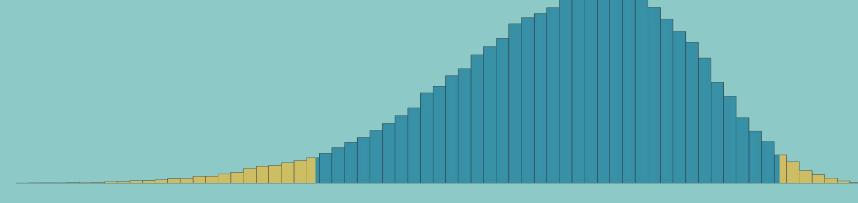
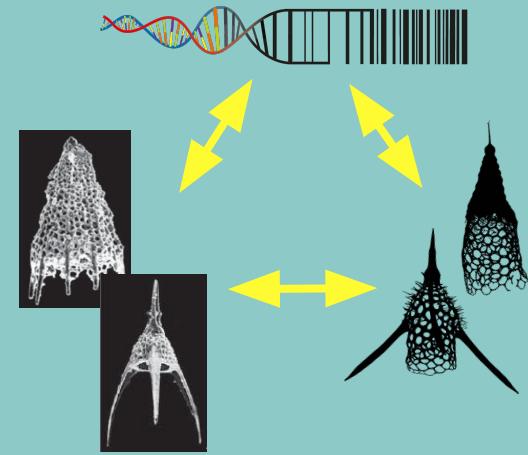
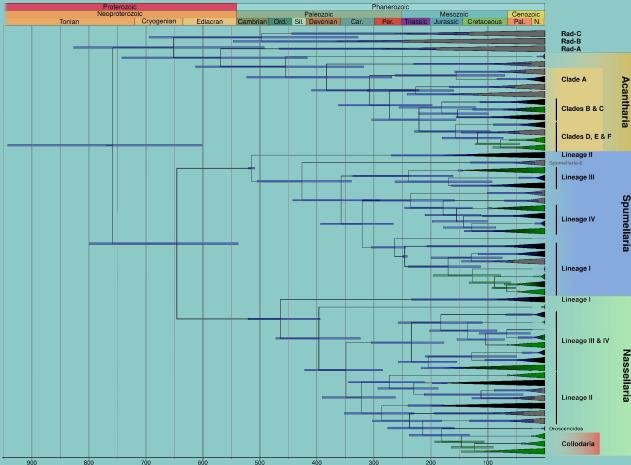
Distribution
 BEAST2 MCMCTree

Prior Posterior

The Life of Retaria Seminar Series

Molecular dating:

- Is an iterative process
- Has to be interpreted
- Best achieved in interdisciplinary collaborations



The Life of Retaria Seminar Series

A meeting to foster exchange among the Retaria community