Introduction to phylogenies & the comparative method

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Phylogenies & the comparative method

- Why do we want to estimate phylogenies?
  - To understand the relationships among taxa.
  - To use the phylogeny to better understand the evolutionary processes that underlie the diversification of life on earth.
- What can phylogenies tell us about evolutionary history?

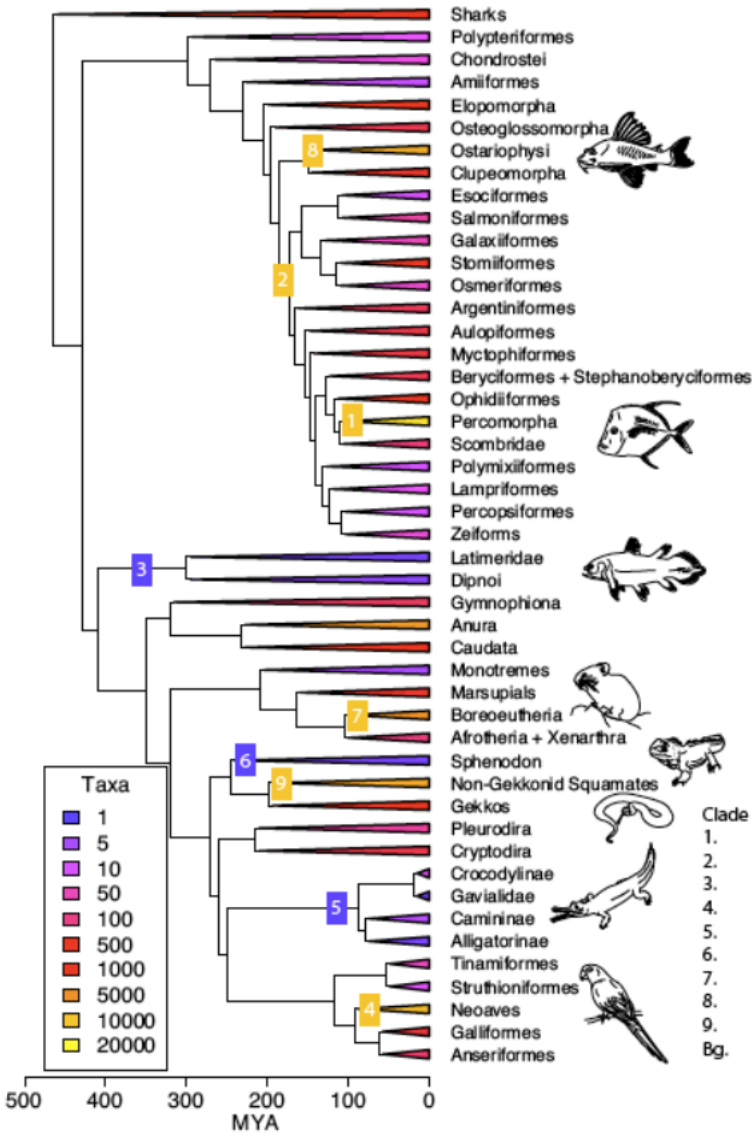
Process from pattern in comparative data

- Fundamentally, the phylogeny & comparative data present a *pattern*.
- However this pattern is the product of a historical *process* and that process may have left behind a distinctive signature in our among-species data.
- If this is the case, then we ought to be able to make inferences about process from the patterns of our data.

What kinds of processes can be inferred from comparative data?

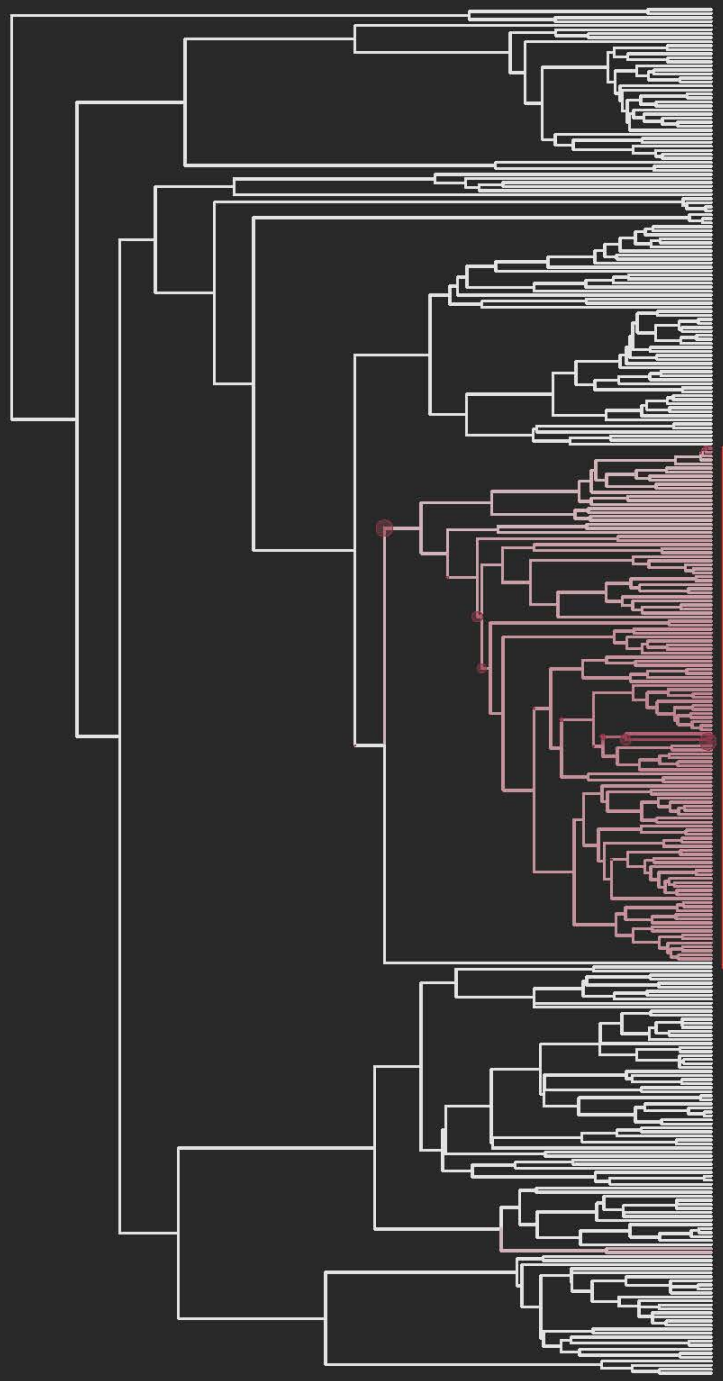
- Diversification (speciation & extinction)
- Character evolution
- Characters & diversification
- Biogeography
- Testing complex evolutionary models

Diversification
(speciation & extinction)



Clade	r	ε	ΔAIC
1.	0.082	*	24.6
2.	0.039	0.00	46.4
3.	0.0017	0.56	22.3
4.	0.089	*	17.7
5.	0.00006	0.99	10.7
6.	0.0014	*	7.4
7.	0.072	*	6.1
8.	0.053	*	11.9
9.	0.040	*	5.6
Bg.	0.010	0.99	

Character evolution



Bolitoglossinae

shift direction

- 1.00
- 0.80
- 0.50
- 0.20
- 0.00
- -0.20
- -0.50
- -0.80
- -1.00

posterior rates

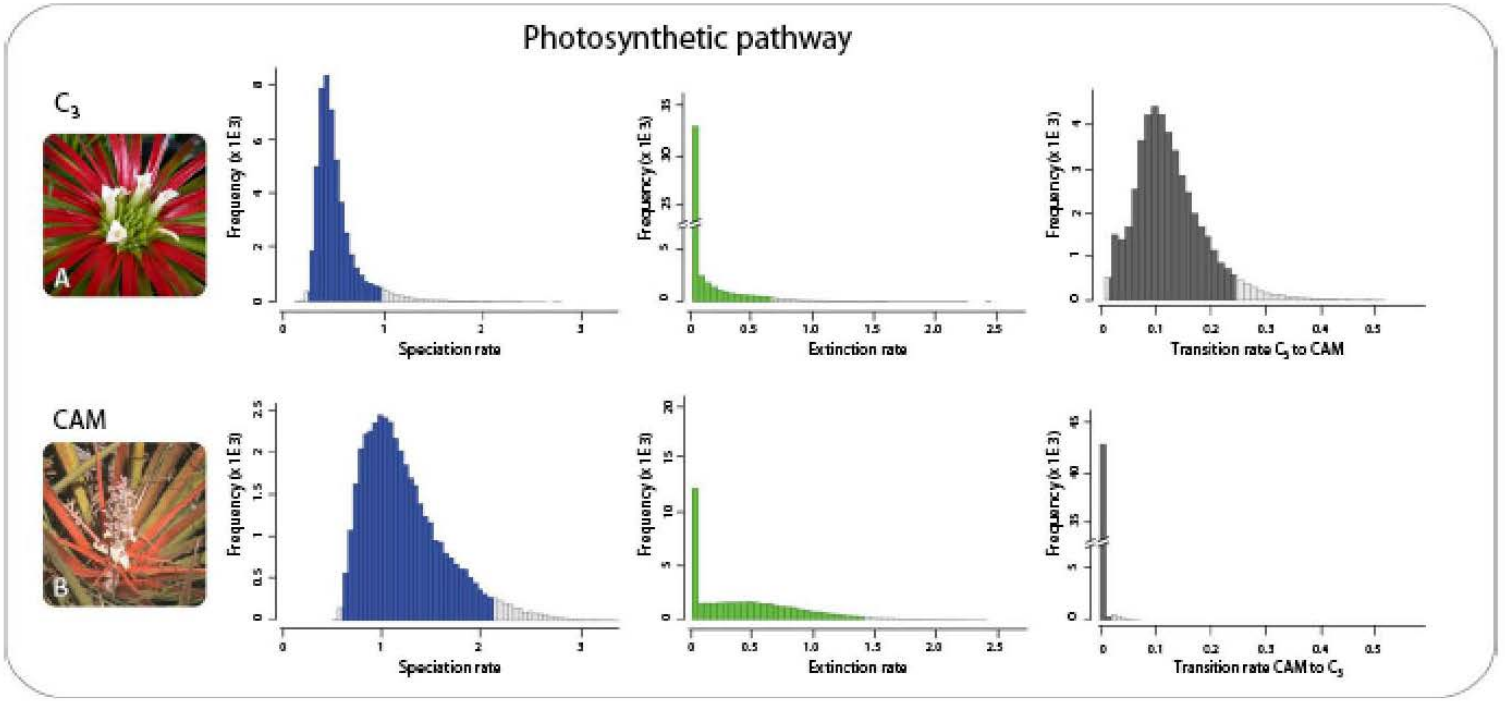
- 3.011
- 0.519
- 0.090
- 0.015
- 0.003
- 0.000
- 0.000
- 0.000
- 0.000

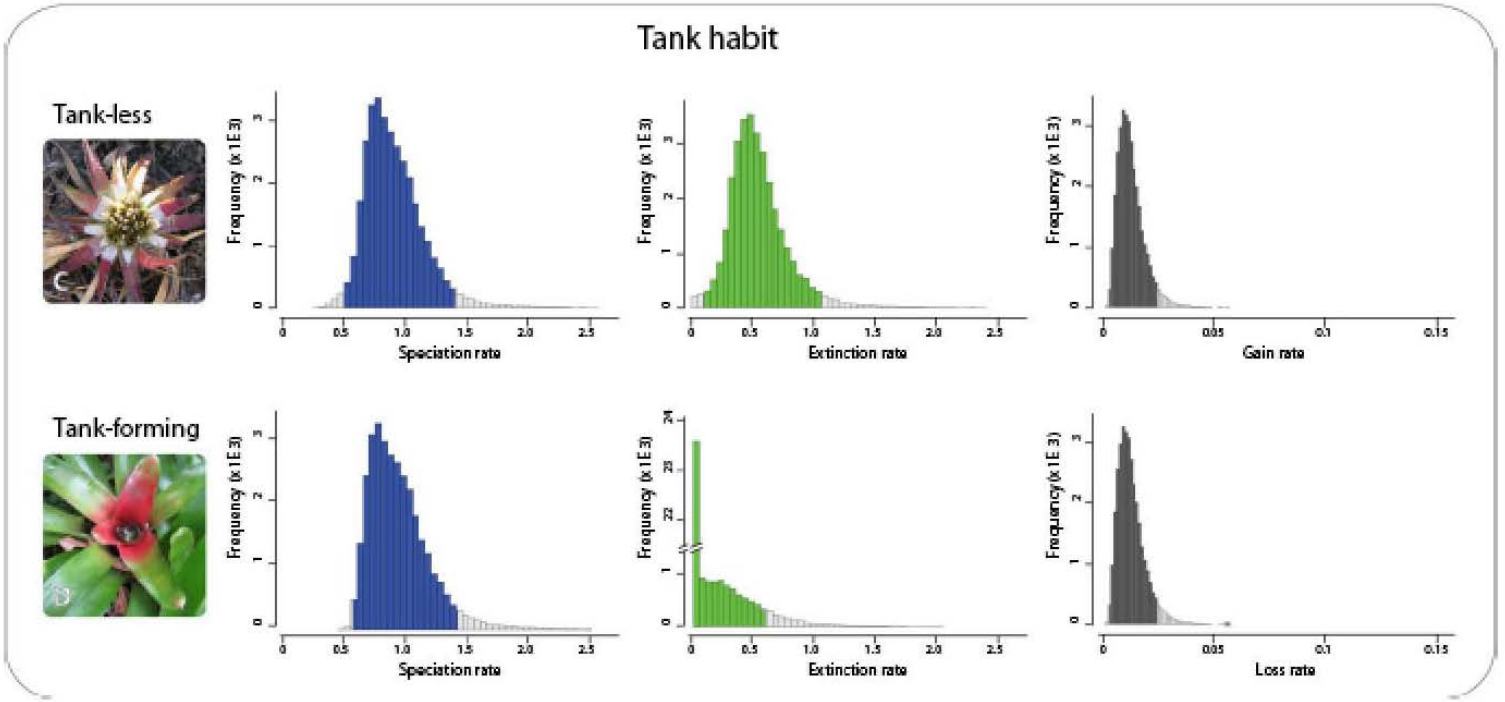
shift probability

- 1.000
- 0.875
- 0.750
- 0.625
- 0.500
- 0.375
- 0.250
- 0.125
- 0.000

photos from wiki commons

Characters & diversification





Silvestro et al. 2013
Evolution

Biogeography

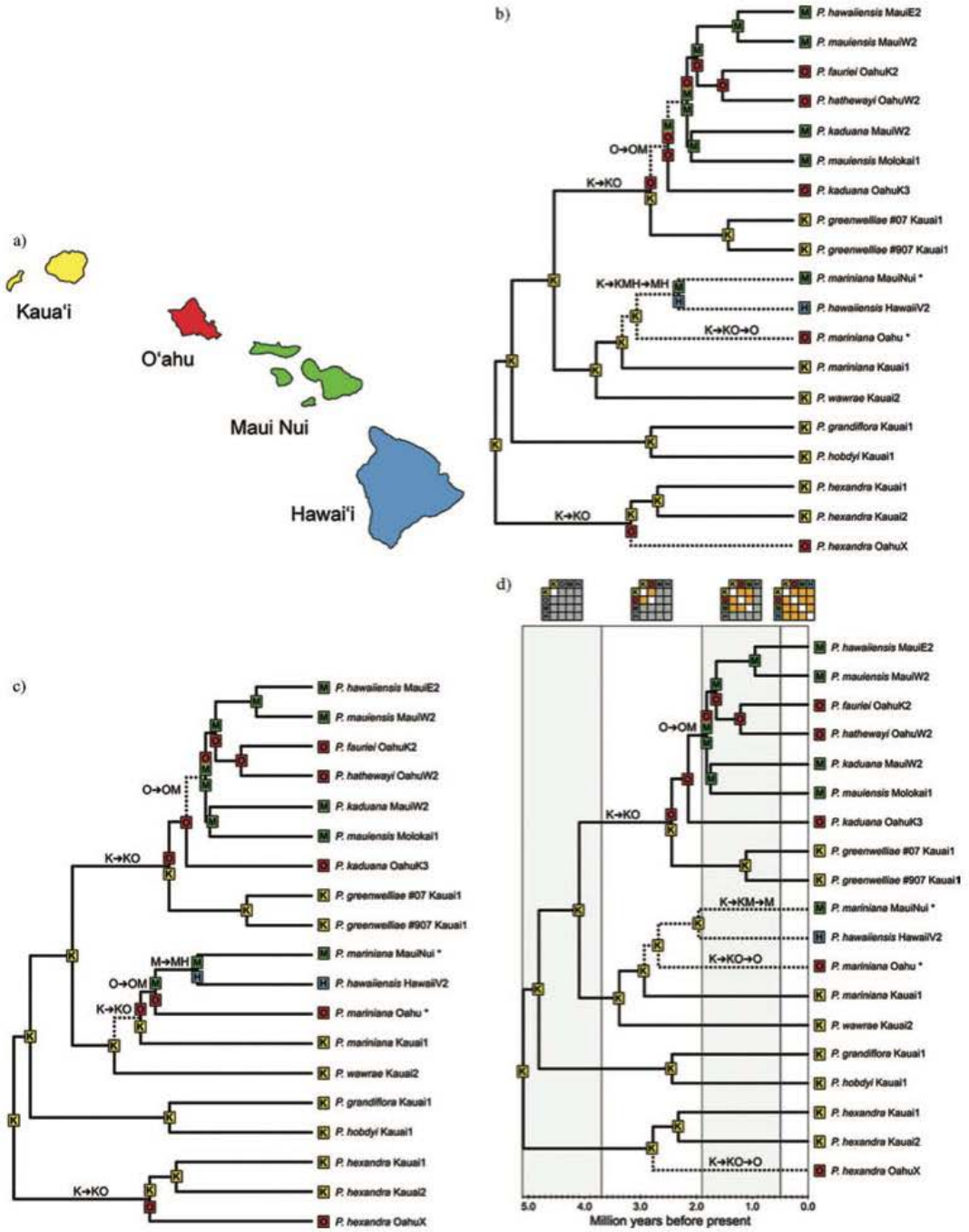
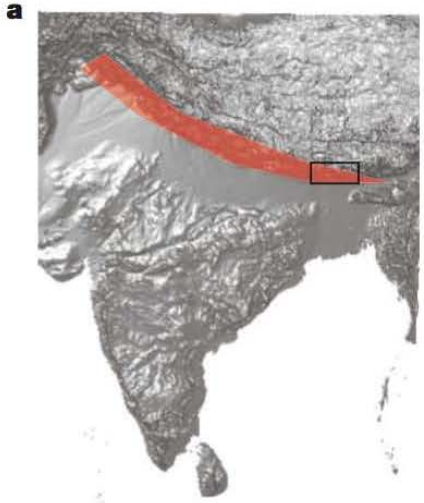
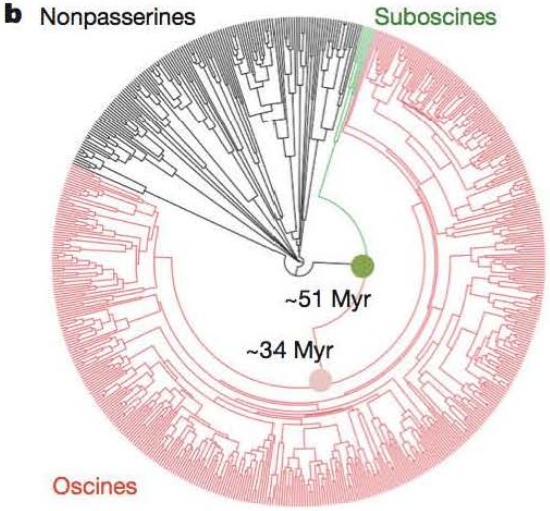


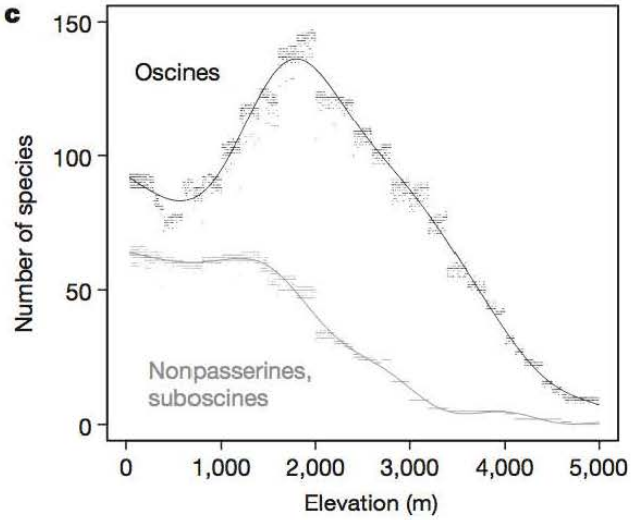
FIGURE 3.

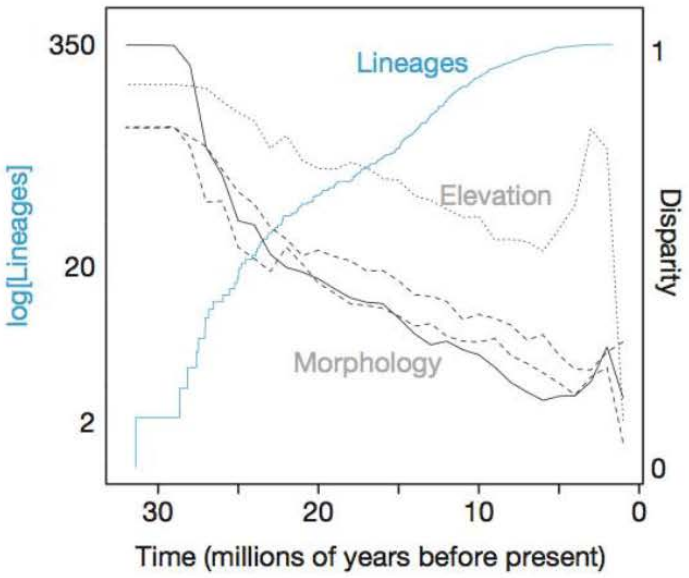
Ree and Smith 2008 Sys Biol

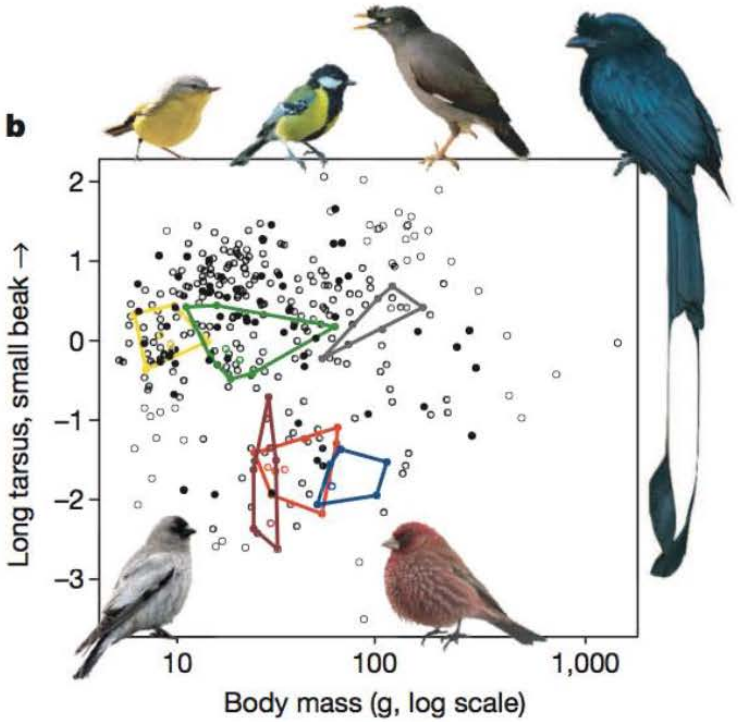
Complex evolutionary hypotheses











Price et al. 2014 Nature

Purpose of the workshop

- Introduce you to the theory, statistical basis, and philosophy of many modern comparative methods.
- Train you to apply these methods using phylogeny packages in the R environment.
- Provide the basis for future exploration of other more advanced methods appropriate to your own research & scientific questions.