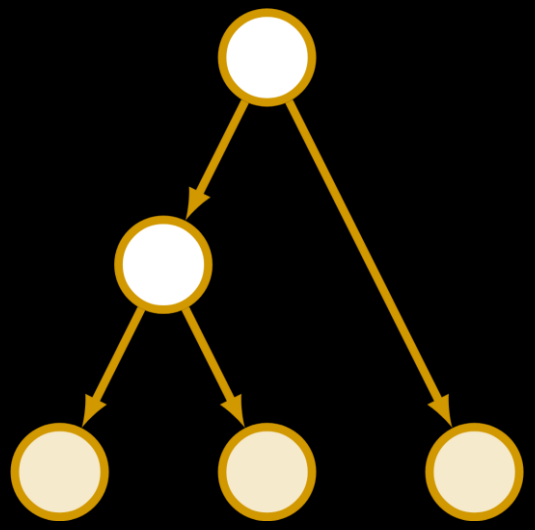


BCB 503:
RevBayes Intro

Third session: Biogeography

Orlando Schwery, 7. Sep. 2021, University of Idaho

Course Plan and Schedule

- 3:30pm Pacific, on Zoom

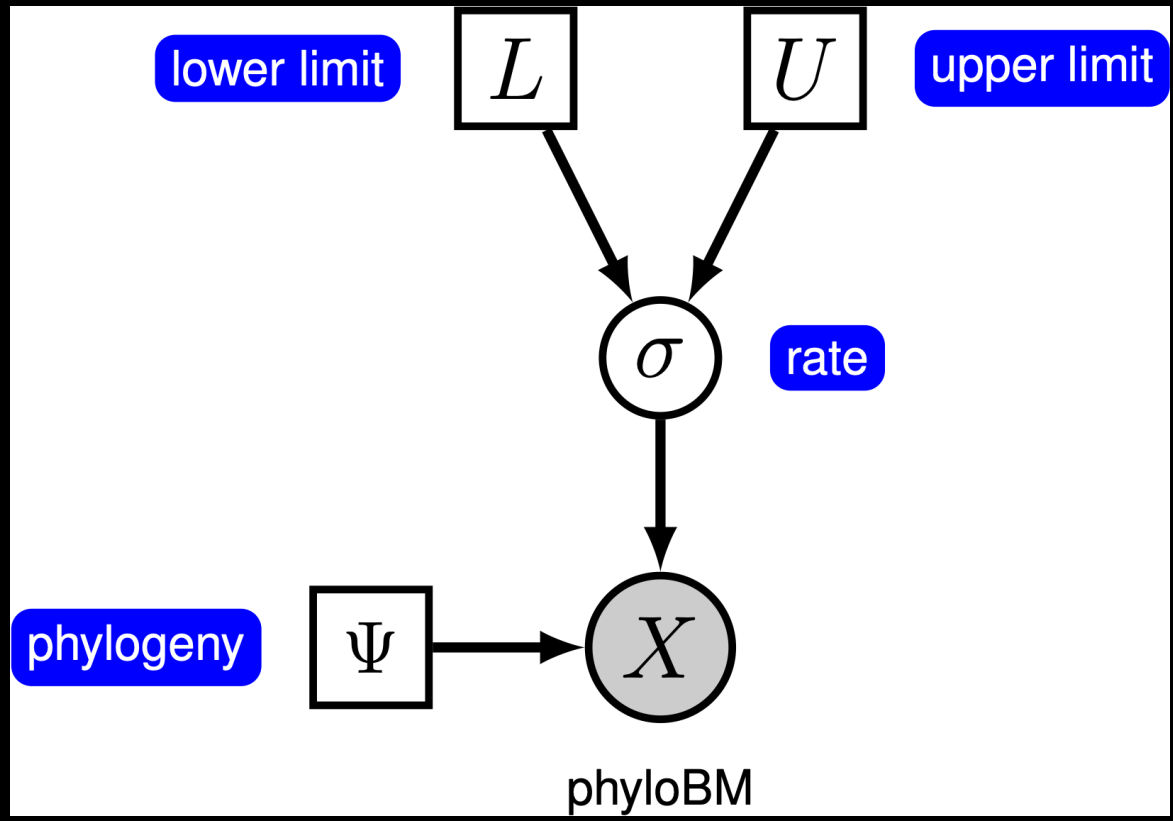
- **24. Aug.:** Intro
- **31. Aug.:** Trait Evolution
- **07. Sep.:** Biogeography
- **14. Sep.:** Diversification
- **21. Sep.:** [Model Testing/Adequacy]
- **28. Sep.:** [Hierarchical Models, FBD, …?]

→ Absences: Recording, Remote, Add-On, …

Briefest recap from last time:

- Trait-evolution models in Rev
- Including phylogeny (constant node)

- Setting up and running MCMC

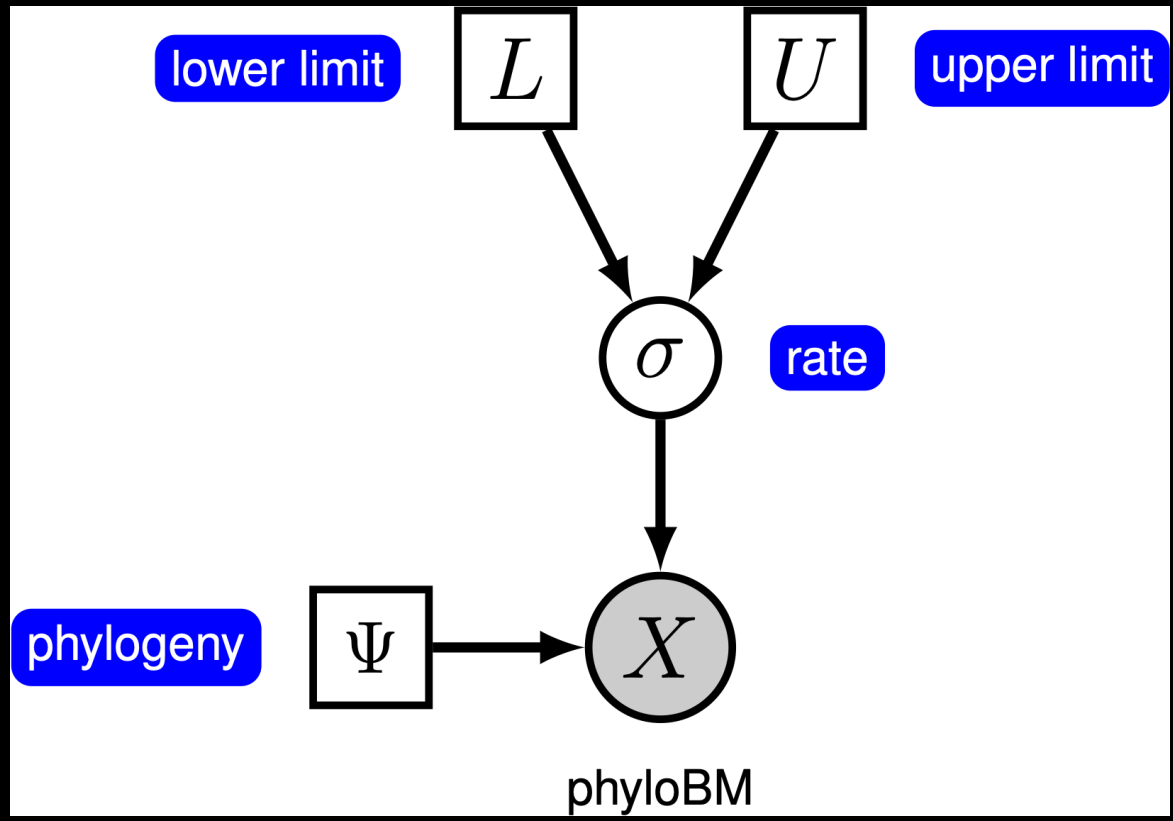


Briefest recap from last time:

- Trait-evolution models in Rev
- Including phylogeny (constant node)

- Setting up and running MCMC

- Let's get active!



Simple Ornstein-Uhlenbeck Model

Trait Strength Optimum Rate

$$dX_{(t)} = \alpha(\theta - X_{(t)})dt + \sigma dB_{(t)}$$

Change in Trait

Change towards Optimum

Brownian Motion

Simple Ornstein-Uhlenbeck Model

Trait Strength Optimum Rate

$$dX_{(t)} = \alpha(\theta - X_{(t)})dt + \sigma dB_{(t)}$$

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DAG?

Simple Ornstein-Uhlenbeck Model

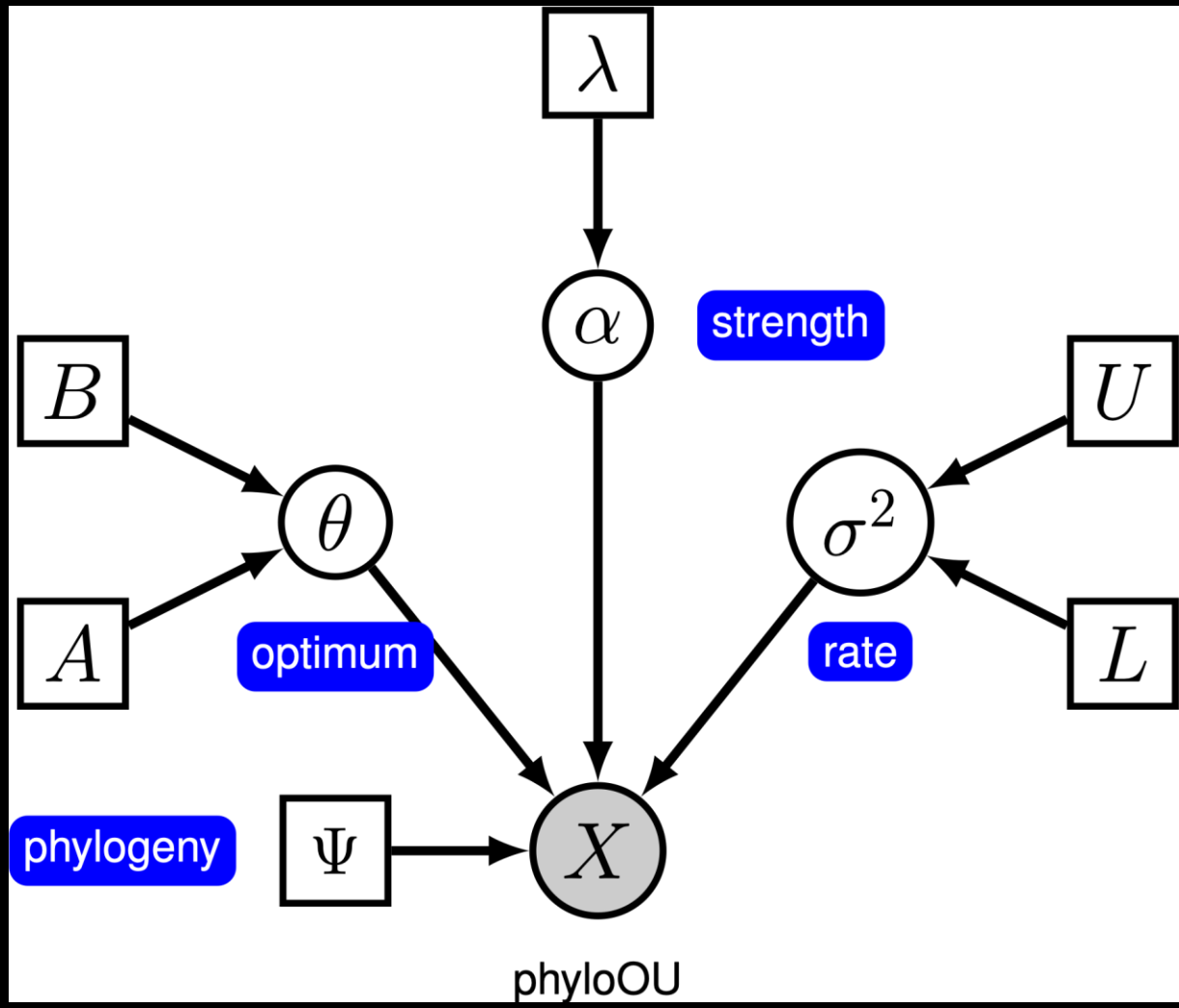
Trait Strength Optimum Rate

$$dX_{(t)} = \alpha\,(\theta - X_{(t)})dt + \sigma dB_{(t)}$$

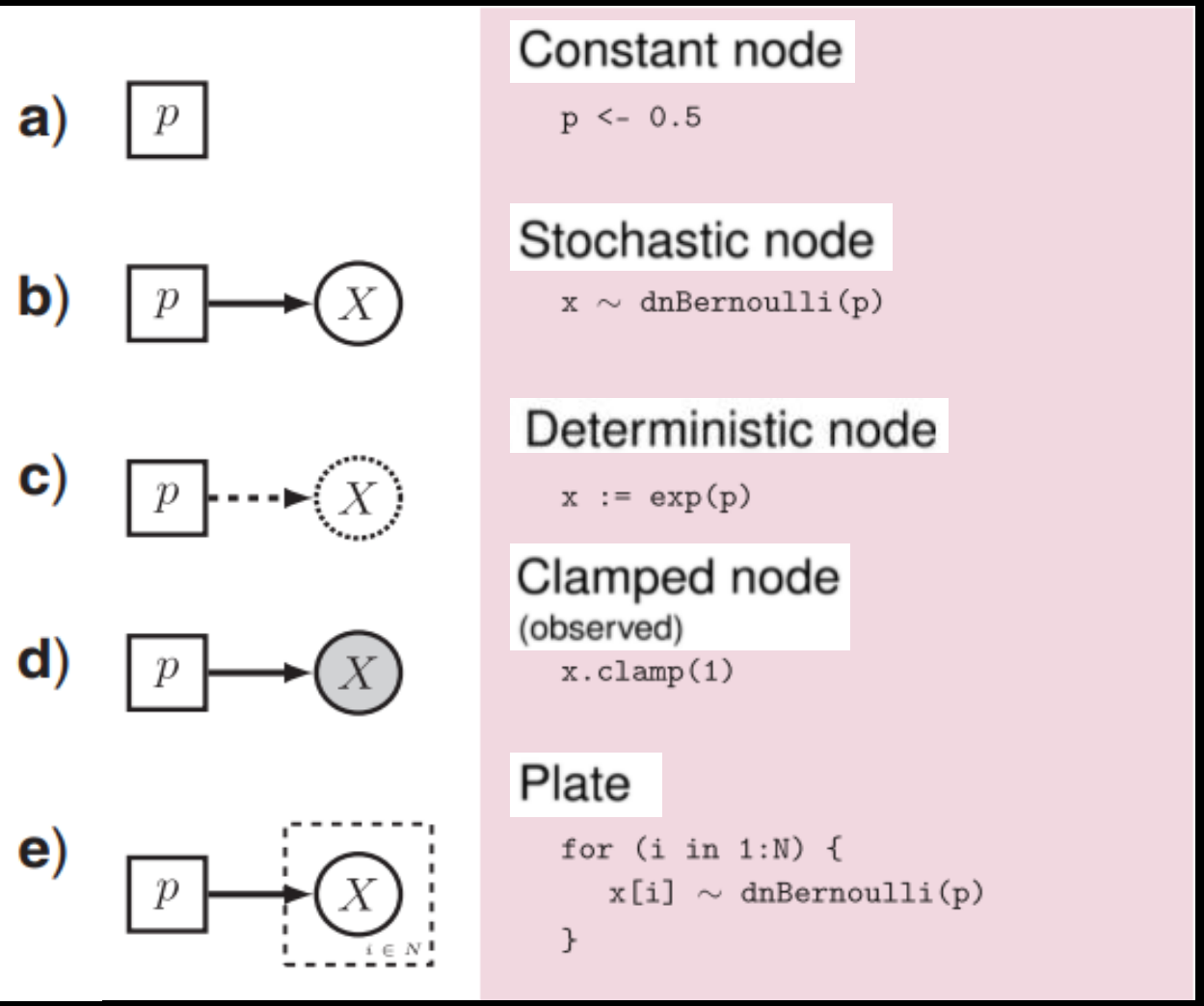
Change in Trait

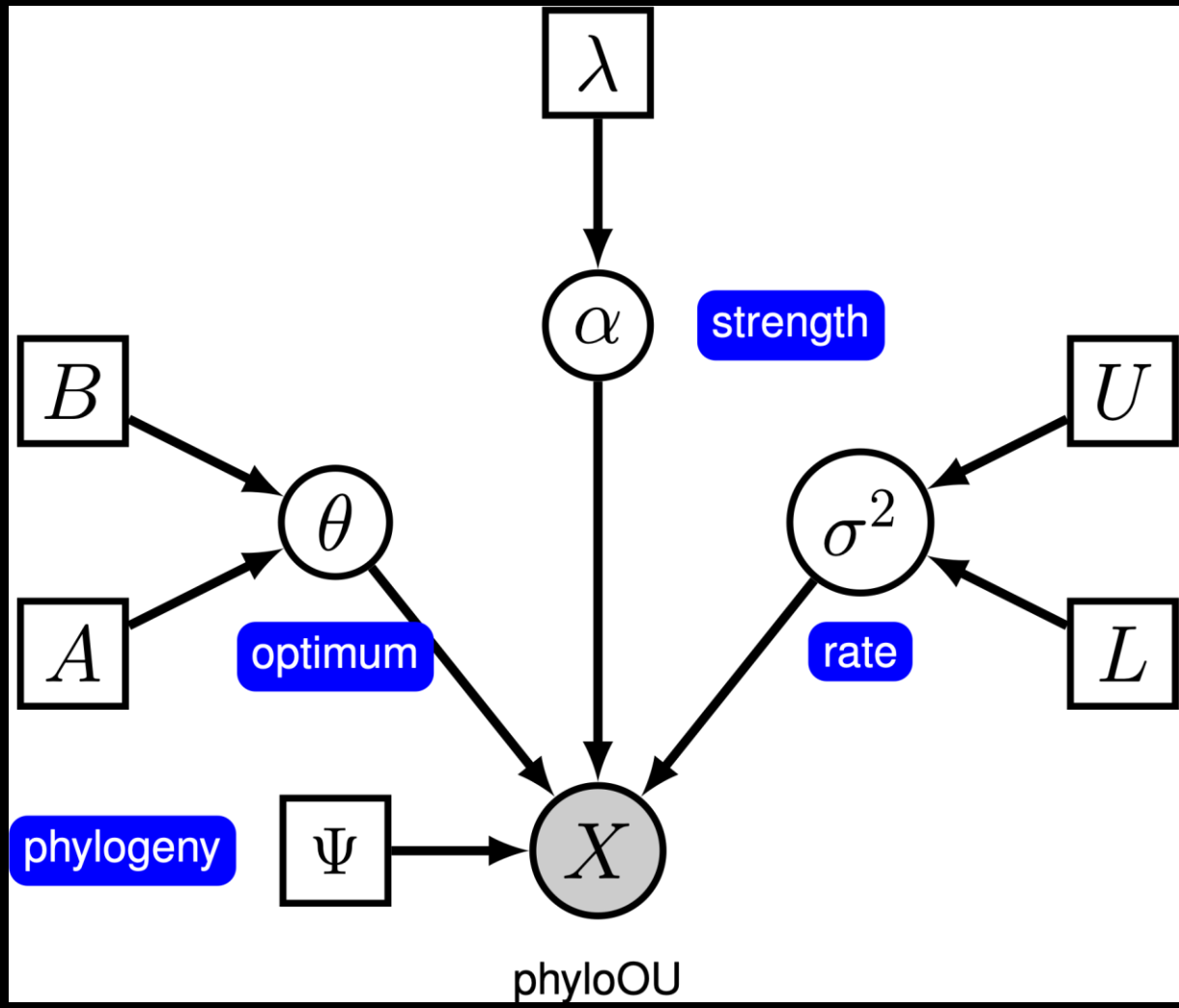
Change towards Optimum

Brownian Motion



Simple Ornstein-Uhlenbeck Model

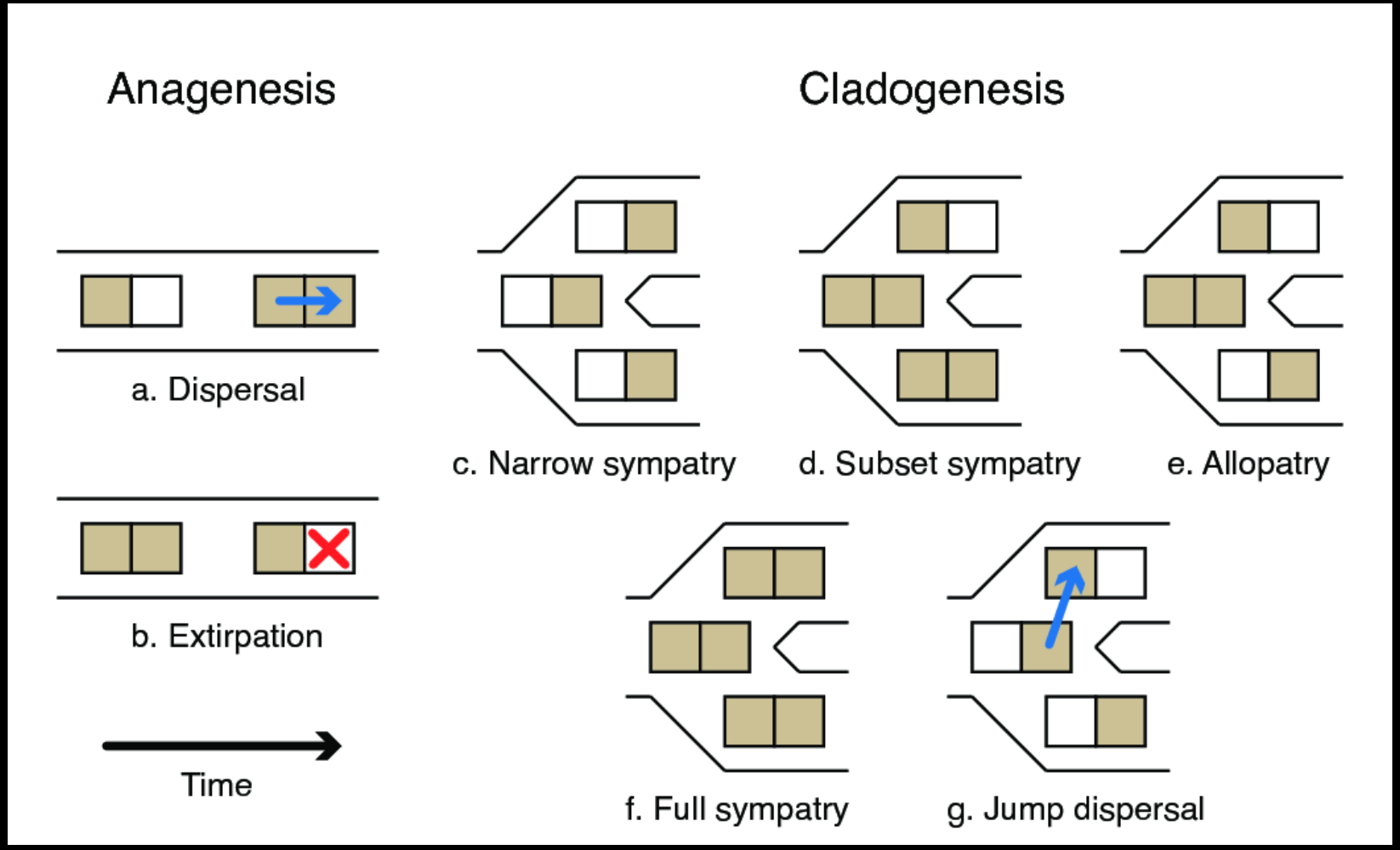




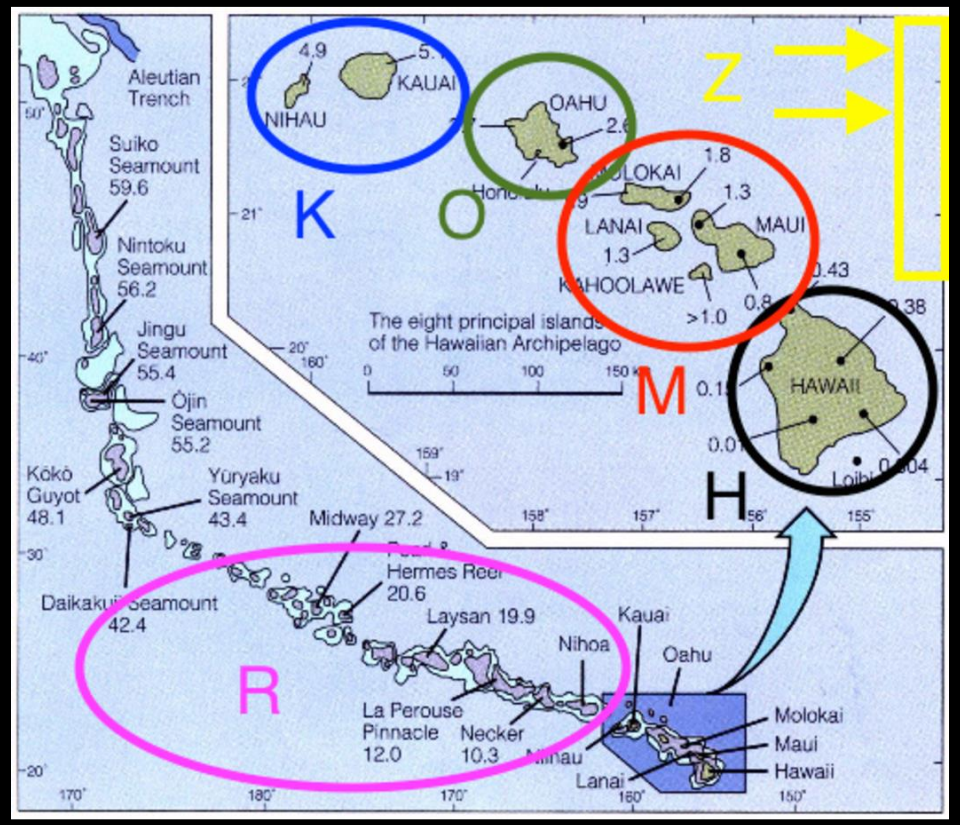
Biogeography in RevBayes - Overview

- Introduction
- Simple Phylogenetic Analysis of Historical Biogeography
- Advanced Phylogenetic Analysis of Historical Biogeography
- Biogeographic Dating and Divergence Times

Simple Dispersal Extinction Cladogenesis (DEC)



Simple Dispersal Extinction Cladogenesis (DEC)



Range	Areas	Size	State
Ø	0000	0	0
K	1000	1	1
O	0100	1	2
M	0010	1	3
H	0001	1	4
KO	1100	2	5
KM	1010	2	6
OM	0110	2	7
KH	1001	2	8
OH	0101	2	9
MH	0011	2	10
KOM	1110	3	11
KOH	1101	3	12
KMH	1011	3	13
OMH	0111	3	14
KOMH	1111	4	15

Simple Dispersal Extinction Cladogenesis (DEC)

- Put data in subfolder “data” for good practice

- Off to the code!

Simple Dispersal Extinction Cladogenesis (DEC)

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$$\mathbf{Q} = \begin{array}{c|cccccccc} & \emptyset & A & B & C & AB & AC & BC & ABC \\ \hline \emptyset & - & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ A & e_A & - & 0 & 0 & d_{AB} & d_{AC} & 0 & 0 \\ B & e_B & 0 & - & 0 & d_{BA} & 0 & d_{BC} & 0 \\ C & e_C & 0 & 0 & - & 0 & d_{CA} & d_{CB} & 0 \\ AB & 0 & e_A & e_B & 0 & - & 0 & 0 & d_{AC} + d_{BC} \\ AC & 0 & e_C & 0 & e_A & 0 & - & 0 & d_{AB} + d_{CB} \\ BC & 0 & 0 & e_C & e_B & 0 & 0 & - & d_{BA} + d_{CA} \\ ABC & 0 & 0 & 0 & 0 & e_C & e_B & e_A & - \end{array}$$