

# Main Points

- 1) Recap from 4 November
- 2) Predator-prey arms races
  - example: a commensal that might be a mimic, and a time where esoteric and seemingly-worthless knowledge about a weird mammal came in handy
  - the Red Queen hypothesis
  - example: coevolution of *Tamiasciurus* and conifer cones
- 3) Phylogenetic inertia and maladaptation
  - the problem with adaptationist explanations
  - example: phylogenetic inertia and horse stripes
  - example: a mammal that everyone loves just the way it is, despite being an evolutionary failure

Terms: commensalism, red queen, arms race, coevolution, parapatry, phylogenetic inertia, disaptation (maladaptation)

Pre-reading: Monday 16 November = Channel and Lomolino (Jake sent through email)  
Wednesday 18 November = Smith et al

Optional\* test 3 Monday December 7; will cover material from lecture from Nov 4 to Dec 3.

Museum skin preparation is optional\*.

**\* OPTIONAL**

*Adj*

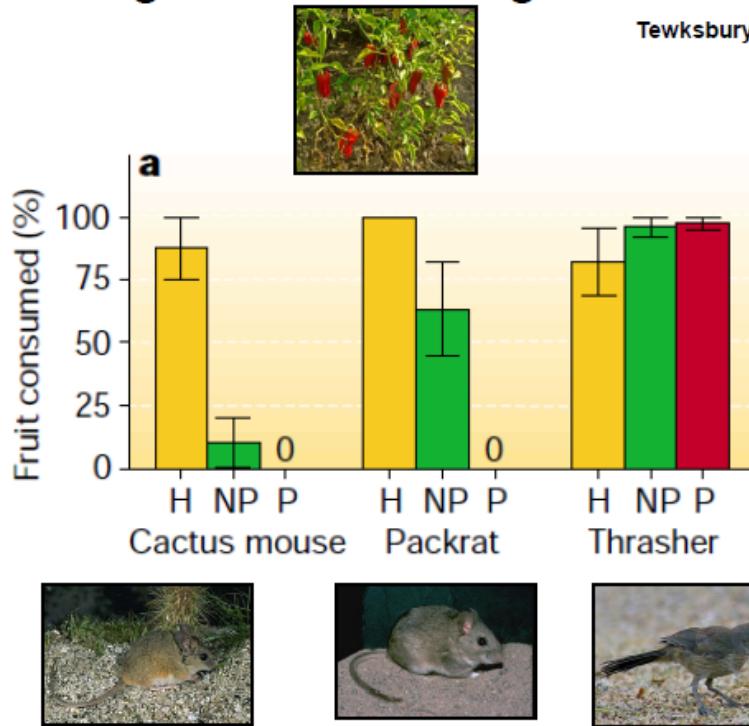
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Definition: involving an option; not compulsory.

# Lecture 15 Recap

Obligate mutualisms are characterized by private property, cheaters, and the exchange of goods and services that are cheap for the provider but valuable to the recipient

## Preventing cheaters in obligate mutualisms



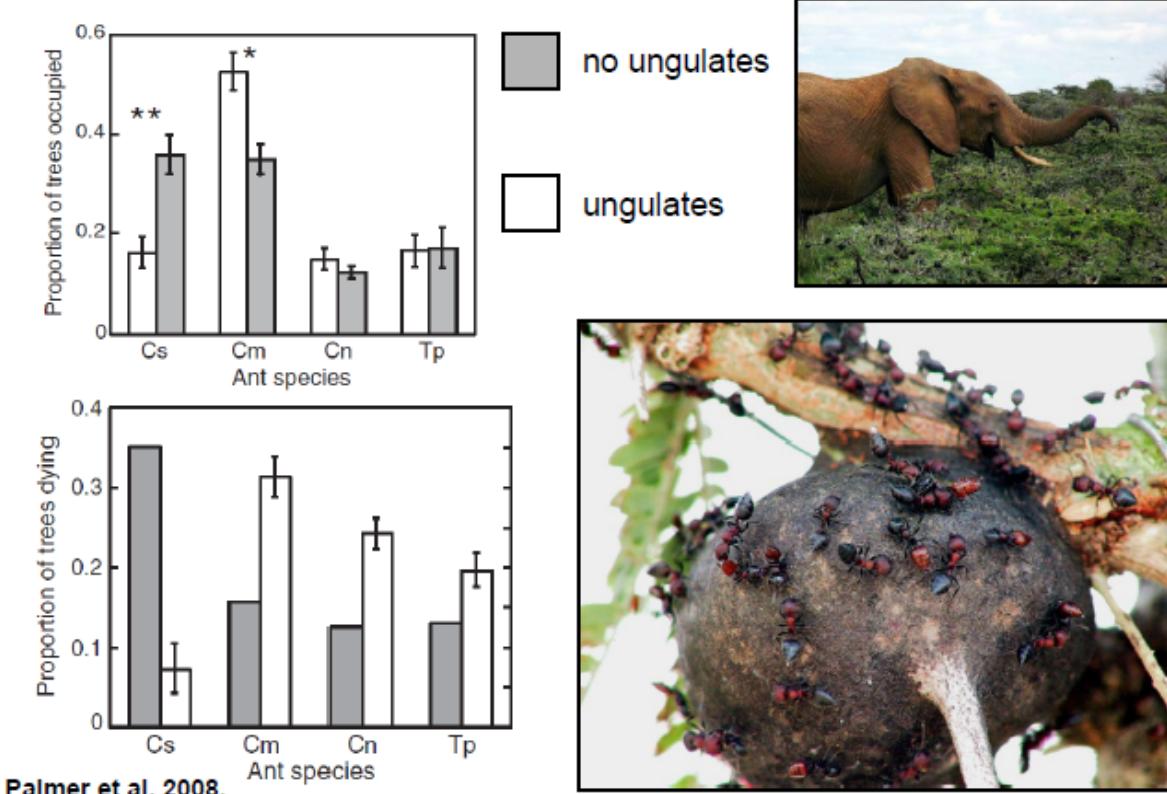
Tewksbury and Nabhan. 2001.



# Lecture 15 Recap

Real mutualisms are complex, and can be characterized by lots of species (e.g., four species of ants that defend a single tree) that vary in the benefits they provide to their partner.

Mutualism breakdown following the loss of large herbivores



# Basic Species Interactions Reviewed

<u>Sign 1</u>	<u>Sign 2</u>	<u>Interaction</u>
+	-	predation/parasitism
-	-	competition
+	+	mutualism
+	0	commensalism/facilitation
-	0	amensalism

# Mimicry, Commensalism and a Lucky Meeting With My Hero



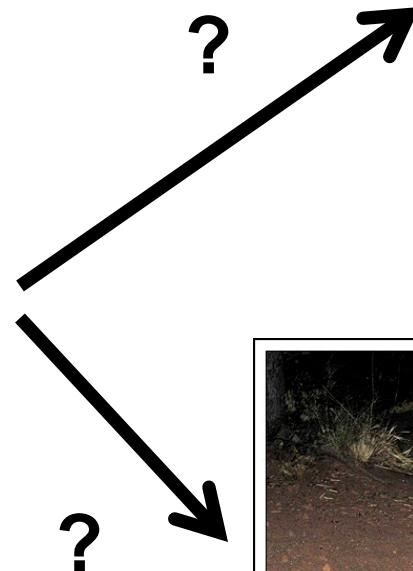
# Mimicry, Commensalism and a Lucky Meeting With My Hero

African maned rat, Lophiomys imhausi



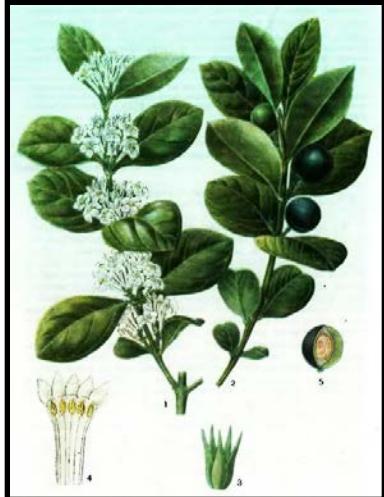
# Mimicry, Commensalism and a Lucky Meeting With My Hero

- An unconvincing mimic of a zorilla, or an unconvincing mimic of a porcupine?



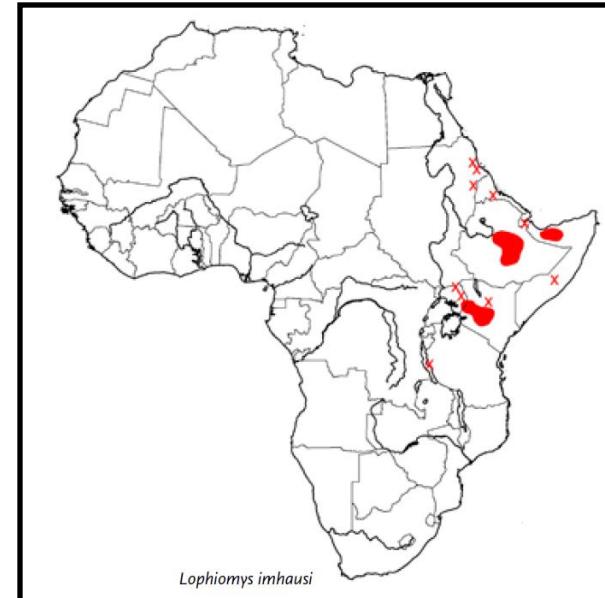
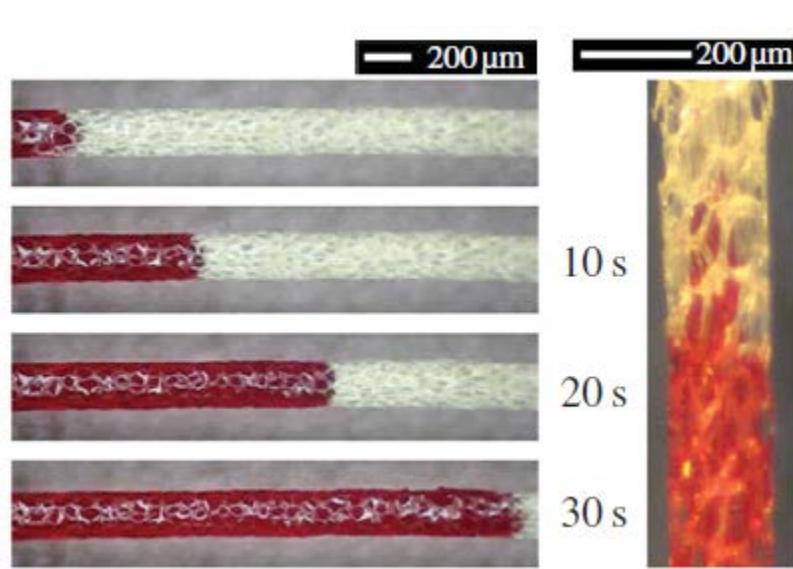
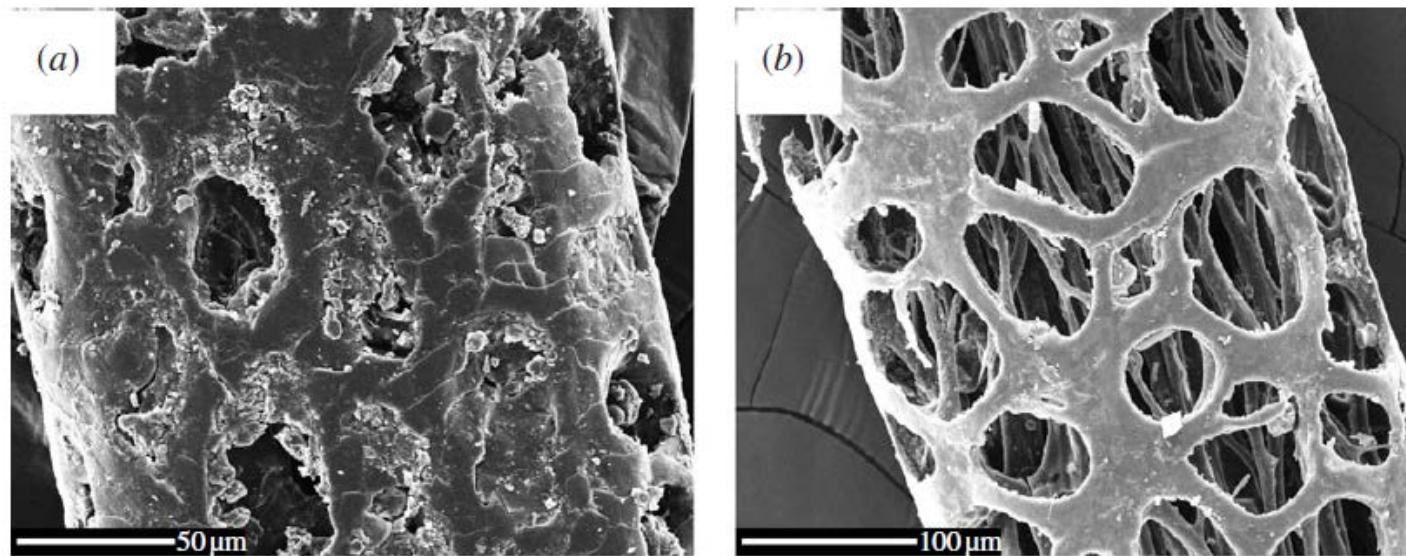
# Mimicry, Commensalism and a Lucky Meeting With My Hero

applying Acokanthera  
to its flank



*Lophiomys imhausi*

# Mimicry, Commensalism and a Chance Meeting With a Hero



# Evolutionary Arms Races

- **evolutionary arms race** = adaptation in one lineage (either predators or prey) gives rise to a reciprocal counter-adaptation in the other.
- often, the prey must stay “a step ahead”
- “the fox runs for its dinner, but the rabbit runs for its life”.  
-- Aesop



# The Red Queen Hypothesis

- Red Queen hypothesis = organisms must adapt, evolve, and proliferate not only to reproduce, but to survive.
- “It takes all the running you can, just to stay in the same place”. The Red Queen, Through the Looking Glass



# The Red Queen Hypothesis

- Red Queen hypothesis = organisms must adapt, evolve, and proliferate not only to reproduce, but to survive.
- “Continuing evolution is needed just to maintain fitness in a world of competitors and predators”.

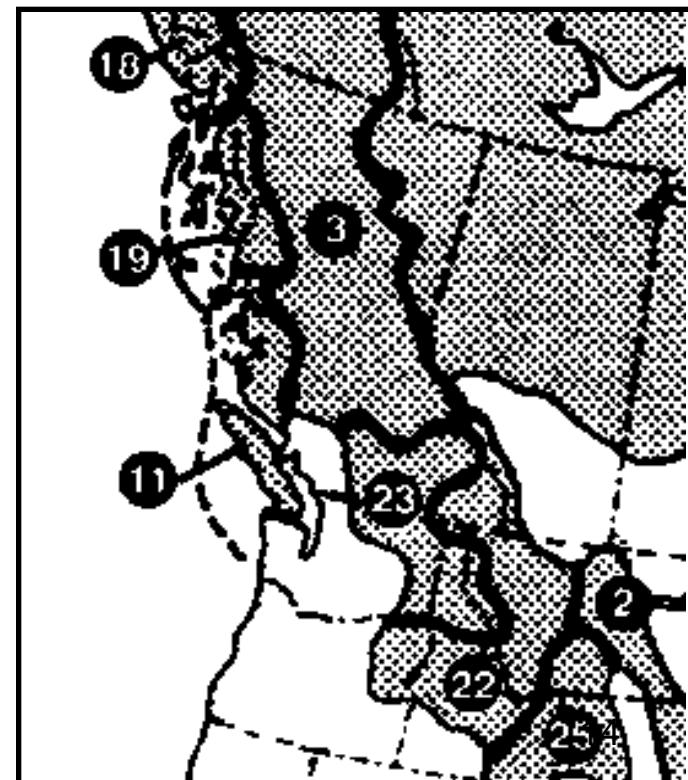
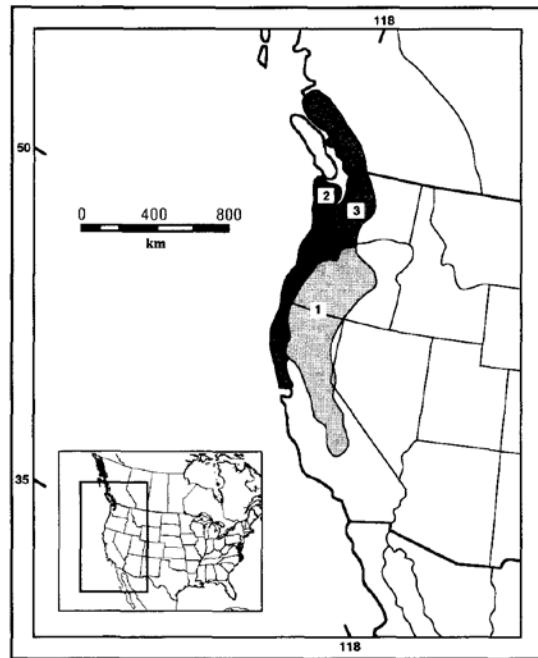


# Coevolution

- **coevolution** = simultaneous, interdependent evolution of two species that interact with each other

# Parapatry

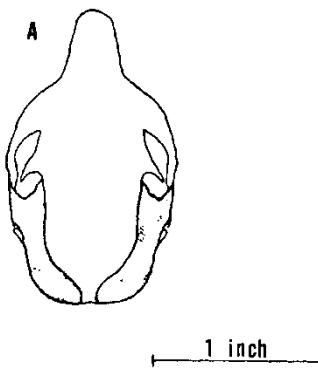
- parapatry = continuous but non-overlapping distributions



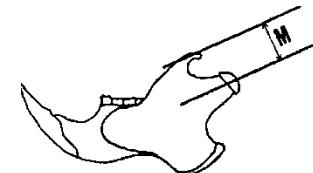
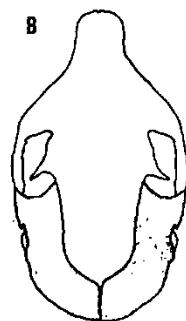
# Coevolution and parapatry

- Cascade mountain range arose about 7 million years ago
- Genus *Tamiasciurus* arose about 13 million years ago in the Pacific NW
- *Tamiasciurus* has coevolved with lodgepole pine in the Pacific NW

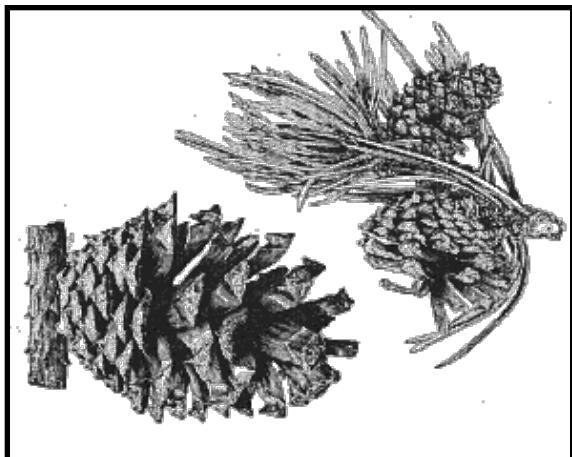
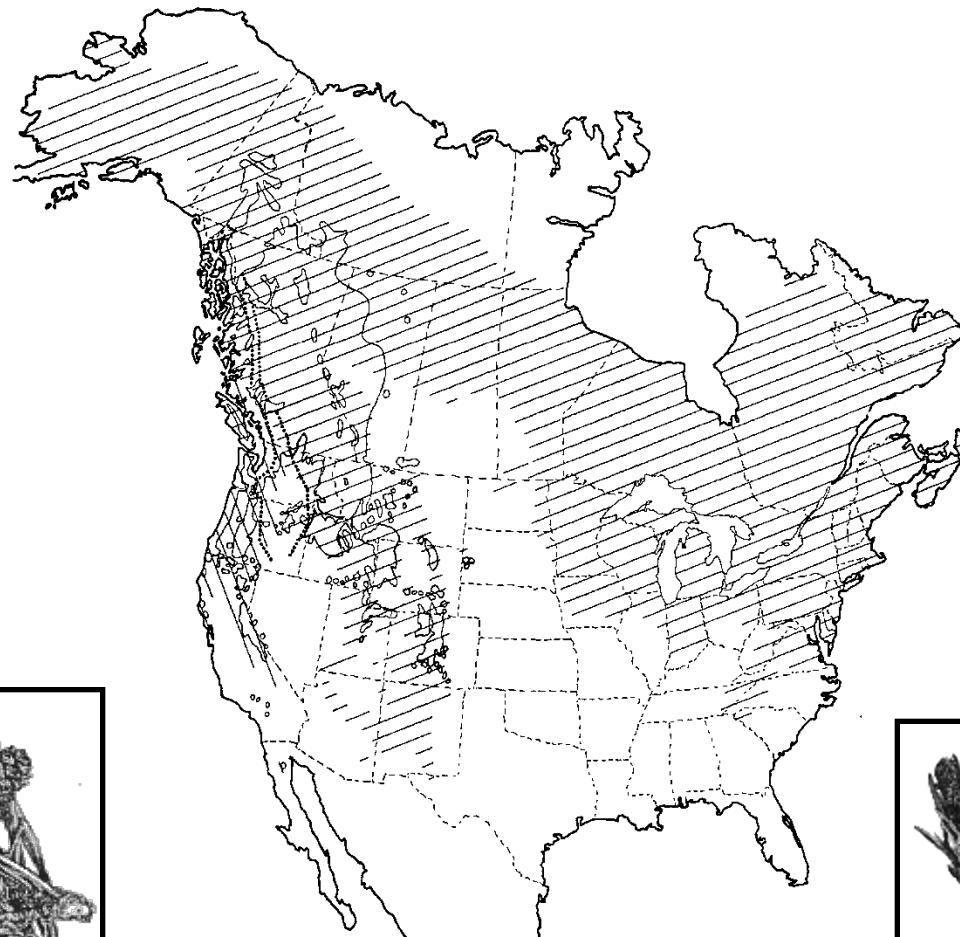
# Coevolution and parapatry



— *Tamiasciurus hudsonicus*  
| | *Tamiasciurus douglasii*  
○ *Pinus contorta*



# Coevolution and parapatry



— *Tamiasciurus hudsonicus*  
| | *Tamiasciurus douglasii*  
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# Disentangling Cause vs Effect

wet maritime climate



lightning rare, fires rare

dry continental climate



lightning common,  
fires common

Cascade Range

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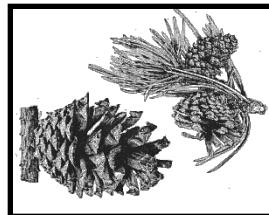
wet maritime climate



lightning rare, fires rare

cones nonserotinous

*Pinus contorta*  
--cones soft



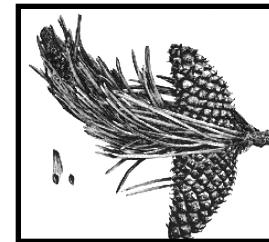
Cascade Range

dry continental climate



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# Disentangling Cause vs Effect

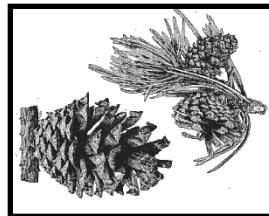
wet maritime climate



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*Pinus contorta*  
--cones soft



*T. douglasii*  
--lighter jaw muscles  
--weaker mandible



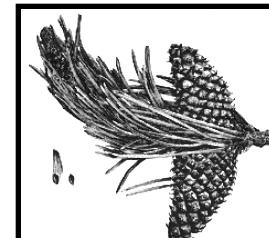
Cascade Range

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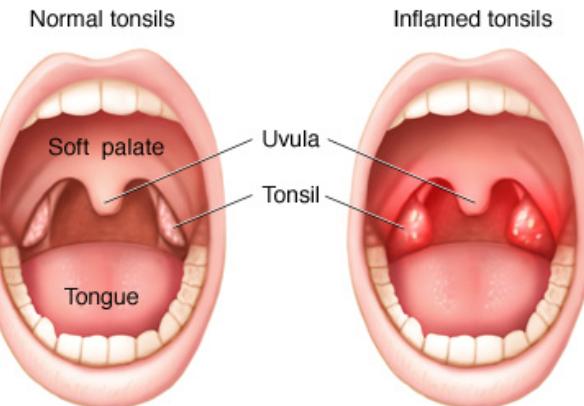
*Pinus contorta*  
--cones hard



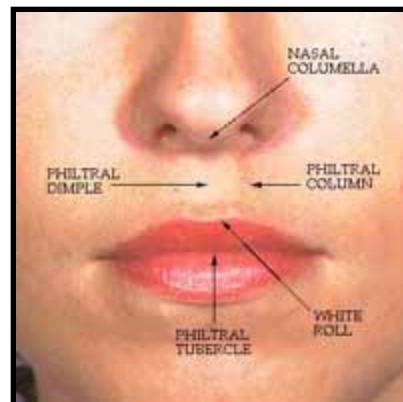
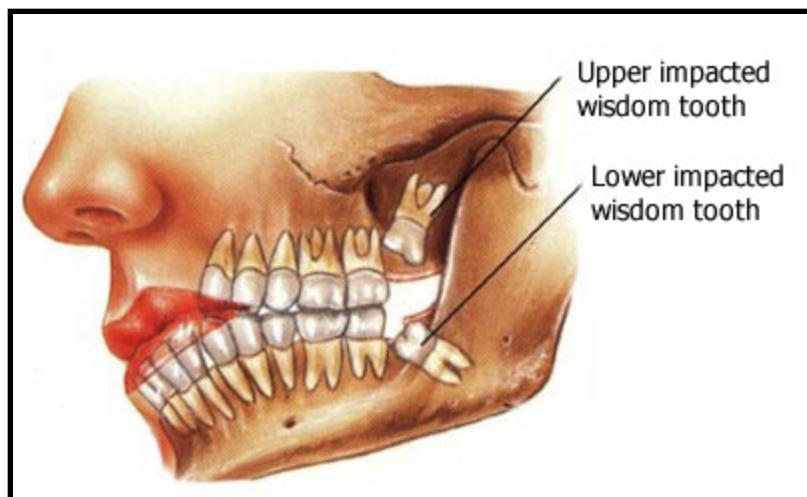
*T. hudsonicus*  
--heavier jaw muscles  
--stronger mandible<sup>20</sup>

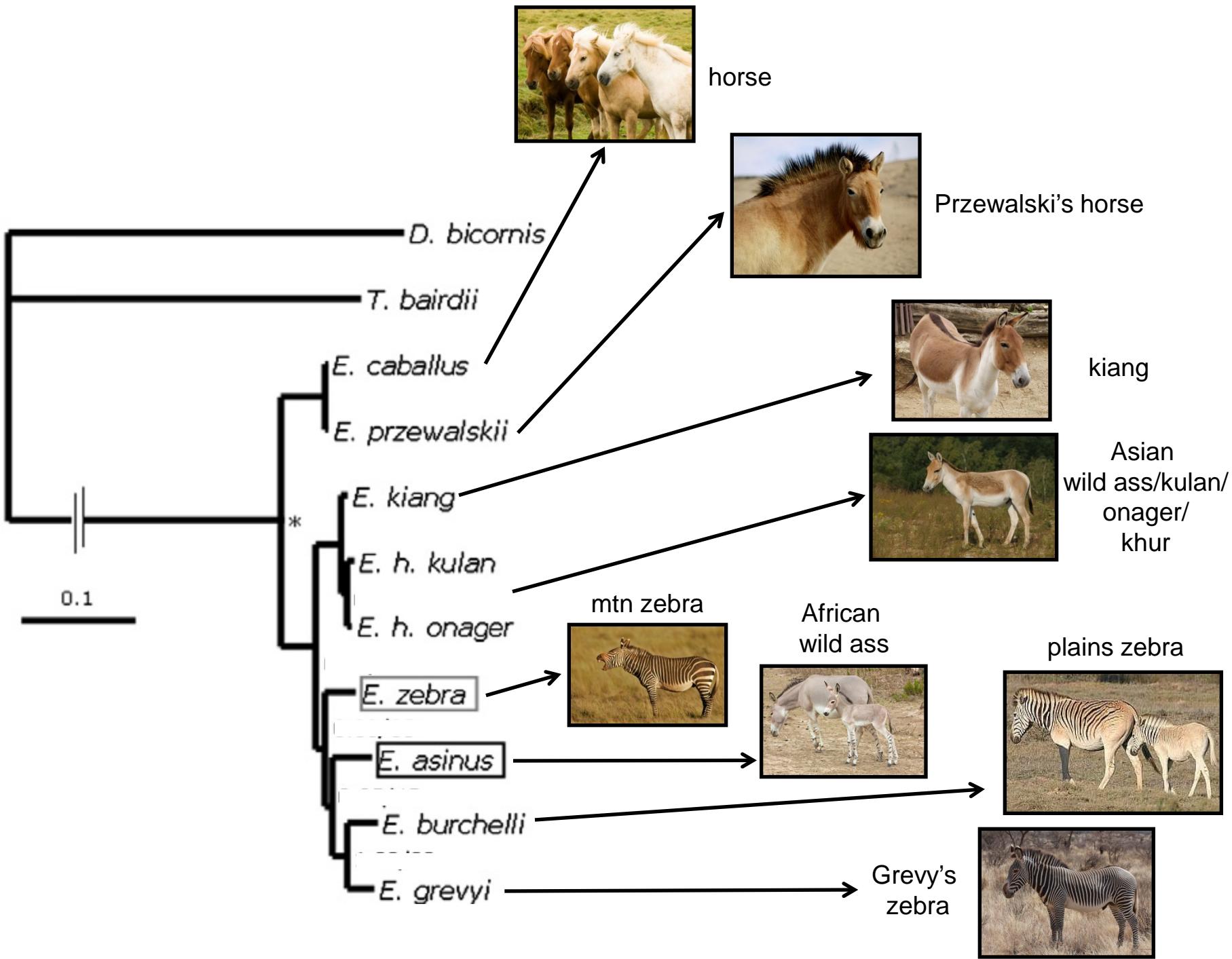
# What good is...?

- **phylogenetic inertia** = non-adaptive influence of an ancestor on its descendants, often leading to stability of traits.



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# How the horse lost its stripes

- we strongly suspect ancestral horses (20,000-50,000 years ago) were patterned; horses in cave paintings from Eurasia and Africa are often depicted as striped and spotted

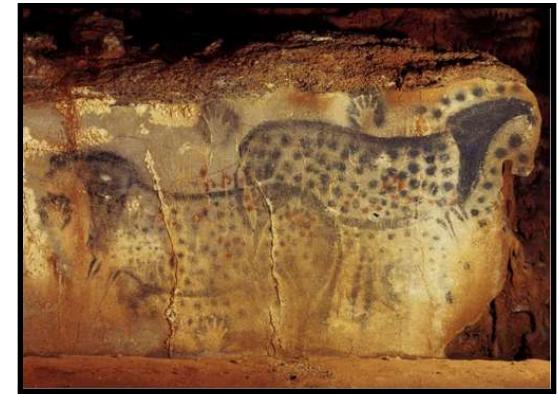
15,000 years ago  
SW Africa



15,000 years ago  
France



22,000 years ago  
France



# Why are most horses not striped?

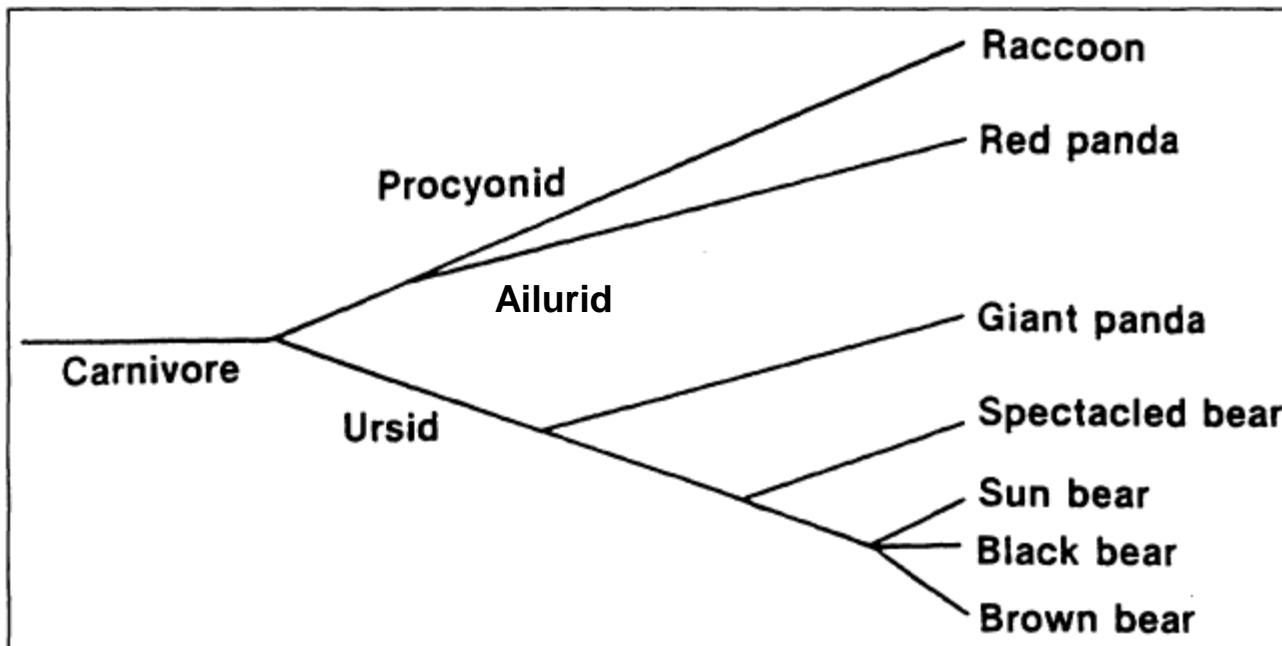


# An Evolutionary Failure

- **disaptation** = a trait or behavior that decreases fitness relative to earlier conditions in a population's evolutionary history

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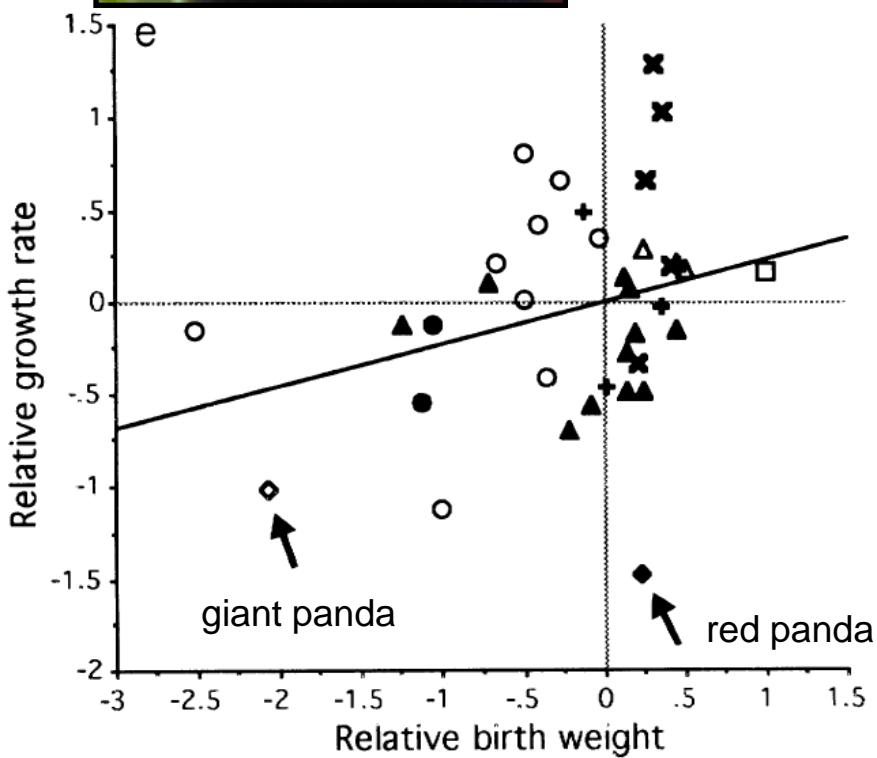


# An Evolutionary Failure

Ailurus

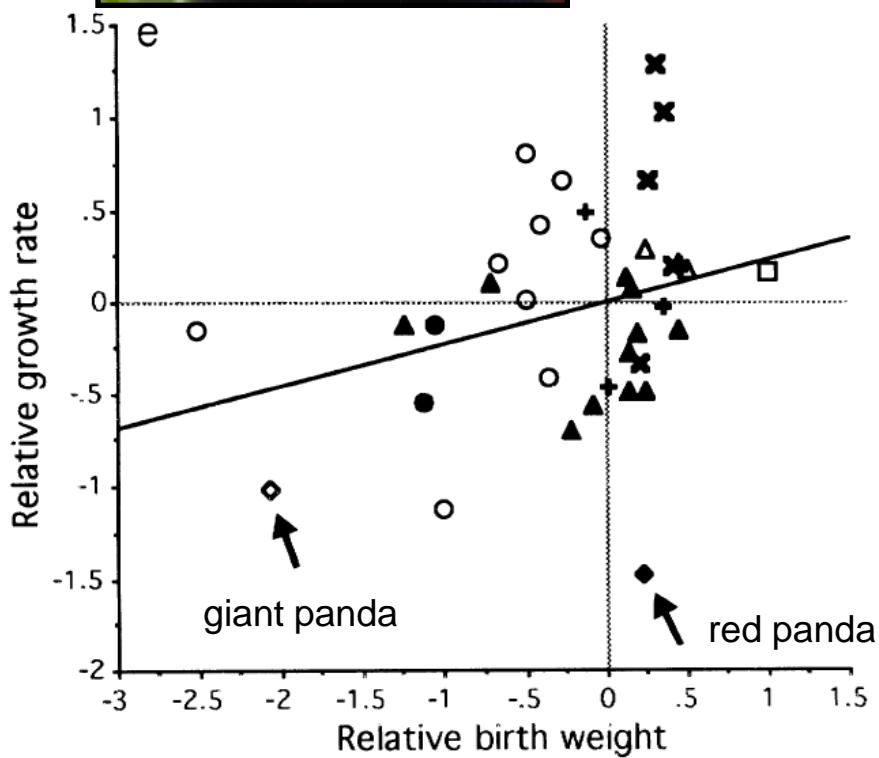


Ailuropoda



# An Evolutionary Failure

## Ailurus



## Ailuropoda

