

# Main Points

## 1) Recap from 6 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 13 November = Channel and Lomolino  
Wednesday 15 November = NA

Optional\* test 3 Monday December 4\*\*; will cover material from lecture from Nov 6 to Nov 29.

### \* OPTIONAL

*Adj*

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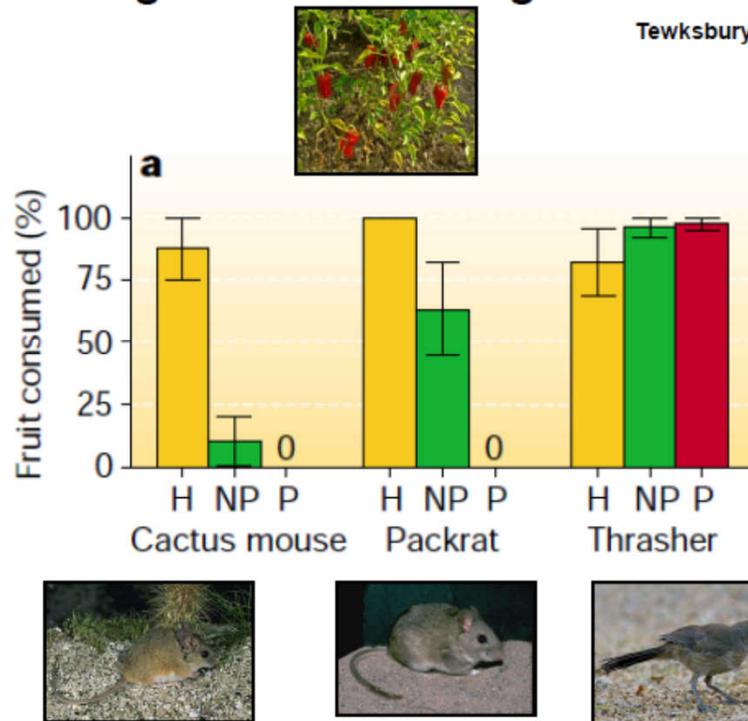
Definition: involving an option; not required.

\*\* Change from syllabus

# 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



## 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

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

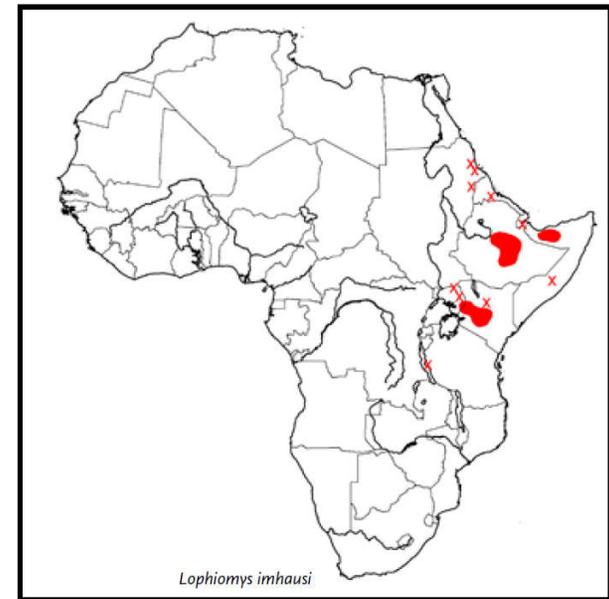


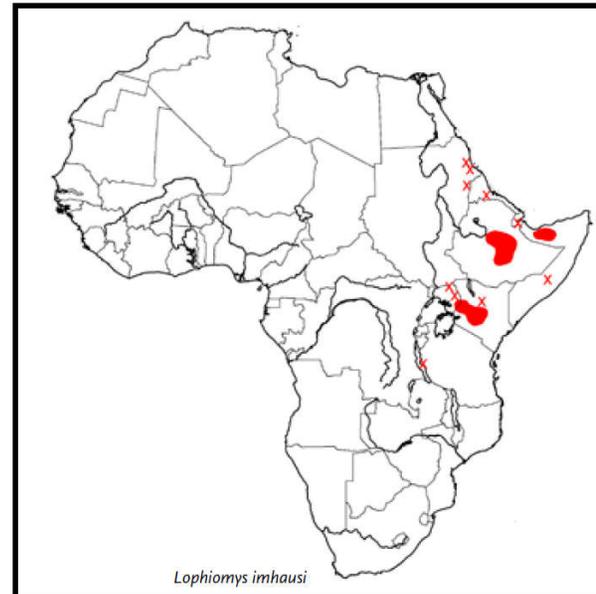
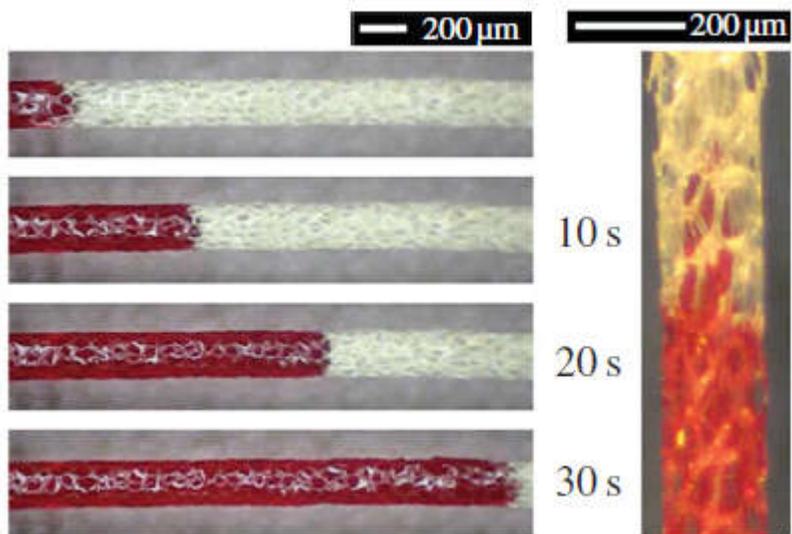
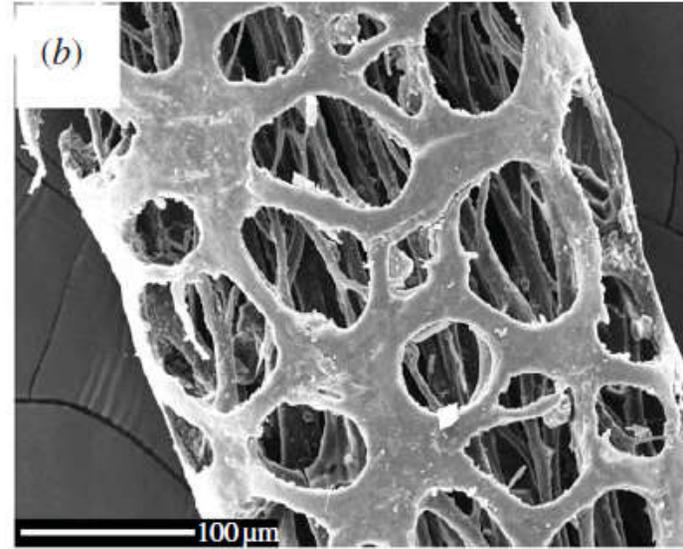
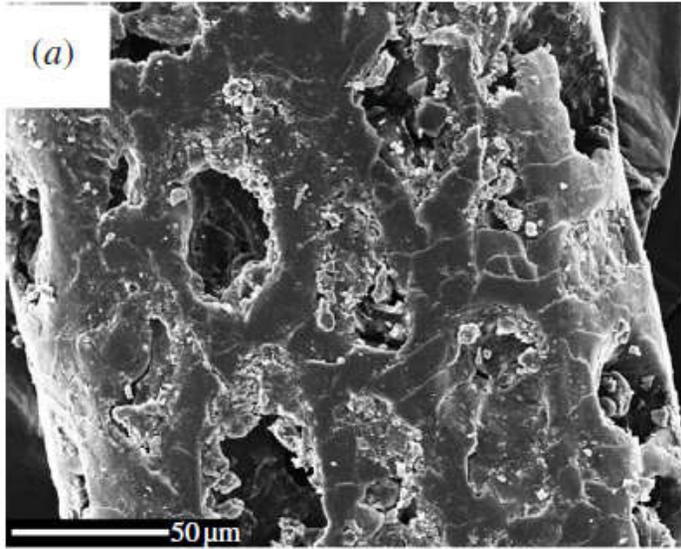
# African maned rat, Lophiomys imhausi



# Mimicry, Commensalism and a Lucky Meeting With My Hero

applying Acokanthera  
to its flank





## 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”.

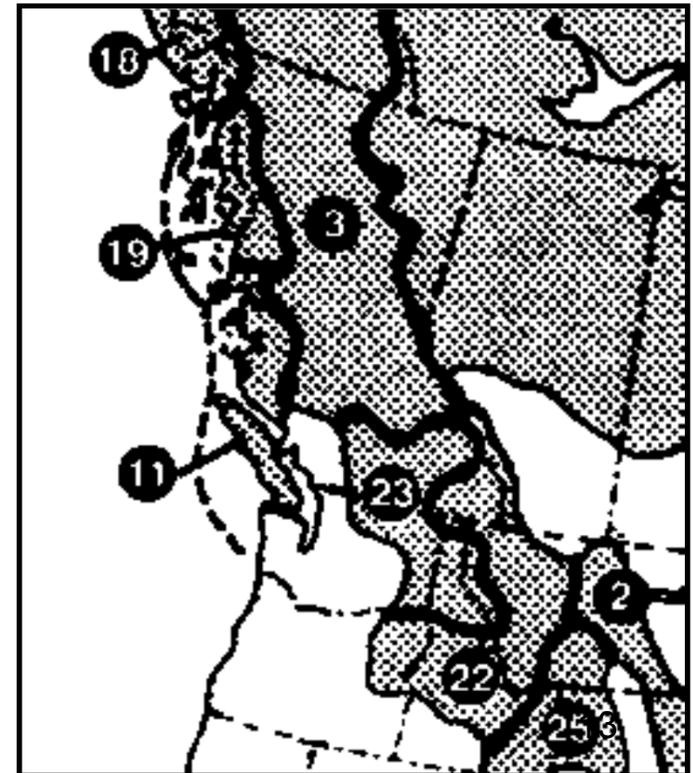
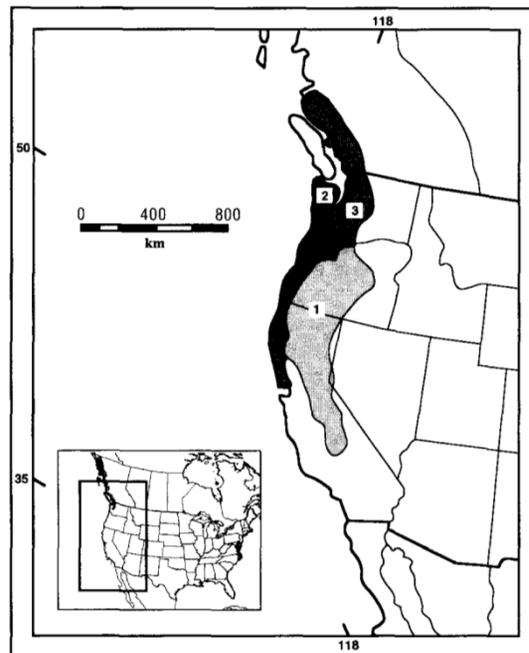


# Coevolution

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

# Parapatry

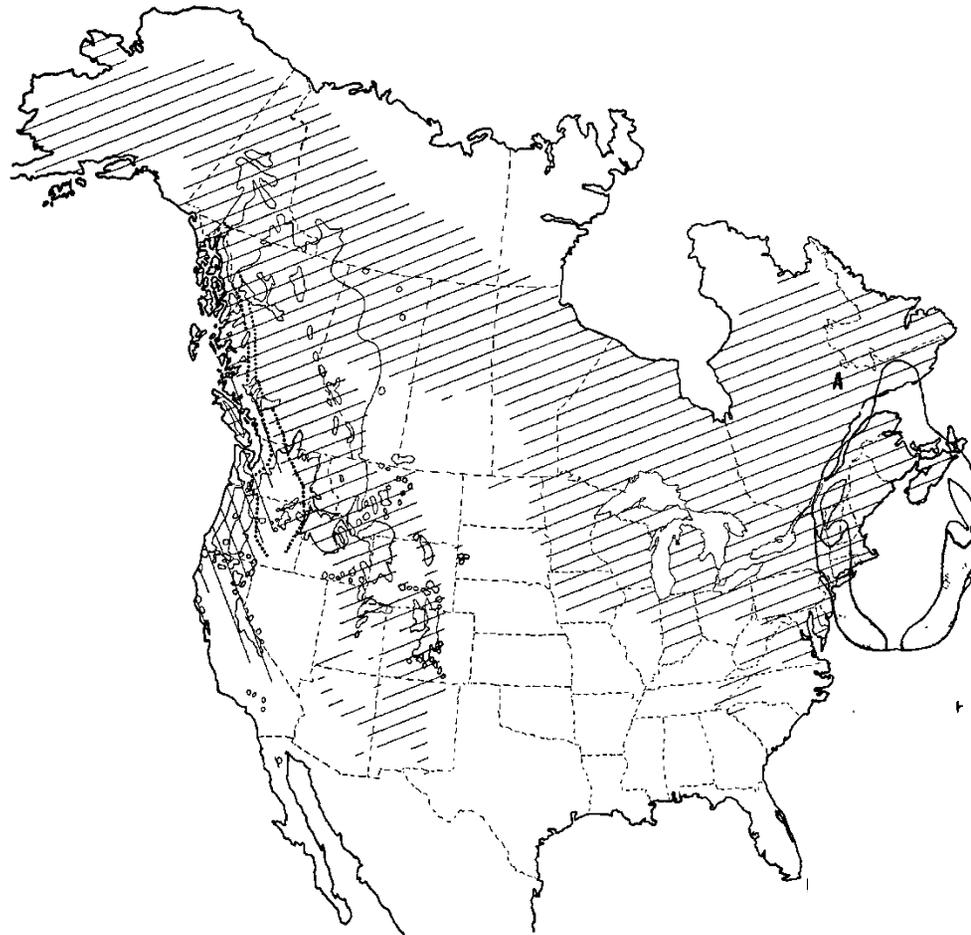
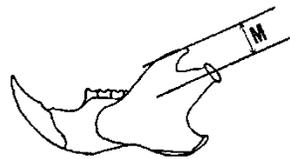
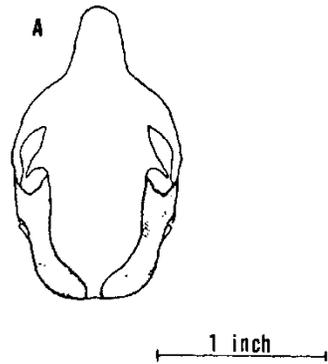
- **parapatry** = continuous but non-overlapping distributions, typically set by interspecific competition



## **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**

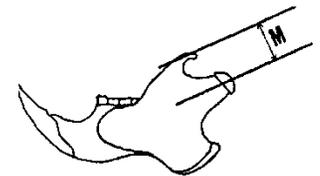
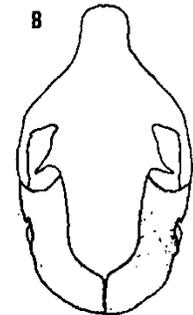
# Coevolution and parapatry



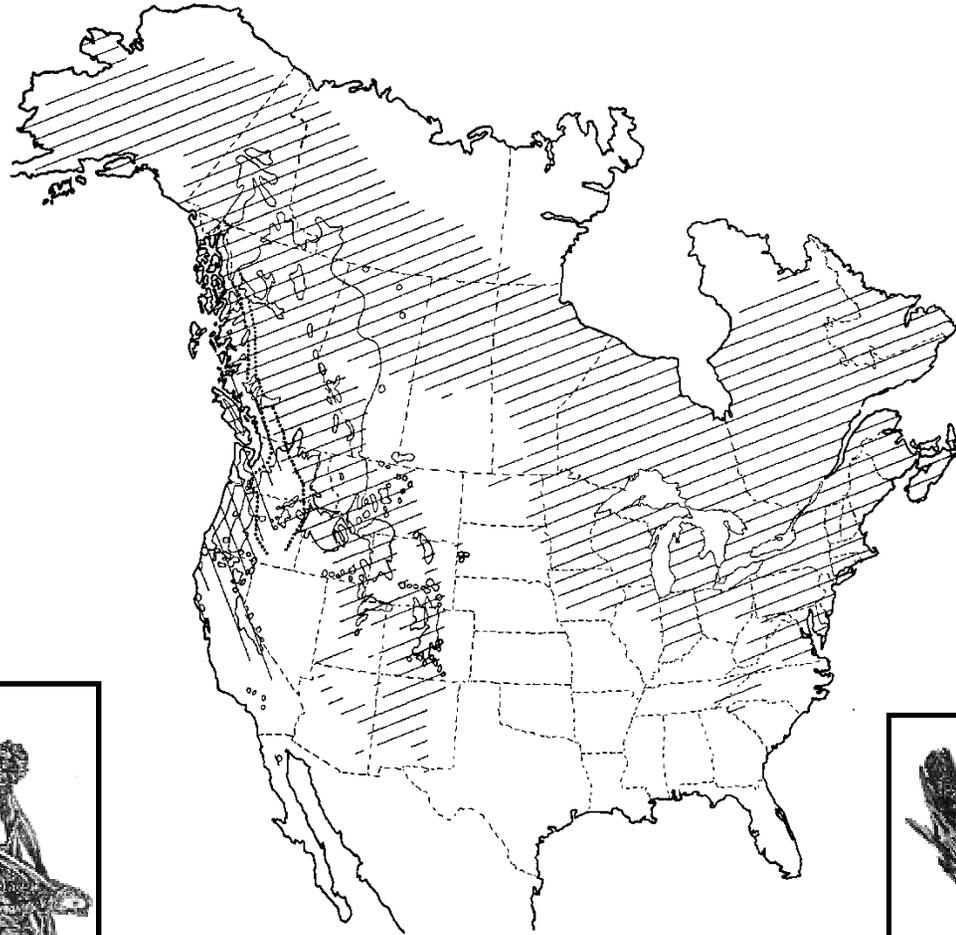
/// Tamiasciurus hudsonicus

||| Tamiasciurus douglasii

○ Pinus contorta



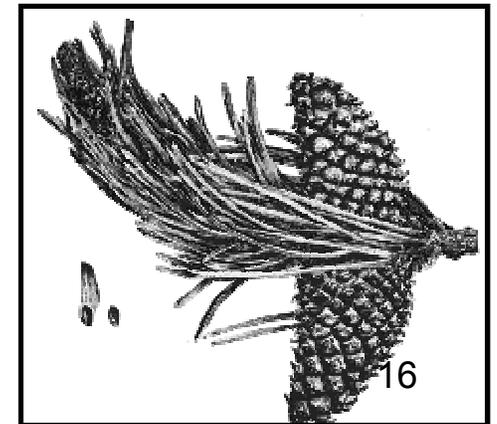
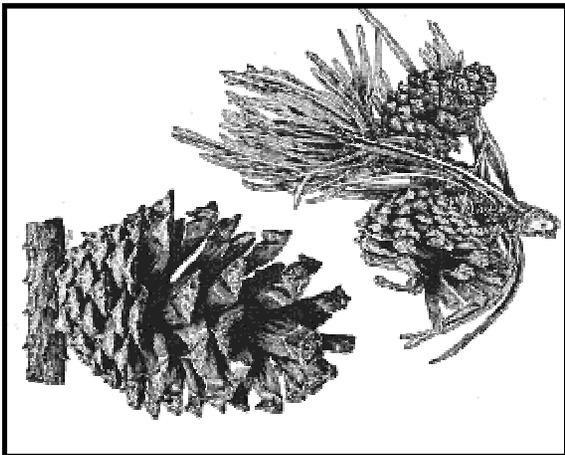
# Coevolution and parapatry



/// *Tamiasciurus hudsonicus*

||| *Tamiasciurus douglasii*

○ *Pinus contorta*



# Disentangling Cause vs Effect

wet maritime climate



lightning rare, fires rare

dry continental climate



lightning common,  
fires common

**Cascade Range**

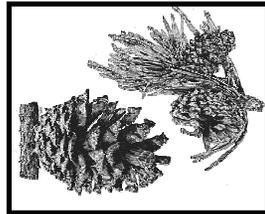
# Disentangling Cause vs Effect

wet maritime climate



lightning rare, fires rare

cones nonserotinous



*Pinus contorta*  
--cones soft

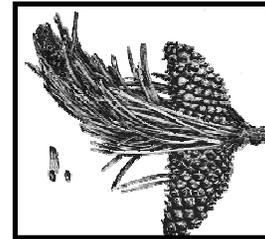
Cascade Range

dry continental climate



lightning common,  
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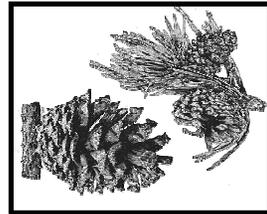
# Disentangling Cause vs Effect

wet maritime climate



lightning rare, fires rare

cones nonserotinous



*Pinus contorta*  
--cones soft

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

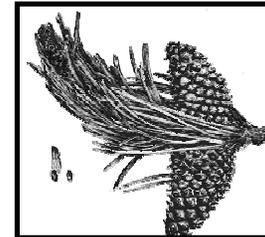


dry continental climate



lightning common,  
fires common

cones serotinous



*Pinus contorta*  
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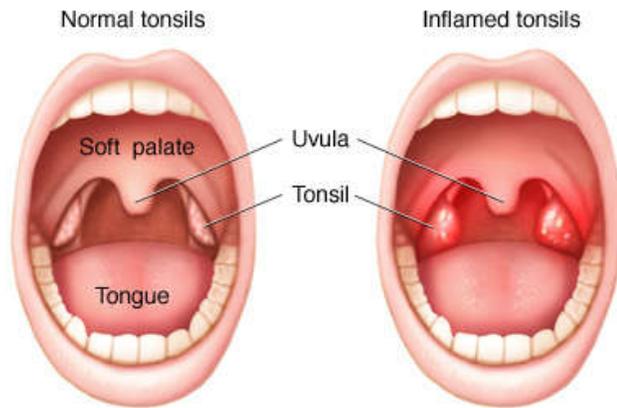
*T. hudsonicus*  
--heavier jaw muscles  
--stronger mandible<sup>19</sup>



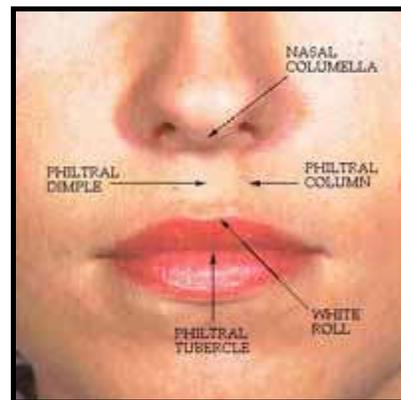
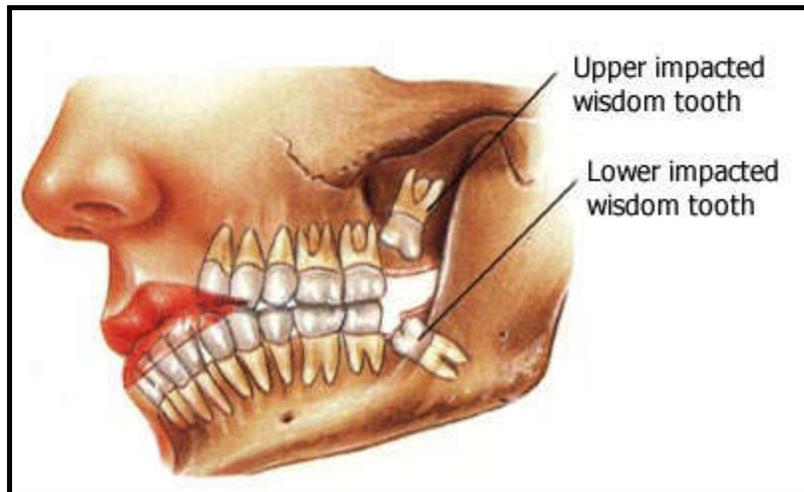
Cascade Range

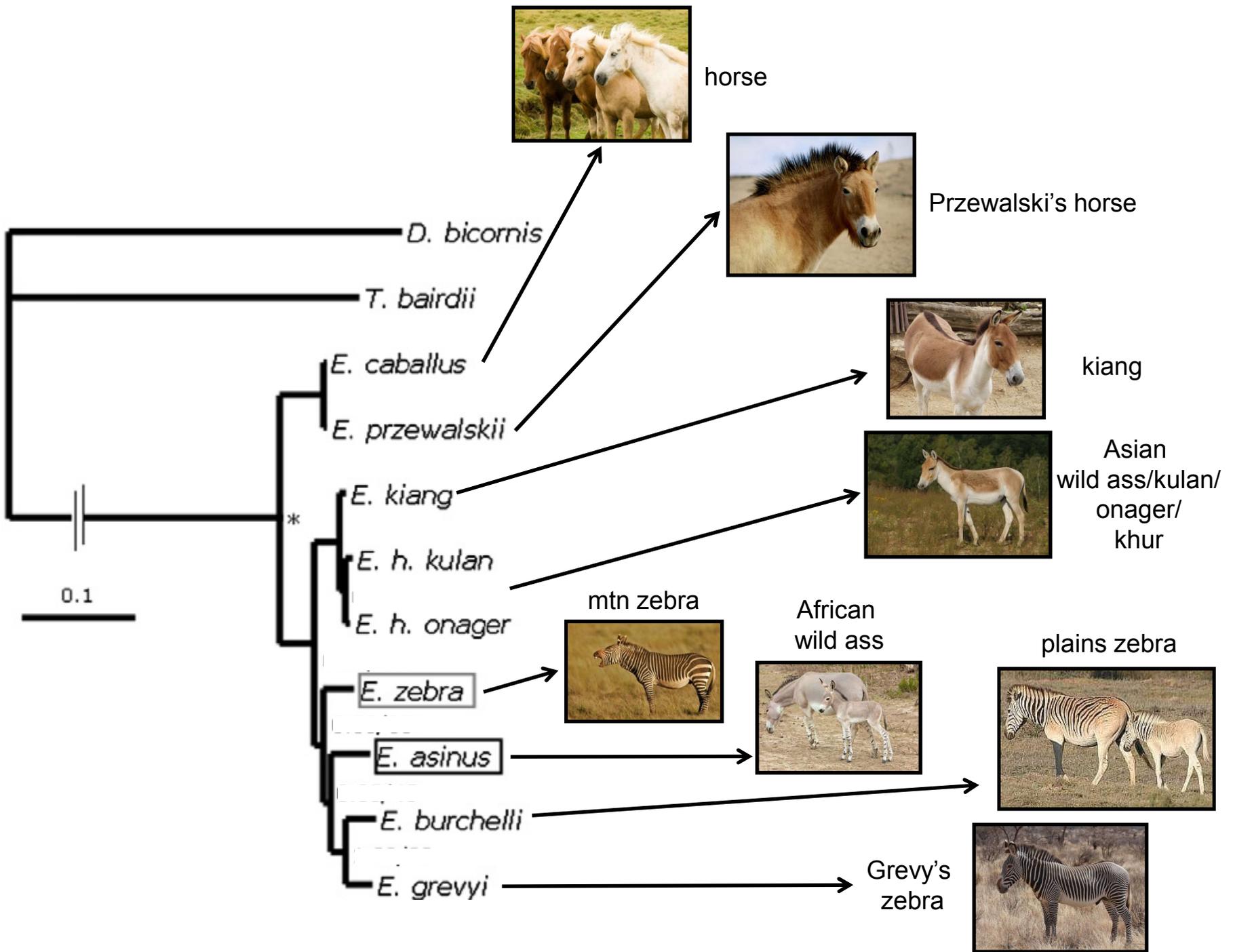
# What good is...?

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



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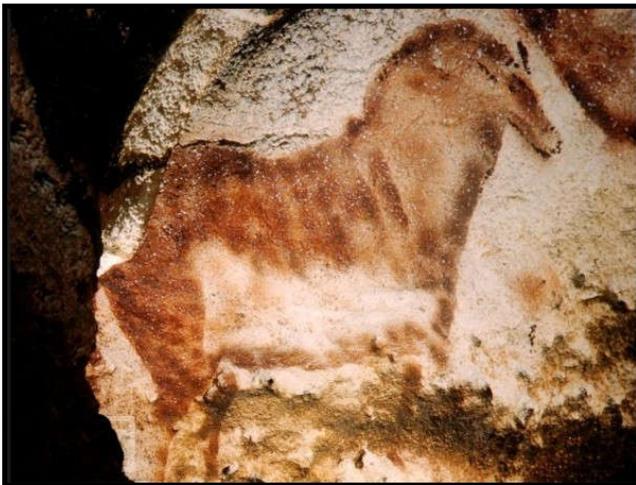




## How the horse lost its stripes

- 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

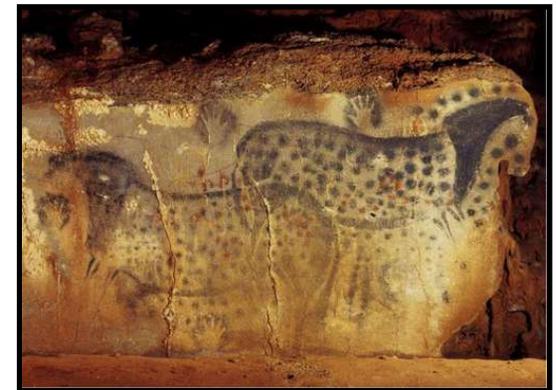
15,000 years ago  
SW Africa



15,000 years ago  
France



22,000 years ago  
France



## Why are most horses not striped?

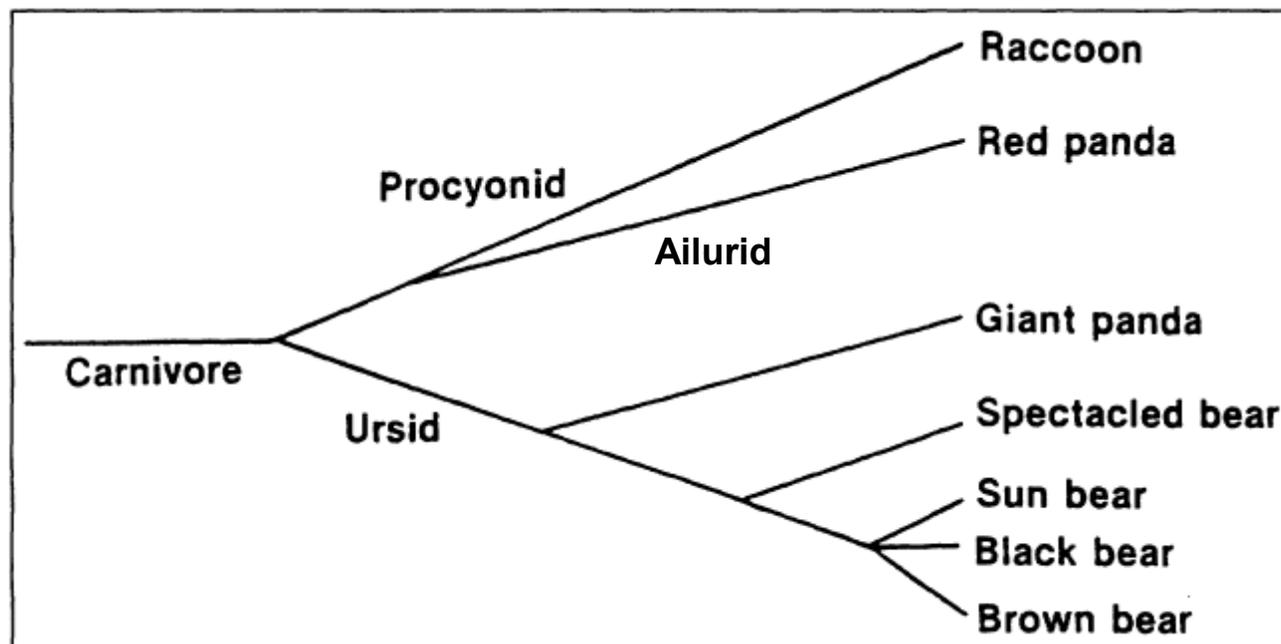


## An Evolutionary Failure

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

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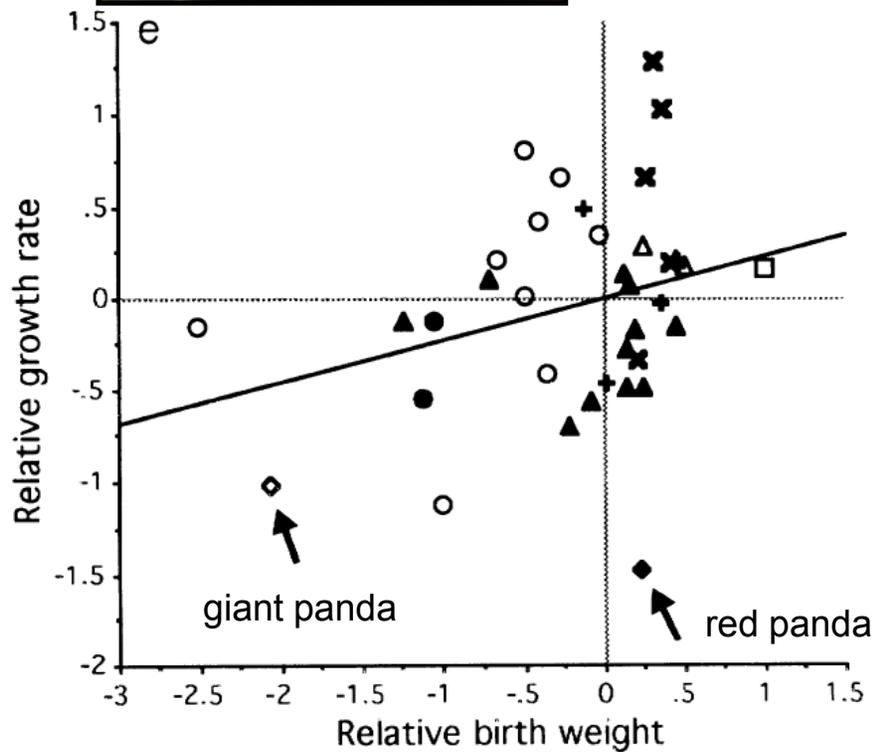


# An Evolutionary Failure

Ailurus



Ailuropoda



# An Evolutionary Failure

Ailurus



Ailuropoda

