

Main Points

1) Diversity, phylogeny, and systematics

- Infraclass Eutheria continued, Orders Lagomorpha through Pholidota

2) Ecology and evolution of mimicry

- example: acoustic mimicry in tiger moths
- example: Batesian mimics as parasites

3) Sykes et al

- cryptozoology and DNA sequencing of 'yeti' and 'bigfoot' hair
- what constitutes scientific evidence?

Q3 available Mon 18 Sep at 5pm, covers today and Mon 18 Sep.

Q1-Q3 are due Weds 20 Sep. There is no lecture this day. Use this class time to take quizzes if you already haven't.

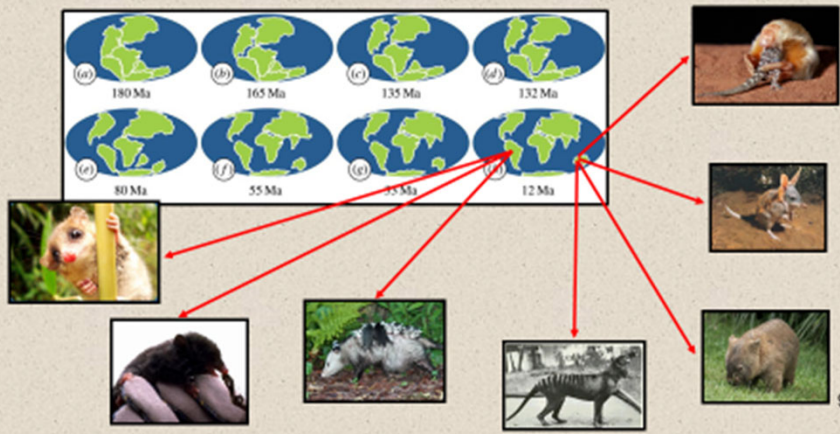
Prereading: Mon 18 Sep = Snyder-Mackler et al; Mon 25 Sep = Bowyer et al

Terms: echolocation, tragus, mimicry, mimic, model, Muellierian mimic, carnassials, Batesian mimic, precocial, arboreal, testability, Sagan standard

Punchline #1: we discussed two pathways by which speciation occurred from an ancestor: vicariance and dispersal. The Great American Interchange involved the dispersal of many mammalian groups southward, but few northward.

Historical biogeography

- **Vicariance** = formation of geographic barriers across preexisting geographic ranges

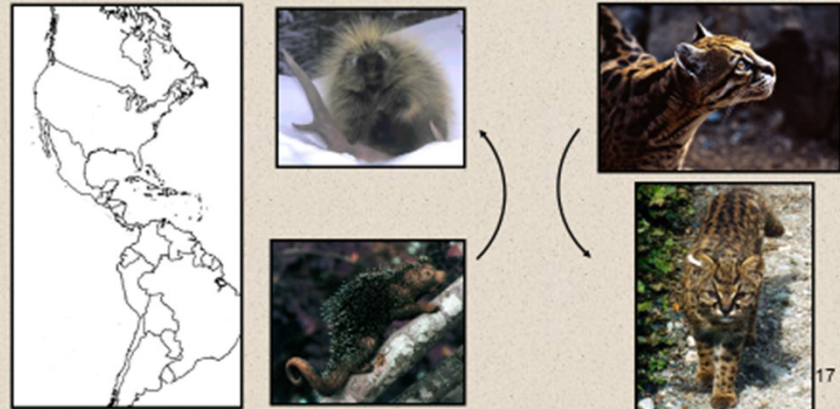


The diagram shows a sequence of eight maps of the supercontinent Gondwana, labeled (a) through (h) with corresponding dates: 180 Ma, 165 Ma, 135 Ma, 132 Ma, 80 Ma, 55 Ma, 25 Ma, and 12 Ma. Red arrows indicate the progressive fragmentation of the landmasses. Below the maps, several images of animals are shown, with red arrows pointing from the maps to them, illustrating the isolation of these groups due to vicariance. The animals include a sloth, a platypus, a kangaroo, a thylacine, and a marsupial lion.

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Historical biogeography

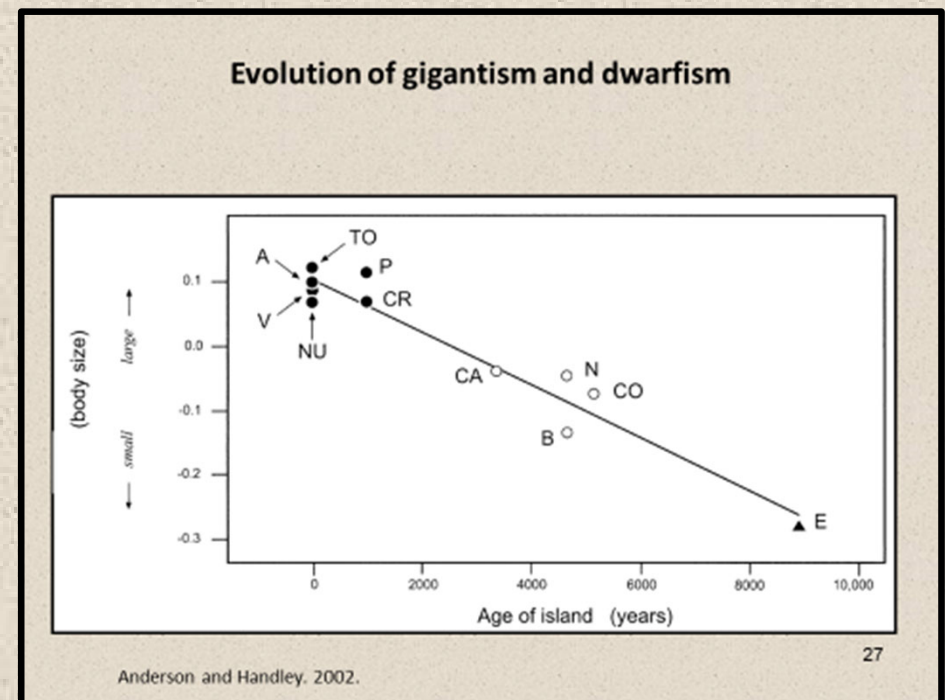
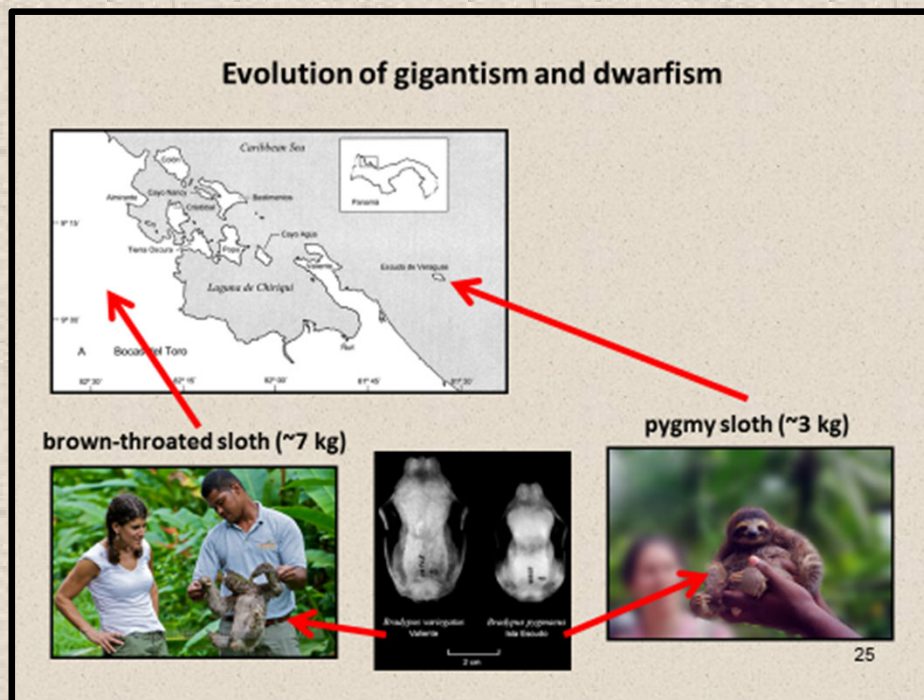
- **Dispersal** (biogeographic context) = movement across preexisting (geographic) barriers after their removal



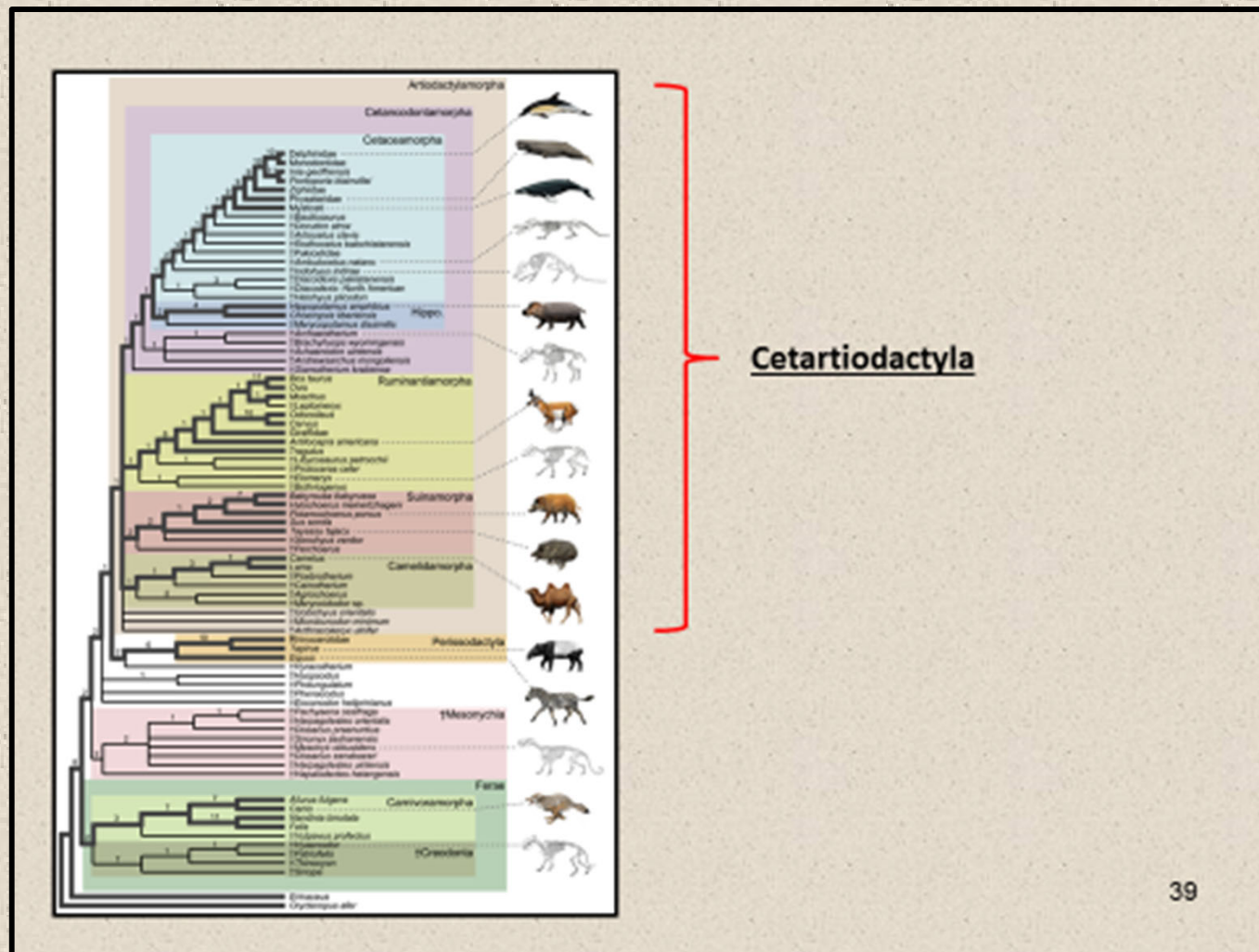
The diagram shows a map of the Americas on the left. To the right, there are four images of animals: a sloth, a platypus, a kangaroo, and a thylacine. Curved arrows indicate the movement of these animals between North and South America, illustrating the concept of dispersal.

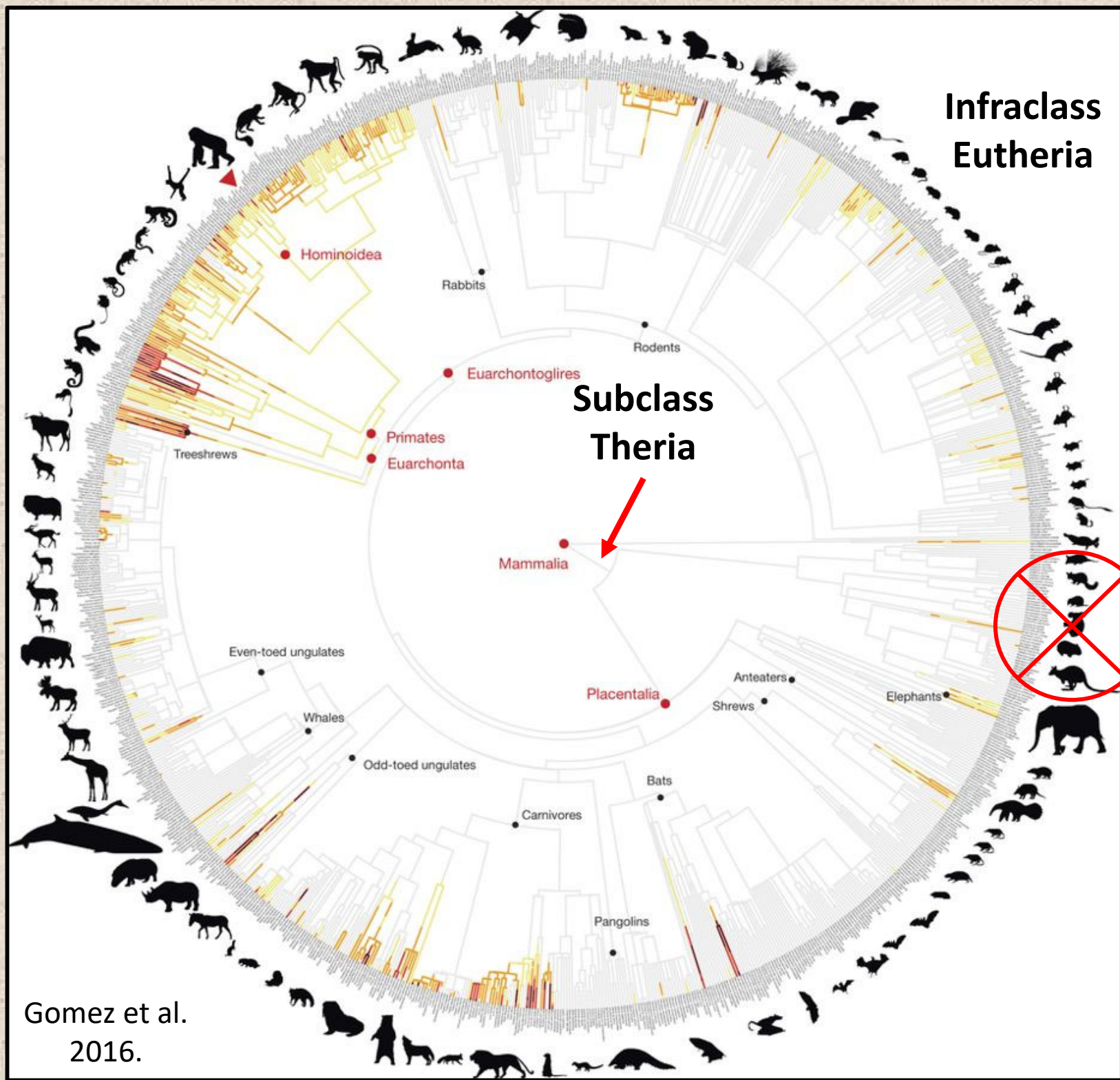
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Punchline #2: over evolutionary time scales, small species tend to increase in size and large species tend to decrease in size, compared to mainland ancestors. We defined “small” and “large”, as applied to mammals.



Punchline #3: whales and hippos evolved from a common ancestor. Hippos are the closest living relatives of whales. Whales and artiodactyls both have an astralagus, a bone derived from the fusion of metatarsals.





Gomez et al.
2016.





Order Lagomorpha: hares, rabbits, pikas

Taxonomy: 80 species

Distribution: cosmopolitan

Characteristics:

- 4 continuously growing upper incisors
- saltatorial
- coprophagic
- cecum

Annamite striped rabbit



black-tailed jackrabbit



black-lipped pika



mountain cottontail



Order Rodentia: rodents

Taxonomy: about 2500 species

Distribution: cosmopolitan

Characteristics:

- 2 continuously growing upper incisors
- skull and jaw musculature adapted for gnawing
- some species coprophagic, with cecum

banner-tailed kangaroo rat



naked mole rat



capibara



Gambian pouched rat



Order Chiroptera: bats

Taxonomy: 928 species

Distribution: cosmopolitan

hammer-headed bat



Honduran white bat



Mexican free-tailed bat



yellow-winged bat (foreground)



Suborder Megachiroptera: fruit bats

Taxonomy: 173 species

Distribution: Afrotropical, Australasian, Oriental

Characteristics:

- pinnae and nose simple and unmodified
- vision is derived (primate-like)
- echolocation and hibernation rare

Egyptian fruit bat



Mauritius flying fox



Gambian epaulettes fruit bat



Suborder Microchiroptera: microbats

Taxonomy: 755 species

Distribution: cosmopolitan

Characteristics:

- elaborate pinna (tragus) and nose modification
- vision is poor
- echolocation and hibernation common

Honduran white bat



spotted bat



frog-eating bat



ghost-faced bat



Echolocation

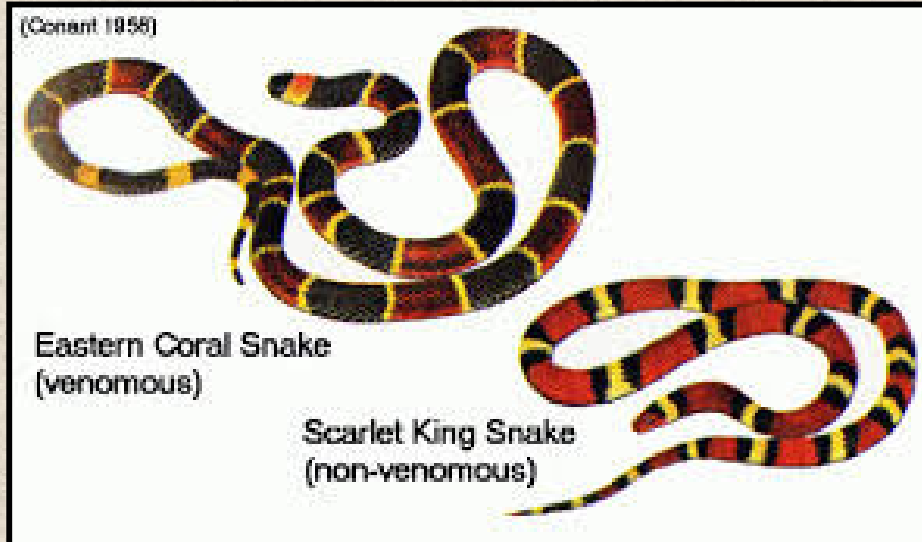
echolocation = emission of high-frequency sound pulses (usually ultrasonic) to gather information about objects from the returning echoes

Mimicry

- **mimicry = resemblance of one organism (the mimic) to another (the model) to confuse the identity of the mimic to enemies, often utilizing aposematic coloration**

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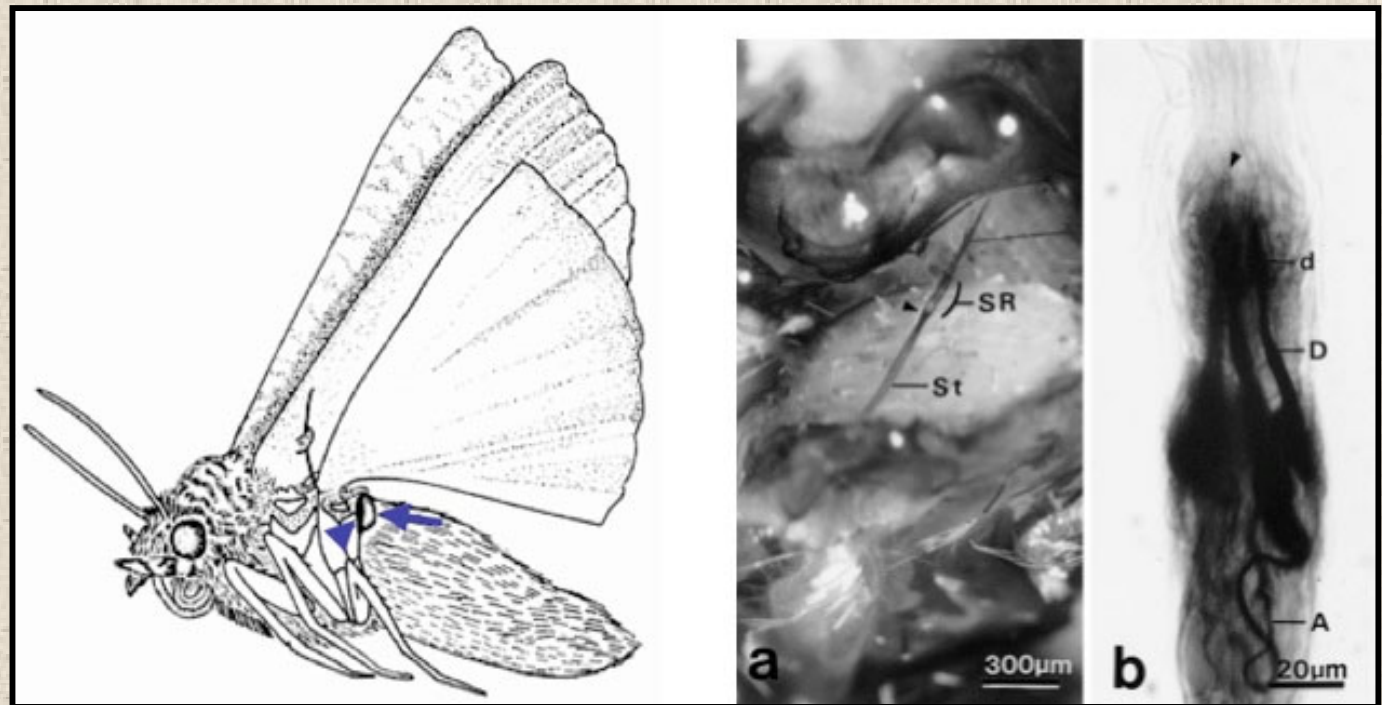
Mimicry

- **mimicry** = resemblance of one organism (the **mimic**) to another (the **model**) to confuse the identity of the mimic to enemies, often using aposematic coloration
- **Muellerian mimicry** = dangerous and/or bad-tasting model, dangerous and/or bad-tasting mimic

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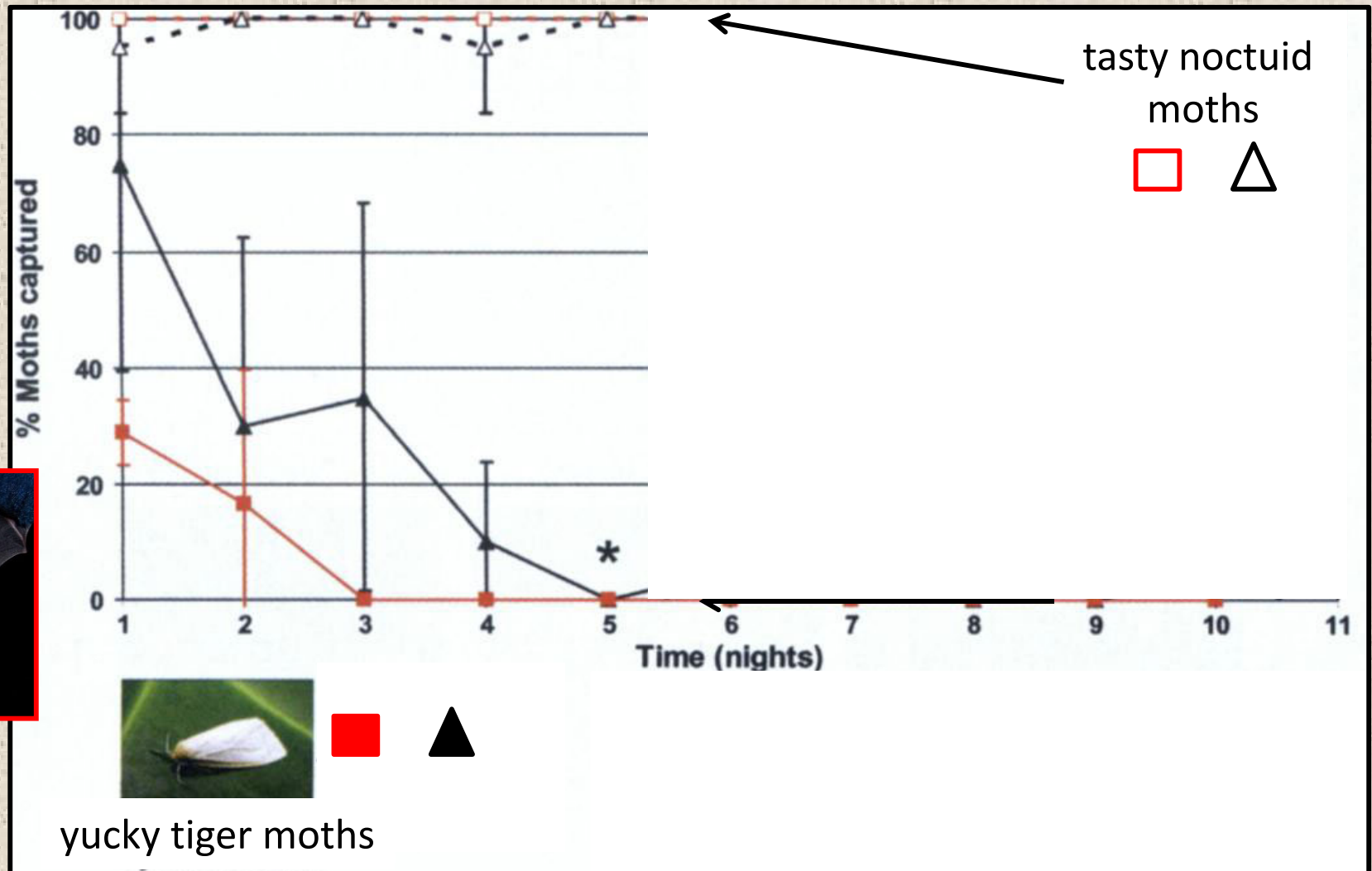
tymbals are
vibrating membranes
that produces sound



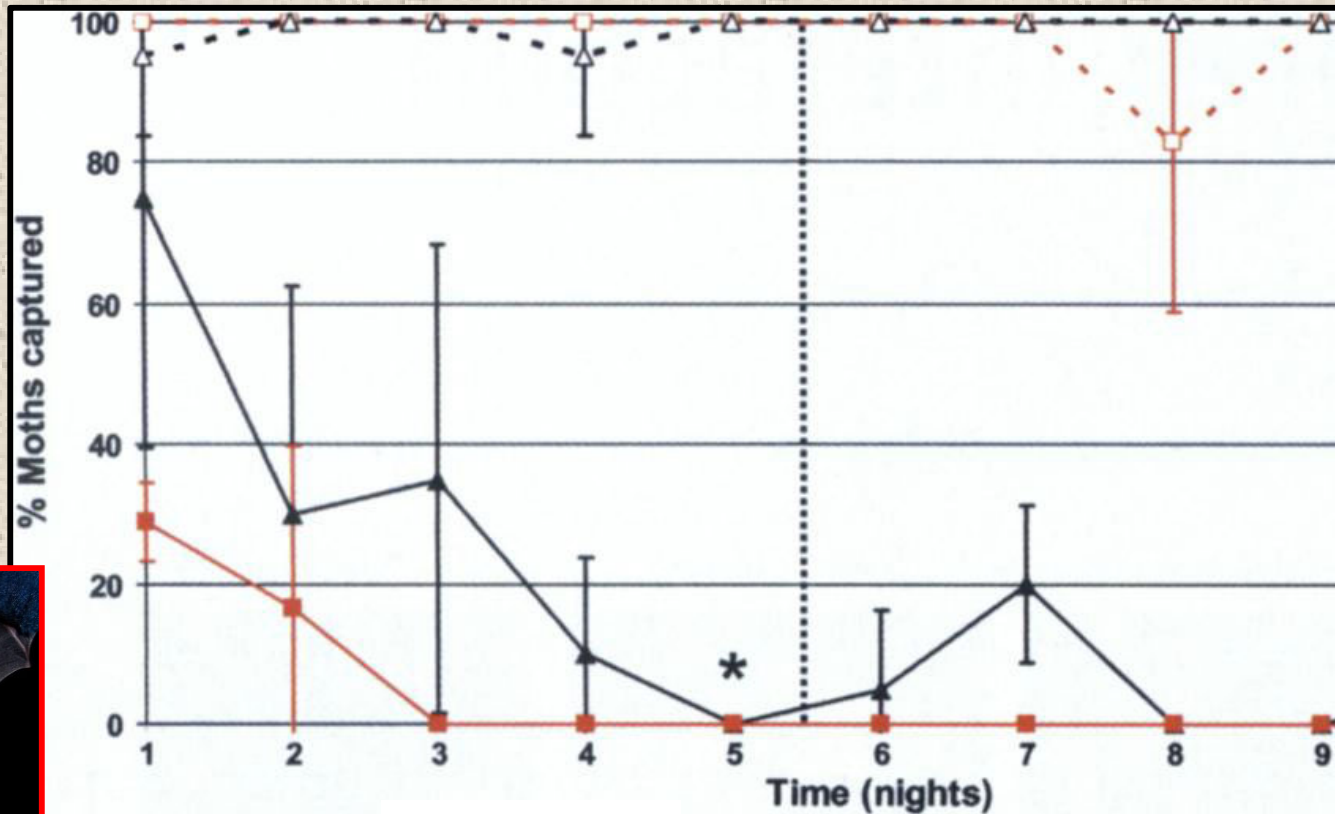
Mimicry



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Mimicry

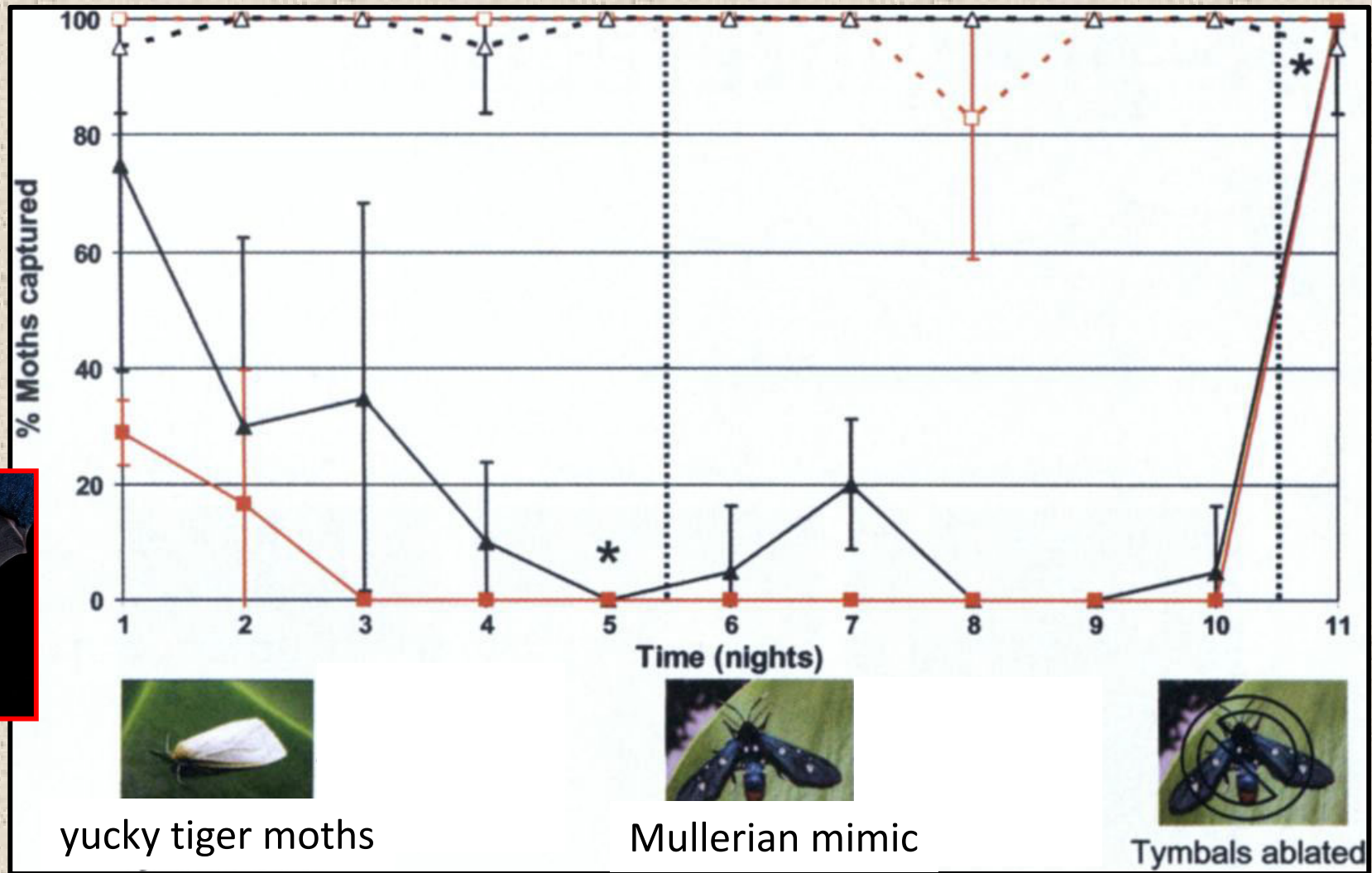


yucky tiger moths



Mullerian mimic

Mimicry



Order Carnivora: carnivores

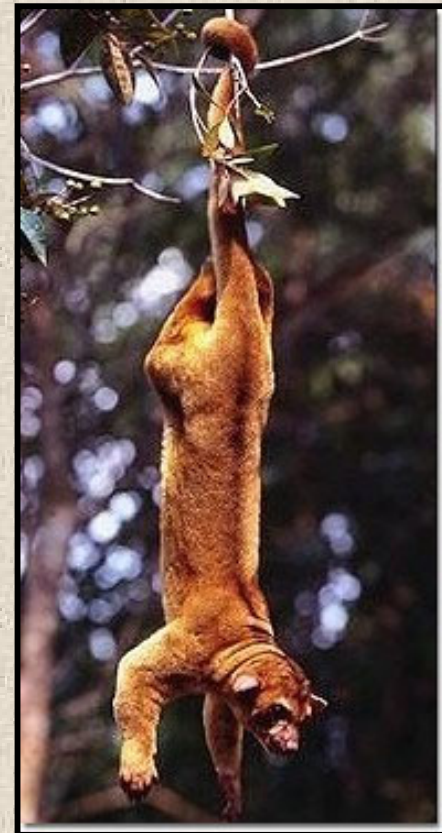
Taxonomy: 271 species

Distribution: cosmopolitan

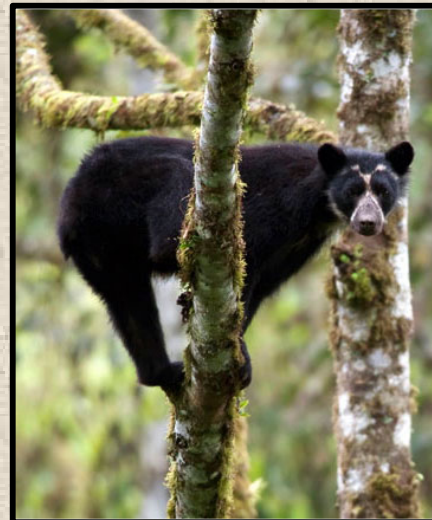
fossa



kinkajou



spectacled bear



sand cat



walrus



Order Carnivora: carnivores

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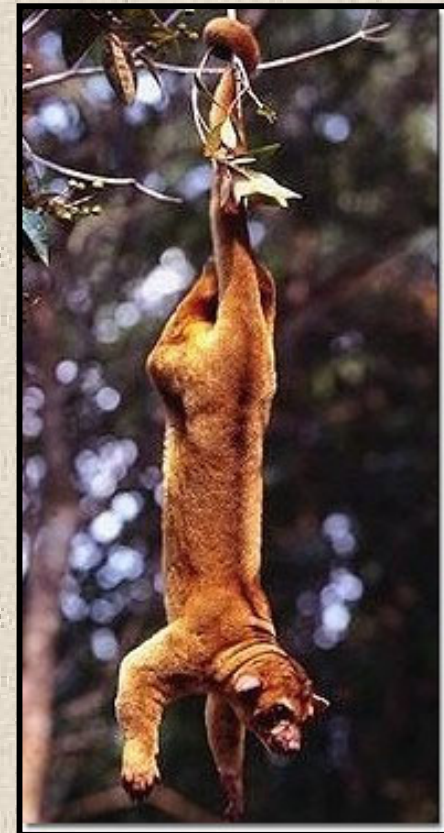
Characteristics:

- derived vision and hearing
- strong jaws and prominent canines
- P4 and m1 = carnassials

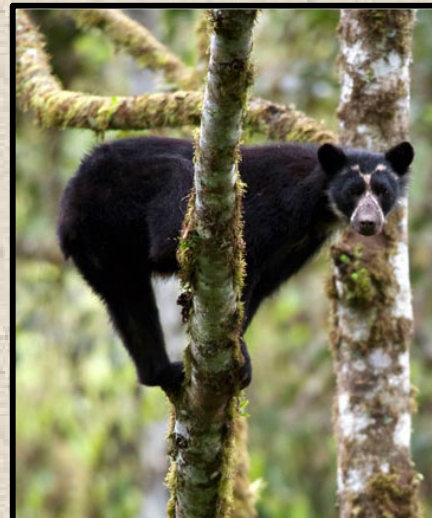
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sand cat



walrus



Mimicry

- mimicry = resemblance of one organism (the mimic) to another (the model) to confuse the identity of the mimic to enemies, often utilizing aposematic coloration
- Batesian mimicry = dangerous and/or bad-tasting model, harmless and/or good-tasting mimic

Mimicry

- myrmecophagous aardwolf mimic, carnivorous striped hyena model
- Batesian mimics as parasites?

Hyaena skull

Proteles skull



striped hyena



aardwolf



Discussion: regarding Batesian mimicry, would you expect mimics or models to be more abundant? Why? Design a field study (IOW, what would you measure?) to test your hypothesis, with one or more predictions.

Hyaena skull



Proteles skull



Order Scandentia: tree shrews

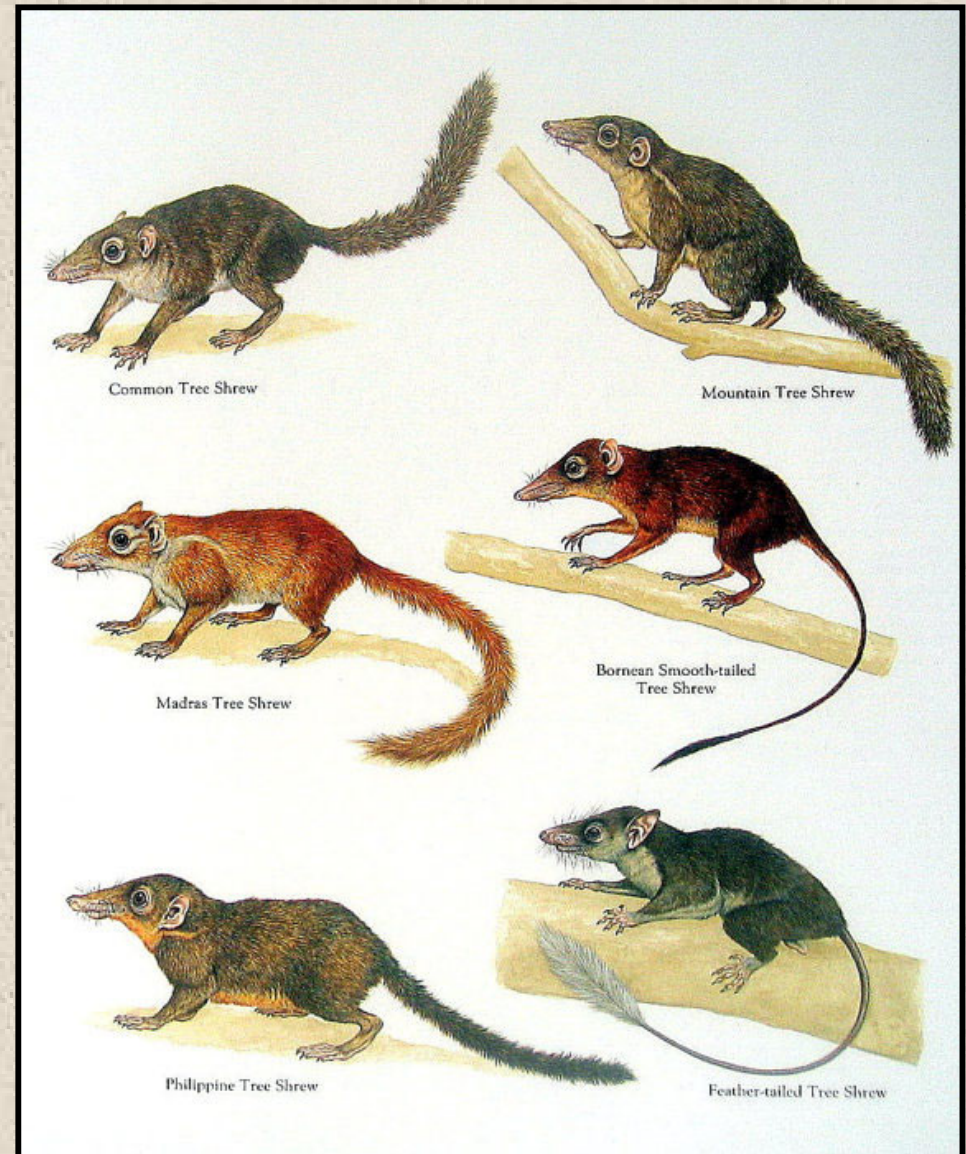
Taxonomy: 19 species

Distribution: Oriental

Characteristics:

- arboreal
- highest brain : body mass of any group of mammals

large tree shrew



Order Dermoptera: colugos or flying lemurs

Taxonomy: 2 species

Distribution: Oriental

Characteristics:

- furred patagium
- comb teeth
- enlarged cecum; typically no coprophagy

Malayan colugo



Malayan colugo



Phillipine colugo

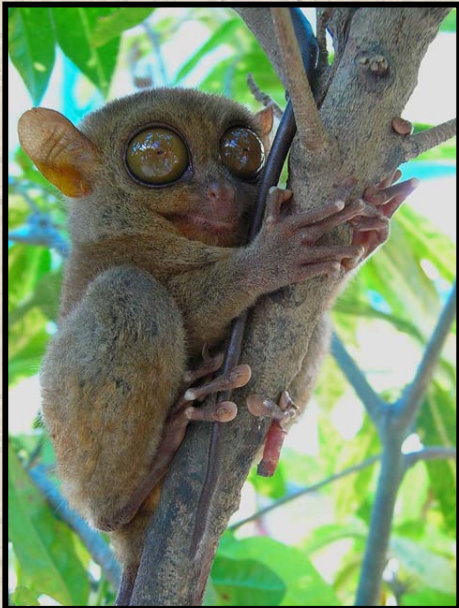


Order Primates: apes, monkeys, prosimians

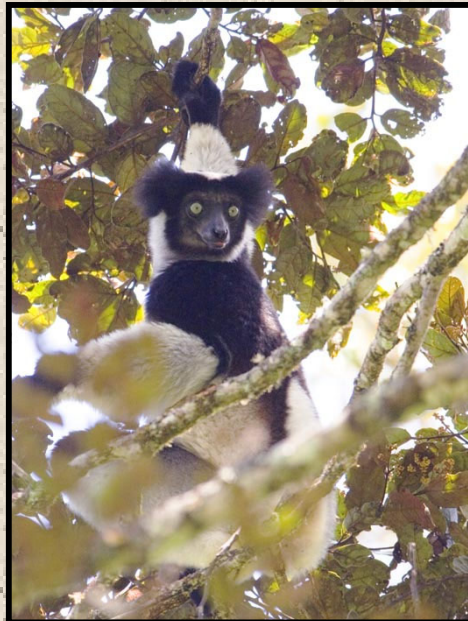
Taxonomy: 12 families, 236 species

Distribution: cosmopolitan, excepting Australasia and Nearctic

Phillipine tarsier



indri



slow loris

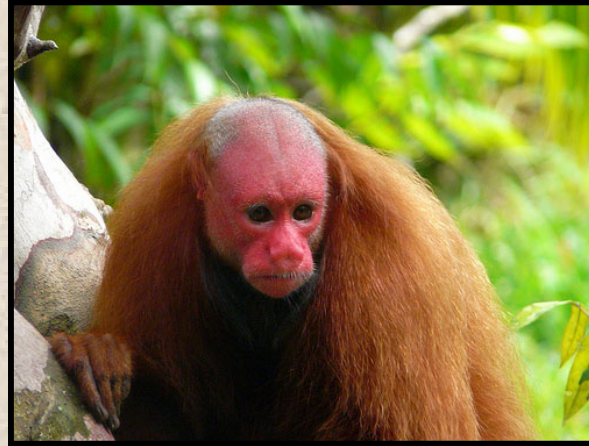


aye-aye



Order Primates: apes, monkeys, prosimians

red uakari



mandrill



white-faced saki



DeBrazza's monkey



vervet



Order Primates: apes, monkeys, prosimians

Taxonomy: 12 families, 236 species

Distribution: cosmopolitan, excepting Australasia and Nearctic

Characteristics:

- reduced rostrum (reduced olfactory region of brain)
- heightened binocular vision (enlarged cranium and cerebral cortex)
- often arboreal
- modified hands and opposable thumbs

human



slow loris



gorilla



Testability distinguishes fact from belief

Testability (or Falsifiability) = an argument or observation that could disprove a statement, hypothesis, or theory.

- requires answering the question “what would be required to convince you that _____ is false?”
- testability distinguishes fact from belief, and is a characteristic of science, data, and fact.

Testability distinguishes fact from belief

Testability (or Falsifiability) = an argument or observation that could disprove a statement, hypothesis, or theory.

- requires answering the question “what would be required to convince you that _____ is false?”
- assertions that are not testable:
 - COVID-19 is being used by the federal government to control us.
 - Elvis is still alive, some place, somewhere.
 - there is a little green martian sitting on my shoulder right now. You cannot see him, because he is invisible to everyone but me. But he is there, I promise.

Sagan standard = the idea that extraordinary claims require extraordinary evidence. Conversely, the simplest/most straightforward explanation probably is the correct explanation.

bigfoot, northern California



yeti footprint, Himalayas



wampa, Hoth



Discussion: Sykes et al study offered something valuable that no other study concerning cryptozoology had attempted. What was this?

bigfoot, northern California



yeti footprint, Himalayas



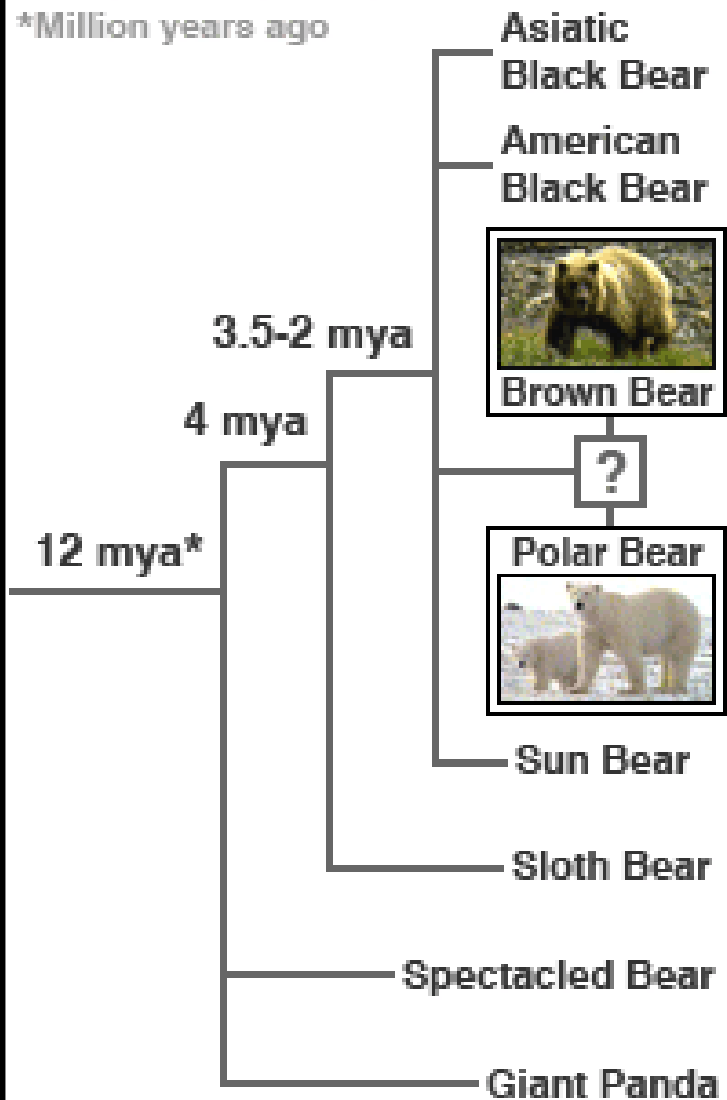
wampa, Hoth



Cryptozoology and an undiscovered bear

POLAR BEAR ORIGINS

*Million years ago



SOURCE: Modified from Waits et al. 1998



Order Eulipotyphla: true shrews, moles, solenodons, hedgehogs

Taxonomy: 429 species

Distribution: cosmopolitan, except for Australasia and southern Neotropics

Characteristics:

- poorly-developed auditory bullae
- enlarged incisors and reduced canines
- echolocation (not diagnostic)

Eurasian hedgehog



white-toothed shrew caravan



Haitian solenodon



Order Pholidota: pangolins or scaly anteaters

Taxonomy: 7 species

Distribution: Afrotropical and Oriental

Characteristics:

- dorsum and tail covered in hardened scales
- myrmecophagous
- convergent with Cingulata

black-bellied pangolin



ground pangolin



Chinese pangolin

