

**Is anyone here afraid of
the dark?**









Tarsiers: Tiny Terrors of the Tropics!



Want to see one in action?

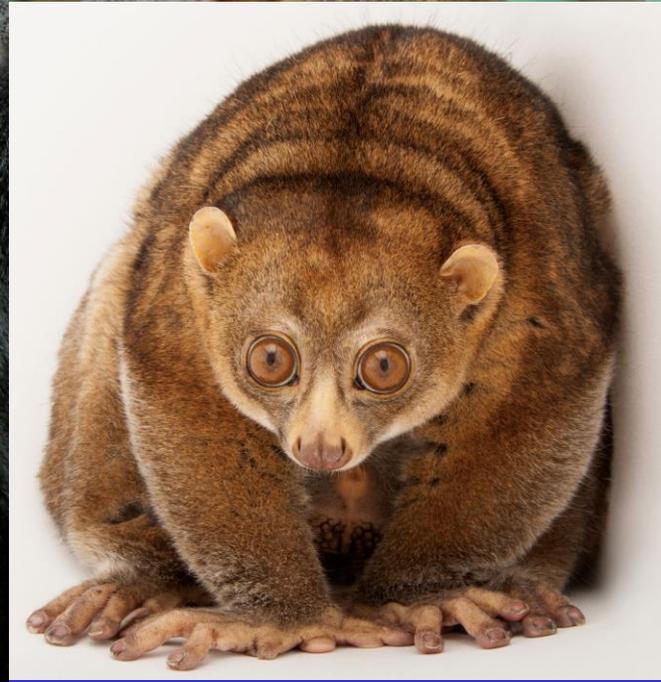


Meet the tarsier!



**One of the most interesting animals
that most people have *never* heard of!**

Tarsiers are Primates



Tarsiers are only found...



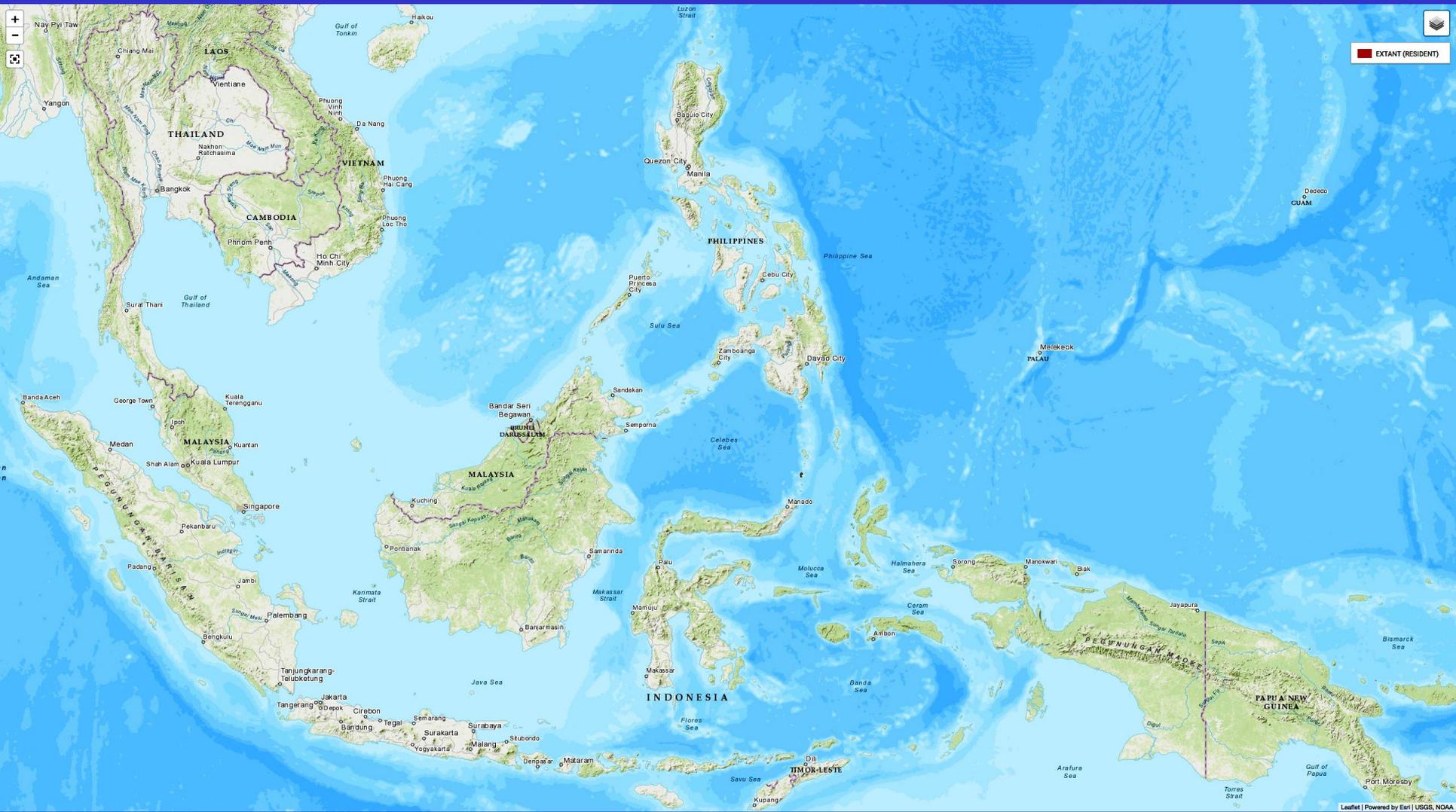
Tarsiers are only found...



**Here
in S.E.
Asia**



EXTANT (RESIDENT)

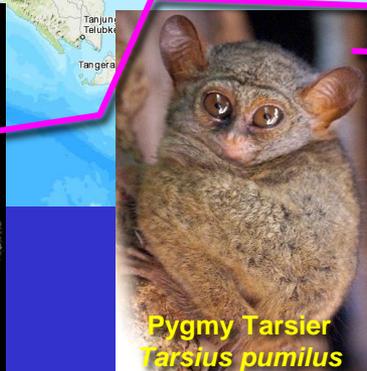
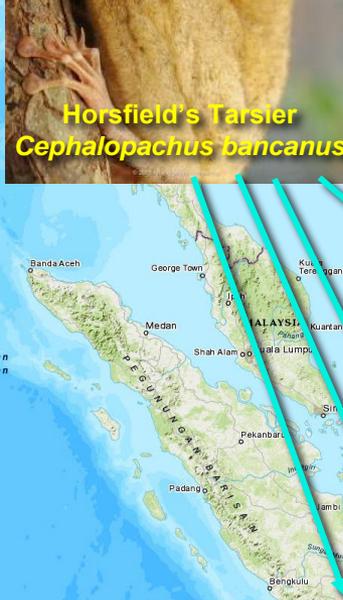
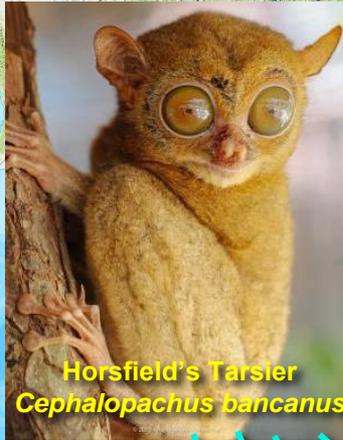




EXTANT (RESIDENT)



14 Species!



Wallace's Tarsier
Tarsius wallacei

Philippine Tarsier
Carlito syrichta

Jatna's Tarsier
Tarsius supriatnai

Niemitz's Tarsier
Tarsius niemitzi

Sangihe Tarsier
Tarsius sangirensis

Siau Tarsier
Tarsius tumpara

Gursky's Tarsier
Tarsius spectrumgurskyae

Larang Tarsier
Tarsius lariang

Pygmy Tarsier
Tarsius pumilus

Makassar Tarsier
Tarsius fuscus

Spectral Tarsier
Tarsius tarsier

Peleng Tarsier
Tarsius pelengensis

Dian's Tarsier
Tarsius dentatus

Sulawesi is in a strange spot...

The Wallace and Weber Lines





**Small: ~ 100-150g
(0.22-0.33 lb.)**



Name “tarsier” derived from tarsus (ankle)

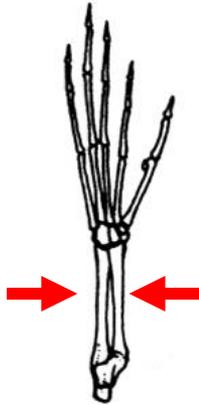


- Very long feet!

- Feet huge due to 2 elongated ankle bones



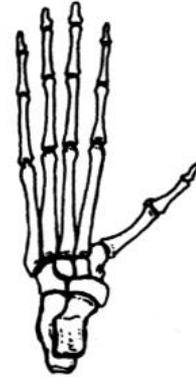
Slow Loris



Tarsier



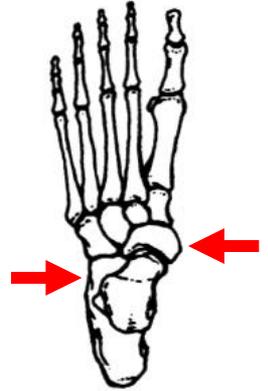
Macaque



Spider Monkey



Gibbon



Human





Bornean Tarsier:

Head + body
length:
~ 150 mm

Foot length:
~ 71 mm

Foot = 47% of head
+ body length



**Prof.
McConaughey**

- Class of '93

**- UT's Minister
of Culture**



**Prof.
McConaughey**

**Foot = 29% of
head + body
length**



**Prof.
McConaughey**

**Foot = 47% of
head + body
length**



**Long feet &
legs are
adaptations
for leaping**



**Tarsiers can
leap more
than 16 feet!
(33 x head +
body length)**

**Elite NCAA long jumpers ~ 22-27 feet
(7-9 x head + body length)**



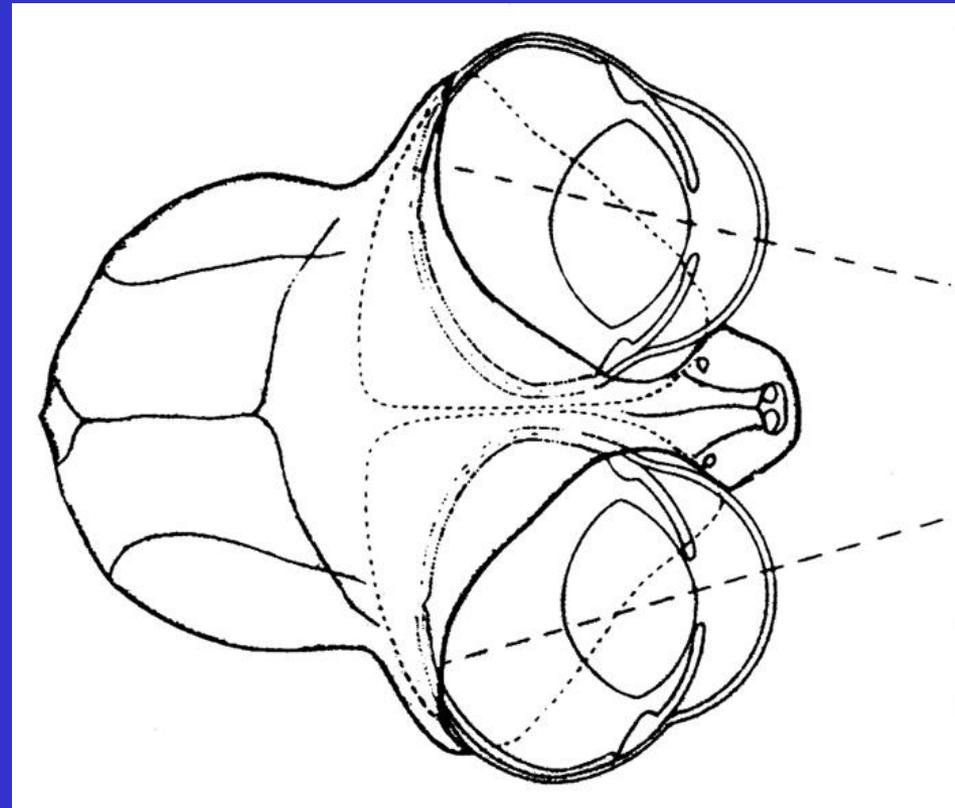
If humans could jump 33 x head body length:
length: ~ 100 feet



- Relative to head and body size, tarsiers have the largest eyes of any living mammal



- Tarsier head length: 40 mm
- Tarsier eye length: 18 mm
(45% head length)

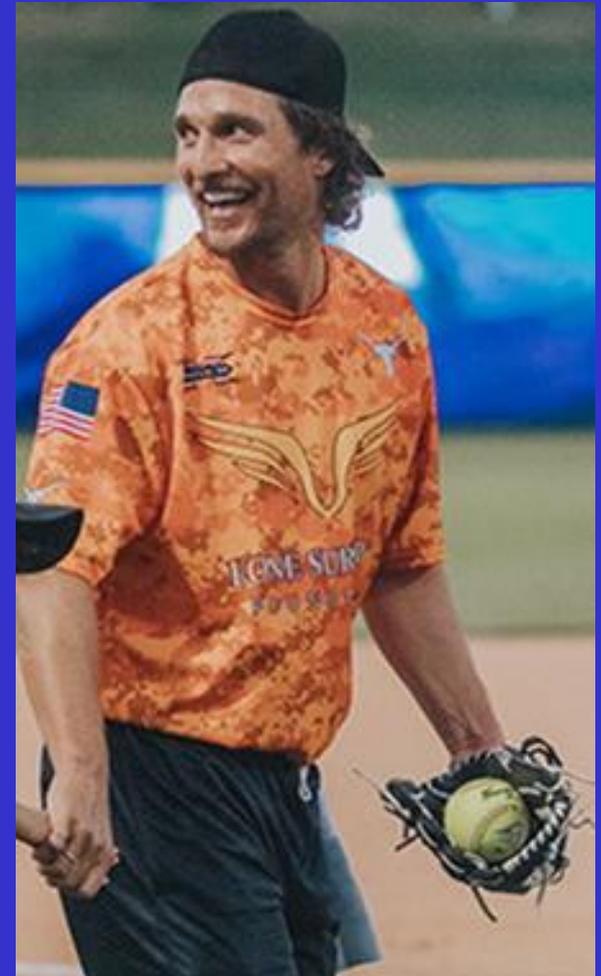




- Human head length:
200 mm
- Human eye length:
24 mm
(12% head length)

- If humans had eyes
45% of head length: 90 mm
- Baseball: 75 mm; Softball:
97 mm

- I just *happen* to have a picture of Prof. McConaughey with a softball...



- I just *happen* to have a picture of Prof. McConaughey with a softball...



- I just *happen* to have a picture of Prof. McConaughey with a softball...



- I just *happen* to have a picture of Prof. McConaughey with a softball...



Diet 100% animals, mainly insects



Tarsiers have sharp, pointy teeth



- Well adapted to dispatch and slice up insects

Very big hands and long fingers



Here's an old tarsier skeleton in the Anthropology teaching collection:



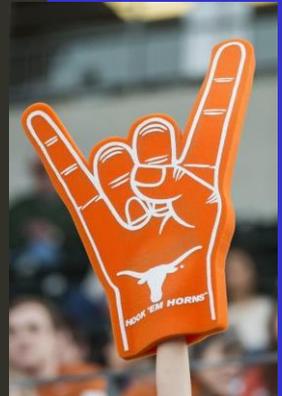
Tarsius fraterculus ♂
Tagbilaran, Bohol
April 1939, Philippines

Ward's Natural Science Establishment, Rochester, N.Y.

I also just *happen* to have a photo of Prof. McConaughey showing his hands...



I also just *happen* to have a photo of Prof. McConaughey showing his hands...



Huge hands used to snatch prey...



Jürgen Freund Photography





**Scientists
used to
think that
all tarsiers
were
solitary**



**Some
species
solitary,**

**Some
species
pair- or
group-
living**

**Infants carried in
mouth and “parked”
while parent(s) hunt**



**Like all primates,
infants take a long
time to mature**

- Gestation ~ 6 months**
- Weaning ~ 80 days**
(rat ~ 22 days for both)



**When tarsiers were first discovered,
no one knew what to think...**



**Georg Kamel
1706:**

Monkey?



**Christian Erxleben
1744-1777**

Lemur?



**Comte de Buffon
1765**

“Le Tarsier!”



Buffon:

“We have obtained this animal by chance and from a person who could tell us neither where it came from nor what it was called; but it is very remarkable for the excessive length of its hind legs... it is from this very noticeable characteristic that we have derived its name.”

Buffon: Maybe *le tarsier* is some kind of jerboa (rodent)?

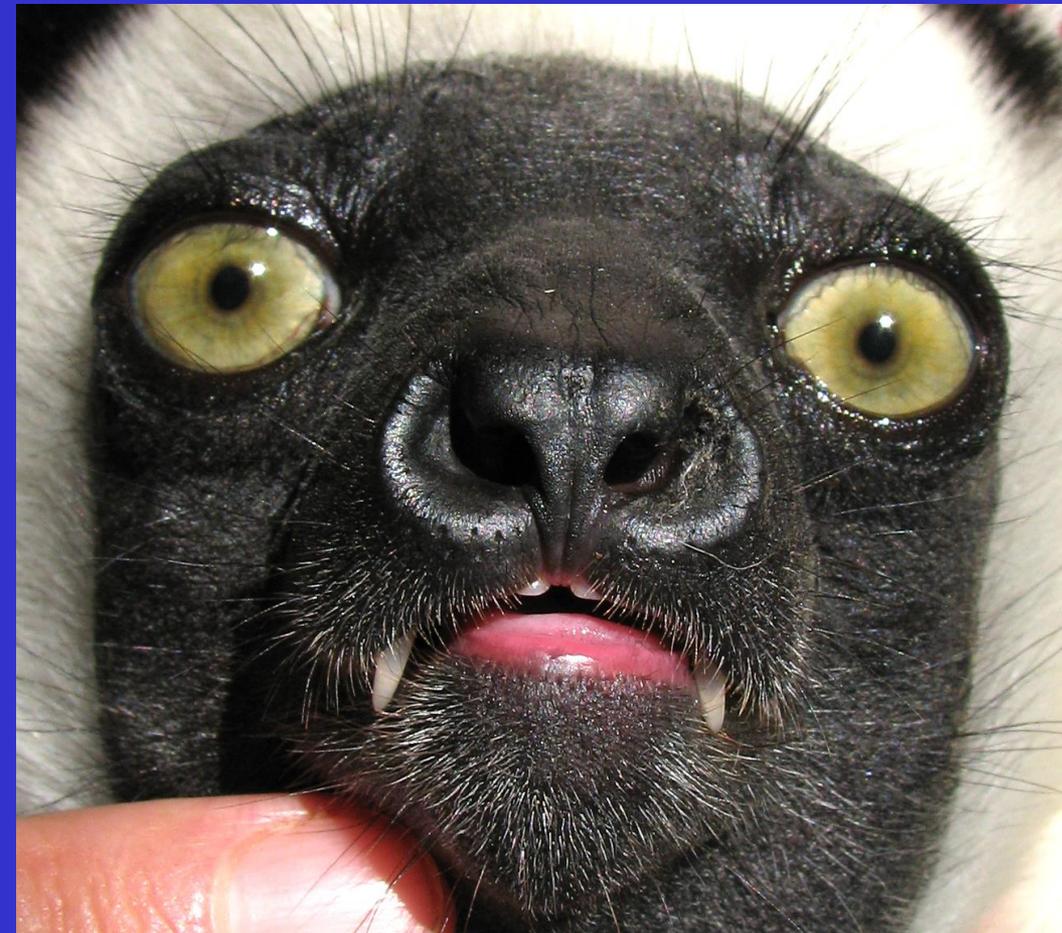




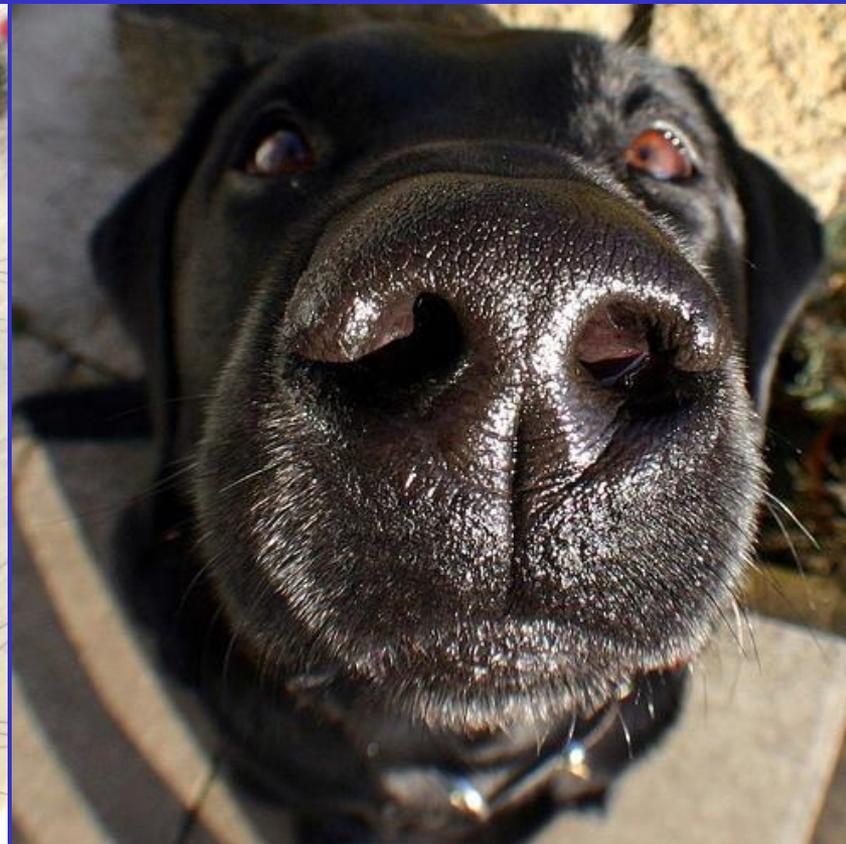
1918: Have you
ever noticed that
tarsiers have
dry noses??

Reginald Pocock

Some primates (e.g., lemurs) resemble other mammals in having a wet, hairless nose (“rhinarium”) & split upper lip



Lemur (sifaka)

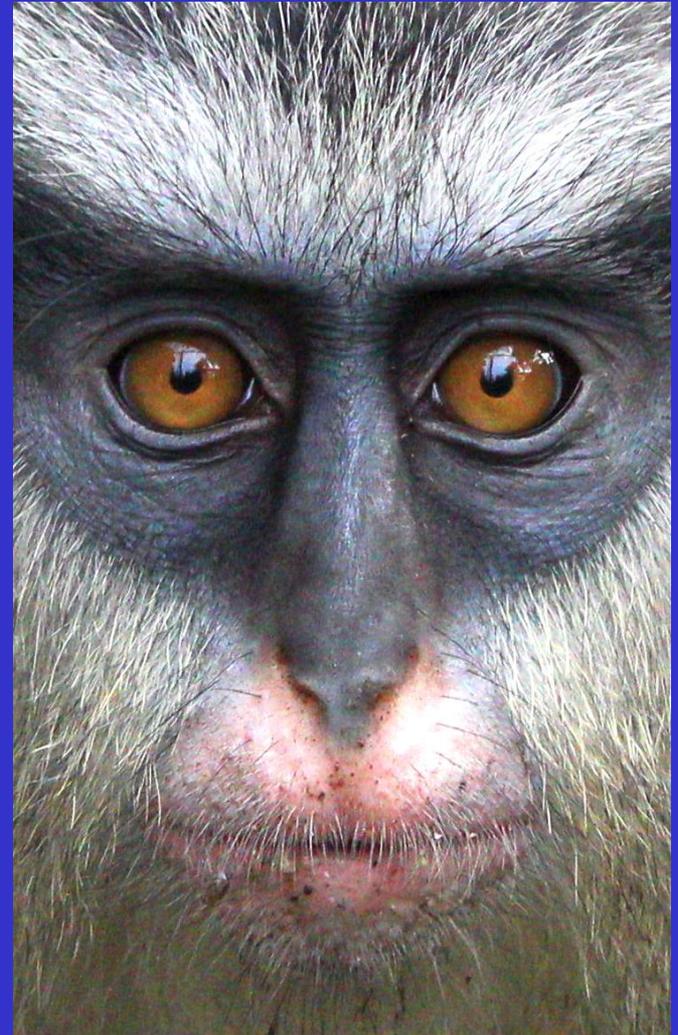


Non-primate (dog)

Like monkeys, apes, and humans,
tarsiers have a dry nose and *lack* a rhinarium



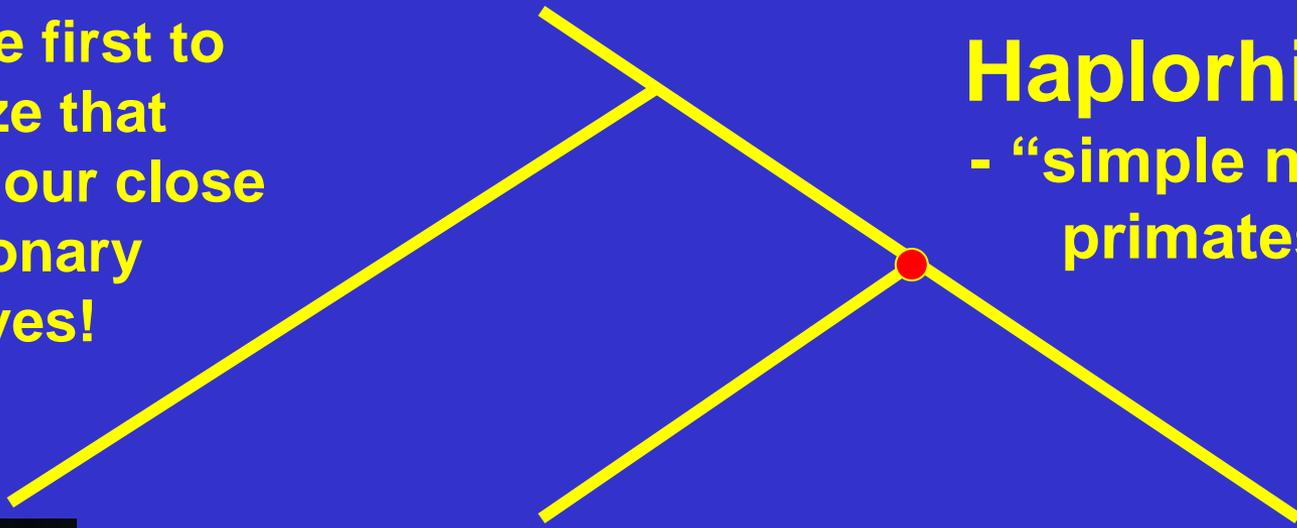
tarsier



monkey

Pocock the first to recognize that tarsiers are our close evolutionary relatives!

Haplorhines
- “simple nosed primates”



Tarsiers



Lemurs & Lorises



**Monkeys,
Apes, &
Humans**

You might be thinking:



“Why is this guy who studies fossil primates so into tarsiers?”



**The fossil record
of definitive
tarsiers starts
during the
Eocene epoch
(56-34 million
years ago)**

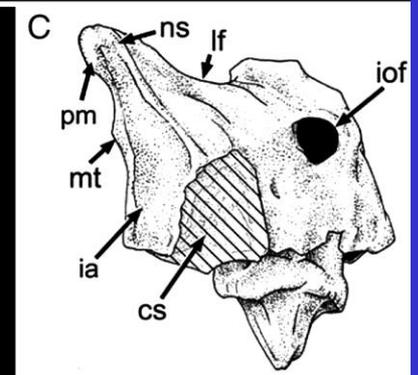
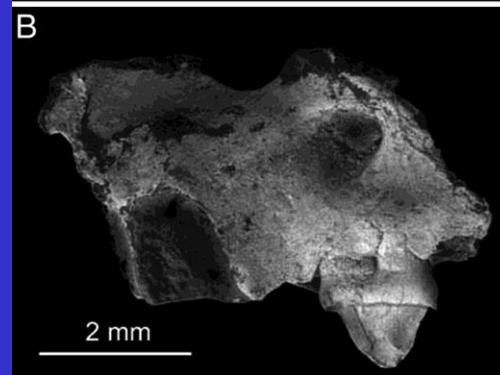
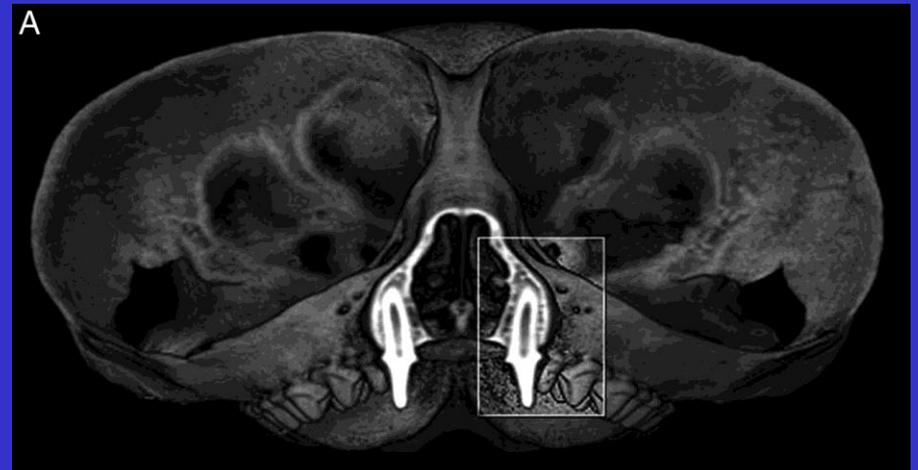
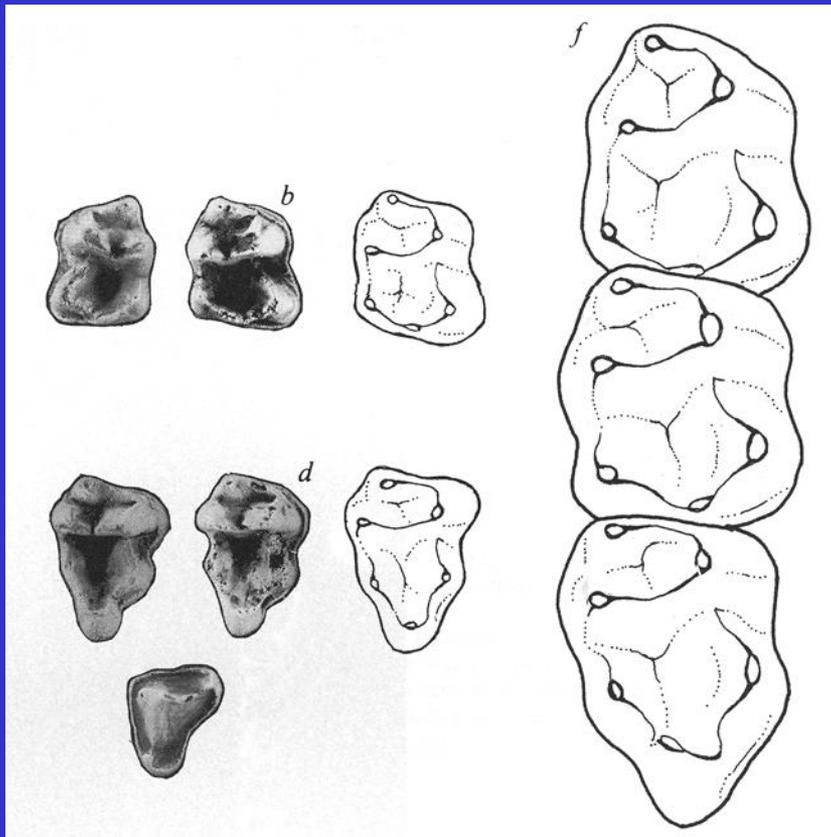
**Shanghuang,
China,
45 million years
old**



**Filled with fossils
of small mammals
eaten by ancient
owls...**



Includes teeth and cranial fragments of a tiny Eocene tarsier: *Tarsius eocaenus*



**Our genus (*Homo*)
has existed for < 3
million years**



(Class of '92)

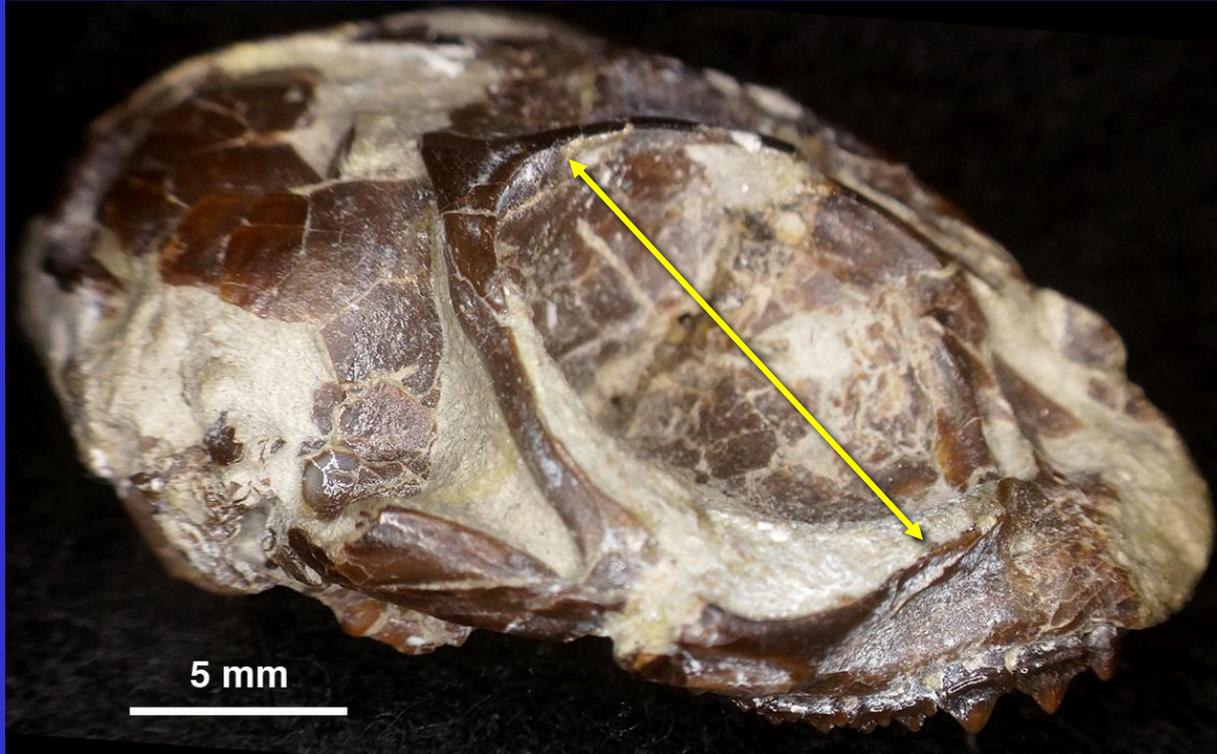
**Tarsiers have been
around for at least
45 million years!**



Most of my fossil research is in North America
Interesting group of Eocene primates: Omomyoids



An omomyoid primate - *Shoshonius*
51 million years old, Wyoming



- Small (115 grams)
- Huge Eye Sockets
- Diet: Insects & fruit

**An omomyoid primate - *Shoshonius*
51 Million Years Old, Wyoming**



**- An early
tarsier relative?**

**But: Didn't
have huge
hands and feet**

**There are also omomyoids from the Eocene
of Texas...**



*Rooneyia
viejaensis*

~ 38 million
years old

UT Prof. John
A. Wilson,
1966



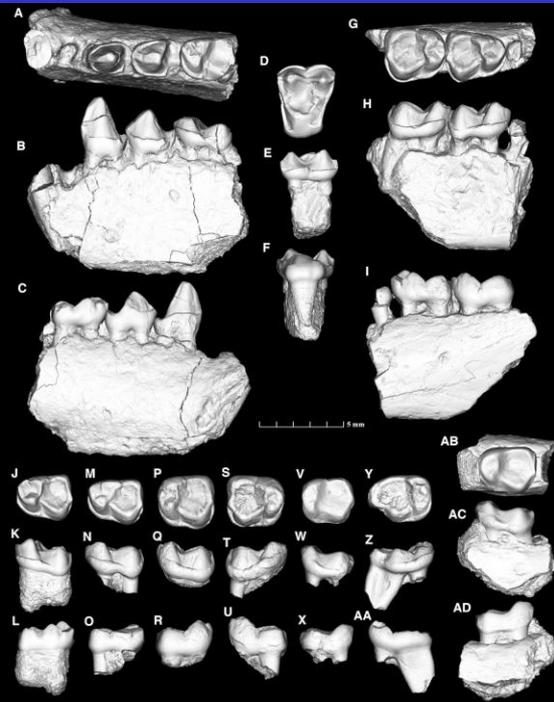
I've been collecting omomyoids in the Big Bend since 2004



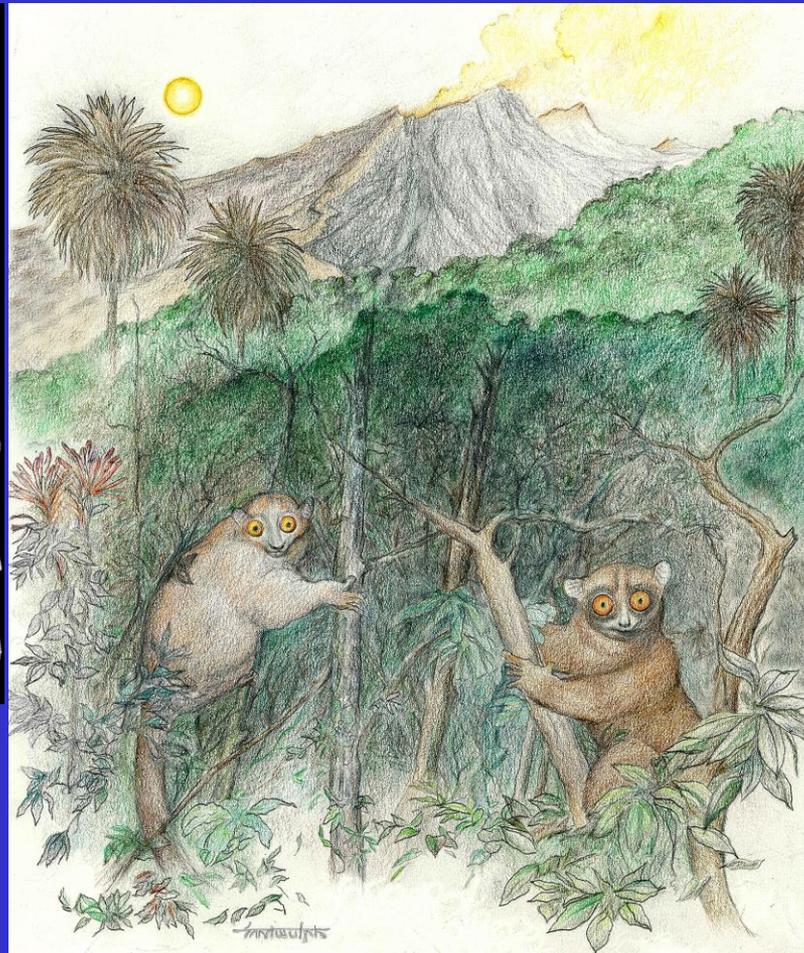
The Big Bend was a different place in the Eocene...



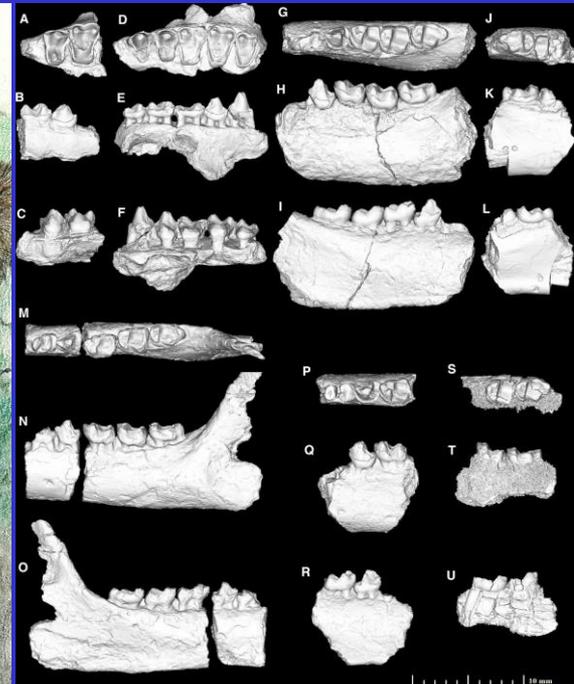
Many species of Big Bend omomyoids!



*Mytonius
williamsae*
(2023)



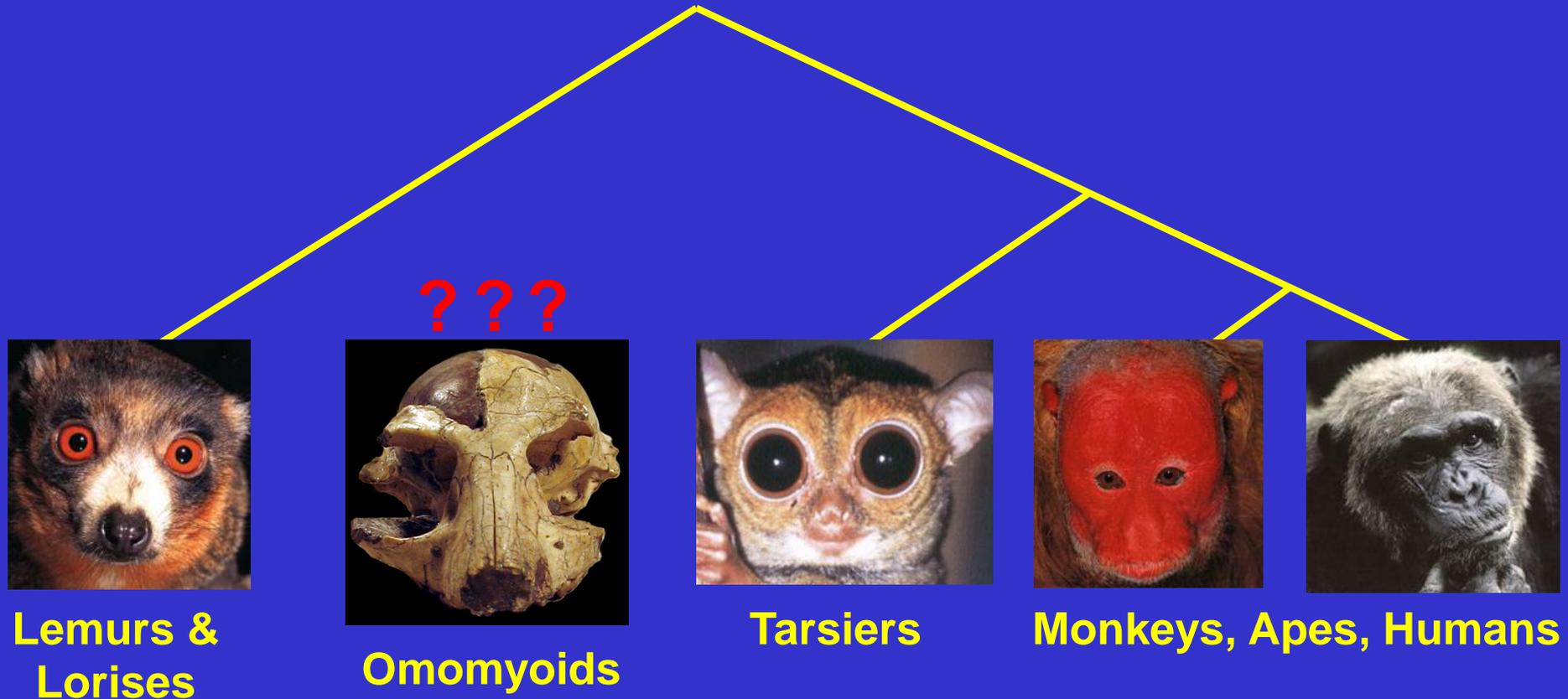
44 million years ago



*Diablomomys
dalquesti*
(2008)

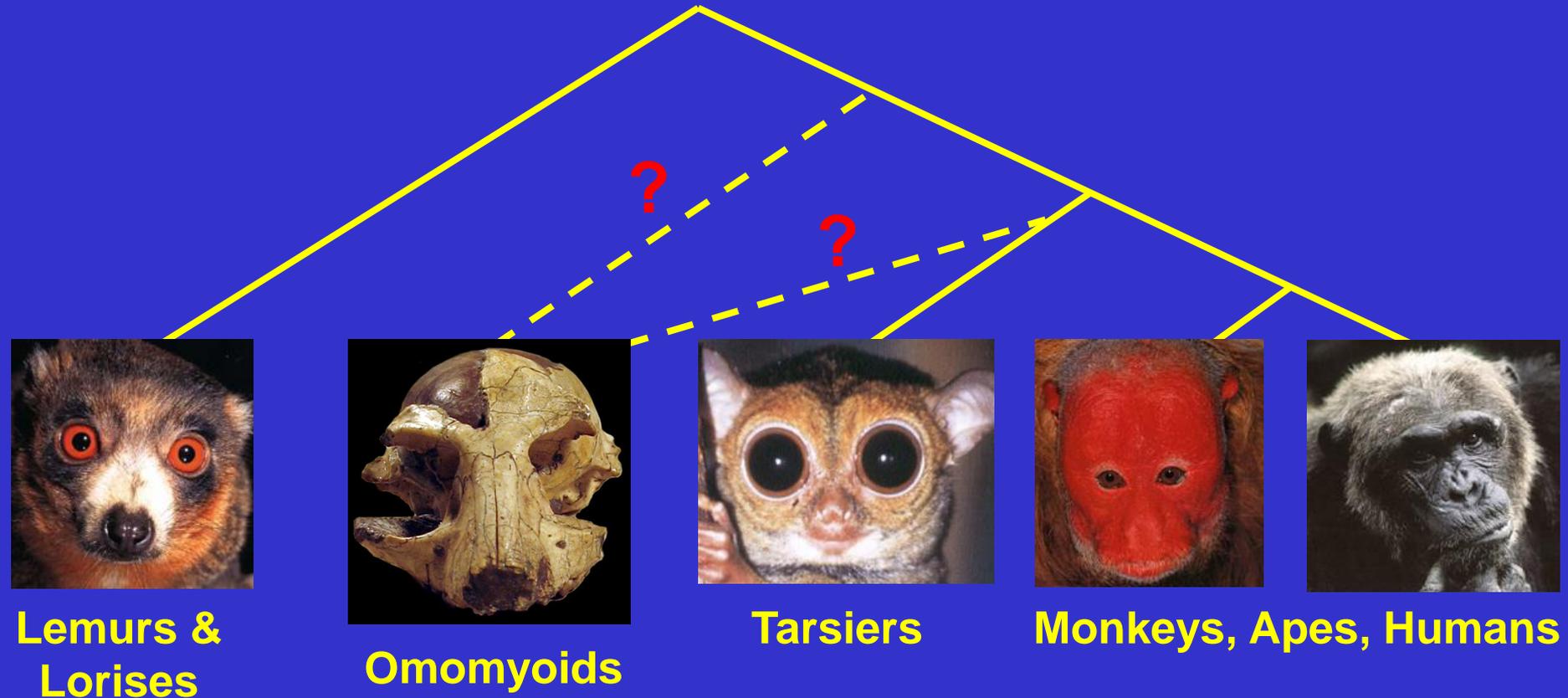
One BIG QUESTION for me:

How are omomyoids related to living primates?



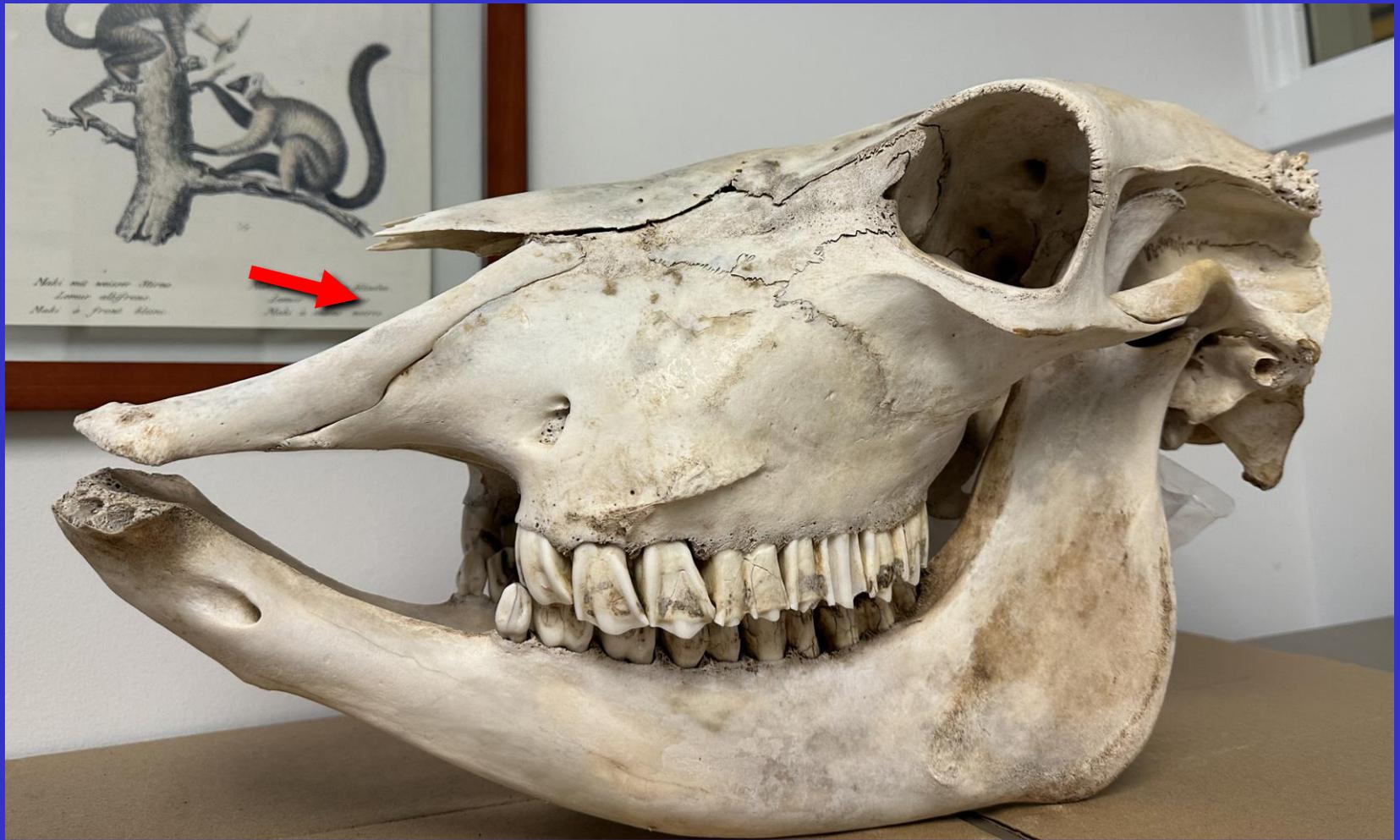
Remember: This diagram is like a “family tree” for primates, but it shows their *evolutionary* relationships...

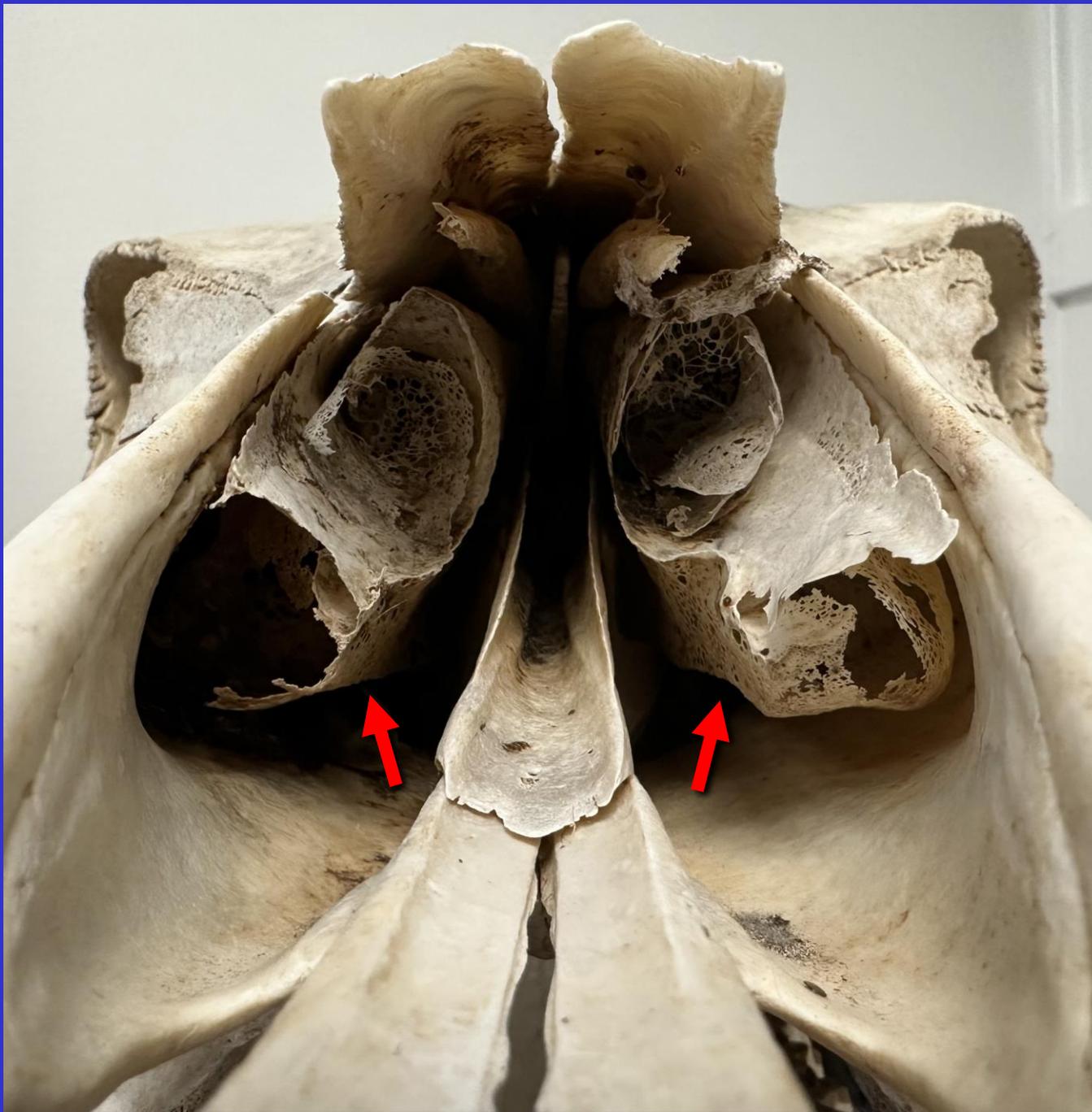
Two main hypotheses for omomyoids: (1) Primitive tarsiers or (2) Early haplorhines



Let's consider the evidence:

Q: Have you ever looked in the nose of a cow skull?





- Paper-thin scrolls of bone: Turbinals

- Covered with mucus membrane

- Some used for air conditioning (“respiratory turbinals”)

- Some used for *smelling* (“olfactory turbinals”)

The BEST way to study turbinals: 3D X-Ray scanning (micro CT)

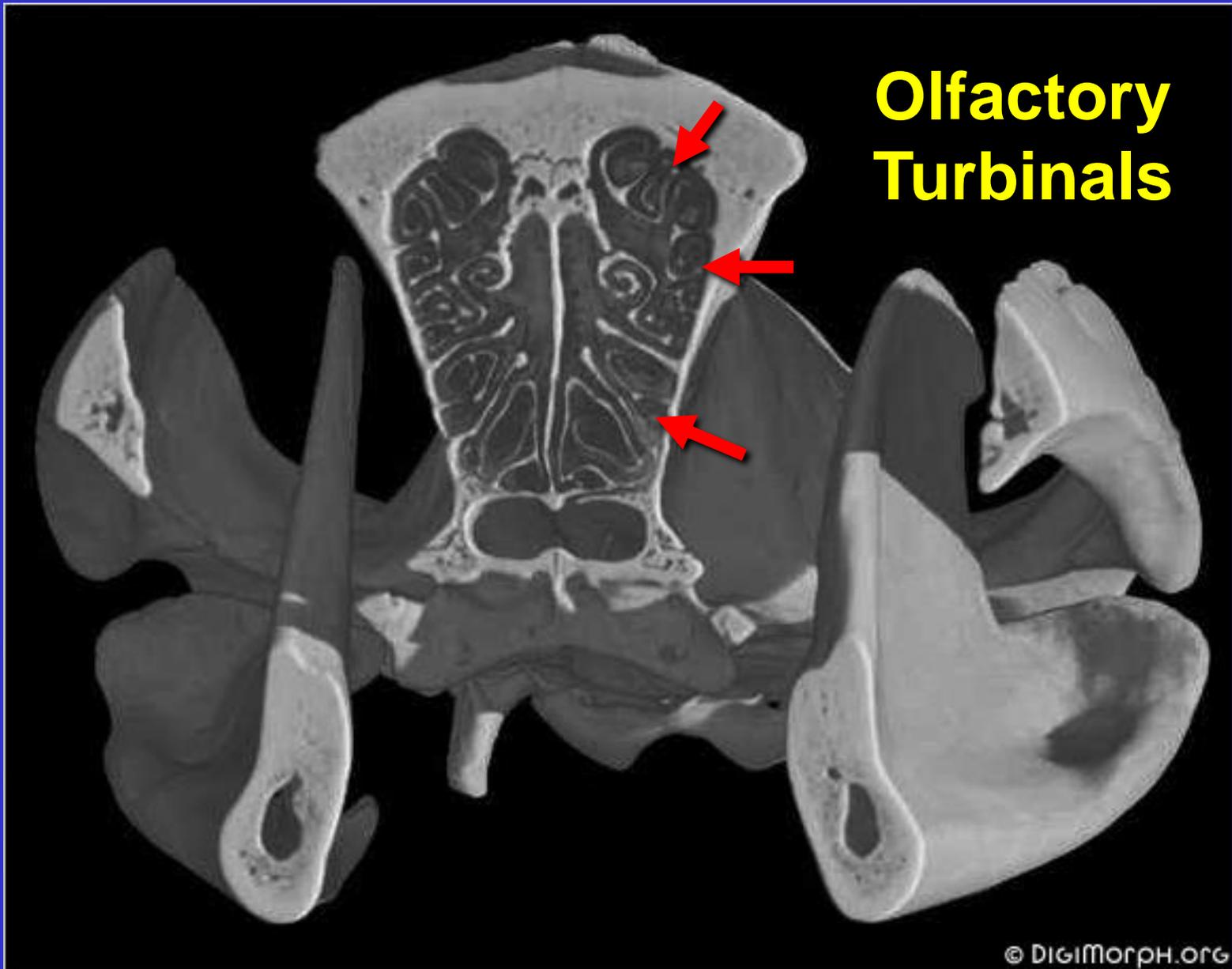


**UT happens to have the premiere micro CT
scanning facility in the world!**



© DIGIMORPH.ORG

Opossum: Typical Mammal

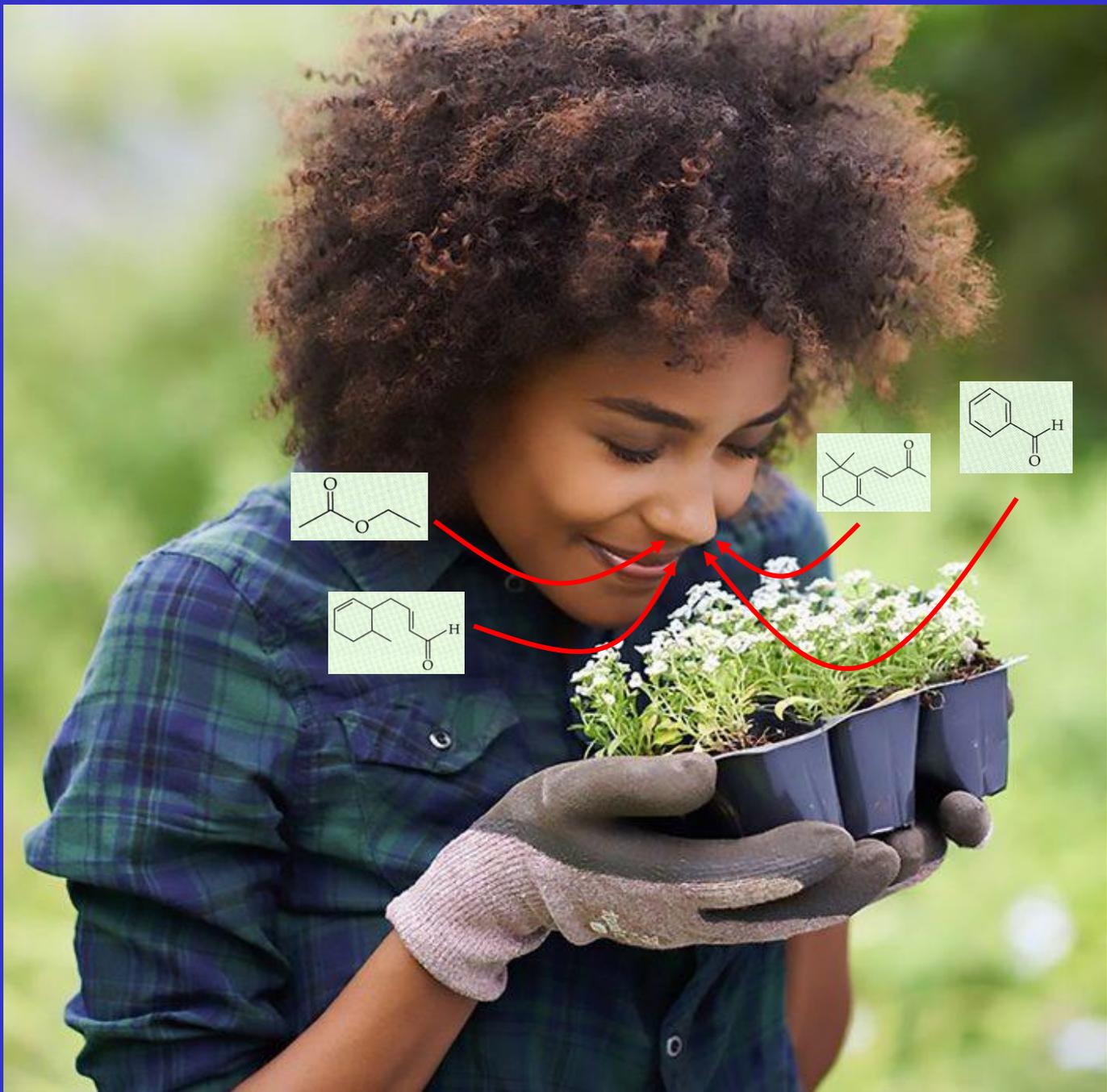


**Olfactory
Turbinals**

Opossum: Typical Mammal



Things that are smelly are shedding chemicals into the air...

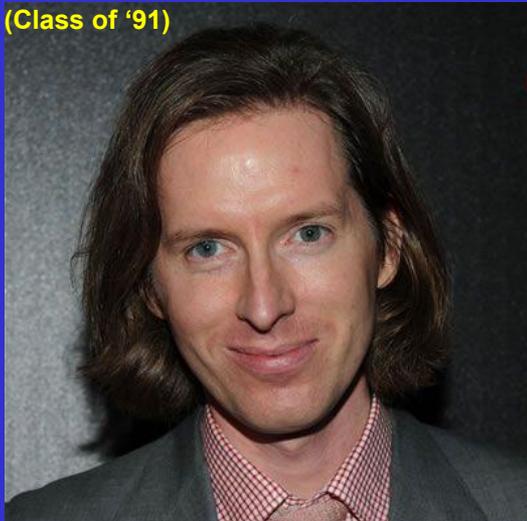


In order to smell them, you have to draw those chemicals into your nasal cavity where they can bind with a specialized mucous membrane

The general rule:

More olfactory turbinals
=
More surface area for smelling stuff
=
Better sense of smell

(Class of '91)



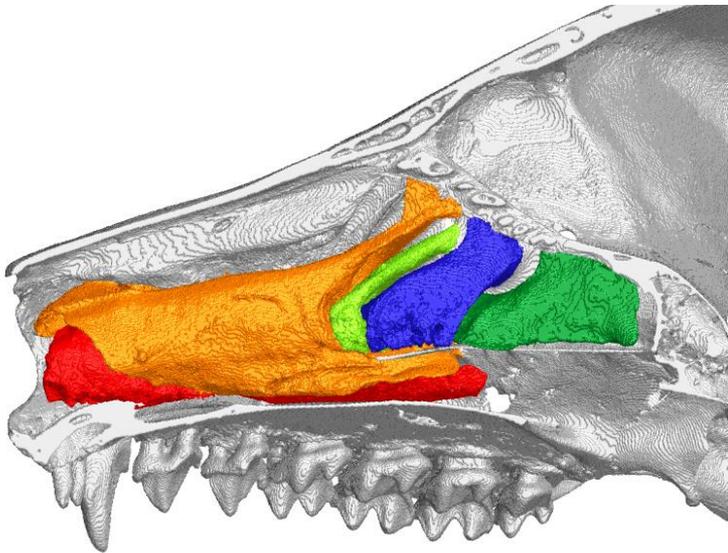
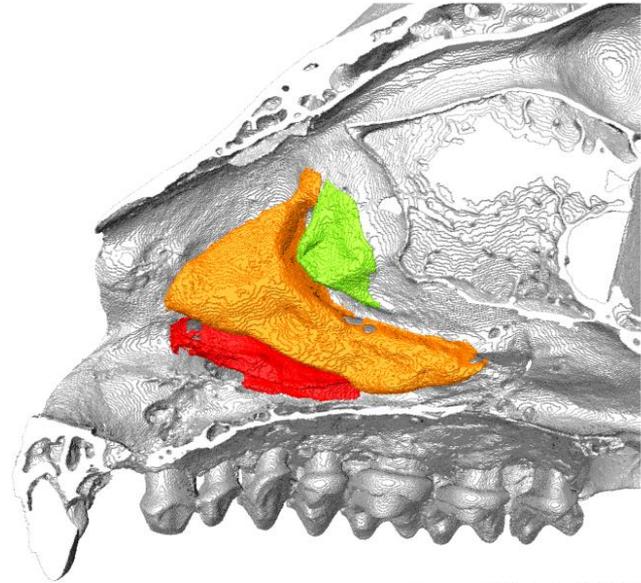
Human: 10 cm²
- 2 olfactory turbinals



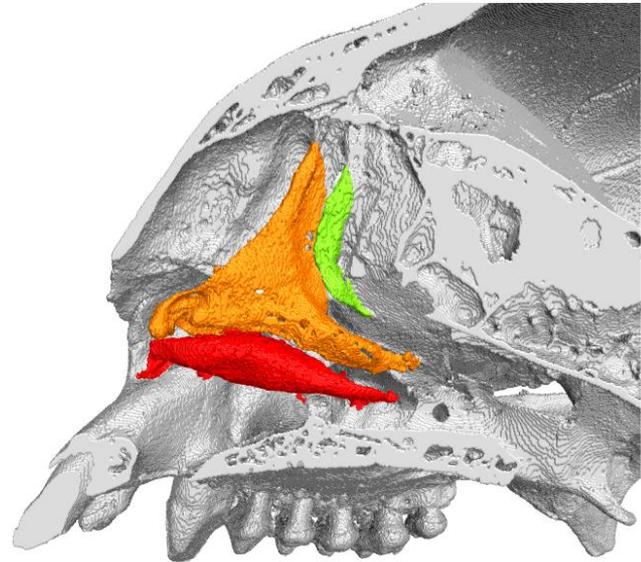
Dog: 160 cm²
- 12-16 olfactory turbinals

**Micro CT images
of primate
turbinals in the
nasal cavity**

Tarsier



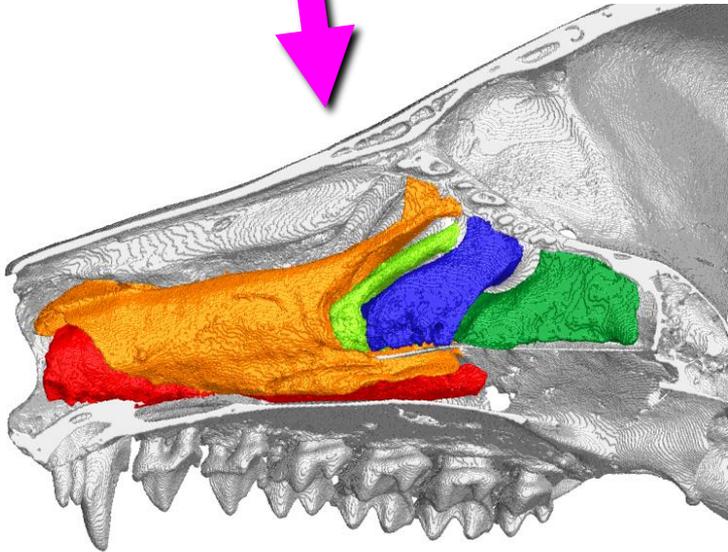
Lemur



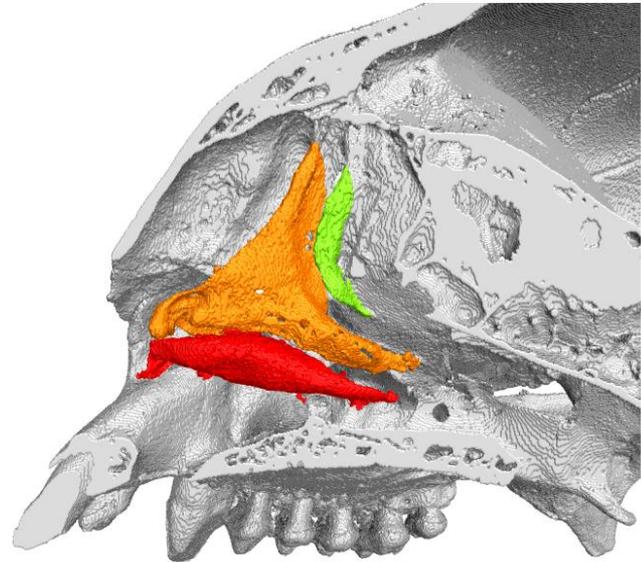
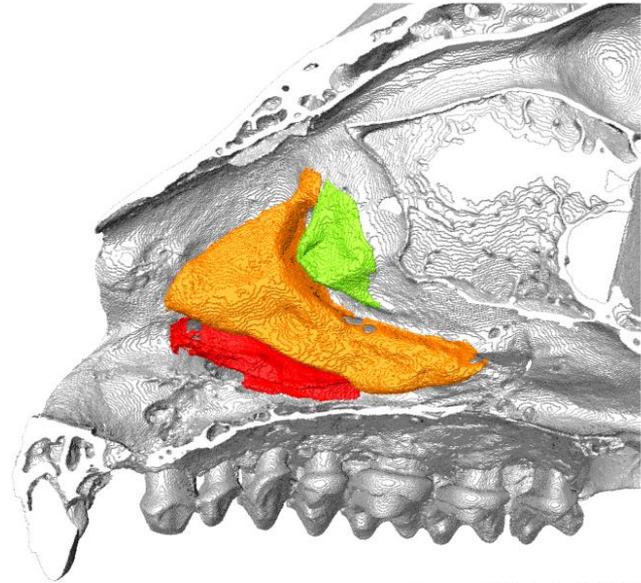
Monkey

Tarsier

Lemur:
Typical Mammal
- Lots of olfactory
turbinals (7-8)



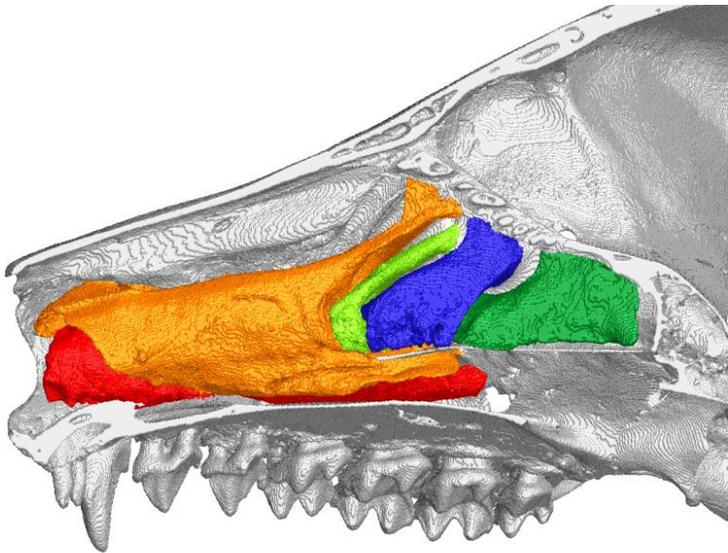
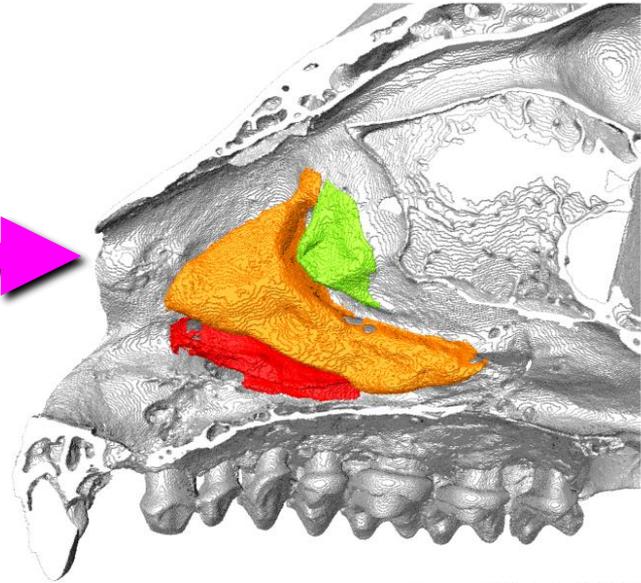
Lemur



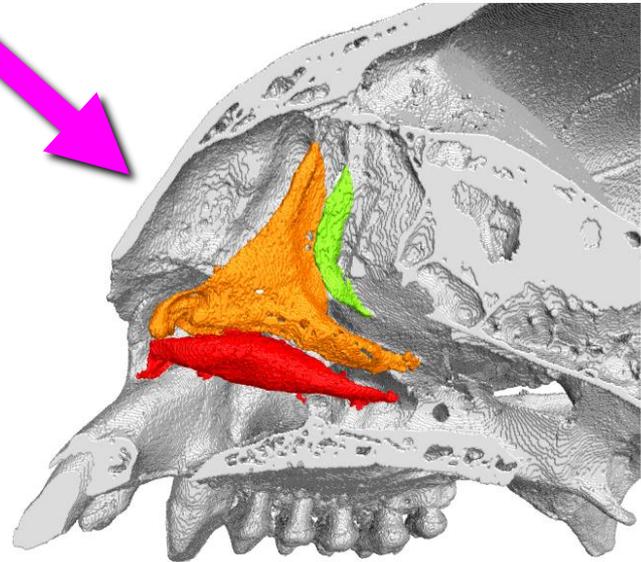
Monkey

Tarsier

**Haplorhines:
Very Unusual
- Only *two*
olfactory turbinals**



Lemur



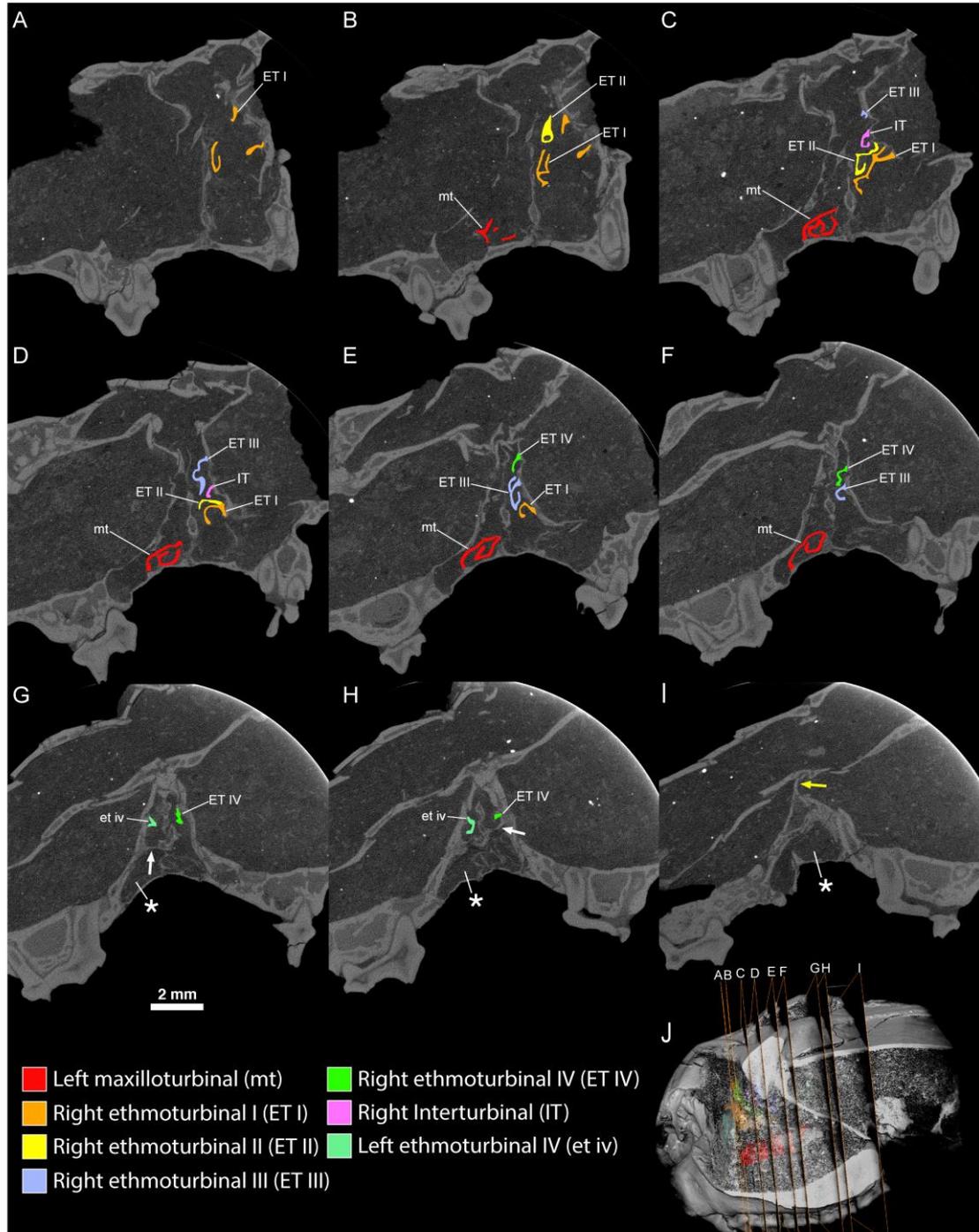
Monkey

Dr. Ingrid Lundeen



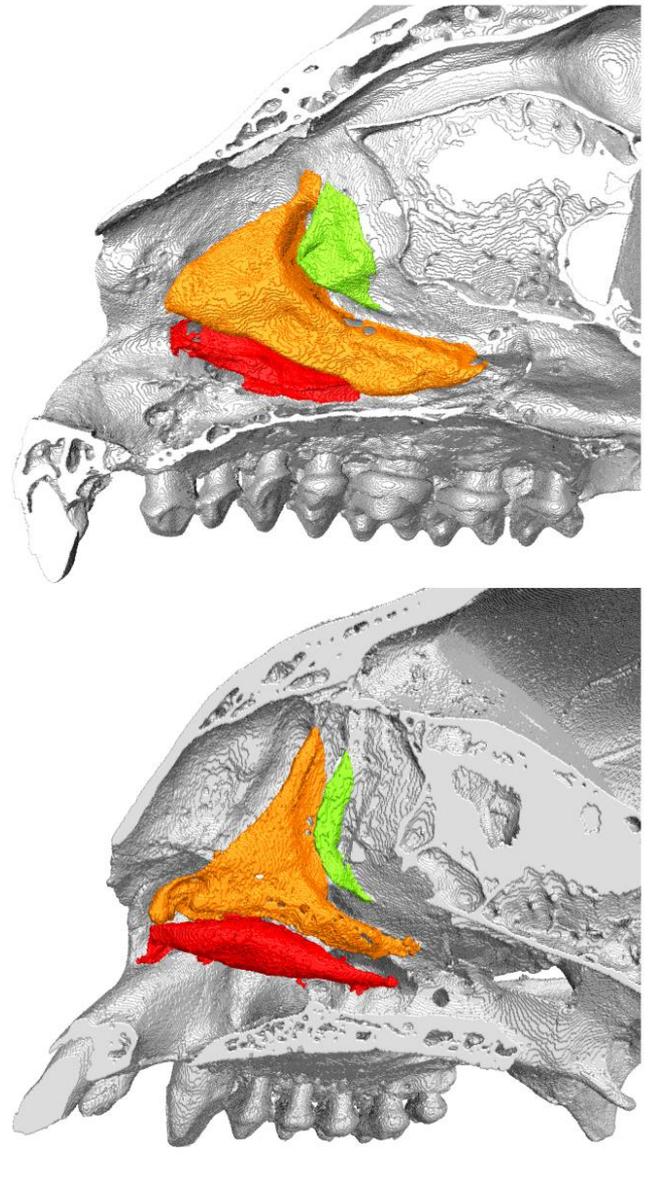
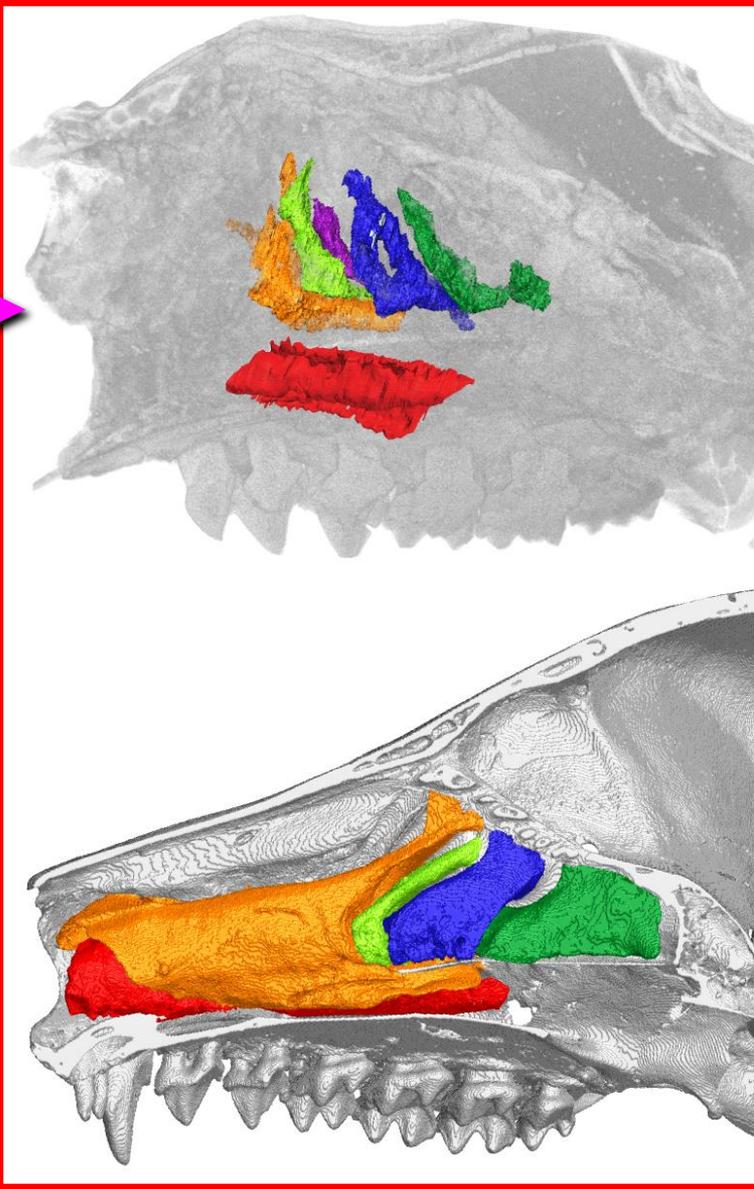
Micro CT scans
from UTCT:

Turbinals of
Shoshonius



Shoshonius: 6 + turbinals

Tarsier



Lemur

Monkey



**More evidence:
tarsiers, monkeys,
apes, & humans have
a visual superpower
that all other
mammals lack...**

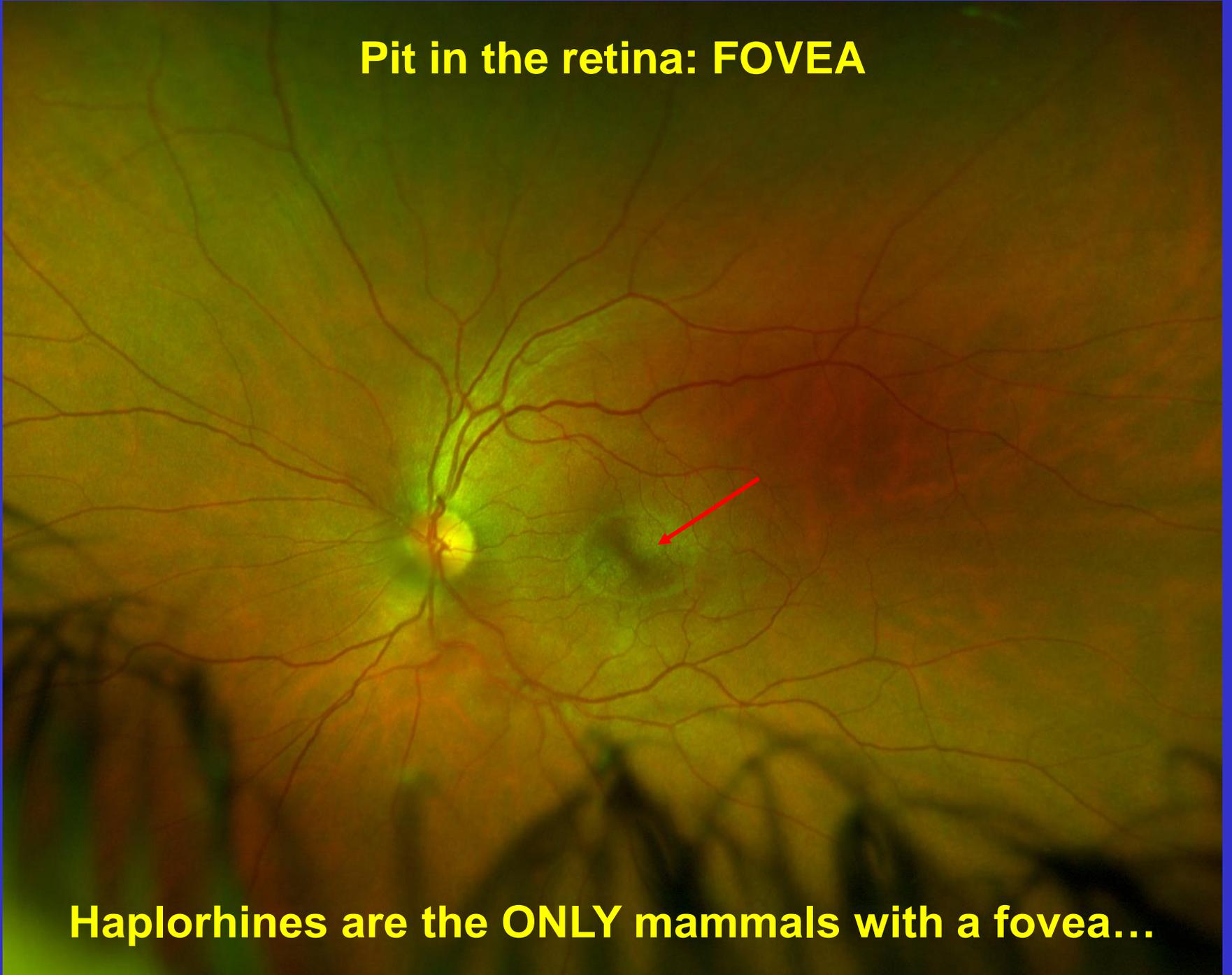


Here's a view of the Retina in the back of my eye



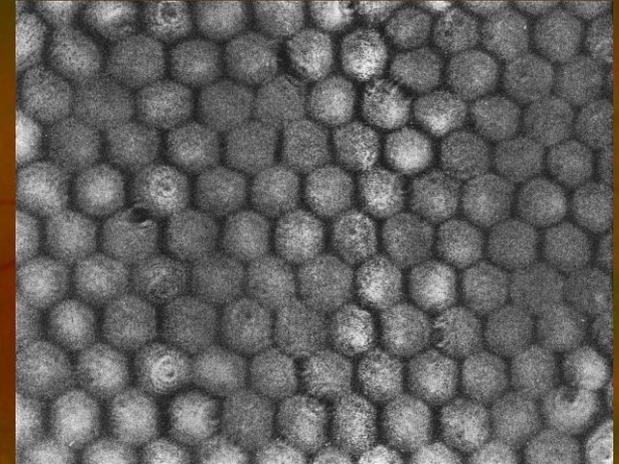
I am a Haplorhine!

Pit in the retina: FOVEA

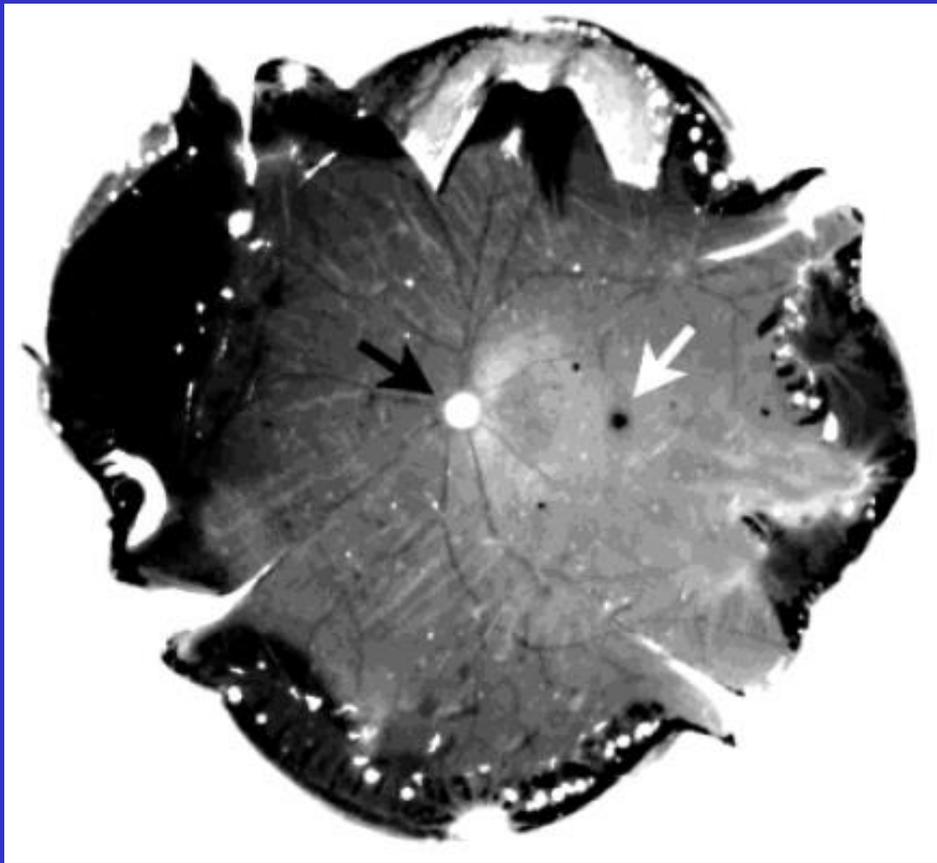


Haplorhines are the **ONLY** mammals with a fovea...

**Inside the fovea: A dense concentration of
visual cells called cones**

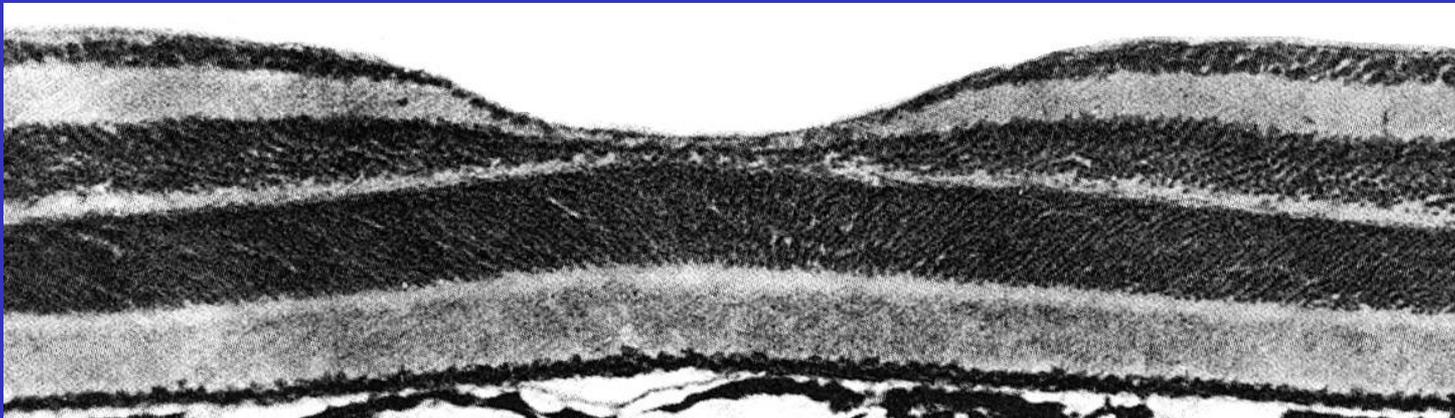


**Gives us exceptional vision for details...
- Very high visual acuity**



**Tarsiers are
extremely weird:**

- Nocturnal, but have a fovea
- Fovea also contains high density of cone cells



As a result, tarsiers have *weirdly* high visual acuity for a nocturnal mammal...



eye 1.8 cm diameter

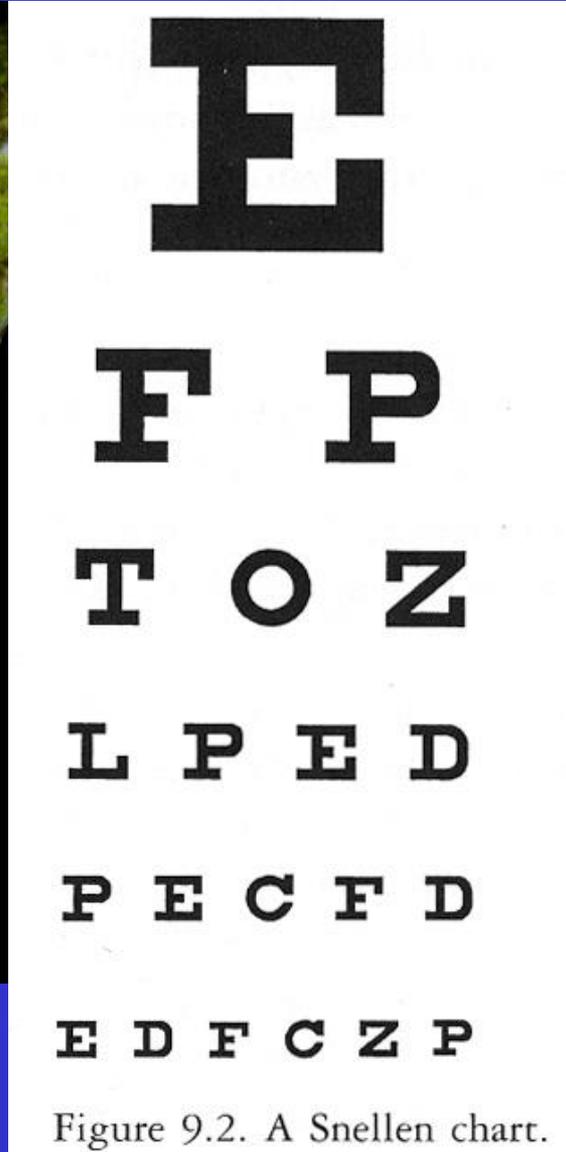


Figure 9.2. A Snellen chart.



eye 4 cm diameter
(~ ping pong ball)

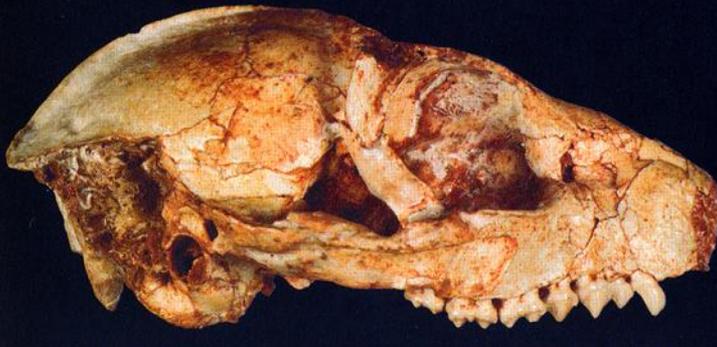
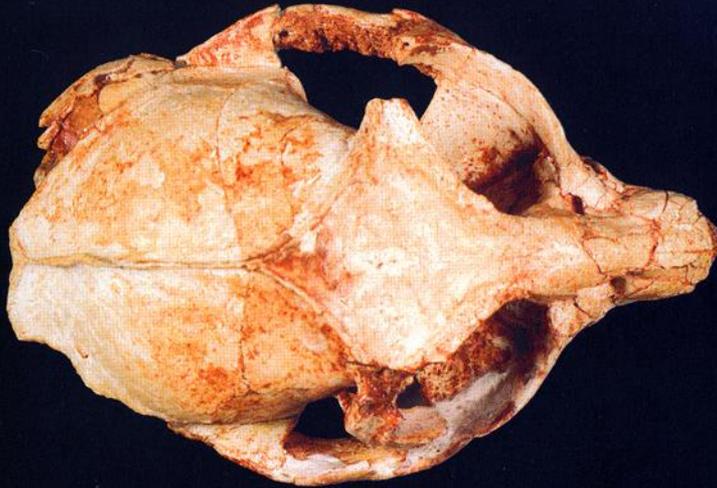
Hold on a tic – you can't measure visual acuity
in a *fossil*, can you?



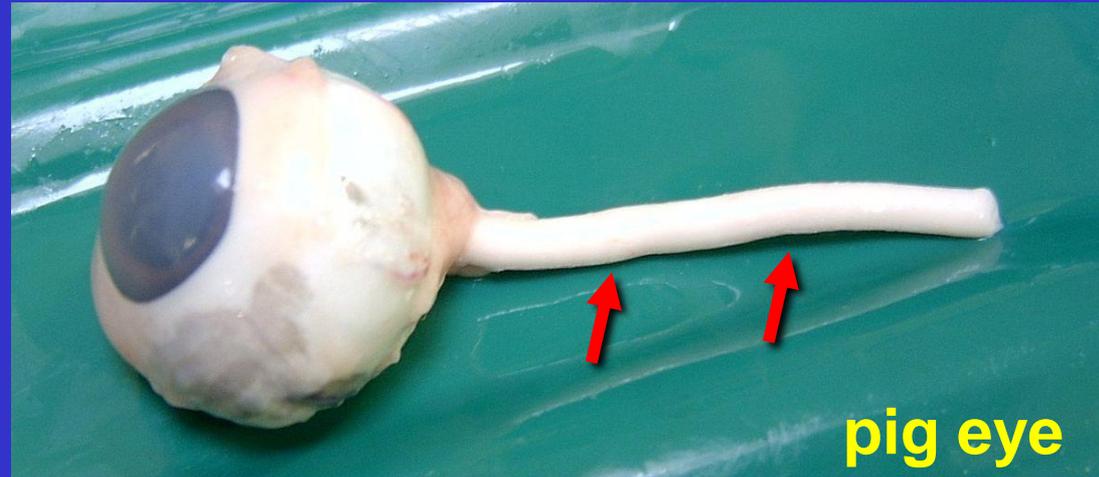
Necrolemur – an omomyoid

Visual cells need to talk to the brain...

- They do this via the optic nerve

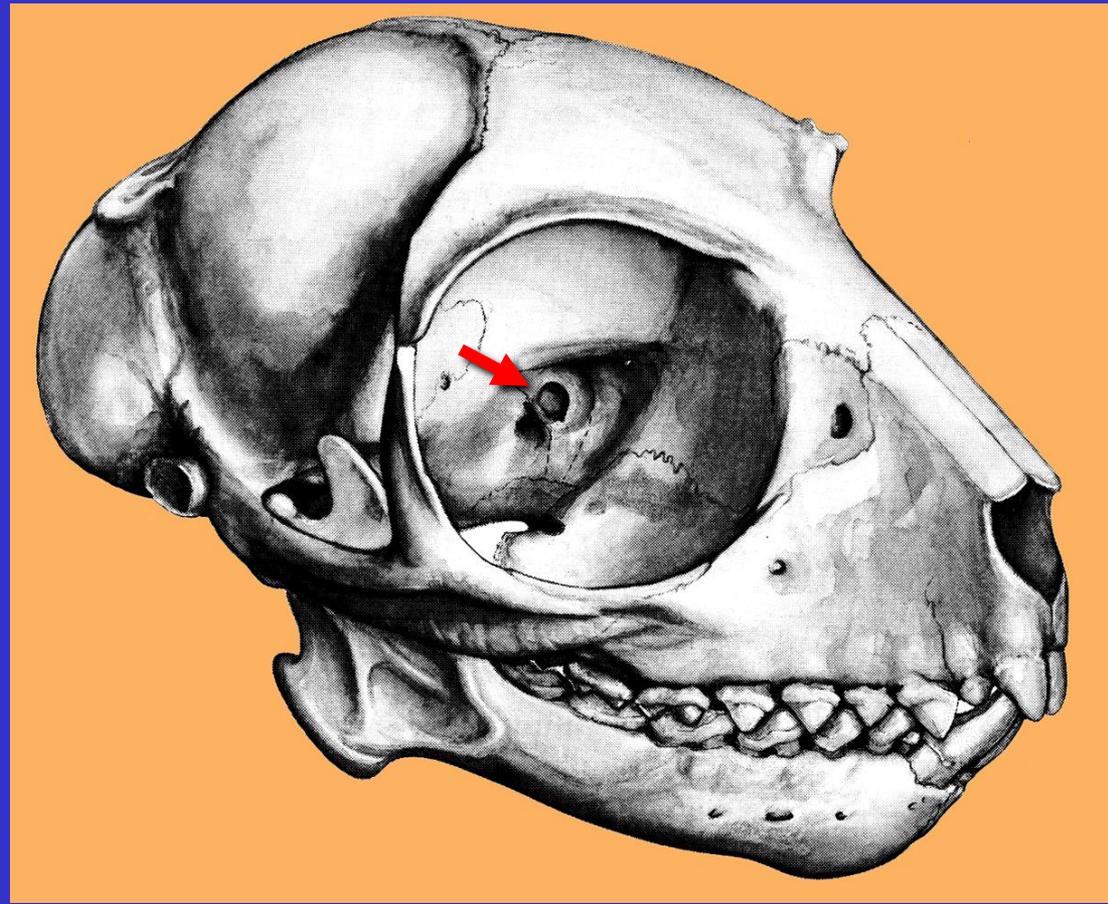


Necrolemur – an omomyoid



**Tarsiers and other
haplorhines have a HUGE
optic nerve...**

So: you can measure the size of the hole in the back of the eye socket (“optic foramen”) that the optic nerve passes through...

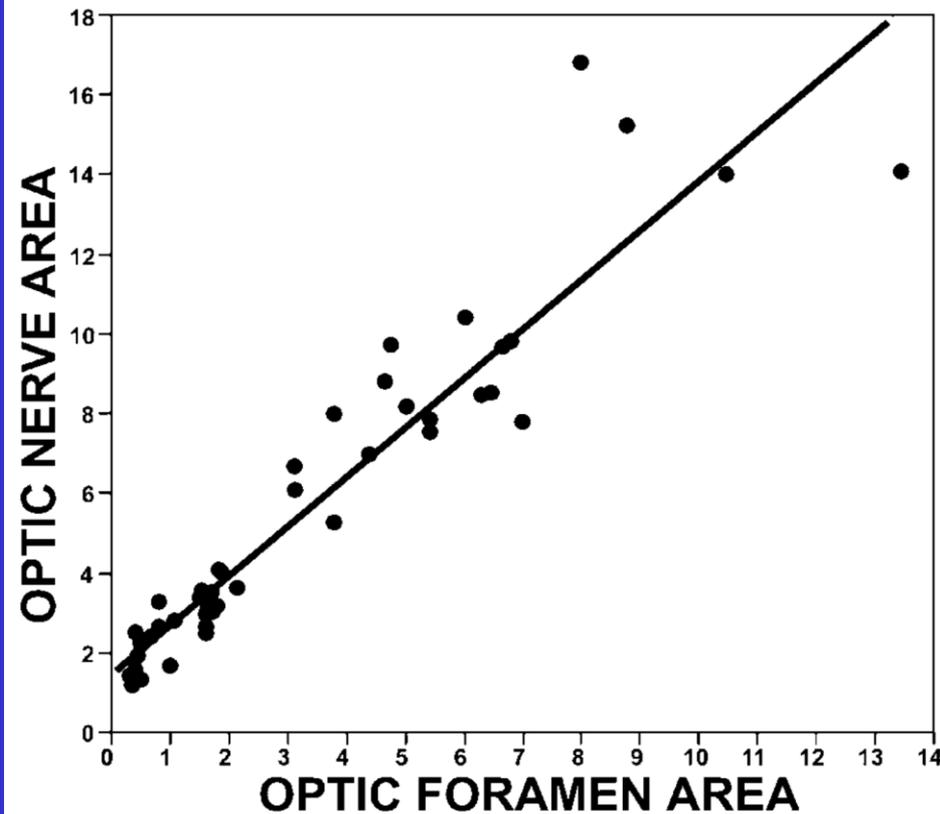


Necrolemur – an omomyoid

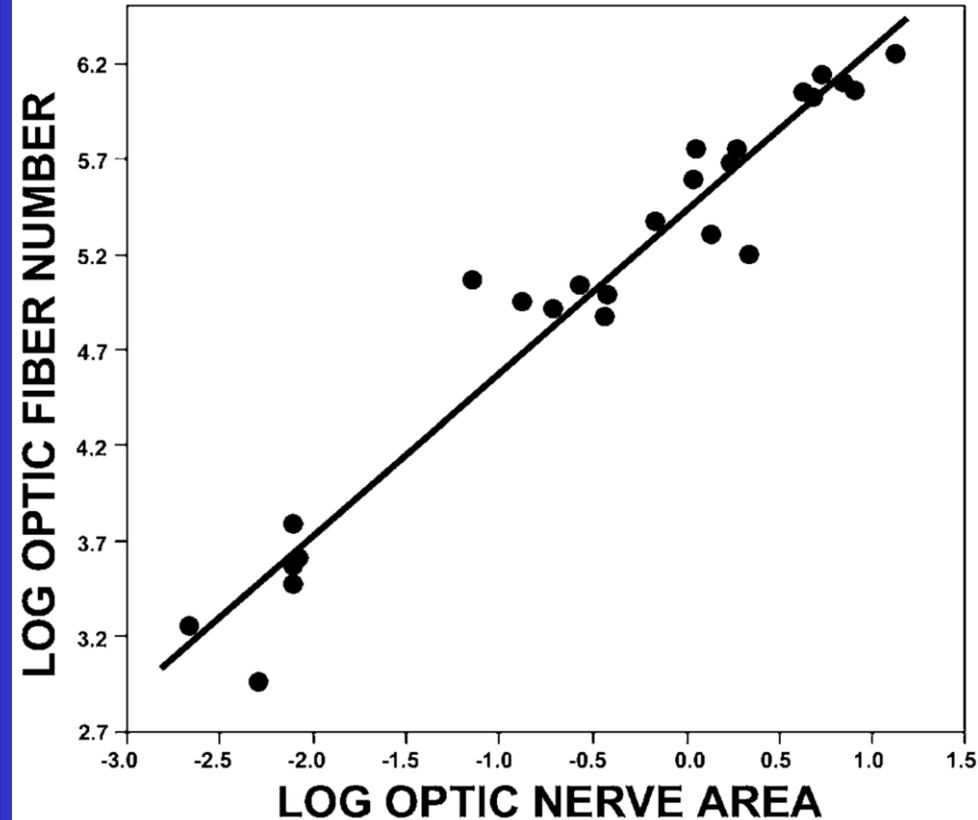
First things first...

Primates with big optic nerves have bigger holes for those nerves

Mammals with big optic nerves are passing more information to the brain

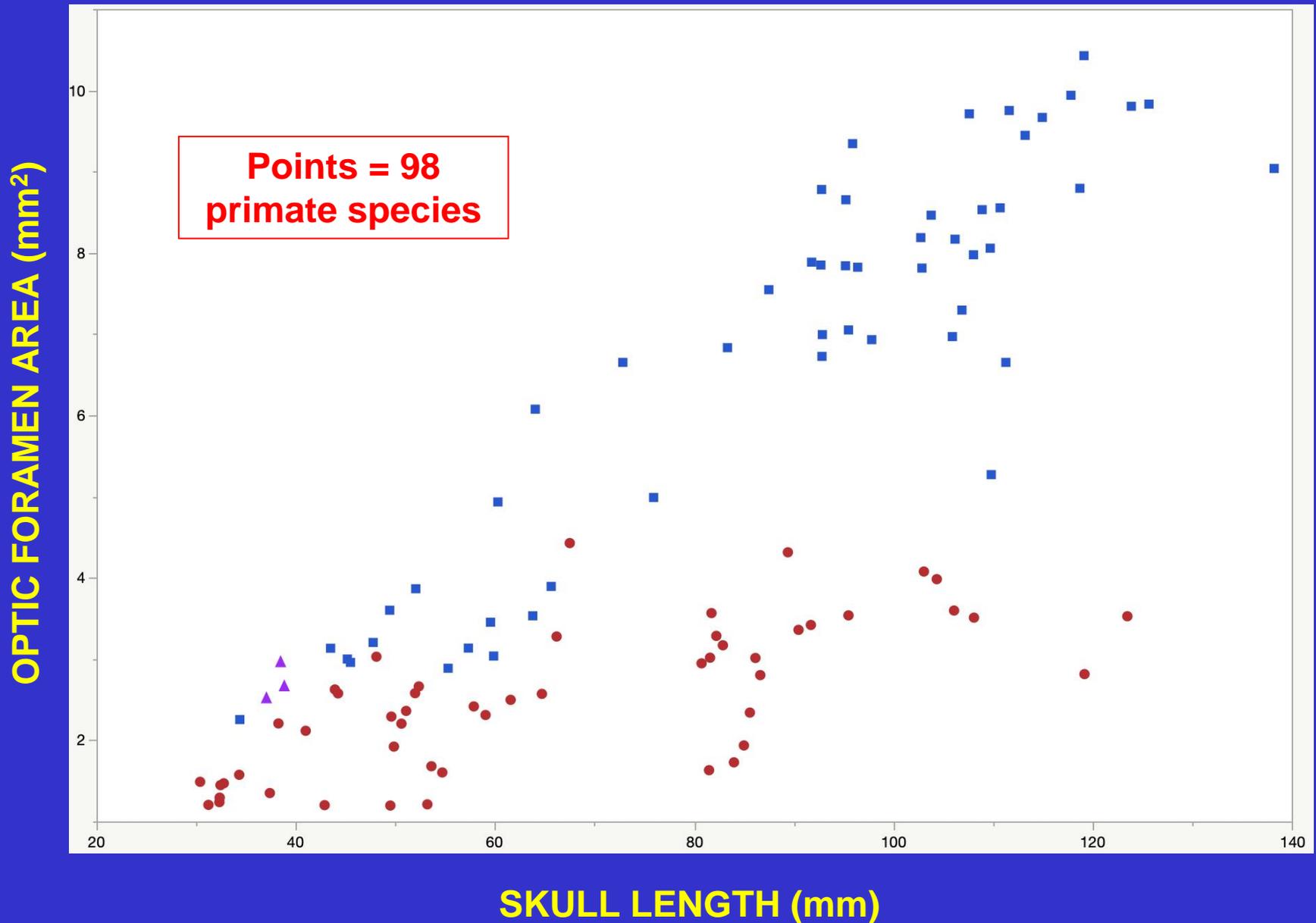


45 Primate Species

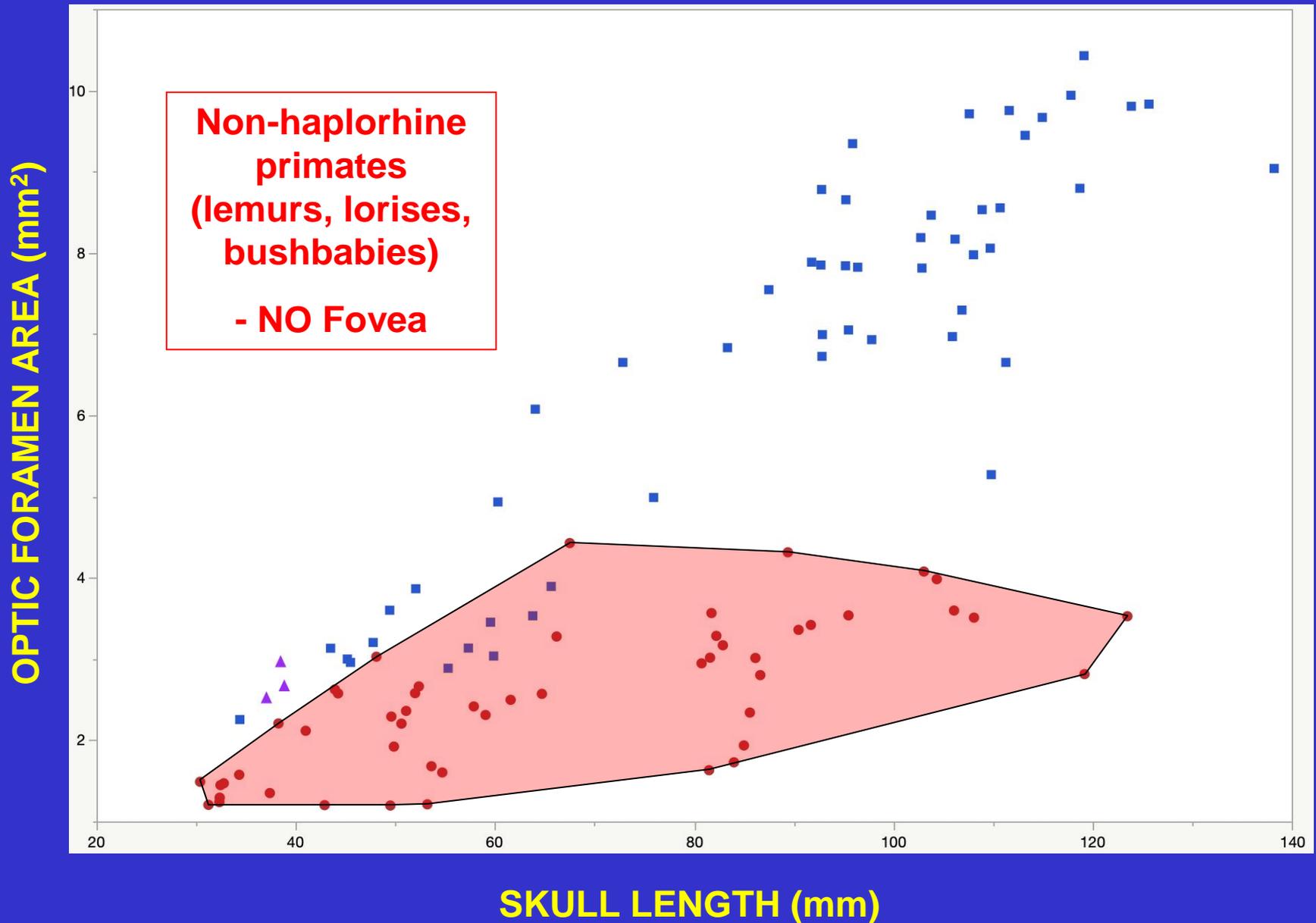


25 Mammal Species

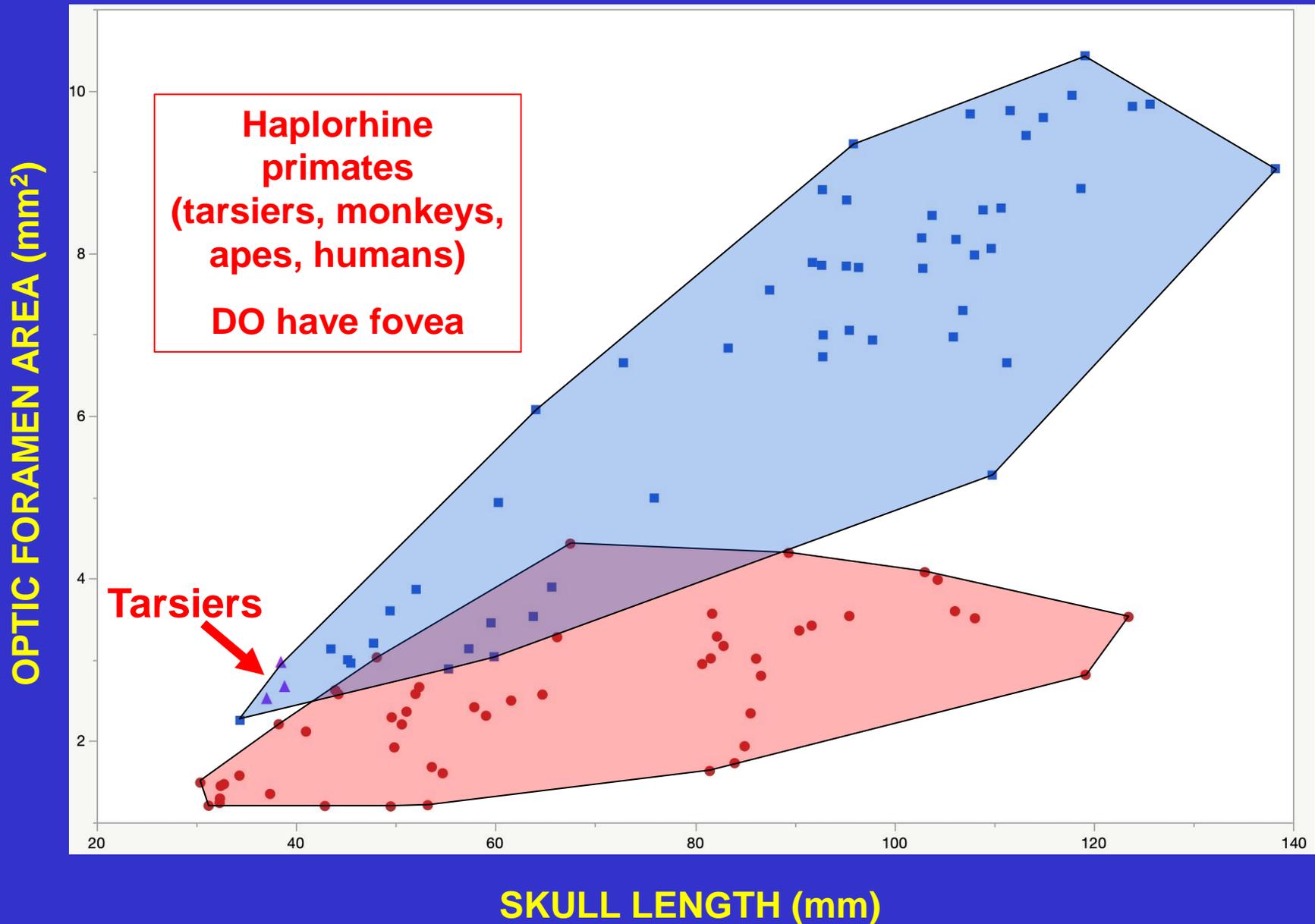
Relative optic foramen size



Relative optic foramen size



Relative optic foramen size



Relative optic foramen size

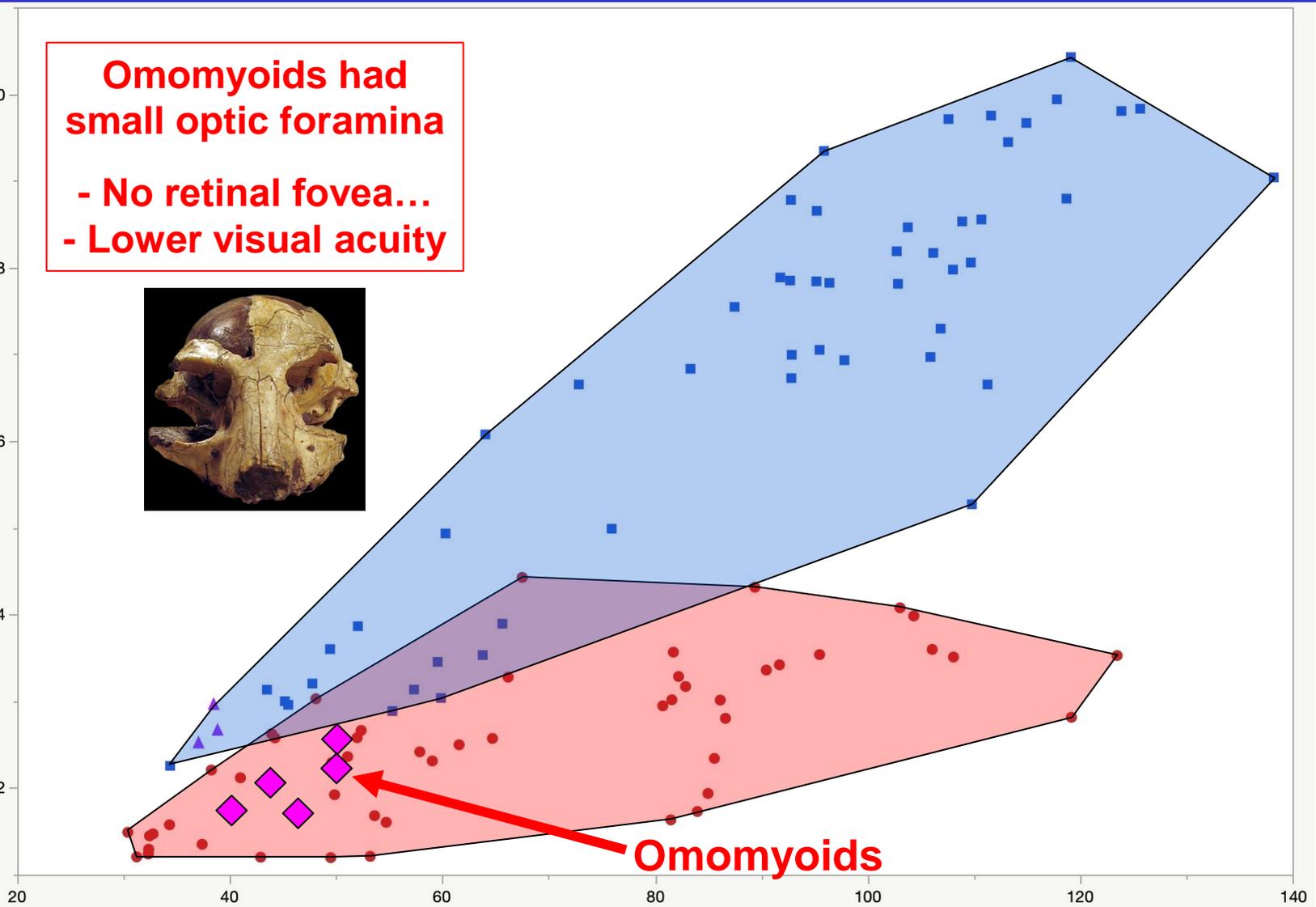
OPTIC FORAMEN AREA (mm²)

Omomyoids had small optic foramina

- No retinal fovea...
- Lower visual acuity

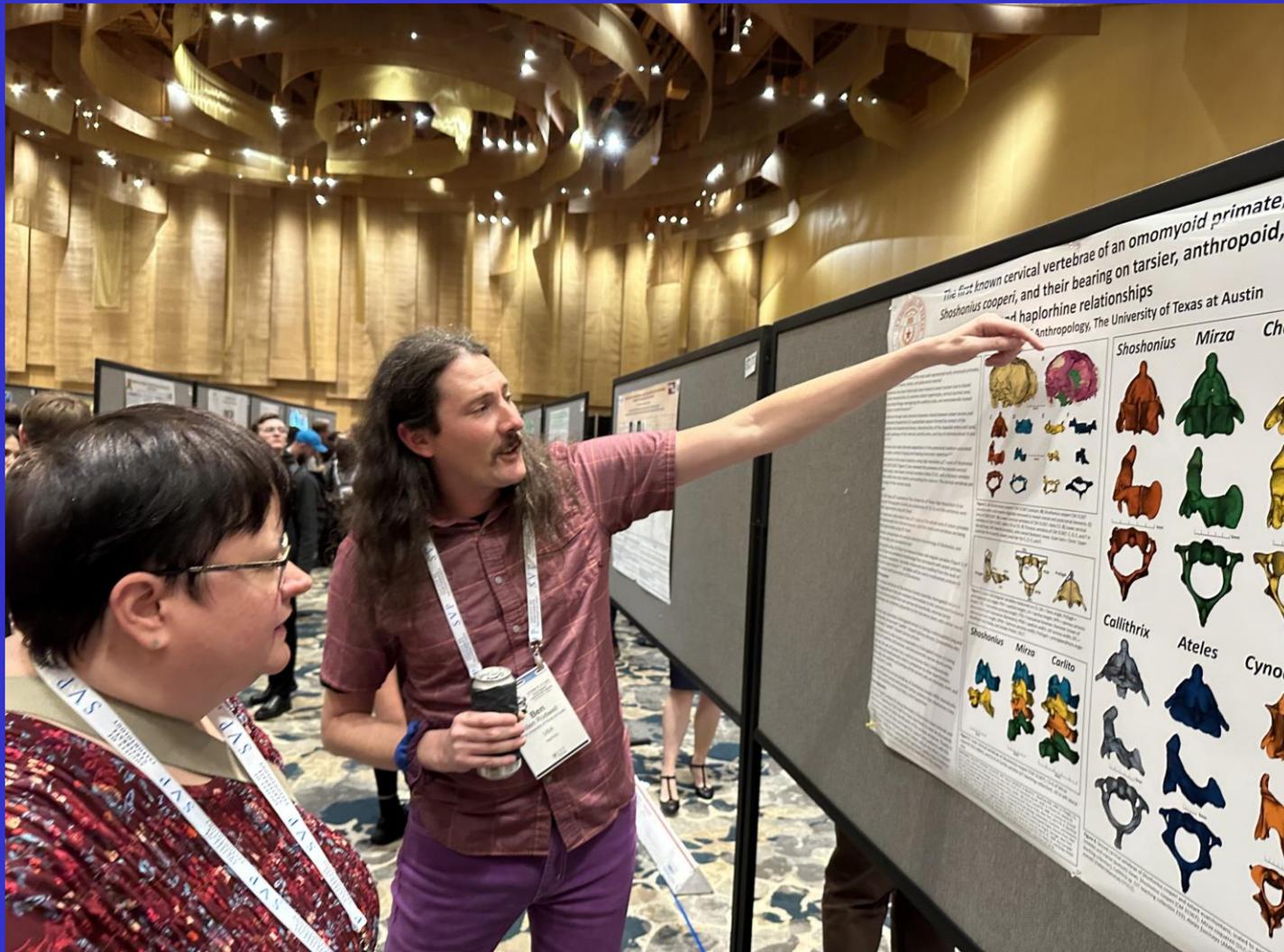


Omomyoids



SKULL LENGTH (mm)

A final piece of evidence – work in progress, courtesy of Ben Rodwell



Tarsiers have an amazing ability to rotate their heads – like an owl!



Tarsiers have an amazing ability to rotate their heads – like an owl!



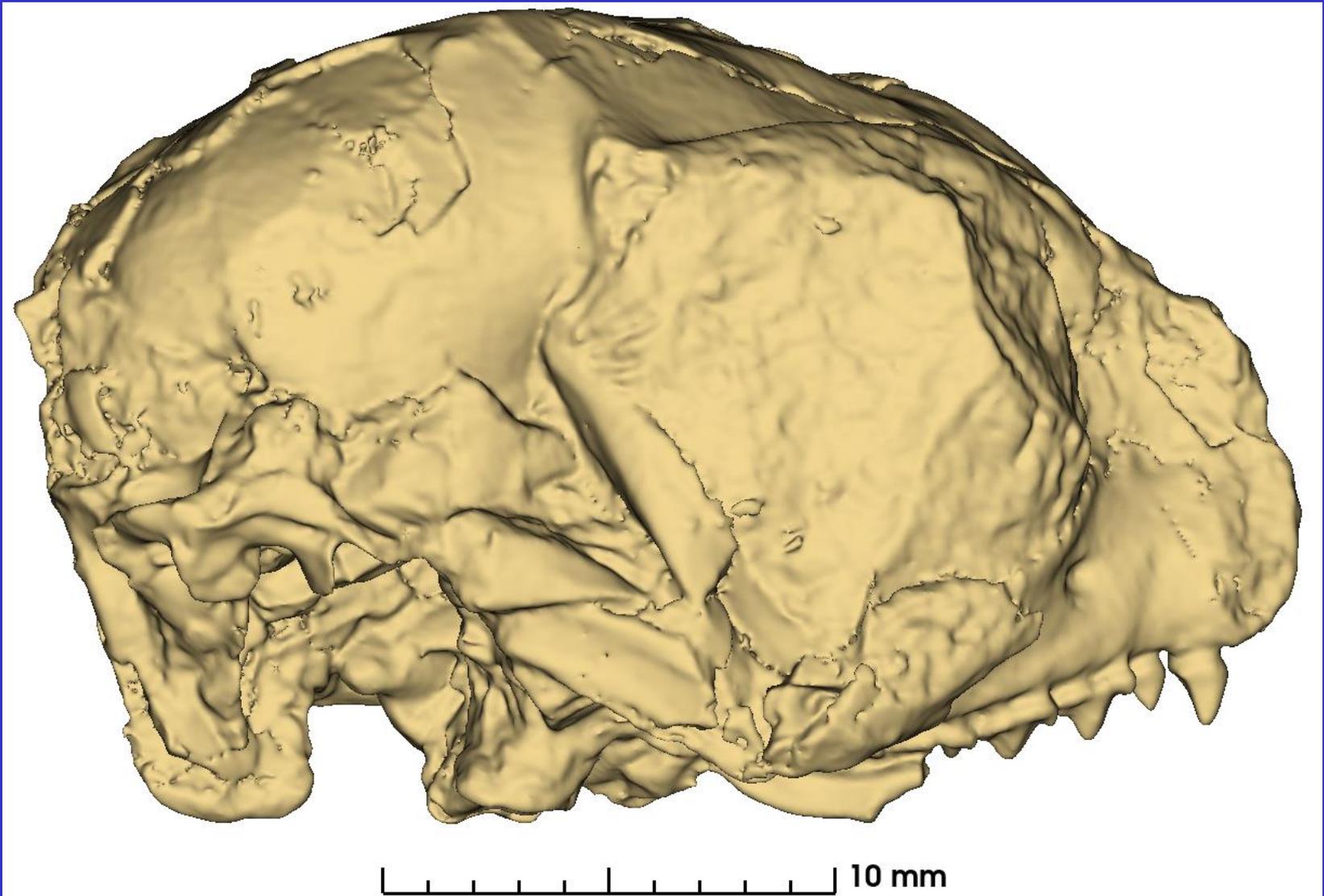
Tarsiers have an amazing ability to rotate their heads – like an owl!



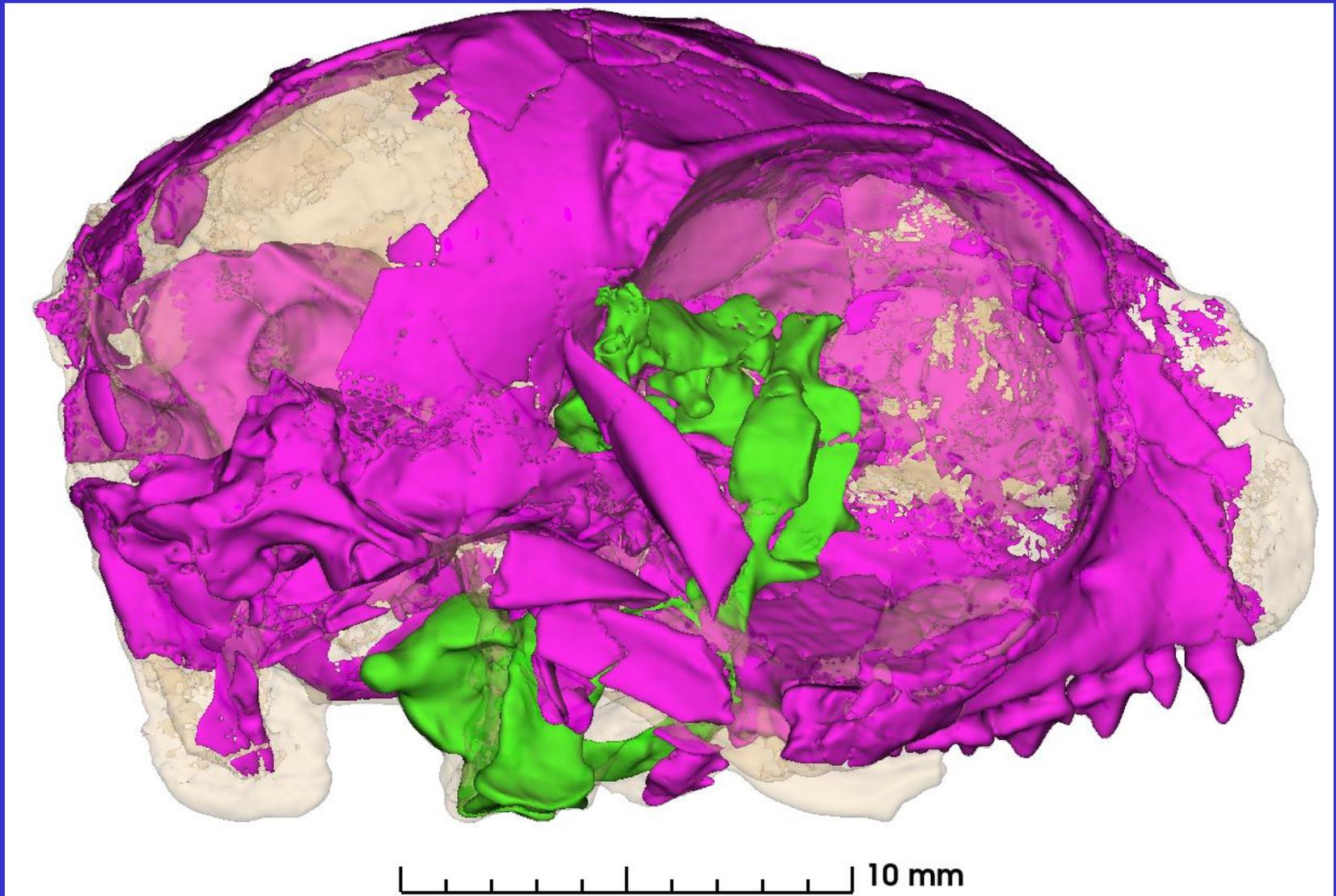
Tarsiers have an amazing ability to rotate their heads – like an owl!



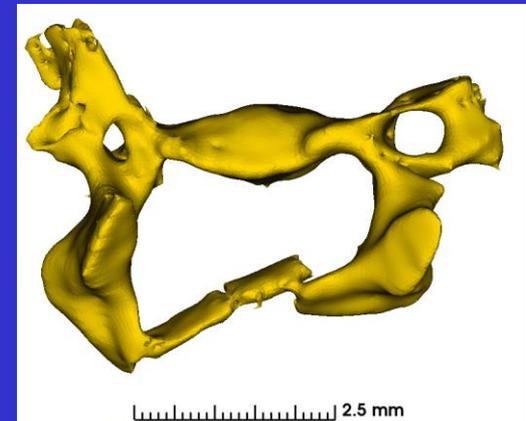
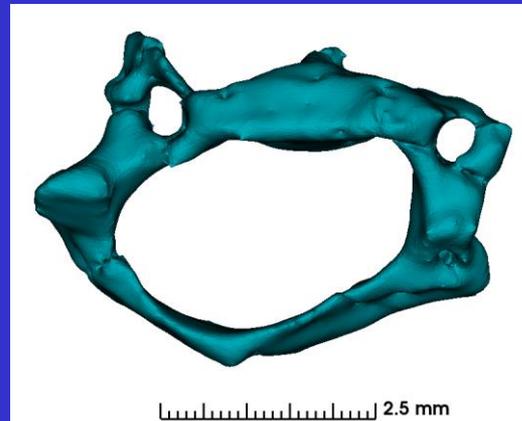
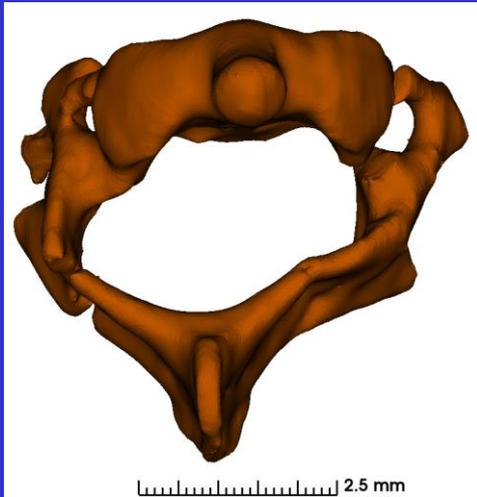
Those micro CT scans of *Shoshonius*
had a surprise hiding in the “matrix”...



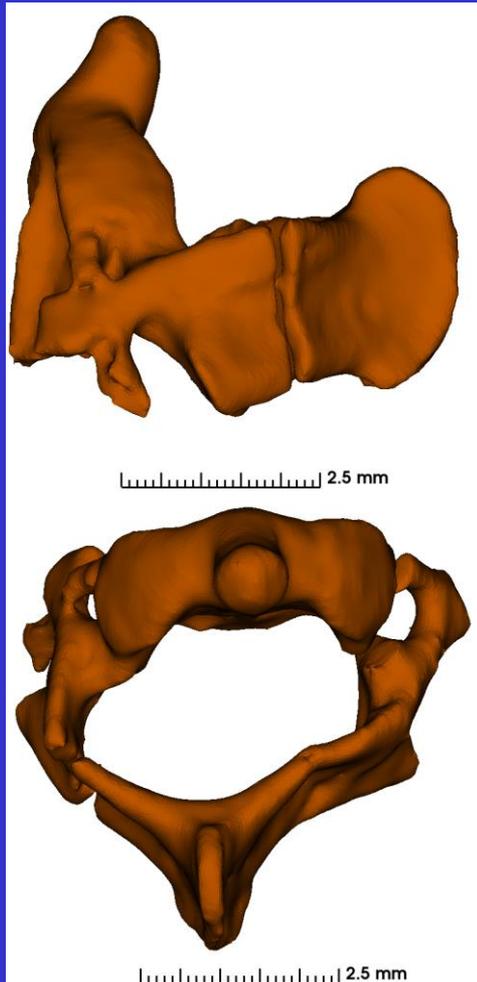
Those micro CT scans of *Shoshonius* had a surprise hiding in the “matrix”...



The first omomyoid neck vertebrae ever discovered...

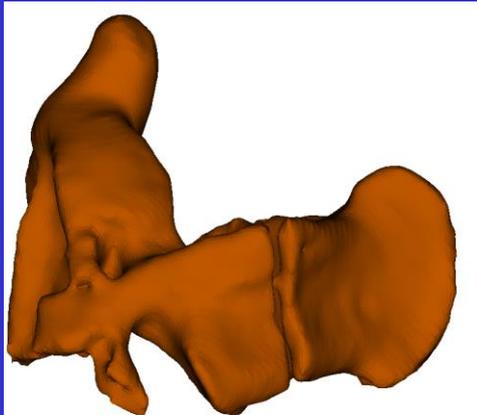


This is the axis (C2) of *Shoshonius* – one of the key neck vertebrae involved in head rotations

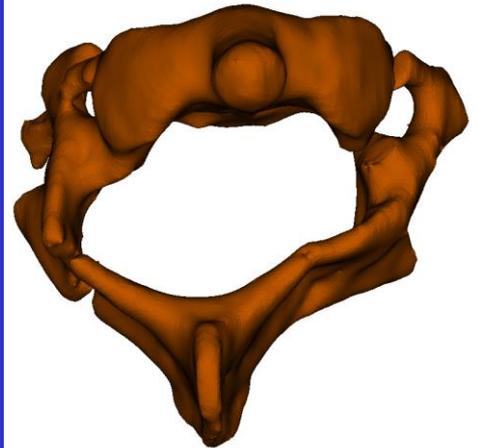


Shoshonius

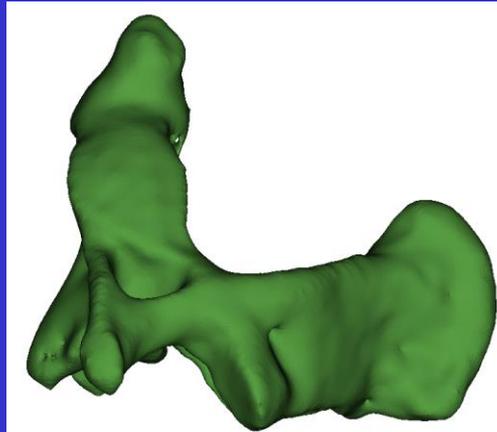
***Shoshonius* did NOT have ability to rotate its head like a tarsier...**



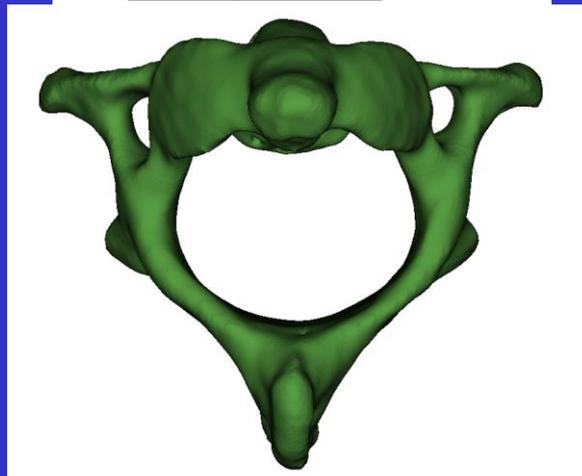
2.5 mm



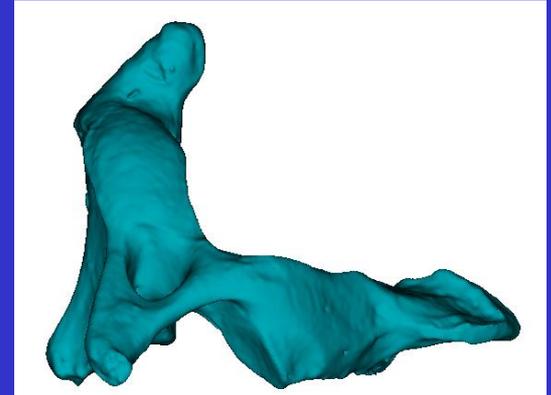
2.5 mm



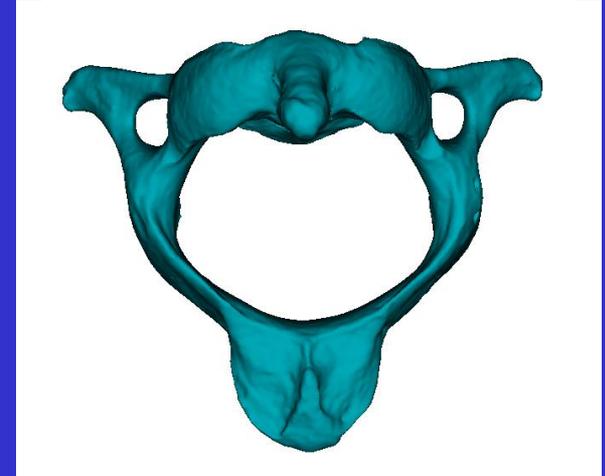
5 mm



5 mm



5 mm



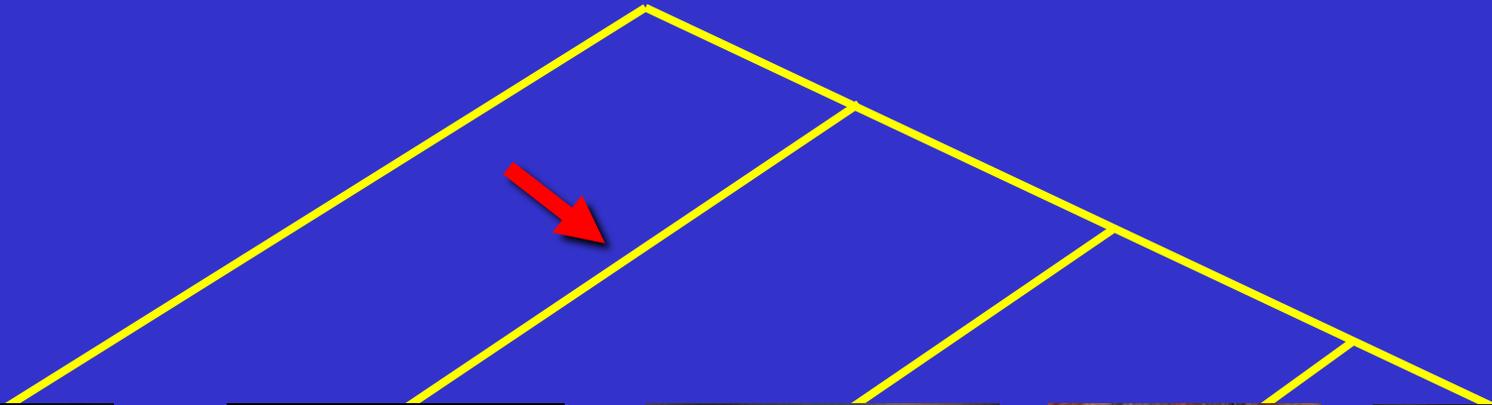
5 mm

Shoshonius

Dwarf Lemur

Tarsier

All of these lines of anatomical evidence favor this relationship to haplorhines



Lemurs & Lorises



Omomyoids



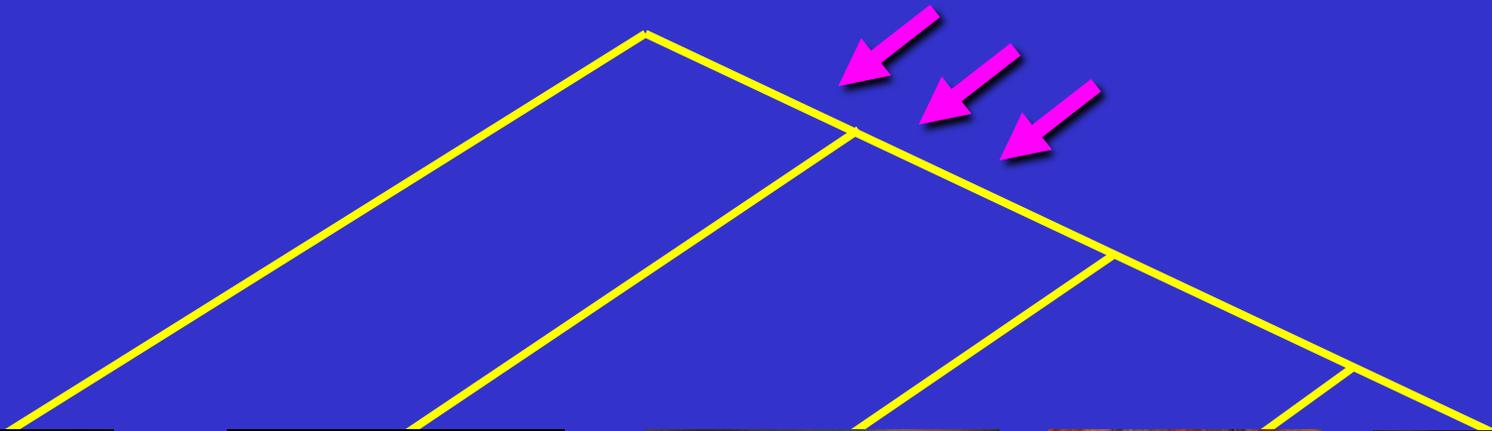
Tarsiers



Monkeys, Apes, Humans



Means that at some point in our distant evolutionary past:



Lemurs & Lorises



Omomyoids



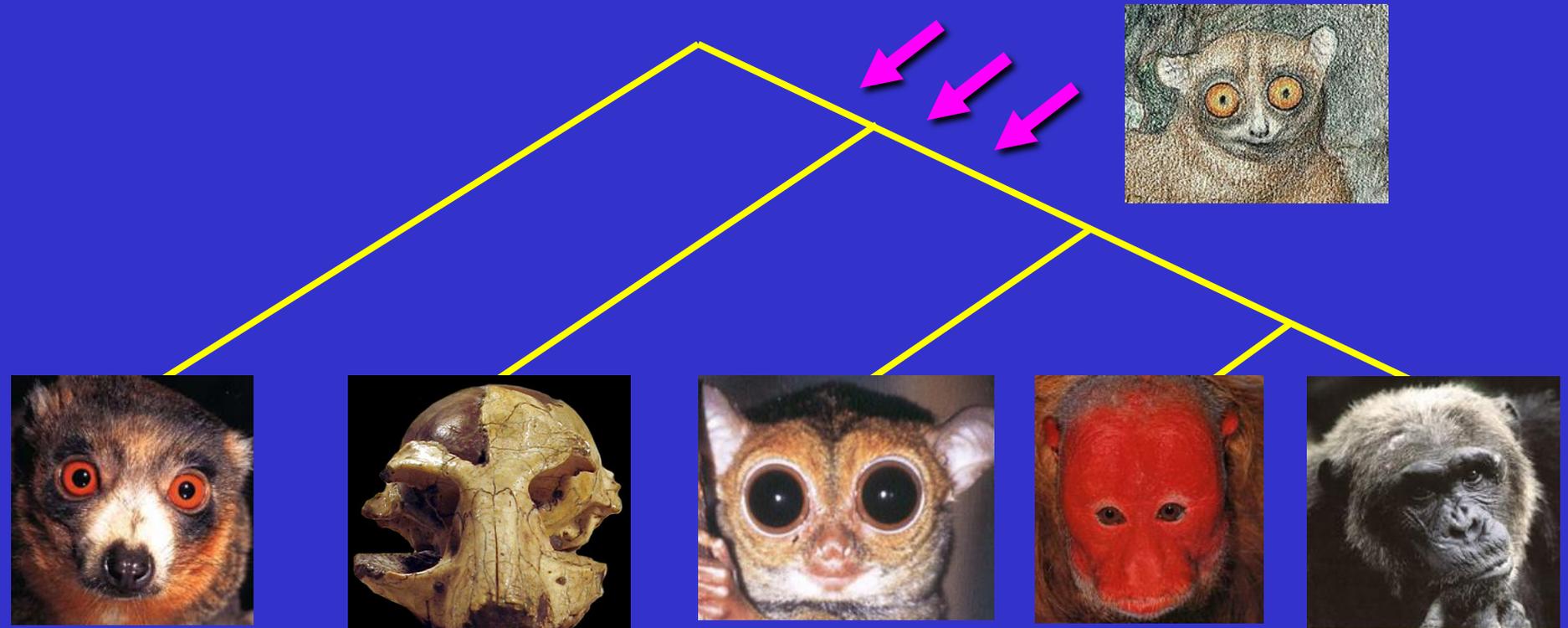
Tarsiers



Monkeys, Apes, Humans



Means that at some point in our distant evolutionary past:



Lemurs & Lorises

Omomyoids

Tarsiers

Monkeys, Apes, Humans

There were probably nocturnal bug eaters!



Take-home messages:

1. If you're an insect, consider somewhere other than Sulawesi for a tropical vacation
2. Tarsiers are superlative in nearly every aspect of their anatomy
3. Tarsiers are have been around for a loooooong time (at least 45 million years)
4. Omomyoids probably *weren't* fossil tarsiers
5. That's OK because they shed light on the earliest stages of haplorhine evolution

Special Thanks To:

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