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DATA Nugget

Reconstructing the behaviour of ancient animals

Featured scientist: Holly E. Anderson (she/her) from Warsaw University, Poland
Collaborating scientists: Mary Silcox, Sergi López-Torres, Ingrid Lundeen, & Adam Lis

Research Background:

Fossils are the ancient remains of organisms that existed thousands to millions of years ago. Scientists look through fossil records to learn about the lives of animals and plants that are extinct today. Fossils can hold clues about the environment, how species interacted with each other, what they ate, and even how they acted.


Holly looking for fossils with her dad when she was young.

Holly found her first fossil at 6 years old when she visited a beach in the United Kingdom. It was a small piece of ancient coral. She thought it was amazing to see a remnant of how something looked over 350 million years ago! Holly loved that fossils allowed her to time travel and explore ancient worlds. She pursued her passion and today is a **paleobiologist**, or scientist who uses the fossil record to learn more about the biology of past organisms. This career has given her the opportunity to study thousands of fossils from many species, from dinosaurs to ancient humans. She has traveled all over the world, including Europe, North America, Asia, and Australia!

Holly specializes in using fossils to paint a picture of the lifestyles of ancient animals. She uses the shape, structure, damage patterns, and burial poses of bones, and compares them to modern bones. By using what we know about living species, Holly can reconstruct the life and death of ancient organisms.

Recently, Holly teamed up with Mary, Sergi, Ingrid and Adam, because they were all scientists curious about the same species – an extinct primate called ***Mioeuoticus*** (phonetic: my-o-you-otikus). This animal is believed to be a relative of modern lorises. Lorises that are alive today live in the treetops of tropical forests in India, Sri Lanka, and southeast Asia. Lorises move very slowly and are **nocturnal**, which means they are typically active at night.

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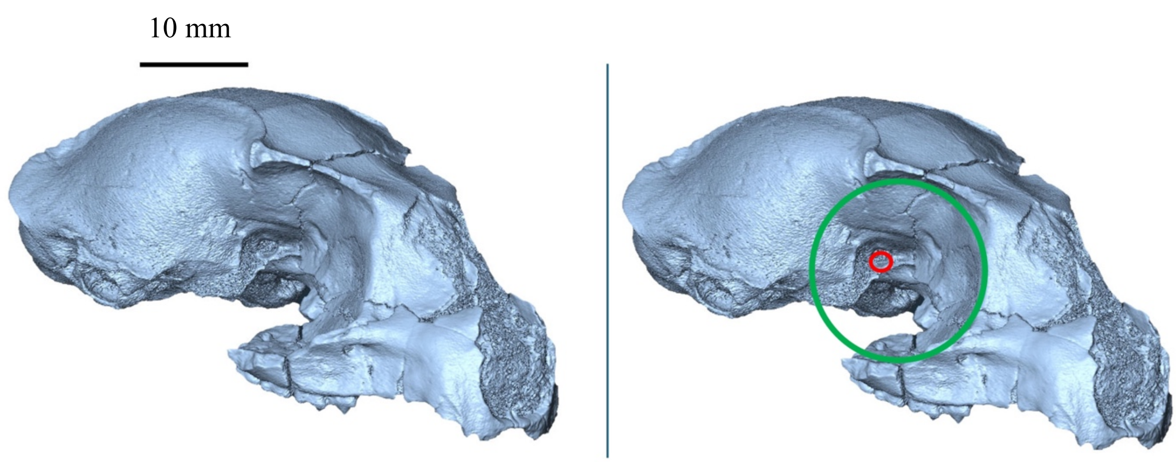
A modern loris species - *Perodicticus potto.*

The skull of *Perodicticus potto.*

Holly and her colleagues wanted to know whether *Mioeuoticus* were nocturnal like their loris relatives. By reconstructing the behaviors of related species through time, the team can map out whether the ancestors of modern species behaved the same way since their origin.

There are a few traits from an animal's skull that can serve as clues. For example, nocturnal animals typically have larger eyes to increase their ability to see at night. Therefore, animals that have proportionally larger **orbital cavities**, or eye sockets, are likely to be nocturnal.

There is only one *Mioeuoticus* skull in the whole fossil record! To answer their question, the research team first measured the orbital cavities of the fossil. They used a computer software program designed to precisely measure 3-dimensional scans of bones. Using this technology, Holly obtained the diameter and area of the *Mioeuoticus* orbital cavities.



Left) CT scan of *Mioeuoticus* cranium. Right) The same cranium with the optic foramen (through which the optic nerve connects the eye to the brain) is highlighted in red and the orbital cavity is highlighted in green.

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They then had to compare the fossil values to values of modern species that are alive today. To do this, the team looked through published data collected by other scientists. They found values for the same features in nocturnal lorises and other primate groups. They compared the value from their fossils to three primate groups:

- **diurnal** - active during the day
- **cathemeral** - active during both the day and night
- **nocturnal** – active at night.

In order to compare primates with different body sizes, the team used an index that looks at **relative orbital size**. This index uses an equation to scale the orbital measurements relative to body size. If *Mioeuoticus* were nocturnal, Holly predicted the relative orbital size to be similar to the strepsirrhines that have been observed to be nocturnal because this group includes the closest living relative, the lorises.

<u>Scientific Question</u>: Does the fossil record show evidence that the extinct *Mioeuoticus* was nocturnal?

<u>What is the hypothesis?</u> Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies.

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Scientific Data:

Use the data below to answer the scientific question:

Primate Group	Lifestyle	Number of specimens	Average relatve orbital size	Minimum relative orbital size	Maximum relative orbital size
Mioeuoticus	?	1	16.9	16.9	16.9
Haplorhines	Diurnal	53	176.8	79.4	282.4
Haplorhines	Nocturnal	1	-64.1	-64.1	-64.1
Strepsirrhines	Diurnal	6	29.2	16.4	38.6
Strepsirrhines	Nocturnal	26	2.3	-33.9	59.8
Strepsirrhines	Cathemeral	4	16.7	-3.5	32.0

Note: Primates are divided into two groups.

- Haplorhines are ‘dry-nosed’ primates that include tarsiers, monkeys, and apes.
- Strepsirrhines are ‘wet-nosed’ primates that include lemurs, **lorises,** pottos, and galagos.

What data will you graph to answer the question?

Independent variable(s): ____

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Dependent variable(s): ____

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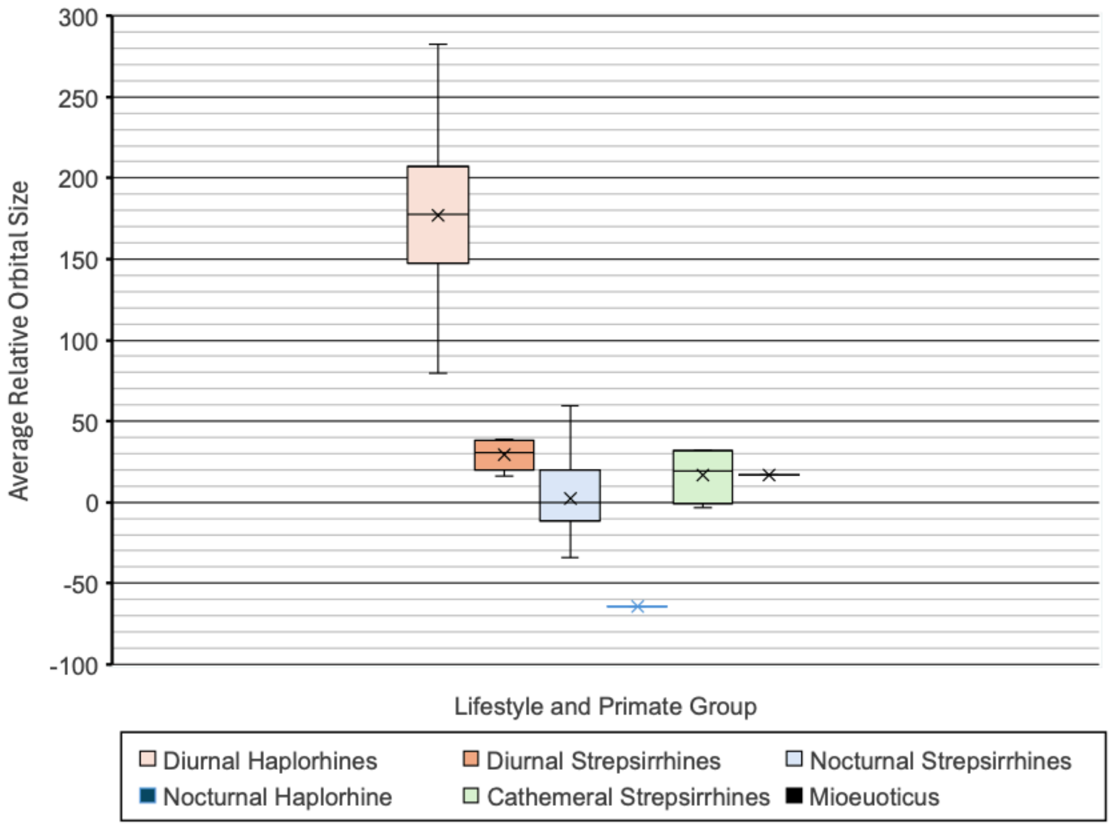
Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question - Did the extinct *Mioeuoticus* have vision adapted to a nocturnal lifestyle?

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What evidence was used to write your claim? Reference specific parts of the table or graph.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how we can compare what we know about living species to fossils. Remember that the shape of the orbital eyesockets can give clues about nocturnal lifestyles.

Did the data support Holly's hypothesis? Use evidence to explain why or why not. If you feel the data are inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Holly's research? How do your questions build on the research that has already been done?