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DATA Nugget

What big teeth you have! Sexual dimorphism in rhesus macaques

Featured scientists: Raisa Hernández-Pacheco from University of Richmond and Damián A. Concepción Pérez from Wilder Middle School

Research Background:

Cayo Santiago rhesus macaques.

It is easy to identify a deer as male when you see his huge antlers, or a peacock as male by his stunning set of colorful tail feathers. But you may wonder, how do these traits come about, and why don't both males and females have them? These extravagant traits are thought to be the result of **sexual selection**. This process happens when females mate with males that they think have the sexiest traits. These traits get passed on to future male offspring, leading to a change in the selected traits over time. Because females are only choosing these traits in males, sexual selection often leads to **sexual dimorphism** between males and females. This means that the sexes do not look the same. Often males will be larger and have more elaborate traits than females.

One species that shows strong sexual dimorphism is rhesus macaques. In this species of monkey, males are much larger than females. Cayo Santiago is a small island off the shore of Puerto Rico. On this island lives one of the oldest free-ranging rhesus macaque colonies in the world. This population has no predators and food is plentiful. Scientists at Cayo Santiago have gathered data on these monkeys and their habitat for over 70 years. Every year when new monkeys are born they are captured, marked with a unique tattoo ID, and released. This program allows scientists to monitor individual monkeys over their entire lives and record the sex, date of birth, and date of death. Once a monkey dies and its body is recovered in the field, skeletal specimens are stored in a museum for further research.

Skeletal specimens of an adult male (left) and an adult female (right) rhesus macaque.

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Damián measuring canine length in a rhesus macaque skeletal specimen.

These skeletal specimens can be used by scientists today to ask new and exciting questions. Raisa and Damián are both interested in studying sexual dimorphism in rhesus macaques. They want to find out what causes the differences between the sexes. They chose to focus on the length of the very large canine teeth in male and female macaques. They expected that canine teeth may be under sexual selection in males for two reasons. First, rhesus macaques are mostly vegetarians, so they don't need long canines for the same purpose as other meat-eating species that use them to catch prey. Second, male rhesus macaques often bare their teeth at other males when they are competing for mates. Females could see the long canines as a sign of good genes and may prefer to mate with that trait. Excited by these ideas, Raisa and Damián set out to investigate the museum's skeletal specimens to check whether there is sexual dimorphism in canine length. This is the first step in collecting evidence to see whether male canines are under sexual selection by females.

They measured canine length of four male and four female rhesus skeletal specimens dating back to the 1970s. Measurements were only taken from individuals that died as adults to make sure canines were fully developed and that differences in length could not be attributed to age. Raisa and Damián predicted that males would have significantly longer canines compared to those of females. If so, this would be the first step to determine whether sexual selection was operating in the population.

Scientific Question: Is there evidence for sexual dimorphism in canine length in Cayo Santiago rhesus macaques?

What is the hypothesis? 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:

Skeletal data of Cayo Santiago rhesus macaques

Tattoo ID	Age (years)	Sex	Canine length (cm)		
			left	right	mean
639	6	male	2.10	2.10	2.10
OY	7	male	2.00	2.30	2.15
E08	10	male	2.60	2.50	2.55
520	15	male	2.40	2.40	2.40
3L	5	female	1.10	1.20	1.15
E835	6	female	1.00	1.00	1.00
I72	7	female	1.10	1.00	1.05
B72	15	female	0.60	0.60	0.60

		Mean	SD
Canine length	male		0.21
	female		0.24

**Standard deviation (SD) tells us about the amount of variation in the data. A large SD means there is a lot of variation around the mean, while a small SD means the data points all fall very close to the mean.*

What data will you graph to answer the question?

Independent variable: _____

Dependent variable: _____

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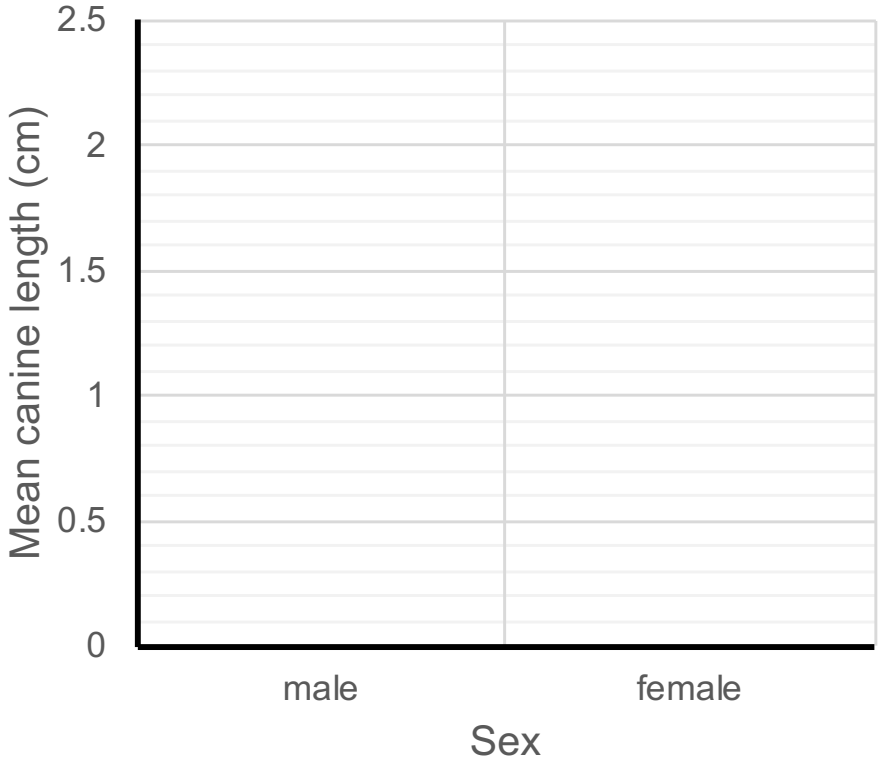
Draw your graph below: Identify any changes, trends, or differences you see in your graph. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

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

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Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about the role canine teeth play for rhesus macaques.

Did the data support Raisa and Damián's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Raisa and Damián's research? What future data should be collected to answer your question(s)?