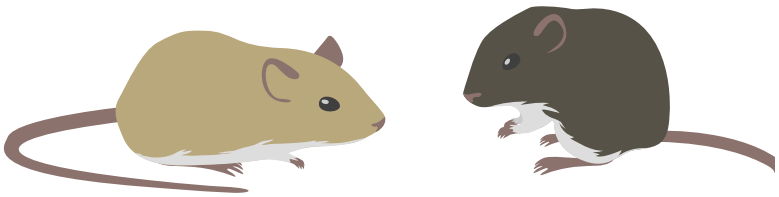
NAME _____ DATE _____

Mutation in Rock Pocket Mice

Background

A mutation is a permanent change in an organism's DNA. Most mutations originate as copying errors. If a mutation happens in a reproductive cell (e.g., egg or sperm), it can be passed to offspring. This is a source of new alleles.



Some rock pocket mice have light fur, and others have dark fur.

Question

In a population of light-colored mice, how often will a pup be born with dark fur?

Instructions

Watch the video *How Often Do Mutations Happen?* on Learn.Genetics.utah.edu
Fill in the numbers as you follow along:

FOR ANY GIVEN BASE:

$$\frac{1 \text{ pup with mutation in that base}}{185{,}000{,}000 \text{ mouse pups}} \times 20 \text{ pups with dark fur mutation} =$$

$$\frac{20 \text{ pups with dark fur mutation}}{185{,}000{,}000 \text{ mouse pups}} \Big/ \frac{20}{20} = \frac{1 \text{ pup with dark fur mutation}}{9{,}250{,}000 \text{ mouse pups}}$$

☐ **POPULATION SIZE:**

$$5{,}000 \text{ female mice} \times \frac{5 \text{ new mice pups}}{1 \text{ year}} = \frac{25{,}000 \text{ mouse pups}}{1 \text{ year}}$$

REPRODUCTIVE RATE: **MUTATION RATE:**

$$\frac{25{,}000 \text{ mouse pups}}{1 \text{ year}} \times \frac{1 \text{ pup with dark fur mutation}}{9{,}250{,}000 \text{ mouse pups}} = \frac{25{,}000 \text{ pup with dark fur mutation}}{9{,}250{,}000 \text{ years}}$$

$$= \frac{1 \text{ pup with dark fur mutation}}{370 \text{ years}}$$

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How many times could a dark fur mutation have occurred in rock pocket mice?

YEARS ROCK POCKET MICE HAVE BEEN IN NEW MEXICO:

500,000 years X

HOW OFTEN DARK FUR PUP IS BORN:

$$\frac{1 \text{ pup with dark fur mutation}}{370 \text{ years}}$$

= 1,351 pups with NEW dark fur mutation

QUESTIONS:

1. How many total locations are there in the MC1R gene where a single-base mutation will make a new dark fur allele? **20**

2. What is the estimated **mutation rate** you calculated specifically for dark fur mutations in the MC1R gene?

$$\frac{1 \text{ pup with dark fur mutation}}{9{,}250{,}000 \text{ mouse pups}}$$

3. What is the **reproductive rate** you calculated for rock pocket mice?

$$\frac{25{,}000 \text{ mouse pups}}{1 \text{ year}}$$

4. Based on our estimate, how often will a pup be born with dark fur due to a mutation in the MC1R gene?

once every 370 years

5. Since rock pocket mice first established themselves in New Mexico, what is the estimated number of times a pup has been born with a new dark fur mutation in the MC1R gene?

1,351 times

6. In the last 500,000 years, how likely do you think it is that a mouse pup with dark fur could have been born in a population of light-colored rock pocket mice?

very likely