2 - Mouse Fur Color

Procedure

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    I. Since we have previously established that menanism is quite a common mutation, it is also likely to have happened to atleast some of the population of rock pocket mice in this area, meaning that a dark fur phenotype exists in this population. Melaninism is also a genetically inherited trait, meaning that such mutations can be passed down to children. Since there is a nearby environment with dark surroundings (the dark rocks) the dark fur of the dark fur mutation mice will have a higher chance of surviving in the area because they will be harder to spot and predate upon. This will give a natural selective pressure towards the darker furred mice. Over time, with this selective pressure, most of the mice living on the dark rocks will have the dark fur.
    II. Needed to, they don't really have influence on whether they want dark fur or not, unless it is seen as a reproductive advantage to these mice and would lead them to increase likelihood of mating. But in this examples, mice probably would not know that they should be self breeding to produce black mice, and instead natural pressures such as predation are more likely to push the population to have darker fur.
3. Table 1

Condition	Description	Evidence
Variation	Individuals in a population or group differ in some trait of interest.	• Melaninism is a common mutation across many animals • Larger populations probably have some dark colored mice due to the common-ness of melaninism

- Black mice likely exist in the population

Inheritance

The variation in the trait of interest is at least partially inherited (passed from parents to offspring). The variation stems from random mutations and the recombination that accompanies sexual reproduction. The genetic variation may have arisen many generations in the past.

- Melaninism is a genetic mutation, meaning it is genetically inheritable
- Fur color is governed by genetics
- Mutations in genetics are inheritable

Differential survival and reproduction

More offspring are born than can survive, resulting in competition among individuals within a population. Some individuals with a particular trait are more likely to survive and/or have relatively more offspring compared to individuals that do not have that trait. Selection depends on the specific context of a species. Traits that are beneficial in one

environment may cause problems in another environment.

- Mice likely do not have a sexual preference when it comes to fur color
- Dark mice are more likely to survive in a dark environment as they blend in to their environment, making it hard to predate on them
- Dark mice have a natural environmental pressure favoring them

Adaption

The frequency of the trait that helps individuals survive or leave more offspring will increase in the population over time, as will the alleles that affect the trait. This process can take many generations and extend over very long periods of time.

- Dark mice are more likely to survive in dark areas
- Since dark fur is inheritable, its increased fitness will be more likely to pass on to the next generation
- Over time, more mice will be dark furred as they are more fit for the environment

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I. Table 2

Population	Christmas Pass	Tule Well	Lava (West)	Lava (Mid)	Lava (East)	O'Neill Pass
Soil color	Light	Light	Dark	Dark	Dark	Light
Number of tan mice	6	80	0	0	3	34
Number of dark mice	0	5	7	5	42	43
Total number of mice	6	85	7	5	45	77
Percentage of tan mice	100%	94.1%	0%	0%	6.67%	44.2%

II. Only the Tule Well, Lava (East), and the O'Neill Pass. this is more likely because the sample size for these populations are larger

III. Variation, this shows that in a larger population there will likely be genetic variation within the population. Additionally, this shows the effects of natural selection through selective fitness, because similar skinned furs hold a higher percentage in their respective environments.

8. Fur color is effected by the genotype of the MC1R gene. Additionally, the more of allele 2 there are, the more likely the mouse is to have dark fur. Heterozygous mice tend to have fur inbetween light and dark on average.
   I. Yes, since there is a significant difference between the strata, this shows that the fur color is in part governed by this gene and is therefore inherited. The spread of each strata is miniscule compared to the differences in percent reflectance across strata.
9. *Figure 4* shows a correlation between the frequency of the MC1R allale 2 and frequency of black mice in a population by comparing it to *Figure 2*. Their visual similarities - the similar peaks in dark mice with peaks in allele 2 frequency show that there is a correlation between the two. Since we know that having dark fur cannot influence the genetic information of the mice, we can say that the MC1R gene causes in part the dark fur of the mice. This contributes to natural selection because the MC1R allele 2 is inheritable through its genetic code.
10. - *(see above)*

Apply what you learned

1. We would need to collect evidence that proves the claim that light fur is more prevalent in light areas and that dark fur is more prevalent in dark areas. Then we can look for variation across the two populations to see if the other variant exists in their non-respective environment. This will prove that there is variation across the population. Then, we will need to prove that fur color for these mice is inheritable. This can either be proven by finding a gene that governs fur color within these mice, which will by definition be inheritable through its genetic information. Alternatively, experiments on the breeding of these mice can be conducted to see the probability of dark fur amongst offspring. If dark furred mice have a statistically significant more amount of dark mice than light mice do, then with a large enough sample size, we can conclude with high certainty that the fur color is indeed inherited. After that, to prove differential survival, we can either conduct an observational study to watch and see the likelihood of different colored mice in each environment and note the predation rates, death rates, and reproductive rates amongst others. If different colored furs have different survival rates, then we can conclude that the environment has a natural selection for a certain fur color with a relatively low certainty, noting that the experiment is merely obervational. Alternatively, we can prove differential survival by placing different colored mice in different environments and noting if they die, reproduce, etc. If there is statistical significance between these data across the different colored furs,

we can conclude that there is natural selection across the fur colors with relatively high certainty. Lastly, to prove adaptation we can conclude a similar experiment to watch as the proportions of different furred mice change over generations.

2. Basically the same data as above ^
3. We have to be more ethical when dealing with humans, so we cannot conduct controlled experiments and rather only observational, which means we cannot prove causation, but only correlation.
    I. Ethics
    II. Humans live much longer, meaning the generational gap will be much larger
    III. Humans don't really have predators or impacted chances of survivals from nature