As you know the process of macroevolution is not directly observable due to the amount of time and the number of organisms involved. We cannot go back in time to observe the changes in physical traits and genes over time as whales evolved from terrestrial ancestors. We can, however, observe microevolution in action!

**Microevolution** is defined as change in a single species over relatively shorter periods of time. In fact, microevolution shows that organisms can and do change over time in response to their environment and contributes strong support to the theory of evolution. When scientists study microevolution, they are really analyzing the **frequency of alleles** within the population. Genes are the root of physical and behavioral variation, so to examine how alleles shift in a population tells us something about how traits are changing in response to the environment.

In the rock pocket mouse, the mutation for dark coat (A) in the MC1R gene is dominant to the variation for light coat (a). You sample a population of mice and sequence their genomes to determine their genotypes and discover the following distribution:

|  |  |
| --- | --- |
| **Genotype/Phenotype** | **Number of Individuals** |
| homozygous for dark coat | 290 |
| heterozygous for dark coat | 425 |
| homozygous for light coat | 270 |

What is the frequency of the “A” allele in this population?

What is the frequency of the “a” allele in this population?

**Hardy-Weinberg equilibrium** is an idealized model, which states that the alleles within a population will remain constant as long as some interfering force does not act them on. All of the following criteria MUST be met by the population for it to be in Hardy-Weinberg equilibrium:

* Population size is large
* No mutations occur
* No immigration/emigration
* All members of a population breed and all mating is random
* Natural selection does not occur

The Hardy-Weinberg model can be used to measure whether the observed genotype frequencies in a population differ from the frequencies predicted by the equation.

|  |  |
| --- | --- |
| **p2 + 2pq + q2 = 1** | **p + q = 1** |
| p =  q =  p2 =  q2 =  2pq = | |

For the above population of rock pocket mice, calculate the following values (assume the population is under Hardy-Weinberg equilibrium) and then answer the questions that follow.

|  |  |
| --- | --- |
| p= |  |
| q= |  |
| p2 = |  |
| q2 = |  |
| 2pq = |  |

1. The frequency of homozygous dominant individuals: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The frequency of homozygous recessive individuals: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. The frequency of heterozygous individuals: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sixteen percent of the human population is unable to taste the chemical phenylthiocarbamide (PTC), a bitter-tasting substance that resembles the toxic alkaloids found in some plants. The ability to taste PTC is encoded by a single gene (TAS2R38) that codes for a taste receptor protein on the tongue. At one time, the ability to taste chemicals like PTC may have been an advantage to our ancestors in helping them to identify which plants were safe to eat and which to avoid. Non-tasters are recessive for the TAS2R38 gene. Calculate the following values (assume the population is under Hardy-Weinberg equilibrium) and then answer the questions that follow.

|  |  |
| --- | --- |
| p= |  |
| q= |  |
| p2 = |  |
| q2 = |  |
| 2pq = |  |

1. What percent of the human population are tasters? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What is the frequency of the dominant and recessive alleles? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. What percentage of the population are homozygous dominant tasters? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. What percentage are heterozygous tasters? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_