THE BENEFITS OF BIODIVERSITY

In this activity you will work with a partner to produce, on paper, a mouse pup. It would be best if your partner is a member of the opposite sex, but if not, just decide which of you will represent the mother mouse and which will represent the father. Each of you will have a penny to flip, and whether you get a heads or tails will determine what form of each gene goes into your egg or sperm. When combined, the egg and sperm will create your mouse offspring, and depending on which forms of the genes your offspring gets, your pup will be born with its own unique set of features. You will keep track of your coin flips on the Student Data Sheet.

Please be aware that the features made up in this activity are somewhat fictional. They were made up to show how much diversity among the mouse offspring can result from only ten sets of genes. The genes created for this activity do not necessarily represent the actual patterns of mouse gene inheritance. In reality, the way genes interact with each other and with the mouse's environment is much more complicated than this simulation.

1. Here is how to determine whether your mouse pup will be born furry or naked. (Don't worry, even if it is born naked, the fur will begin to grow in a day or two.) In this and most of the features that follow, a coin flip resulting in a heads will represent the dominant gene. If you are the father mouse, you are flipping your coin to see whether your sperm for making this particular mouse pup will carry the furry or naked gene. In this example, the gene for nakedness is dominant, so if you get heads, your sperm carries the naked gene. Similarly, if you are flipping for the mother mouse, and you get heads, this means your egg cell will also carry the gene for being born naked. On the other hand, if one parent gets heads and the other gets tails, your pup will have one of each type of gene. Even so, the pup will be born naked, because the gene for nakedness dominates over the one for furriness. The only way for a pup to be born furry is for both parents to get tails on their flips. That way there will be no naked gene present to dominate over the furry genes. Once you have flipped your coins, record your results on the Data Sheet.

2. Determine whether your mouse pup will have gray fur or brown fur. The gene for gray fur is dominant, so a heads will indicate the contribution of a gray gene to the pup. Record your results on the Data Sheet.

3. Determine whether your mouse pup will have short whiskers or long whiskers, and record your results on the Data Sheet. The gene for long whiskers is dominant.

4. Determine whether your mouse pup will have small ears or large ears, and record your results on the Data Sheet. The gene for small ears is dominant.

5. Determine whether your mouse pup will be a fast runner or a slow runner, and record your results on the Data Sheet. The gene for running fast is dominant.

6. Determine whether your mouse pup is tolerant of extreme heat or not, and record your results on the Data Sheet. A mouse is tolerant of extreme heat only if both parents flip tails.

7. Determine whether your mouse pup is tolerant of extreme cold or not, and record your results on the Data Sheet. A mouse is tolerant of extreme cold only if both parents flip tails.

8. Determine how effective your mouse pup is at storing fat during times when food is abundant. In this case neither the highly-effective nor the poorly-effective gene is strictly dominant. Instead, if both parents flip heads, the mouse pup is highly effective and storing fat. If only one parent flips a heads, the pup is moderately effective. If neither parent flips a heads, the pup is not very effective at storing fat.

9. Determine the body size of your mouse pup and record your results on the Data Sheet. Like the fat storage gene, neither the large size nor small size is dominant. Two heads will result in a large pup, two tails will result in a small pup, and one of each results in a medium sized pup.

10. Determine the tail length of your mouse pup and record your results on the Data Sheet. Like the body size gene, neither the long tail gene nor short length tail gene is dominant. Two heads will result in a short tail, and two tails will result in a long tail. One of each results in a medium length tail.

• What is the probability a mouse pup will have gray fur? What about brown fur?

• What is the probability a mouse pup will have a short tail? Long tail? Medium length tail?

• Compare the features of your mouse pup to those best suited to the different environment types in Table 1. In which environments would your pup be most likely to survive? In which would it be least likely to survive?

• Compare the features of your pup to those of other members of the class. Were any two mouse pups identical?

• With only ten pairs of genes to consider, there is a reasonably good chance that two mice could be born with identical genes. In real mice, however, there are thousands of sets of genes. How likely would you say it is that in the real world two mice could be born, even to the same parents\ that have identical sets of genes?

• Examine the list of features most suited to life in a temperate forest. If the climate changed rather abruptly and became more tropical (warmer), which of the mice living in the temperate forest would be more likely to survive?

• If the mice living in a temperate field environment were to experience a climate change that made their environment more like a tundra (colder), which mice would be most likely to survive?

• If the climate suddenly becomes very dry and a tropical grassland were to become more like a desert, which mice would be most likely to survive?

• If a tropical rainforest were cut down and the environment became more like a tropical grassland, which mice would be most likely to survive?

Figure 1. Mouse features best suited to different environment types.

Features	Temperate forest	Tropical rain forest	Temperate field	Tropical grassland	Swamp	Tundra	Desert
naked vs. furry skin	either	either	either	naked	either	furry	either
fur color	either	either	brown	either	gray	either	either
whisker length	long	long	either	either	either	either	either
ear size	either	either	either	either	either	small	large
running speed	either	either	either	fast	either	fast	fast
heat tolerance	either	tolerant	either	tolerant	either	not	tolerant
cold tolerance	either	either	tolerant	either	either	tolerant	not
fat storage effect'ness	moderate or highly	any	moderate or highly	any	any	highly	highly
body size	small or medium	medium or large	small or medium	medium or large	large	small	medium or large
tail length	any	any	any	any	short or medium	short or medium	medium or long