

## Natural Selection Lab- PhET Simulation



EQ: How do individual characteristics affect a population's reproductive success?

EQ: How does natural selection drive the process of evolution?

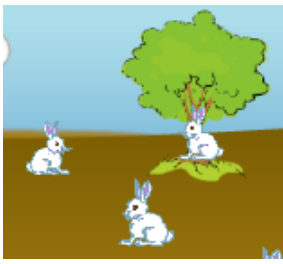
### **Introduction:**

Run the PhET Natural Selection Simulation" application

Carry out "scientific play," by manipulating the variables available in the simulation. Get familiar with the program by adding friends; add a food source/predator, mutations, etc. Do not move past this stage until you are familiar with what the variables do. Be sure you understand the effect on survival of each mutation phenotype.

### Pre-Lab Questions

1. What variables can you influence in this lab?
2. Define what a genetic mutation is. How do genetic mutations happen?
3. What do the terms fitness and adaptation mean?
4. What selection factors might effect an animal population besides the ones used in this lab?



## **Part I: Designing The Experiment**

In this lab investigation you will be controlling the mutations and environment of a population of rabbits. You will create two hypotheses and design an experiment to test each one. Your hypothesis will follow the format where you fill in the (\_\_\_\_) with your own ideas and reasons.

**I hypothesize that (select a rabbit phenotype) rabbits will be (more/ less) likely to survive under (type of selective factor) within the (select type of environment) environment, because..... (explain how their trait will help them to survive or not)**

**\*\*\*You must make a hypothesis for two different types of phenotype mutations\*\*\***

- For each experiment you must have a control (no mutation) and fill in the charts on the following page.
- For both control and experimental groups begin by adding a friend. Build a population by letting the sim run through 3 generations (F3). At the end of F3 add a selective pressure and run an additional 4 generations (F7 total).
- For experimental group ONLY: add a phenotypic mutation at the same time as the friend.
- Run the simulation three times (3 trials) each for both the control and experimental groups.
- Use the population numbers from the chart to get your numbers for the table, remember you can zoom in and out on the chart to get more accurate reads. Calculate final population percentages for each of the phenotypes in the experimental group.

Post-Lab Questions

1. Based upon your evidence from the simulation, list the rabbit phenotype that would be the most fit in each of the following environments:

equator, wolf	
arctic, food	
arctic, wolf	
equator, food	

2. What happens to animals that cannot compete as well with other animals in the wild?
3. If only one species is considered the "fittest", why do we still have so many variations among species. (For example, why do some birds have very long pointy beaks, while other birds have short flat beaks?)
4. How does this computer simulation of natural selection accurately represent the way the process works in the real world?
5. In what ways does this simulation fail to represent the process of natural selection in the real world?

## Part II- Changing the Dominance and Recessive Alleles

Take one of the experiments from the lab. Recreate the same experiment, EXCEPT when you add the mutation EDIT THE GENES by switching the dominant and recessive allele for that trait. Make a hypothesis, fill in the chart again and compare the results to your initial experiment.

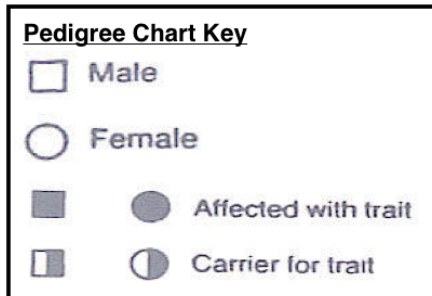
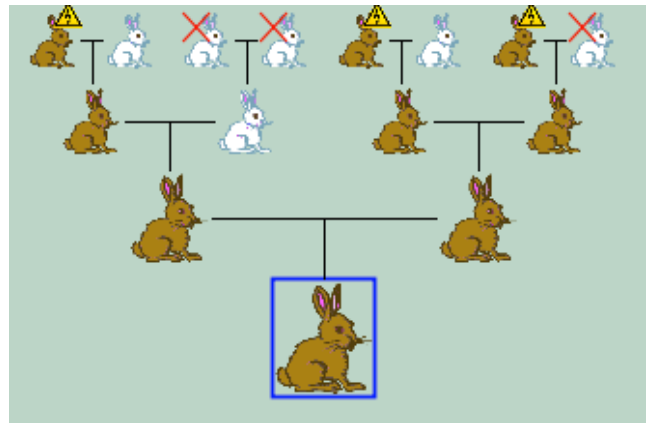


Control Group		w/o mutation	w/ mutation		w/o mutation % of total	w/o mutation % of total	Total Pop
	Trial 1 Initial F3 pop				Trial 1 Final F7 pop		
Trial 2 Initial F3 pop				Trial 2 Final F7 pop			
Trial 3 Initial F3 pop				Trial 3 Final F7 pop			
Experimental Group		w/o mutation	w/ mutation		w/o mutation % of total	w/o mutation % of total	Total Pop
	Trial 1 Initial F3 pop			Trial 1 Final F7 pop			
	Trial 2 Initial F3 pop			Trial 2 Final F7 pop			
	Trial 3 Initial F3 pop			Trial 3 Final F7 pop			

1. Did switching the alleles for dominant and recessive have any impact on the population of rabbits? If so Why? In nothing changed Why not?
2. Two parent rabbits are both heterozygous for the trait. Create Punnet squares for the original experiment and the new experiment (with the changed alleles). What are the phenotype ratios of the Punnet squares? Does this evidence support your finding? and how?
3. If this new experiment were to run longer would the end result be the same or different from the original experiment?

**Part III- Working with Pedigrees-** Switch from the population chart to the pedigree chart

Begin by adding a friend and a mutation. Wait until the F5 generation. Copy the Pedigree for two rabbits (described below) using the key. Assume that male rabbits are on the left and female rabbits are on the right.



Find these two rabbits, make sure they have **at least four generations**:

1. Select a rabbit that has the mutation.
2. Select a rabbit without the mutation but with parents or grandparent with the mutation.

Answer the following questions:

1. How could using a pedigree be helpful?
2. What does it mean to have a yellow triangle above the rabbit?
3. What does it mean when a rabbit has a red X over it?
4. How accurate are the pedigrees used in this lab? Did each couple only have one baby?