The natural selection of bunny simulation essay sample

Science, Genetics

Charles Darwin discovered and developed this evolutionary mechanism called natural selection. It basically stated that if there existed variation in population there would be a struggle of survival. Darwin meant that those traits that were the most fit would be passed on to the next generation more often.

Charles Darwin’s experiment was not 100% accurate. His definition of mechanism of evolution was quiet accurate but two major factors were missing. 1. He knew little about the factor causing the variation that he saw in nature 2. He could not explain how variations were passed from parents to offspring A discovery of the DNA in 1953 would change the way science studied evolution. Now, science knew that it was DNA that caused the variation seen in nature and DNA that caused those traits to be passed from parent to offspring.

Purpose of experiment

We will be studying how mutations in the DNA of an organism can lead directly to the evolution of the population it is a part of. This will be done by tracking how allele frequency is dependent upon the core principles of natural selection. Pre simulation

Mutation is a change in DNA. An organism’s DNA affects all aspects of its life. An Allele is an alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome. Allele frequency is a measurement that determines how frequent the allele expression of a particular gene arises in a population. In your own words explain how you think DNA, mutation, genotype, phenotype and natural selection

interconnect to cause evolution. Variation in traits, differential reproduction and heredity all construct to evolution with an outcome of natural selection.

Material

The simulation software ‘’The Natural Selection Bunny Simulation (http://phet. colorado. edu/en/simulation/natural-selection). The use of instructions provided.

Computers.

Method

1. Go to the website and click on the ‘’run now’’ button under the picture of the simulation. 2. Add a friend to the bunny and let it run for 2 generations 3. For each individual experiment, add to the experiment respectively what is requested (for experiment 1: add the recessive brown gene, for experiment 2: long teeth and for experiment 3: long tail). Let it run for two more generations and note down the results. 4. Now add either wolfs or food depending on what’s requested in the information provided. Run for 3 generations and note down the results. 5. Let it now run for three more generations and note down the results again.

In this experiment you will be examining the effect of a recessive mutation that changes the color of the organism and alters how it avoids predators.

‘’I believe that by changing the color of the organism, recessive mutation ultimately and slowly will dominate over the non-recessive mutation based on the fact that the originate color is adaptable to the environment. So based on their color, they will survive or they won’t.’’

Analysis for Experiment 1

Briefly explain how this change in DNA affected the allele frequency of the population. Be sure to use your data in this explanation. In the table you can see results of a total of 18 bunnies after two generations with a percentage of a hundred being white. After four generations brown rabbits have started to slowly come into the generations. Adding on multiple generations, the white rabbits begin to become more and more recessive as the brown ones are getting more and more dominant. By the time of that of 10 generations passing, the white rabbits have become altered and there is only an existence of brown bunnies left. The DNA for the white bunnies has been taken over completely and only brown bunnies were left. Based on the color of the brown bunnies, it was easy to adapt and ‘’melt in’’ into the environment, as for the white bunnies it was not, since they ‘’stood out more’’ and became an easy catch for predators.

In this experiment you will be examining the effect of a dominant mutation that changes how the organism obtains food.

‘’My beliefs for this experiment is that the dominant mutation will eat all the vegetation there is, which will lead to the recessive ones dying out in lack of food.’’

Briefly explain how this change in DNA affected the allele frequency of the population. Be sure to use your data in this explanation. In the table it is shown that the factor of food plays and important role. For the dominant mutation, the ones with long teeth, it takes more than 10 generations to

grow stronger. The number shows that the dominant mutation uses up most of the vegetation which leads to less food to the recessive ones. The change in DNA led to the normal tooth rabbits becoming less frequent in the population. Having long tooth brought the benefit of adapting in the environment.

Experiment 3

In this experiment you will be examining the effect of a dominant mutation that changes the length of the rabbit's tail. Your job in this simulation is to determine whether or not having a longer tail gives the rabbits an advantage when trying to escape predators.

Hypothesis experiment 3

" I think that the rabbits with short tails will struggle when it comes to escaping from predators. But in the other hand, the rabbits with long tails will have an advantage escaping due to better balance and stable pace."

Briefly explain how this change in DNA affected the allele frequency of the population. Be sure to use your data in this explanation. There is a clear view of the ones with long tail having advantage in this situation. Not until in generation 10 you are able to see results of the long tail rabbits taking over and survive. These results are produced like this because the rabbits with long tails, just as stated in the hypothesis, have better balance and a stable pace, which makes it easier for them to escape the predators so they have a higher chance in surviving. The DNA change led to the long tail becoming a dominant mutation.

Discussion

1. Given the current definition of evolution being a change in allele frequency over time, did any of the mutations above fail to cause the population to evolve? If so which one? Use your data to explain how you know. In each of the three experiments there was an evolution.

In the first experiment they start of as white bunnies but end up developing to brown ones. In the second experiment they started of having normal teeth to ending up with long teeth. In the third experiment they start with having short tails to ending up with long tails.

2. Predict what would have happened in simulation 1 if you had switched the environment from equator to arctic. Do you think the brown rabbits could have been completely bred out of the population like the white ones may have been in simulation 1? Why or Why not? If the environment had been switched from equator to artic the brown rabbits would have had an advantage and could have bred out of the population. The results would have been reversed as the brown bunnies would have had an easier time to adapt to the environment where as the white bunnies wouldn’t.

3. In simulation three there should have been very little change in the percentage of each type of rabbit. Why did the allele frequencies not change as drastically in this simulation as they did in the other two? The changes were major in the results that I received, so cannot agree to the statement or give any answer related to agreement of the question. 4. Compare your data from simulation 1 and simulation 2. In simulation 1 the mutation was

recessive; in simulation 2 the mutation was dominant. What was different about how these two populations evolved after the mutation? Did being the dominant form of the trait insure that it would be selected for? For the first experiment, the mutation was recessive, this was because the rabbits began to adapt to their environment. This led to the white bunnies having a harder time adapting to the surroundings so they died out. For the second simulation, the dominant mutation had not taken over completely; there was still an 18% amount of bunnies with normal tooth left. So only because it was dominant doesn’t insure it to be selected. It depended not on being dominant or recessive but on how well they were able to adjust to the surroundings and environments.

5. The mutations you made were in reality small changes in the DNA. Briefly explain how a small change in DNA can cause such a huge evolutionary shift within a population. The DNA develops throughout and during the generation process successively. This results to evolutionary shift within the population.

Does the data in the table support the hypothesis for experiment 1? Yes it does.
Does the data in the table support the hypothesis for experiment 2? Yes it does.
Does the data in the table support the hypothesis for experiment 3? Yes it does.

Weaknesses

There is a chance of reading results wrongly from the program. There instructions were a bit confusing to understand at first

Limitations

We used only one source to collect data, so we had nothing to compare our answers to.

Improvements

Improvement could be done by repeating all three experiments multiple times, to make sure that you get more frequent and sustainable results.

Conclusion

This simulation was a bit of a challenge for me. This way of handling a report and constructing one is completely new for me. I have learnt how generations of this kind of organisms adapt after the circumstances. I have also learnt how having a dominant gene doesn’t always secure survival, it depends on how well you adjust to the environment and surroundings. I have also been educated in the area of escaping predators and what benefits that is needed. However, comparing results and tracking, I was not completely off track with the conducted hypothesis, and analysis.