Peppered moth lab pdf

Peppered Moth is widespread in the UK and Ireland and is often found in ordinary gardens, but its amazing story has made it famous all over the world. It is one of the most famous examples of evolution through natural selection, the great discovery of Darwin, and is often referred to as the mole of Darwin. Peppered moths are usually white with black specks across the wings, giving it their name. This pattern makes it well disguised against lichen-covered tree trunks when it rests on them during the day. There is also a natural genetic mutation that causes some moths to have almost black wings. These black forms (called melanic) are not as well camouflaged as conventional oversaturated forms, and are therefore more likely to be eaten by birds and other predators. This means that fewer black forms survive to reproduce, and so they are less common in the population than the paler-filled forms. This is a normal situation observed in rural Britain and Ireland.However, in the nineteenth century it was noticed that in towns and cities it was actually a black moth shape that was more common than pale pepper form. Industrialization and internal coal fires have caused air pollution to be contaminated, killing lichens and blackening urban tree trunks and walls. So now it was a pale form of moth that was more obvious to predators, while the melance shape was better camouflaged and more likely to survive and degenerate offspring. As a result, over the next generations, black moths outnumbered pale shapes in our towns and cities. Since moths are short-lived, this evolution of natural selection occurred quite quickly. For example, the first black Peppered Moth was recorded in Manchester in 1848 and by 1895 98% of Peppered Moths in the city were black. In the mid-twentieth century, controls were introduced to reduce air pollution and, as air quality improved, tree trunks became cleaner and lichen growth increased. Again the normal pale Peppered Moths were disguised and the black shapes were more noticeable. Now the situation in urban areas has again become the same as in rural areas, with normal pale Peppered Moths much more often than black forms. Thus, natural selection has been seen to work both ways, always in favor of the moth that is best suited to environmental conditions. The same was observed throughout Europe and the United States. Unfortunately, having adapted so well to survive the previously devastating effects of industrialization, this species is now declining altogether. Between 1968 and 2002, the number of Peppered Moth in the UK fell by almost two thirds, although the reasons are not yet known. Page 2Moths overlooked And wrong. Most people love butterflies, but many of us know less about moths and often don't appreciate them. This website will change that by explaining, explaining moths, blast some negative myths and showing you that they are beautiful and amazing ... Even amazing! Have you realized that some moths are more colorful than butterflies? Compare the cinnabar moths and meadow brown butterfly on this page. Both are seen flying around sunny meadows, but people may assume a Cinnabar butterfly. In fact there are more types of daytime moths than there are butterflies! And of course there is even more at night. There are an amazing 2,500 species of moths in the UK. Most of them live here all year round, but some visit on migration issues. Moths come in a variety of sizes, colors and shapes. Your own garden will probably have more than a hundred types. Our mole gallery can help you identify many common moths you can find. Some of them have lovely names. Moths play an important role in the wildlife ecosystem. They pollinate flowers and are vital food for many other animals (and have evolved shiny camouflage to hide from them). Many garden birds need moth caterpillars for their young ones. Each brood of Blue Tit chicks will eat about 15,000! Moths are also useful to us, providing vital information about our own environment, especially about climate change. But now moths are in decline and need our help. There are many ways you can help with conservation efforts, including moth friendly gardening. Learn more about moths using links on the left. Natural Selection and Mutation - The peppered Moth case The purpose of this laboratory exercise is to simulate the effect of natural selection on the appearance and genetic makeup of the natural population (pepper moth). We will build a STELLA model for this population that incorporates the basic principles of population genetics. Figure 1 Peppered Moth (Biston betularia) Before we begin, we will need to define some important genetic terms: Alternative forms of the gene are called alleles; All sexually multiplying organisms have two alleles - one inherited from each parent The genetic constitution of an individual called his genotype Physical expression of a genotype called phenotype If two alleles are identical, a person is considered homogeneous for this gene; if the two alleles are different, the person is said to have a heterozygous dominant allele has such a strong phenotypic effect in heterozygous individuals that it hides the presence of a weaker (recessive) allele Introduction Case of pepper moth (Biston betularia) is a classic example of evolution through directed selection (choice in favor of extreme phenotypes). Before the Industrial Revolution in England (until 1740) the peppered moth was found almost entirely in a light form (light body painted with black spots). Moths will hold time of day in the trees covered with light lichen, their light colors, giving them almost perfect camouflage against Birds. There were several dark individuals in the population, but their appearance was very rare. Scientists have found that the color of the body in pepper moth is controlled by one gene. The allele (gene version) for the dark color of the body is dominant, meaning that a mole possessing at least one such allele will have a dark body. To have a light body, the mole must have both alleles for a light-colored body. Figure 2 Dark and light phenotypes peppered moths on a dark bark (right) and lichen-covered (left) dark moth trees were at a distinct disadvantage, however, due to their increased vulnerability to bird prey. Thus, the frequency of dark allele was very low (about 0.001%), supported primarily by spontaneous mutations from light to dark alleles. By 1819, the proportion of dark moths in the population had increased significantly. which, against the background of the dark bark of the trees, were less visible to the birds. In 1848, dark moths made up 1% of the population, and by 1959 they made up 90% of the population. So, for 100 years the frequency of dark moths has increased by 1000 times! Figure 3 Composition of different populations of pepper moths in the British Isles In this exercise we will build a model, simulating the effect of the differential pressure of the predator on the hypothetical population of moths. To do this, we will need to incorporate the genetics of the mole's body color into the population dynamics model. We assume that body color is the only trait that gives any significant selective benefits to pepper moths.   Creating a model When creating this model, you will have to use ghosts to create copies for duplicate variables. However, it is extremely important to make the Total Moths converter at the bottom of the model the original. Make sure the ghost stocks are at the bottom of the model. Then everyone else can be ghosts copied from it. To use the Ghost icon, click on the icon, then click on the variable you want to copy and add it to the model. The ghost converter should look dark, with dotted contours. You should only edit the original variables in the model, not the ghosts. Note: Always connect all the necessary components to the converter or stream before entering the equations Ultimately, the structure of your model will look like this: Figure 4 STELLA model pepper moth As in any system, we must first identify and determine the stocks and flows of the system. Stocks are starting to build their model the next three shares. We have three different genotypes presented in our model: AA mothies: homozygous dominant moths that are dark-colored Aa mothlets: heterozygous moths that are also dark in color aa moth: homozygous recessive moths that are light in color Note: STELLA will not allow you to repeat the variable names. Since STELLA is not a delicate case, it does not distinguish between the names aa moths and Aa moths, so make sure to change them (i.e. moths vs. moths). Streams of our genotypic subpopulations are birth and death. First, take a look at the birth streams: The components on the right side of the equation are below, and it will be your converters. First, create the threads, then create the converters needed to enter equations into threads, and then connect those converters to the connectors. Finally, in the resweave the right equations. At this point, you don't make any changes to converters, which will happen below. birth1 (repro - total moth) - (large allele)2) birth2 (perpro - total moth ratio) - (2'big A allele'little a allele) birth3 (repro ratio - total number of moths) (a little allele-2) In these flow the birth rate is calculated by multiplying the reproduction rate of the total population with the frequency of the appearance of a specific type. Allele frequencies are calculated as: large allele (2'AA mothies/total moths) - (Aa mothlets/total moths) / 2 small alleles ((2'aa moths/total moths)) / 2 Terms for common moths calculated by ghost, to make copies of 3 stocks and add them together: common moths and AA moths - Aa moths also identify variables, which calculate the relative frequencies of dark moths (AA and AA) and light moths (aa): dark freq (AA mothies and Aa mothlets) / whole moths light freq and aa moths /total moths Now look at the streams of death for stocks: death1 and AA mothies (natural mortality - bird prey dark) death2 - Aa mothlets - (natural mortality - bird prey dark) death3 - aa moths (natural mortality - avian bird light) Death streams include natural mortality rate as well as death as a result of bird prey. Note that the rate of bird prey is different for dark and light moths. These two different predation rates are defined: bird predator light and pollution - bird predation bird predator dark - bird pred rate - (pollution - bird pred rate) Bird predators speed and pollution are proportions between 0 and 1. Note that at high levels of pollution, the bird's predation light is higher, while the bird's predation dark is highest when is low. Below are the constants and rates we chose for this model: repro rate of 0.055 natural mortality mortality aa moths No. 250 Set up two graphs to view the results. The first (graph 1) should display a dark frek and light frek (this is a phenotypic graph). To cover the second graph (graph 2) to display the numbers of AA moths, AA moths and aa (this is a genotype graph). The launch features for these launches start at 0.0 to 200.0 with DT and 1.0, and units of time installed over the years. Next, adjust the numerical displays (an icon that looks like a figure 8) to observe numerical changes in allele frequencies (small allele and large allele.) The study of the system Since pollution is the true factor of the genotype change in the pepper moth population, it is the variable that we are most interested in changing. Pollution is a proportional term, i.e. if it is zero, it has no pollution, and when it is equal to 1, pollution is at its maximum. Simulate the following three scenarios with a model. For each scenario, save graphs 1 (phenotypic response) and 2 (genotypic response) and copy and paste them into your word document. Make sure to mark each graph with the value of the variable pollution (or write it in the caption below the graph). First, run a model without pollution (pollution 0) #1 2. Next, start the model with maximum pollution (pollution 1) #34. Finally, start a model with a changing rate of pollution that we can identify graphically (as opposed to mathematically). Click on and open the pollution converter, and then select and click on the TIME feature in the built-in list. (First delete the value in the equation box.) Now click on the graphic function tab, and then the graphic function of the box at the top of the bar. Please note that the X axis is the time and the Y axis is polluting. Change the number at the top of the Y axis to 1.0 to limit the pollution range between 0 and 1. Make sure the X-axis ranges from 0 to 200, which is a time span of 200 years. Next, using the mouse (or entering the desired output), draw a s-shaped graph that starts at 0 (no pollution) and increases rapidly, then aligns to 1 (maximum pollution) halfway through the graph (i.e. TIME 100). Figure 5 Screen Shot Run the model according to this pollution scenario, copy and paste graphs that reflect the increase in pollution around 100 years (graphs #5-6). The timing of the pollution increase is now changing by changing the position of lifting on the X-axis. Make two new graphs and look at how time affects the dynamics of different genotypes #7 8. Question 1 - Include in graphs showing phenotypic (graph 1) and genotypic (graph 2) responses in the moth population for each of the scenarios you tested. You should have eight charts in total at the moment. Not mark your graphics. - In a paragraph, describe the dynamics you observe in each scenario. What happens to genotypes and phenotypes of moths when added to the system (scenario 3)? Why? Issue 2 - Name and describe the consequences of two important assumptions we made in building this model. - What will be the effect of relaxing (changes) of these assumptions?   Question 3 - What would you expect to happen (in terms of genotypic and phenotypic frequencies) if pollution levels fluctuated widely? - Check your hypothesis by changing the pollution function (add some spikes and dips to make it very variable) - Turn on your graphs graphics #910, make sure they are labeled). Question 4 - What aspects of the model would you change if the Aa genotype made moths grey (i.e. between dark and light)? - Adapt the structure of your model to reflect this change and include a screenshot. Note: We're not asking you to enter equations or actually run a model - we just want you to change the structure of the model. question 5 - If you changed pollution levels in your new model with dark, light and gray moths, predict how the new gray phenotype will fare? - In your model, life adapts to pollution levels and survives. Do you think that this is the representative of most real situations in the world? Explain. As usual to present a one-word document as an application on canvas, it should contain: Answers to questions 1-5, with related graphs (you must have 10 common graphs for the entire assignment). Please make sure to label all your graphics! A screenshot of your final model structure (Use a screenshot from question 4 that includes grey moths) Copy and paste the final equations of your final model (at the bottom of the Word document) Sources Futuyma, Douglas J. 1979. Evolutionary biology. Sinauer Associates, Sunderland, Massachusetts. Hartle, Daniel L. 1988. Primer of population genetics, second edition. Sinauer Associates, Sunderland, Massachusetts. Back to the index peppered moth lab answers. peppered moth lab report. peppered moth lab report answers. peppered moth lab quizlet. peppered moth lab pdf. peppered moth lab middle school. peppered moth lab weebly. peppered moth lab activity worksheet