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Subjecting fruit flies to poison will trigger evolution to occur, and thus the flies will, over time, become immune to the poison.

Prediction

If flies are subjected to continual doses of poison, then they will slowly become immune to it, thus exhibiting evolution.

Materials/Costs

Fruit Flies (2 vials)…$ 30.00

Containers (2 sets)…$20.00

Pesticide (quantity)…$4.95

Fly Kit: anesthetize, labels, brushes, medium, etc. (quantity)…$50.00

Microscope…$

Concerns

My two main concerns when I began this experiment were time and costs. I was not aware of the amount of money that would be necessary to launch my experiment. It turned out to be more costly than I had expected. Despite this difficulty, however, funds were produced and so my experiment continued. Another concern was time. When I first began to consider this project, I estimated the length of time that I would need to fully complete It; and I realized that it would take at least five months. This quickly became the main focus, as it was necessary to begin very early in the school year. I had to be sure that I would have the correct amount of time to breed all of the generations, and still have enough time to collect data. After successfully dealing with these beginning obstacles, however, my experiment ran smoothly.

Controls

Throughout the course of the experiment, I kept control groups of flies, which did not have any poison in their habitats. All of the habitats, including the control, were given the same amount of food, light, care, and examination. They were placed in identical containers with equal numbers of male and female flies in them. The amount of poison that was doled out to the different containers is the only variable. These measures were taken to ensure complete and accurate data.

Procedure

It is important to prepare an area for the experiment. Although the flies will not be let out, you might want to choose an outside location. Wherever you choose, you must read the directions from the manufacturer and verify that the flies will be in the correct light and temperature environment. Be certain that you will have enough room to operate the anesthetizing kit and the microscope with ease.

The Fruit flies will come to you in the larvae stage, so they will need at least a week to become mature. Use this waiting period to obtain the other materials needed. You will notice that the pupa will crawl up the side of the container. The pupa begin to darken just before they emerge. You will be able to see the outline of the wings about two days before they are ready to emerge.

After observing the darkened pupa and outline of the wings, you will know that it is almost time to begin the handling of the flies. This is an excellent time to read *very carefully* the directions of the manufacturer on the process of anesthetizing the flies.

1. Following the manufacturer’s directions, anaesthetize the flies.
2. Handling the flies very gently, place them on a white card. This will help with the process of separating the males and the females. When observing them under the microscope, use at least a 12X magnification. Separate the males and the females. Handle the flies with a needle, a brush, or any suitable tool that won’t harm them.
3. Using the manufacturers directions, prepare ten containers for the flies. These should all contain the same amount of medium and water.

*Caution: The next steps involve a toxic material, and requires the use of gloves.*

1. Using an eye dropper, place four drops of pesticide into two of the containers. Then add three drops to the next two containers. Then two drops to the next couple, one drop to the next two. Leave two containers free of poison.
2. When transporting the flies from the cards to the jars, set the containers on their sides, and place the flies onto the side of the containers. This will eliminate the flies sticking to the medium. Plug the tops of the containers with the foam plugs provided for you. When the flies awake and begin to move, turn the containers right side up.
3. Observe the flies for ten minutes.
4. All flies except for the lucky twenty in the control containers will die.
5. To dispose of the dead flies, simply shake the medium and dead flies into a garbage can. Throw away the plugs. Wash out the containers with a steady flow of hot water and soap.
6. Wait two and a half weeks until the control groups have bred enough flies to continue the experiment.
7. Repeat steps 1,2, and 3.
8. Using the eye dropper and an extra jar, mix one drop of pesticide and fifteen drops of water.
9. Using your new mixture, drop four, three, two and one drops into the ten containers as you did in step four.
10. Repeat step five.
11. Place the flies into their area and wait for them to complete their life cycle.
12. Flies will die within four days.
13. Repeat step 8.

Recommendations

Having completed my experiment, I can look back on it with an objective eye. There are a few key points that I suggest to ensure that the experiment will work without a hitch.

I. Materials

Supplies

1. In order to eliminate excess materials at the completion of the experiment, it would be necessary to correctly estimate the amount of supplies that you will need. This would include medium, containers for the flies, and anesthesia. If ordering from a catalogue, ask enough questions to avoid wasting money.

Fly Supply

1. Because of the time limitations set on this experiment, it is necessary to begin as soon as possible. I suggest buying enough flies so that when you receive them, you can start immediately. This will save the time that would be needed to breed a whole new generation just to begin the project. Although cost plays a part in this decision, it might be worth it if you happen to need extra time during the course of your experiment.

II. Experiment

Pesticide

As the results of my experiment display, too much poison can destroy the entire experiment. To avoid this fatal mistake, the most important suggestion that I make is this: TEST THE POISON FIRST. This is absolutely imperative to the success of the experiment. Using a sample group of flies, test different amounts of the poison to figure out the highest and lowest amounts that can be used. This will eliminate any questions of toxicity. This will guarantee solid results (or at least *some* results)!

Time

As I spoke of in Concerns, time played an important factor in the experiment. I planned for the project to finish in plenty of time before it was due. I did not, however, plan for mistakes, which was the most enormous mistake I could have made. In order to avoid situations such as that one, it is necessary to plan for mess-ups. I wasn’t able to begin again because I didn’t have adequate time left over. If I had left room for error, I might have been able to continue the experiment and obtain results.

The intricacies of life on Earth have not been fully explained by humans, although in the past 200 years science has made many bounding leaps in the direction of finding the truth. Although not completely guaranteed to exactly exhibit what they are summed up to be, the findings of scientists are rapidly answering long asked questions. One of those questions is existence. This question has plagued scientists since the beginning of time. Through heated disputes and raging arguments, a solid foundation of facts has been laid down, and the beginnings of an understanding have begun to appear. On account of these supports, the theory of evolution is credited with belief.

Evolution is defined as,” genetic change in a populations.” Put simply, evolution is the answer to life’s existence on Earth. The theory has been vehemently criticized by many people, but has been supported by such strong evidence that it is difficult to ignore. The young naturalists who first published the idea suffered much criticism. Charles Darwin had recently returned from the Galapagos Islands, where he had completed his studies and collection of evidence to support his new idea. Darwin published the first few works, but not much notice was paid to the articles. It was not until the publishing of his book, Origin of Species, that the world exploded, buzzing with controversy over the issue. Although there was plentiful evidence to support his hypothesis, the public was collectively unsatisfied with hid findings. It was only after many years of other proof surfacing that the idea became accepted.

Obviously, Darwin was not the only contributor to the progress of the scientific journey. Many other scientists contributed information that gave power and knowledge to the cause. Bits and pieces of information and evidence were sorted out through time, and each new theory that was presented was used to strengthen the theories of others. Contributors such as Mendel, Lamarck, Huxley, Ray, and Wallace all aided in the completion of a revolutionary idea.

Although the theory of evolution has been scrutinized since its emergence, the sheer number and strength of the evidence supporting it has proven it to be legitimate. The different aspects and pieces of information that prove the theory are numerous, but there are four major arguments that nail down the four corners of this mighty theorem.

One support is comparative anatomy. The term refers to organs that are related to each other through common descent, but probably function differently from one another. These organs are also termed homologues. A solid example of homologous organs would be the forearms on many vertebrates. A study was completed that explicitly displays that, despite differences in size, shape, and function, the bones are obviously derived from a common source (see picture). As Darwin once said, ” What can be more curious that that the hand of man formed for grasping, that of a mole, for digging, the leg of a horse, the paddle of a porpoise and the wing of a bat, should all be constructed on the same pattern and should include similar bones and in the same relative positions?”

In the early 1800’s, scientist von Baer noticed striking similarities between embryos of different vertebrates. Therefore, the beginning stages of development were considered more “evolutionarily stable.” As Darwin stated, “ In two groups of animals, however much they may at present differ from each other in structure and habitats, if they pass through the same or similar embryonic stages, we mat feel assured that they have both descended from the same or nearly similar parents, and are therefore in the degree closely related. Thus community in embryonic structure reveals community of descent.”

The German evolutionist, Ernst Haeckel, developed this idea even further, and summed it up into the Biogenetic Law, which states,” Ontogeny [development of the individual] is a concise and compressed recapitulation of phylogeny [the ancestral sequence]… The organic individual repeats during the rapid and short course of its development the most important of the form-changes which its ancestors traversed during the long and slow course of their paleontological evolution according the laws of heredity and adaptation.”

What Haeckel apparently thought was that the early stages of development mirror both the embryological and the adult ancestral forms. That idea, however, was rejected as being oversimplified, and it was instead molded to fit more modern thoughts. It is now interpreted that although organisms use the common embryological patterns as foundations upon which they have built their vastly different adult patterns.

The most solid example of this is the existence of organisms who have nearly identical embryos (see picture). The vertebrates shown not only look similar, but they also possess gill arches, which in adult stages are only useful to the fish. The arches are transformed into head and thoracic structures, but no gills ever form. Correspondingly, the human, chick and other advanced vertebrate embryos undergo a stage in which they posses a two chambered heart. That is also a trait useful only to the fish. Such evidence as this would clearly support the notion that these vertebrates have a common ancestor.

Quite definitely the most indisputable evidence of evolution is the fossil record. Surely something so tangible and solid would compel even the most obstinate people to think twice about its validity. However, there were obstacles that were necessary to overcome in order to accomplish that task. Fossils are usually found in sedimentary rock, which presents gaps for the scientists. This rock was originally a deposit in the ocean, desert, or lake, and thus fossils are in some areas, but not others. Another problem arises when the organism decomposes before the rock has a chance to fossilize it. The largest problem concerning fossils is the dissemination of the fossils. Evolution is sparked by isolation, and thus transitional fossils between two organisms are rarely found near the fossils of the original two species. An important discovery that made serious progress for the cause was made in 1860. The discovery of Archaeopteryx bridged the gap between birds and reptiles, consequently ending any dispute over the validity of both the fossil record and the evolutionary process. The creature, which had a number of reptilian features, including teeth and a tail, also possessed a number of bird like features. The wishbone and the feather feature were what scientist Huxley used to argue the evolutionary point. He disputed that it inevitably had to be evolution that had produced this creature, as it was in the intermediate stages between birds and reptiles. That important discovery was a key element to proving the fossil theory to be valid. Those and other modern discoveries have all but proven the trail of evolution.

Evolution cannot occur without mutation. A mutation is a changes in the genetic code of an organism. The idea of mutations was explained by George Simpson as, “Then De Vries(1901), referring to the already long-known fact that individuals may suddenly appear with hereditary characters sharply different from those of their ancestry, applied the same word, “mutation,” to this altogether different phenomenon. Mendelian genetics took over De Vries’ term in a similar but more precise sense, applying it to a distinctly variant phenotypic character associated with a change at some one locus in a chromosome and segregating according to determinable rules. Then it was found that more or less similar phenotypic changes may be related, not to such a locus, but to various rearrangements within a chromosome or to changes in the number of chromosomes. (De Vries’ mutations later proved to be chromosomal, not genic.) These changes were, and still often are, also called “mutations," or “chromosome mutations, ”structural or numerical, to distinguish them from the point, locus, or gene mutations. It is sometimes difficult to make a sharp distinction between the three established sorts of genetic mutations or to determine which is involved in a given case. “Mutation” may then be used as a general term for the appearance of any character not inherited from the ancestors of an organism but heritable by its descendants…The general relationship of mutation, among genetically processes… is diagrammatically suggested in the figure.”

You can see from the explanation given above that when mutations alter the chromosomes of an organism, and the mutation is expressed as a phenotypic, (or outside appearance) characteristic, then evolution will take its course throughout the population of organisms. Although the diagram does not take every detail of the process of evolution into consideration, it simplifies the phynotypical cycle.

The passage by Simpson also leaves out the intricate and complex process of evolution. IT is not simply one gene mutation and then <<*POUF*>>a new species. As Simpson puts it, “The obvious conclusion would seen to be that since single mutations occur within an established reaction system and do not immediately convert this into another, distinctly different, integrated system, the development of such a new system must involve more than one mutation and a period of reintegration.” This statement inevitably has the most impact on evolution, because it fully supports it. Darwin argued that evolution was happening, and much of his evidence was based on this idea. Darwin realized that it took many stages and generations to evolve enough to notice. The fossil Archaeopteryx, which was in intermediate stages of evolution is a perfect example of this. The evolving process was a series of mutations that eventually led to what it is today. The chain of mutations caused the evolution of the organism; the fossil record kept tabs on the different stages of the mutations.

Although mutation does occur naturally in organisms, it can also be coerced. This is what Darwin termed artificial selection. Human intervention is the source of this occurrence. Breeding different species and populations to acquire the desired characteristics has resulted in the evolution of species’. “Dogs, for example, have been selected by humans for thousands of years and now range in size form the St. Bernard to the Chihuahua, and in features from the greyhound to the bulldog. Pigeons, long bred by fanciers, now show a wide variety of beaks, shapes, and feathers. The same is true for sheep, cattle, and all the many different agricultural species of plants and animals.”

The two ideas of evolution and mutation gave me the idea for my experiment. Although I knew that a huge change, such as wings on a dog, or banana eating fish would involve millions of years of evolving; I did know that something small might be attainable. My curiosity was enticed by the idea of mutating an organism just a little bit. I was only looking for small changes. I knew very little about the subject; I had only a bit of information on radiation poisoning. The results of that study were encouraging to my cause, however. They stated, “ Radiation is an energy emitted as electromagnetic waves, as gamma or x-rays, or as energetic particles, as neutrons. The defects occurred in about 20% of the children and grand-children of male mice whose gonads were exposed o extremely high radiation levels prior to mating…the researchers found that the effect can be inherited by the offspring of the individual males.” I knew that I would need an organism whose life cycle was relatively short. I chose Drosophila on the advice of knowledgeable informants. The fruit fly would be perfect for such an experiment for a few strong reasons. For one, they breed in huge numbers, and so I could obtain results without having to breed many generations just for the starting number. The life span of Drosophila is not so long that I would be handling thousands of them at a time. Flies are not cuddly, and so there would not be the problem of becoming attached to them. I decided to use pesticides because any other outside influence would have either required too much time and money (such as radiation) or too much time to see the results(such as breeding two different species). I decided to go ahead, just for the chance that it might actually work. I simply hoped for scientific results and self satisfaction that I answered my questions adequately.

Conclusions

The results of my experiment were, to say the least, disappointing. I did not obtain enough information to come to any scientific conclusions.

I realize that with the changes that I suggested in my ‘Thoughts’ section, the experiment could have run a great deal more smoothly. Overall, I think that my procedure would have been effective, had the most fatal mistake not have been made. I feel that my procedure would have been solid enough to create a successful experiment. The changes that I mentioned would strengthen it. Although the second part of the experiment was not completed by myself, it would be a very effective method to determine the accuracy of the hypothesis. The time and effort that I put into creating it would have proven a solid path to accurate results. The research that I did on Drosophila helped me to develop my procedure so that I could perform it with confidence. Despite the failure of the actual experiment, I feel that my procedure would have been successful, had the flies lived.

My data suggests nothing scientific above the knowledge that an unmeasured toxin will kill Drosophila. I would conclude, however, from my limited research on the subject of evolution and mutation, that there probably would have been a change. Even if those changes had been negative, I feel that there would have been at least the beginnings of change. The amount of toxin that was to be integrated into their systems would have inevitably affected the flies in some way. The radiation poisoning that I spoke of in my introduction supports this hypothesis. To issue a pesticide in an amount that is just short of fatal is bound to effect the living systems in a powerful way. If one-fifteenth of a drop produced death, then virtually any amount of the same pesticide would have a small influence on their bodily systems. Though the toxins might not affect the first or second generation, the odds point to it eventually effecting the genetic code somewhere down the line of matings.

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