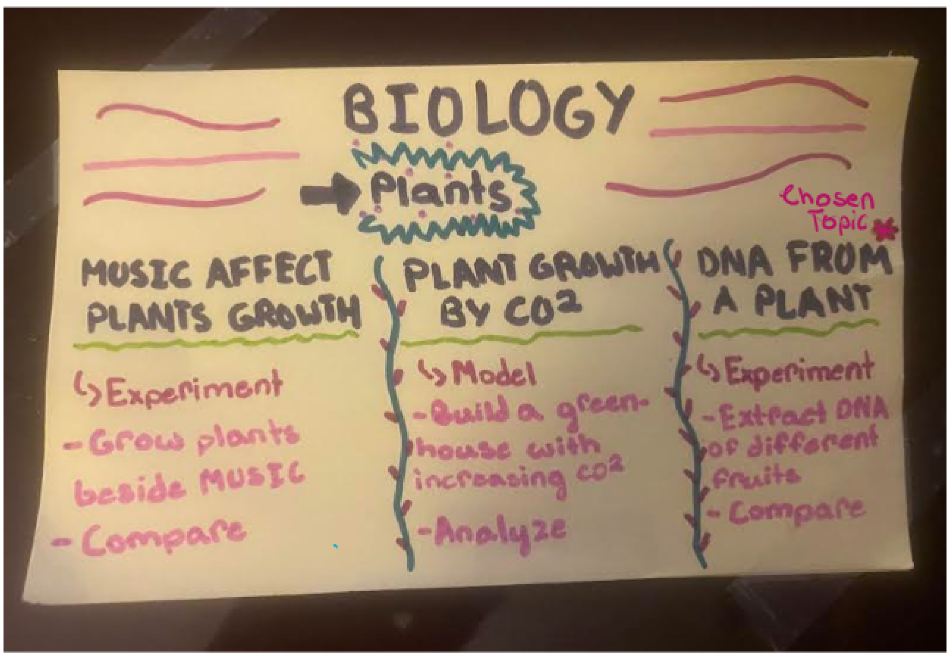
Logbook

(Day 1) Nov 20, 2022

-Today we chose a topic; **Comparing DNA of Strawberries to a Banana and a Blueberry.** We chose this topic as we found most of our ideas were related to biology. Starting broad we slowly narrowed it down to plant growth and even farther into cells. By doing some research we came across a guiding question "Is a strawberry really a berry?" We thought about it and decided we should find out. We chose something that we knew for sure was a berry, and another normal fruit, to compare what the DNA was more similar to.

We Narrowed it Down as Shown:



(Day 2) Nov 23, 2022

-We made final edits to our proposal and we submitted it. This included the basic information about what the project was about, whether it was experimental or not, if it was safe and a list of all the materials we needed to start our experiment.

(Day 3) Nov 27, 2022

-We finished backing up our hypothesis with explanations of how strawberries have several traits that are similar to a blueberry, which contain the characteristics of a true botanical berry, and also how apples have many traits that match up with a banana's. We found several reasons including: both apples and bananas grow on trees, change color due to lack of chlorophyll, release ethylene gas, have somewhat of an outer layer and a few more, while both strawberries and blueberries sprout from flowers and grow on plants.

(Day 4) Dec 4, 2022

- We figured out all the materials we needed for this project, and started thinking about how these would be included in our variables. We arranged the variables into controlled (maintained) variables, independent (altered) variables and dependent (responding) variables. After we were done this, we made a procedure with all the steps we needed to extract and compare the DNA of the fruits.

(Day 5-16) Dec 16 2022 to Jan 4 2023

-We did research based on 7 questions;

1. What is DNA and what is its impact on fruits? Parts of DNA. Why are genes important, especially in fruits?
2. How DNA affects genetic traits in general and in fruits?
3. What gel is gel electrophoresis and how does it work? Why is it so frequently used when comparing DNA used when "measuring" DNA?
4. What other methods can you use to compare DNA?
5. Are any of the genes in the fruits modified and how can this affect our experiment?
6. What causes different genes and what makes different fruits. Where does the genetic variation come from?
7. Similarities and Differences between strawberries, blueberries, bananas, and apples. General similarities and differences that are Visible/Physical and genetic similarities and differences.

When all of our research was done we were clear about how we needed to compare the DNA, and we had all the knowledge we needed for our observations and experiments.

This project is all about comparing the traits of different fruits through their DNA, finding out what actually makes a berry a berry, or a banana. We hypothesize that strawberries will have many traits that are similar to a blueberry's, while a banana's traits would be similar to an apple's. Our first thought was that since a strawberry has the word *berry* in it, it was probably going to be similar to blueberries, which are real botanical berries. Fruit is classified as a berry if it has more of a fleshy inside, sprouts from the ovary of a flower ,and has many seeds. While a strawberry isn't exactly a fleshy fruit, it does indeed have many visible seeds, and also does grow from the small white flowers that appear on their plant. That brings to my next point, both of the following fruits grow on plants not trees like apples and bananas, which both happen to grow on deciduous trees. Along with this, apples and bananas also have the same peaches, yellow tone and a peel-like outer layer that's quite different from the inner parts. More specifically in color, for a banana, the peel is usually more vibrant and where all the scars are, for an apple the peels are usually a red or a greenish yellow, nevertheless quite distinct from the inside, and this is where most scars are as well. Another reason is both fruits, the rotting (or brown spots) are usually more apparent here. Lastly, both of the fruits start off green when they are still quite unripe, and then turn to different shades; this is due to the lack of chlorophyll they get as they ripen. For red apples the anthocyanins, water-soluble pigments belonging to phenolic groups (a group of chemical compounds), that give certain fruits their red, purple, and blue color, cover up the green pigment chlorophyll. For yellow apples it's the same reason they change colors, except the pigment concealing the chlorophyll is known as a carotenoid. On the other hand, for bananas, while the starch turns into sugar that gets released from the peel to the rest of the fruit, it loses chlorophyll and a yellow color appears if it is exposed to ethylene gas that bananas and apples both happen to release. In the end, it was all these reasons that made us come up with our hypothesis.

(Day 17) Jan 7 2023

We finished our procedure and are moving on to collect all our materials for our experiment.

(Day 18) Jan 19 2023

We went out and searched for all our materials to conduct our experiment in two days. We hit some dead ends with trying to find the agarose gel powder which was crucial for our experiment. We thankfully found it after going to many stores and shops.

(Day 19) Jan 21 2023

We started the first attempt of our experiment. It didn't work as we weren't able to extract the DNA in the correct way. We plan to meet again to try and to it correctly.

(Day 20) Jan 27 2023

We had a sleepover so we can start as early in the morning as possible. We finished the part that took the most time the last time we did this, the agar gel. We created that in 5 minutes and we thought that we were golden. Then we started mixing our crushed fruits with our buffer solution, which is one step to the actual extraction process. Once we did that, we added the vodka which we used to actually lift out the DNA or of our fruit/buffer solution. This is the part which we messed up completely. We used big plastic cups instead of small plastic cups. It was difficult to pull out the specific DNA from the big cups, so we just used the liquid WITH the DNA in it. We put it in our gel and it sort of worked! The DNA was spreading like it was supposed to do.

(Day 21) Feb 8 2023

We added our finalizing details on the computer.

(Day 22) Feb 12 2023

We printed out our pictures and glued everything on our trifold. We are ready for the science fair.

Might Help:

Apples and bananas are genetically similar in that they both contain DNA, which is the molecular code that contains the instructions for building and operating the cellular machinery of all living organisms.
At a molecular level, both apples and bananas contain a similar type of DNA molecule called double-stranded deoxyribonucleic acid (dsDNA). The DNA in apples and bananas is composed of four basic building blocks called nucleotides: adenine (A), cytosine (C), guanine (G), and thymine (T).

The specific sequences of these nucleotides in the DNA molecule determine the genetic information for a particular organism. For example, the DNA sequence for the fruit's color may differ between apples and bananas, but both will have a similar code for important biological processes such as replication and metabolism.

While the specific DNA sequences of apples and bananas are unique to each species, the overall genetic structure and function of their DNA is highly similar. For example, both apples and bananas contain genes that code for proteins involved in metabolic processes and the regulation of gene expression.

In summary, apples and bananas are genetically similar in that they both contain DNA that is composed of the same basic building blocks and serves as the genetic code for their respective species

One example of a similar DNA sequence between apples and bananas can be found in the gene encoding for the protein Rubisco (Ribulose-1,5-bisphosphate carboxylase/oxygenase). Rubisco is a key enzyme involved in photosynthesis, the process by which plants convert light energy into chemical energy stored in sugars. The DNA sequence for the Rubisco gene in apples and bananas will likely be very similar, as the protein must perform the same basic function in both species.

Previous results of experiments comparing these four fruits through gel electrophoresis or other methods used to compare DNA vary depending on the specific parameters that were tested. Generally, studies have found that the genetic diversity of bananas is much higher than apples, blueberries, and strawberries. In one experiment, researchers used DNA fingerprinting to compare the genetic variability of apples, blueberries, and strawberries and found that the genetic diversity of apples was significantly higher than that of blueberries and strawberries. In another experiment, researchers compared the genetic variability of bananas and apples and found that bananas exhibited much higher genetic variability than apples. In addition, some studies have also compared the genetic variability of these fruits using methods such as restriction fragment length polymorphism (RFLP) and found that bananas had the highest genetic diversity of all four fruits.

Explanation:

The genetic diversity of organisms is an important factor in determining how they interact with their environment and how they can adapt to changing conditions. In order to better understand the genetic diversity of different organisms, researchers use a variety of methods to compare their genetic makeup. Gel electrophoresis and other methods used to compare DNA are some of the most commonly used methods for this purpose. In this text, we will discuss the previous results of experiments comparing bananas, apples, blueberries, and strawberries through gel electrophoresis or other methods used to compare DNA.

Gel electrophoresis is a method used to separate molecules of DNA, proteins, or other molecules based on their size and electrical charge. It works by passing an electric current through a gel matrix, which separates molecules of different sizes. The larger molecules move more slowly and are separated out first, while the smaller molecules move more quickly and are separated out last. Gel electrophoresis is a useful tool for comparing the genetic make-up of different organisms, as it can be used to compare the size and charge of different DNA fragments from different organisms.

Previous results of experiments comparing the genetic diversity of bananas, apples, blueberries, and strawberries using gel electrophoresis or other methods used to compare DNA suggest that the genetic diversity of bananas is much higher than that of apples, blueberries, and strawberries. In one experiment, researchers used DNA fingerprinting to compare the genetic variability of apples, blueberries, and strawberries and found that the genetic diversity of apples was significantly higher than that of blueberries and strawberries. In another experiment, researchers compared the genetic variability of bananas and apples and found that bananas exhibited much higher genetic variability than apples.

The results of these experiments suggest that bananas possess greater genetic diversity than apples, blueberries, and strawberries. This is likely due to the fact that bananas are a highly diverse species, with numerous varieties that have been bred by humans over the centuries. Bananas are also able to reproduce through asexual reproduction, which allows them to quickly adapt to new environments and to maintain their genetic diversity. In contrast, apples, blueberries, and strawberries are generally less diverse and reproduce through sexual reproduction. This means that their genetic diversity is limited and less likely to change over time.

In addition to the experiments discussed above, other studies have also compared the genetic variability of these fruits using methods such as restriction fragment length polymorphism (RFLP). RFLP is a method used to compare the DNA sequences of different organisms. It works by cutting the DNA at specific locations and then analyzing the resulting fragments. In this study, researchers compared the genetic diversity of bananas, apples, blueberries, and strawberries using RFLP and found that bananas had the highest genetic diversity of all four fruits.

The results of these experiments suggest that bananas possess a much higher level of genetic diversity than apples, blueberries, and strawberries. This is likely due to the fact that bananas are able to reproduce through asexual reproduction, which leads to quicker adaptation to new environments and a greater level of genetic diversity. In contrast, apples, blueberries, and strawberries are generally less diverse and reproduce through sexual reproduction, which leads to a slower rate of adaptation and a lower level of genetic diversity.

Overall, the results of experiments comparing the genetic diversity of bananas, apples, blueberries, and strawberries through gel electrophoresis or other methods used to compare DNA suggest that bananas possess a much higher level of genetic diversity than apples, blueberries, and strawberries. This is likely due to the fact that bananas are able to reproduce through asexual reproduction, which leads to quicker adaptation to new environments and a greater level of genetic diversity. In addition, other studies have also compared the genetic variability of these fruits using methods such as RFLP and found that bananas had the highest genetic diversity of all four fruits.

The results of these experiments have important implications for our understanding of the genetic diversity of different organisms. They suggest that the genetic diversity of different species can be significantly affected by their mode of reproduction, with asexual reproduction leading to higher levels of genetic diversity than sexual reproduction. In addition, these results may also be useful for developing conservation strategies for different species, as they suggest that species with higher levels of genetic diversity are more likely to be able to adapt to changing environmental conditions.

Agarose gel electrophoresis is the most effective way of separating DNA fragments of varying sizes ranging from 100 bp to 25 kb1. Agarose is isolated from the seaweed genera *Gelidium* and *Gracilaria*, and consists of repeated agarobiose (L- and D-galactose) subunits2. During gelation, agarose polymers associate non-covalently and form a network of bundles whose pore sizes determine a gel's molecular sieving properties. The use of agarose gel electrophoresis revolutionized the separation of DNA. Prior to the adoption of agarose gels, DNA was primarily separated using sucrose density gradient centrifugation, which only provided an approximation of size. To separate DNA using agarose gel electrophoresis, the DNA is loaded into pre-cast wells in the gel and a current applied. The phosphate backbone of the DNA (and RNA) molecule is negatively charged, therefore when placed in an electric field, DNA fragments will migrate to the positively charged anode. Because DNA has a uniform mass/charge ratio, DNA molecules are separated by size within an agarose gel in a pattern such that the distance traveled is inversely proportional to the log of its molecular weight3. The leading model for DNA movement through an agarose gel is "biased reptation", whereby the leading edge moves forward and pulls the rest of the molecule along4. The rate of migration of a DNA molecule through a gel is determined by the following: 1) size of DNA molecule; 2) agarose concentration; 3) DNA conformation5; 4) voltage applied, 5) presence of ethidium bromide, 6) type of agarose and 7) electrophoresis buffer. After separation, the DNA molecules can be visualized under uv light after staining with an appropriate dye. By following this protocol, students should be able to: 1. Understand the mechanism by which DNA fragments are separated within a gel matrix 2. Understand how conformation of the DNA molecule will determine its mobility through a gel matrix 3. Identify an agarose solution of appropriate concentration for their needs 4. Prepare an agarose gel for electrophoresis of DNA samples 5. Set up the gel electrophoresis apparatus and power supply 6. Select an appropriate voltage for the separation of DNA fragments 7. Understand the mechanism by which ethidium bromide allows for the visualization of DNA bands 8. Determine the sizes of separated DNA fragments

Blueberries and bananas are not closely related species, but they do share some genetic similarities. Both plants belong to the kingdom Plantae, and they have several common features in their genetic makeup, such as the presence of DNA as their genetic material, the use of chlorophyll for photosynthesis, and the presence of similar structures for cell division and reproduction. Additionally, both blueberries and bananas contain similar types of genetic information, including information for the development and function of their cells, tissues, and organs. This genetic information is encoded in the DNA molecules within their cells, which are organized into chromosomes and are composed of sequences of nucleotides. These genetic similarities demonstrate the evolutionary relatedness of all living things and the conservation of certain genetic features across the plant kingdom.

Comparing DNA of fruits: Apples, Bananas, Strawberries and Blueberries

Answer: Comparing the DNA of different fruits can reveal similarities and differences in their genetic makeup. Although apples, bananas, strawberries, and blueberries are all members of the plant kingdom, they belong to different families and genera, and therefore have different genomes.

Apples, bananas, and strawberries are all flowering plants and share many similarities in their DNA structure and function. For example, all three fruits contain the same type of genetic information encoded in DNA, including information for the development and function of their cells, tissues, and organs. Additionally, all three fruits have similar mechanisms for transmitting genetic information from one generation to the next through the process of reproduction.

Blueberries, on the other hand, are a type of flowering shrub and belong to a different family than apples, bananas, and strawberries. As a result, they have a different genome, although they share many of the same genetic features with other flowering plants, such as the presence of DNA as their genetic material, the use of chlorophyll for photosynthesis, and the presence of similar structures for cell division and reproduction.

In conclusion, while all four fruits belong to the plant kingdom, they have different genomes and genetic features that distinguish them from one another. These differences reflect their evolutionary history and the specific adaptations that have enabled each fruit to thrive in its particular environment.