SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

Prize Winner

Scientific Inquiry

Year 9-10

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Emmaus Christian College

Government of South Australia
Department for Education

SASTA South Australian Science Teachers Association

ROWE SCIENTIFIC PTY. LTD. www.rowe.com.au

Science Project Online Journal.

Instructions:
Use this document to record the progress of your science project.
You should not correct notes. Once you type it, DON'T DELETE IT!

Each Entry should have a date at the beginning.
Eg. 25/2/19 Today I started…….

Make sure you discuss the following in each Journal entry.

- ❏ What you worked on
- ❏ Listing websites you visited
- ❏ Phone calls you have made (if any)
- ❏ Summarise any information that you learned.
- ❏ Copy and paste sections of websites that have been useful
- ❏ Include photos of your project
- ❏ List anything that you have learnt, changed about your project
- ❏ Anything else relevant

Start Journal Here: ↓ ↓ ↓

3/3/20

Today I brainstormed some ideas for the science project. I tried narrowing down the ideas but then decided to some more research on other topics to give me more varitey to choose from.

Brainstorm:

- How do the surroundings have an effect on the growth of bacteria
- **Which out of the three DNA extraction methods are the most effective? (organic extraction, Chelex extraction, and solid-phase extraction), extract DNA from plants.**
- Do electromagnetic waves affect a plant's growth.
- What are the differences between genetically modified foods and organic fruits (skin)
- **Can rinsing seeds in different chemicals increase their growth rate (hydrogen peroxide solution, diluted hydrochloric acid solution, diluted isopropyl alcohol solution, and fruit juice? Some of these agents are thought to be able to loosen the seed coat surrounding the plant embryo)**
- Stroop effect on different ethnicities.
- **Does gender influence memory?**
- **How does Viscosity change with the change of temperature in the water**
- How do different chemicals affect corrosion?

- Which out of the three DNA extraction methods are the most effective? (organic extraction, Chelex extraction, and solid-phase extraction), extract DNA from plants.
- How do different detergents affect the DNA extraction methods

4/3/20

Today I narrowed down my ideas and ended up with four main ideas, I further researched these ideas to determine which idea would be the most efficient and effective. I found an easy, doable method to extract DNA from fruits and even cheek cells, therefore. I decided to further research the method to determine a question. I eventually realised that using different DNA extraction methods was an unrealistic task for the amount of time and resources we were provided with therefore I decided that I would research the effect of different dish soaps on the extraction of DNA.

Narrowed down answers:

- Which out of the three DNA extraction methods are the most effective? (organic extraction, Chelex extraction, and solid-phase extraction), extract DNA from plants.

- Can rinsing seeds in different chemicals increase their growth rate (hydrogen peroxide solution, diluted hydrochloric acid solution, diluted isopropyl alcohol solution, and fruit juice? Some of these agents are thought to be able to loosen the seed coat surrounding the plant embryo)

- Does gender influence memory?

- How does Viscosity change with the change of temperature in the water

dish soap contains sodium laurel sulphate, which cleans dishes by removing fats and proteins. It acts the same way in the DNA extraction protocol, pulling apart the lipids and proteins that make up the membranes surrounding the cell and nucleus. Once these membranes are broken apart, the DNA is released from the cell.
https://www.researchgate.net/post/What_is_the_function_of_detergent_in_DNA_extraction

Your DNA's sugar-phosphate backbone is charged. By adding salt, we help neutralize the DNA charge and make the molecule less hydrophilic, meaning it becomes less soluble in water. The salt also helps to remove proteins that are bound to the DNA and to keep the proteins dissolved in the water.

http://www.ncbionetwork.org/sites/default/files/DNAExtractionHandout.pdf

Since DNA is insoluble in ethanol and isopropanol, the addition of alcohol, followed by centrifugation, will cause the DNA proteins to come out of the solution. When DNA concentration in the sample is heavy, the addition of ethanol will cause a white precipitate to form immediately

https://info.gbiosciences.com/blog/bid/156468/work-of-salt-isopropanol-and-ethanol-in-dna-extraction

https://learning-center.homesciencetools.com/article/how-to-extract-dna-at-home/

5/3/20

Today I devloped the Aim, Hypothesis, Method and Materials, but I found that I wasn't offering enough information needed for the particular topic. The aim needed some more information on the motive of the experiment rather than what is actually being done. The Hypothesis needed the independant and dependant variables. I also forgot to write the method in the correct perspective. The materials did not have the accurate measurements. I worked on all these aspects and developed the project.

As I furthur developed the project I came across another thought, why can't I try to do different fruits rather than different detergents. I was thinking about this as we can explore the different amounts of DNA each fruit has, it would be a more reliable experiment in comparision to dish soapas well as a more intresting experiment. As I was confused as to what I would like to do I decided to continue researching.

https://learning-center.homesciencetools.com/article/how-to-extract-dna-at-home/

https://www.stevespanglerscience.com/lab/experiments/strawberry-dna/

http://www.madsci.org/posts/archives/2011-02/1298351209.Gb.r.html

6/3/20

Today I discovered yet another different way I can conduct the experiment, I can have two detergents and four fruits after much research I decided that I would write the Aim, Hypothesis and Materials for each topic and compare all of them to decide which topic would be more logical to go with. At the end of the lesson I decided that I will be researching the effect of different detergents on different types of fruit as there was more to experiment on and more to discuss.

To observe the effect of dish soap on the extraction of DNA.

To investigate about which fruit has more recognizable chromosomes.

I believe that the stronger the dish soapis the more effective the DNA extraction will be, I state this as the dish soapis being used to loosen up the cell and let the DNA out. If the dish soapis very strong more DNA can be brought out of the cell.

I believe that the fleshier and the more moisture the fruit has the more DNA it contains. Although all fruits have different amounts of DNA, some fruits are dryer than other therefore the cells may not allow the cell walls to be broken as easily therefore making it harder to extract the DNA.

- 10 mL or 2 teaspoos of each of the four different detergents.
- Two 100mL beakers
- 20mL (5mL per batch) chilled Isopropyl alcohol.
- Stirring rod or skewer

- Safety goggles
- Apron
- 1 teaspoon of sodium chloride (salt, ¼ teaspoon per batch)
- 360 ml Distilled Water
- Watery fruit
- Sieve or Filter paper
- Four small dishes

Different Fruits

- 20mL dish soap (A total of 100 mL of deteregent)
- Two 100mL beakers (You need 2 beakers per batch)
- 5mL chilled isopropyl alcohol (20mL of alcohol in total)
- Stirring rod or Skewer (Different one for each batch)
- Safety goggles
- Apron
- ¼ teaspoon sodium chloride (salt) (a teaspoon of salt in total)
- 90 mL plain water or distilled water (360mL in total)
- DIfferent fruits: Strawberry, Watermelon, Kiwi and Banana
- Sieve or Filter paper.

9/3/20

Today I looked through the safety form and attempted to fill it out, but when I was writing the description it was too long and not completly on topic. So I refilled it in and although it is still quite long, I will research more about writing description to ensure that I stay on topic while offering an adequate amount of information. I also figured out the amount of each material I would need, I had to multiply most of the measurements as I had to make eight batches. I also tried to evaluate the variables. I looked up the definitions of independant, dependant and controlled variables, to make sure that I do not incorrectly identify the variables

Independant Variable: Fruit and Variable

Dependant Variable: The amount of DNA extracted

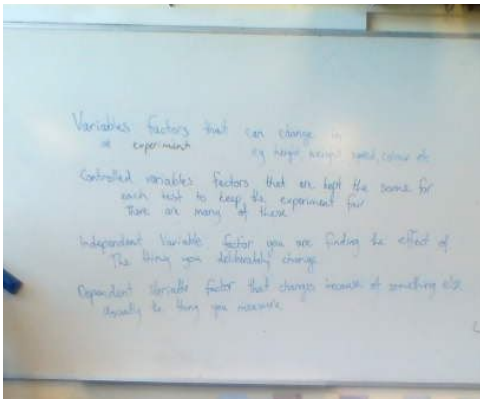
Controlled Variable: The method of extraction, the amount of materials used per batch of the experiment, the amount of fruit extract, the amount of dish soap and the temperature of the ingredients.

10/3/20

In today's science lesson we went through variables and the different types of variables, since I had already done some work on the topic I looked at the variable descriptions and what I had already done then I furthur develpoped the variables.

How to control, controlled variables:

- The method of extraction will be controlled by using the same materials and equipment as well as method.
- The amount of materials will be controlled by using weighs
- The amount of fruit extract will be weighed and measured in a measurement beaker.
- The amount of dish soap will be both weighed and measured.
- The temperature of the ingredients will be controlled by keeping all the ingredients except the isopropyl alcohol, at room temperature. I will let all the ingredients sit outside for 10 minutes to ensure the temperature.



11/3/20

Today I decided to research the method of extraction seperatly for each fruit. I quickly realised that all fruits are different therefore their DNA extraction methods are different. As I researched that each fruits I chose, except for the watermelon and strawberry, had a different way of doing the extraction. I had to rewrite the materials and method according to the findings.

- 8 pieces of fIlter Paper
- 40mL 99% Isopropyl Alcohol (5mL of alcohol for each batch)
- 720mL Water (90mL for each batch)
- Two kiwi fruits
- Two banana
- ¼ of a Watermelon
- Punnet of Strawberries
- Two different dish soaps: Palmolive and Earth's Choice (10mL of each dish soap for each batch)
- 16 beakers
- 2 teaspoon of Sodium Chloride (salt) (¼ teaspoon of salt for each batch)
- Eight small dishes
- Stirring rod or skewer
- Safety Goggles
- Apron
- 8 plastic ziplock bags
- Strainer
- Spoon
- Weigh

1. The Ipropyl alcohol was placed in the deep freezer to chill.
2. Eight small containers were weighed before the experiment so that the weight of the DNA can be subtracted from the weight of the container, to get the accurate weight of the DNA.
3. A measuring cylinder was used to measure 90mL of water, the water was placed in a 100mL beaker.
4. Measuring spoons were used to measure 10mL or 2 teaspoons of dish soap, it was added into the water.
5. Measuring spoons were once again used to measure ¼ teaspoon of salt, it mixed into the water until it was completly dissolved.
6. The strawberries were placed in a ziplock bag, and the strawberries were crushed until no lumps.
7. The strawberry mixture was poured into a strainer and a spoon was used to encourage the

mixture through the strainer, only 15mL of the mixure was used. If 15mL was not there more fruit was crushed and strained.

8. The water, dish soap, salt mixture and extracted strawberries were mixed together.
9. 5 mL of chilled isoproyl alcohol was measured and slowly poured into the water, slowly so that no bubbles were formed.
10. Slowly small white strings were recognized in the mixture.
11. A piece of filter paper was put on top of the previous beaker used to make the extraction mixture and the mixture with the DNA was poured through the filter paper.
12. The DNA was emptied into a petri dish.
13. The procedure was repeated on the remaining 5 strawberries with the other dish soap.
14. This procedure with the two different dish soaps were repeated for all the other fruits.
15. 8 batches of DNA were produced.
16. The dishes were place on the weigh and the DNA's weight was subtracted from the container's weight, (which was taken at the start of the experiment).
17. The weights were compared to see which fruit had the most DNA and which dish soap was used to extract the DNA.

https://thenode.biologists.com/outreach-activity-extracting-dna-from-kiwi-fruit/resources/
https://askabiologist.asu.edu/activities/banana-dna

12/3/20

Today I finalised the materials and method for all of the fruits. I ensured that I had all the equpiment and that the measurements were accurate. I had to make sure I included all the equipment, such as a knife, chopping board or weigh. To help myself to recognize the different materials and write an accurate method, I visualized the procedure of each fruit and what I would require and how I would conduct it.

13/3/20

Today I had the opportunity to do a test run of the project. Although the experiment looked very short and straight forward to me, when I was conducting it there was much more to it. I made sure that all the measrements were accurate by measuring them with a weigh, measuring cylinder and beaker. I found that I needed to be very time conscience when I was conducting this experiment. The first time I made a batch I took a very long time figuring out how to measure everything and how I was going to mix everything together, how I was going to smash the fruit without contaminating it with my hands, how I was going to collect the right amount of liquid and whether I was going to put the right measurements in. When it came to pouring the dish washing liquid in I found that most of it stuck to the beaker, so for the second batch I decided to do 0.5ml more than the original amount, even though I don't get it all in I will be closer to the amount listed as some of the soap stuck onto the beaker. Time came in the way once again when I ahd finished with the strawberry and had to move onto the watermelon, I had to wash all the equipment including the sieve, beakers, stirring rod, knife and chopping board. I had to make sure they were as clean as possible to avoid contamination. I had also not been able to conduct the experiement for the banana and kiwi, this gave me a disadvantage as the next time I would not be as familiar with the kiwi and watermelon. However I have understood how to extract the DNA from watermelon and strawberries effectively and I have also been able to identify DNA. I have also made the conclusion that filter paper is a neccissity to this experiment, I had later identified a lot of DNA that was both sitting in the alcohol and sitting at the bottom of the beaker.

18/3/20

Today I worked on the risk assessment form. I had to think for every possibility when I was doing the form, even things like ingesting isopropyl alcohol, although it may not be as possible. I came up with four main risks after filling in the form:

1. Isopropyl Alcohol: If alcohol was spilt anywhere immedietly go to the teacher and ask for assistance.
2. Broken Glass: If you break any glass **do not** try and pick it up, go ask the teacher for assistance.
3. Fruit allergies: Investigate prior the experiment whether anyone has fruit allergies. If an allergic reaction occurs immedetly tell the teacher and stop handling the fruit.
4. Sharp objects: Do not put sharp objects at the edge of the table as the object may fall and do not wave the object around.

OSA RISK ASSESSMENT FORM

for all entries in (✓) ☐ Models & Inventions and ☐ Scientific Inquiry

This must be included with your report, log book or entry. One form per entry.

NAME: Ishana Paula ID:

SCHOOL: Emmaus Christian College

Activity: Give a brief outline of what you are planning to do.

The experiment I am conducting is based on the DNA extraction. I was researching different ways to do DNA extraction and I figured that the experiment is conducted with different detergents and different fruits. I quickly realised that different dish soaps have different strengths. Fruits also have different amounts of DNA, therefore I decided that I would research different fruits and dish soaps on the extraction of DNA.

Are there possible risks? Consider the following:

- Chemical risks: Are you using chemicals? If so, check with your teacher that any chemicals to be used are on the approved list for schools. Check the safety requirements for their use, such as eye protection and eyewash facilities, availability of running water, use of gloves, a well-ventilated area or fume cupboard.
- Thermal risks: Are you heating things? Could you be burnt?
- Biological risks: Are you working with micro-organisms such as mould and bacteria?
- Sharps risks: Are you cutting things, and is there a risk of injury from sharp objects?
- Electrical risks: Are you using mains (240 volt) electricity? How will you make sure that this is safe? Could you use a battery instead?
- Radiation risks: Does your entry use potentially harmful radiation such as UV or lasers?
- Other hazards.

Also, if you are using other people as subjects in an investigation you must get them to sign a note consenting to be part of your experiment.

Risks	How I will control/manage the risk
see attached table.	

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Ishana Paula

SIGNATURE(S):

☐ By ticking this box, I/we state that my/our project adheres to the listed criteria for this Category.

TEACHER'S NAME: Angela Sucker

SIGNATURE: DATE: 15/3/2020

Risk	How I will control/manage the risk
1. Isopropyl Alcohol 2. Broken Glass 3. Fruit allergies 4. Sharp Objects	1. If alcohol was spilt anywhere immediately go to the teacher and ask for assistance. 2. If you break any glass **do not** try and pick it up, go ask the teacher for assistance. 3. Investigate prior to the experiment whether anyone has fruit allergies. If an allergic reaction occurs immediately tell the teacher and stop handling the fruit. 4. Do not put sharp objects at the edge of the table as the object may fall and do not wave the object around.

I also did some more research on each fruit and dish soap individually as well as on the effectiveness of the method and the DNA of the fruit and in general.

DNA, or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms.

Most DNA is located in the cell nucleus

https://ghr.nlm.nih.gov/primer/basics/dna

a dish soap will cause the cell to pop open, or lyse, so that the DNA is released into solution. Then alcohol added to the solution causes the DNA to precipitate out. strawberries will be used because each strawberry cell has eight copies of the genome, giving them a lot of DNA per cell.

the dish soaphelped lyse (pop open) the strawberry cells, releasing the DNA into solution. The salt helped create an environment where the different DNA strands could gather and clump, making it easier for you to see them. After you added the cold rubbing alcohol to the filtered strawberry liquid, the alcohol should have precipitated the DNA out of the liquid while the rest of the liquid remained in solution. You should have seen the white/clear gooey DNA strands in the alcohol layer as well as between the two layers. A single strand of DNA is extremely tiny, too tiny to see with the naked eye, but because the DNA clumped in this activity you were able to see just how much of it three strawberries have when all of their octoploid cells are combined!
https://www.scientificamerican.com/article/squishy-science-extract-dna-from-smashed-strawberries/

DNA extraction is a routine procedure used to isolate DNA from the nucleus of cells.

Step 1. Breaking cells open to release the DNA

The cells in a sample are separated from each other. The positively charged sodium ions in the salt help protect the negatively charged phosphate groups that run along the backbone of the DNA. A dish soapis then added. The dish soapbreaks down the lipids in the cell membrane and nuclei. DNA is released as these membranes are disrupted.

Step 2. Separating DNA from proteins and other cellular debris

To get a clean sample of DNA, it's necessary to remove as much of the cellular debris as possible. This can be done by a variety of methods. Often a protease (protein enzyme) is added to degrade DNA-associated proteins and other cellular proteins. Alternatively, some of the cellular debris can be removed by filtering the sample.

Step 3. Precipitating the DNA with an alcohol

Finally, ice-cold alcohol is carefully added to the DNA sample. DNA is soluble in water but insoluble in the presence of salt and alcohol. By gently stirring the alcohol layer with a sterile pipette, a precipitate becomes visible and can be spooled out. If there is lots of DNA, you may see a stringy, white precipitate.

Step 4. Cleaning the DNA

The DNA sample can now be further purified (cleaned). It is then resuspended in a slightly alkaline buffer and ready to use.

Step 5. Confirming the presence and quality of the DNA

For further lab work, it is important to know the concentration and quality of the DNA.

Optical density readings taken by a spectrophotometer can be used to determine the concentration and purity of DNA in a sample. Gel electrophoresis can be used to show the presence of DNA in your sample and give an indication of its quality.

Once extracted, DNA can be used for molecular analyses including PCR, electrophoresis, sequencing, fingerprinting and cloning.

https://www.sciencelearn.org.nz/resources/2036-dna-extraction

human DNA is very similar to that of other species. We share most of our genes, which make up DNA, with fellow primates such as chimpanzees and with other mammals such as mice. We even have genes in common with the banana plant!
https://www.scientificamerican.com/article/find-the-dna-in-a-banana-bring-science-home/

Ripe **strawberries** are an excellent source for extracting **DNA** because they are easy to pulverize and contain enzymes called pectinases and cellulases that help to break down cell walls. And most important, **strawberries** have eight copies of each chromosome (they are octoploid), so there is a lot of **DNA** to isolate

https://www.gs.washington.edu/outreach/dhillon_dnaprocedure.pdf

With the high-quality **watermelon** sequence now complete, it is hoped that breeders can now use the information to recover some of these natural disease defenses. The authors reported that the genome of the domesticated **watermelon** contained 23,440 genes, roughly the same number of genes as in **humans**.

https://www.sciencedaily.com/releases/2012/11/121126151023.htm

A **kiwi is** only hexaploid, which means that they **have** 6 copies of each type of **DNA** chromosome per cell

https://prezi.com/tnuaxlwlgh2r/experiment-lab/

By chopping and mashing up the kiwi fruit, then leaving it in the salt and dish soapmix, we break open the cell walls, called **membranes**. This lets all the cell contents out, including the DNA. But the DNA is still surrounded by polymers called **proteins**. Luckily, kiwi fruit contain an **enzyme** called proteinase – this attacks and breaks up the proteins, freeing the DNA.

https://www.york.ac.uk/res/sots/activities/diydna.htm

19/3/20

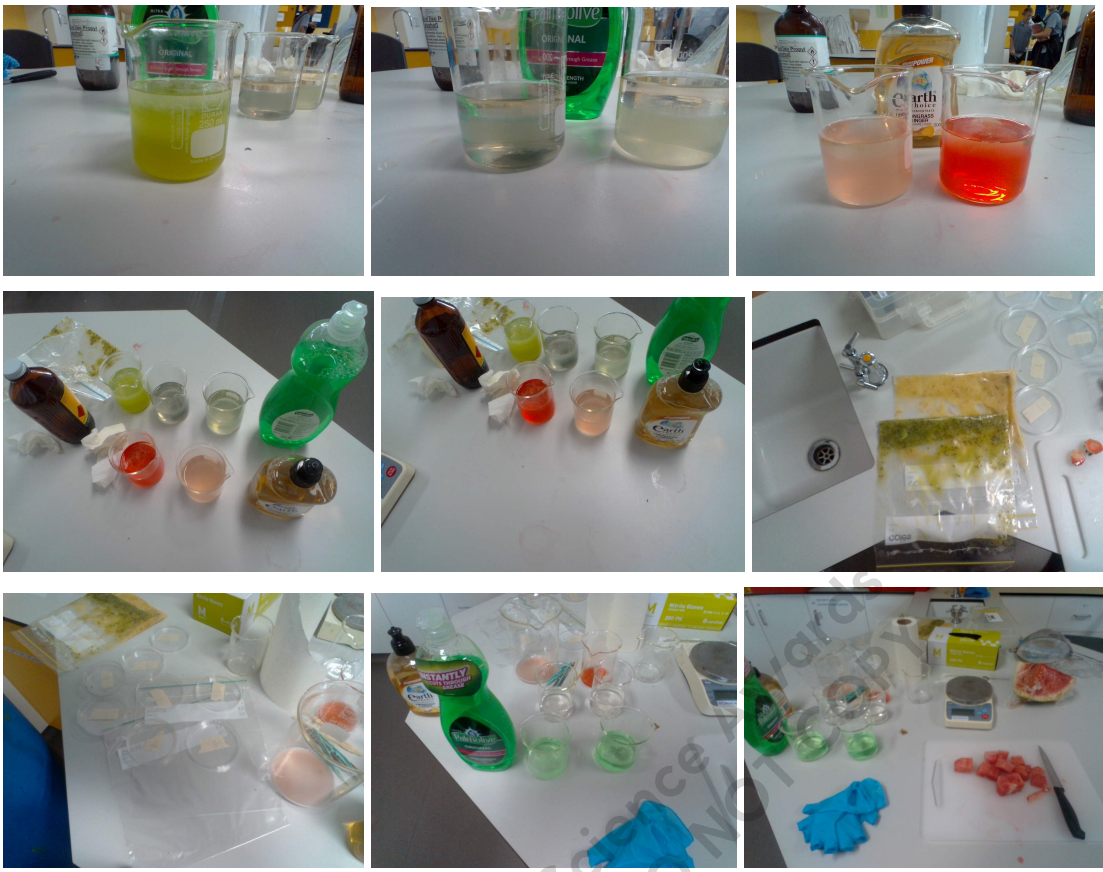
Today I went through the method and materials to give myself a rough idea of the process. If I do this then I will have a rough plan that I can follow when I re-conduct the experiment, the plan had very few steps, but with generalised steps. Also, I wrote down the rough timing for each step. However I tried to overestimate a little so that I don't end up with the a time that is lower than the time I actually take.

Step	Time
Weigh petri dishes	16 min
Smash all the fruit	16 min
Make all the extraction liquids	16 min
Get the alcohol	2 min
Mix fruits and extraction liquids	5 min
Slowly mix all the mixtures	8 min
Slowly pour all the alcohol in	8 min
Pack up while the mixture sits	5 min
Get Petri dishes ready	2 min
Filter all the dna, use a big beaker for all the extra liquids from the extraction mixture	16 min
Weigh all the DNA and record in table	16 min
Total	110 min = 1h 50 min

This table helped me a lot when I was doing the testing as I knew what I had to do and how to manage the time given.

20/3/20

Today I got another opportunity to test and I had the opportunity to make 5 different batches. I got to making two watermelon batches, two strawberry batches and one kiwi. However I tried a different way of extracting the fruit juice and it proved to be less successful than completly crushing the fruit. This proved that crushing the fruit is a vital step for the entire process. I also observed that the kiwi, strawberry and watermelon all used the same amount of equipment and process of extraction. I decided to change the process and method of the kiwi fruit to match the strawberry as I realised that the process changed, even though it consists of the same steps slightly changed, this effects the fair-testing element of the experiment. I also observed that the kiwi and strawberry have the largest amount of DNA, therefore I will be testing them first for the final testing. It was shown that the compositions of the fruits I chose were quite different, the strawberries were moist but not as water-based as watermelon and banana was a complete contrast to both the fruits, it is more of a solid fruit with not as much water as the other fruits. I also observed that the ripness of the fruits, the conditions they were placed in and the growth of each fruit (organic and non-organic).



25/3/20

Today I attempted to write the abstract and did more reasearch on the use of the experiment. I also proof read the method, and realised that it may be too hard to effectively extract the DNA from the banana as it is very solid, therefore, I chose to take the banana and watermelon out of the project as the watermelon had too much water making it hard to crush the particules and encourage the DNA out of the fruit while the banana was in contrast too solid to extract enough liquid with the method I was applying. I was also faced with time contraint having to finish the project in the following week and it was shown with the two practice tests that it is a challenge to finish all eight batches in the time we were offered.

The ability to extract DNA is of primary importance to studying the genetic causes of disease and for the development of diagnostics and drugs. It is also essential for carrying out forensic science, sequencing genomes, detecting bacteria and viruses in the environment and for determining paternity.

Strawberry and Watermelon:

- 4 pieces of fIlter Paper
- 99% Isopropyl Alcohol (25mL of alcohol for each batch)
- 90mL Water (90mL for each batch)
- ¼ of a Watermelon
- Punnet of Strawberries
- Two different dish soaps: Palmolive and Earth's Choice (10mL of each dish soap for each batch)

- 6 beakers
- ½ teaspoon of Sodium Chloride (salt) (¼ teaspoon of salt for each batch)
- Two small dishes
- Stirring rod or skewer
- Safety Goggles
- Apron
- 4 plastic ziplock bags
- Strainer
- Spoon
- Weigh
- Knife
- Chopping board

Kiwi:

- Two kiwi fruits
- 5g of each dish washing liquid
- 4g salt - 2g per batch
- 200ml tap water - 100g per batch
- 200ml Isopropyl - 100ml per batch - the alcohol needs to be ice cold, so freeze before
- Kettle
- Two beakers
- Large basin - something so that the beakers can sit in it.
- 100ml beaker - to mash the kiwi in
- A spoon
- A fork
- Sieve
- Two pieces of filter paper
- Knife - to cut the kiwi fruit
- Thermometer

Banana:

- 1 banana (½ banana used for each batch)- the banana should be ripe
- 1 (½ cup water per batch) cup water
- Kettle
- 2 tsp salt - 1 tsp per batch
- 1 tsp dish soap - ½ teaspoon per batch
- 2 plastic ziplock bags
- 1 cup (½ cup per batch) 99% Isoprpoyl alcohol - it needs to be ice cold, so place in freezer ahead of time.
- Two pieces of filter paper
- Two beakers
- Stirring rod or skewer

Method:

Strawberry and Watermelon:

1. The Ipropyl alcohol was placed in the deep freezer to chill.
2. The petri dishes were weighed before the experiment so that the weight of the DNA can be subtracted from the weight of the container, to get the accurate weight of the DNA.
3. A measuring cylinder was used to measure 90mL of water, the water was placed in a 200mL beaker.
4. Measuring spoons were used to measure 10g or 2 teaspoons of dish soap, it was added into the water. The mixture was mixed very slowly so that no bubbles appeared.
5. Measuring spoons were once again used to measure ¼ teaspoon of salt, it mixed into the water until it was completly dissolved.
6. The strawberries were placed in a ziplock bag, and the strawberries were crushed until no lumps.
7. The strawberry mixture was poured into a strainer and a spoon was used to encourage the mixture through the strainer, only 15mL of the mixure was used. If 15mL was not there more fruit was crushed and strained.
8. The water, dish soap, salt mixture and extracted strawberry liquid were mixed together.
9. 25 mL of chilled isoproyl alcohol was measured and slowly poured into the water, slowly so that no bubbles were formed. The alcohol sat on the top of the mixture as it is less dense than the mixture.
10. Slowly small white strings were recognized in the mixture.
11. A piece of filter paper was put on top of the remaining beaker and the mixture was poured through gently, so that the DNA was left on the top of the filter paper.
12. The DNA was emptied into a petri dish.
13. The procedure was repeated on the remaining strawberries with the other dish soap.
14. 2 batches of DNA was produced.
15. The dishes were place on the weigh and the DNA's weight was subtracted from the container's weight, (which was taken at the start of the experiment).

Kiwi:

1. The kiwi fruit was peeled and chopped. The skin was not used as there weren't enough living cells for the DNA to be extracted from.
2. The chunks were placed in the 100ml beaker and mashed with the fork.
3. The dish soap, salt and normal water were mixed together slowly so that no bubbles were formed, to create the extraction mixture.
4. The extraction mixture was added to the mashed up kiwi fruit, and the kiwi was further mashed.
5. The large basin was filled halfway with boling water from the kettle, to create an incubator for your mixture. To cool the water down the same amount of normal water was filled into the basin. A thermometer was used to measure the accurate temperature needed for the mixture. The mixture was left in the incubator for 15 minutes.
6. The mixture was seived into another jar so that the lumps and unwanted particles were left behind.
7. The cold alcohol was poured slowly into the mixture, after a period of time, small DNA strings were recognized.

Banana:

1. The banana was mushed in ziplock bag until no lumps were detected.
2. A cup was filled with hot water and salt.

3. The saltwater was poured into the bag with the banana and they were mixed togther.
4. The dish soap was slowly mixed with the banana and saltwater mixture.
5. A sieve was placed on the top of one of the beakers and the mixture was poured through the sieve and encouraged through with a spoon.
6. The chilled alcohol was slowly poured into the mixture. The alcohol should not be poured right through the mixture but rather to rest on the top of the mixture.
7. After a few minutes the DNA was detected in the mixture.
8. The mixture was carefully stirred so that the DNA collected onto the skewer or stirring rod.

Palmolive:

Fruit	**Weight (g)**
Strawberry	
Watermelon	
Banana	
Kiwi	

Earth's Choice:

Fruit	**Weight (g)**
Strawberry	
Watermelon	
Banana	
Kiwi	

27/3/20

Today when I conducted the experiment, I reflected on the previous attempts and I made sure I paid attention to every detail such as contamination, crushing the fruit and maintaing the controlled variables. I had also observed that over the three attempts there have been various results of DNA, I believe there were many different elements that contributed to the results.

28/3/20

Today I researched advice and tips on scientific abstracts, introducton, results, discussion and conclusion.

When you added the salt and dish soapmixture to the smashed strawberries, the dish soaphelped lyse (pop open) the strawberry cells, releasing the DNA into solution, whereas the salt helped create an environment where the different DNA strands could gather and clump, making it easier for you to see them. (When you added the salt and dish soapmixture, you probably mostly just saw more bubbles form in the bag because of the detergent.) After you added the cold rubbing alcohol to the filtered strawberry liquid, the alcohol should have precipitated the DNA out of the liquid while the rest of the

liquid remained in solution. You should have seen the white/clear gooey DNA strands in the alcohol layer as well as between the two layers. A single strand of DNA is extremely tiny, too tiny to see with the naked eye, but because the DNA clumped in this activity you were able to see just how much of it three strawberries have when all of their octoploid cells are combined! ("Octoploid" means they have eight genomes.)

An abstract should be:

- Informative (a brief overview of your research)
- Descriptive (including the research aim, objectives of your project, and the analytical methodologies applied)
- Critical (the key outcomes and limitations of your work should be described)
- Written in a formal language
- A conference abstract should contain 150–1000 words (limiting yourself to the word count indicated by the conference organizers)

https://www.ptglab.com/news/blog/how-to-write-a-good-scientific-abstract/

Statement of the problem

Does the type of dish soap used for the extraction of DNA of different fruits effect the amount of DNA extracted?

Name

Sohana Pasula

Date

3/3/2020

Teacher

Angela Ducker

All this information is only to be on this page and nowhere else in the report

Abstract - COMPLETE THIS LAST!!!

The purpose of this experiment was to test the effectiveness of dish soaps during a DNA extraction process from fruits with various moisture levels. The findings of this experiment was encouraged with the idea that the more sets of chromosomes a fruit has the more DNA is extracted, strawberry was said to have more sets of chromosomes, therefore, more DNA was produced. It was also shown that DNA can be extracted and observed with household items, an extraction solution of water, dish soap and salt. The extraction solution played a key role in the extraction, the dish soap allowed the lipids and proteins surrounding the cell to be broken down, the salt solidified the DNA so that it was visible, the water kept the proteins and fats away from the DNA while the alcohol precipitated the DNA out of the liquid. Once the experiment was completed it was concluded that the dish soap and composition and ripeness of the fruit contributed to the complete amount of DNA extracted. This project showed us that DNA is a real substance that all living organisms contain, as well as being able to study the chemical reaction involved in DNA extraction.

Aim

To investigate what effect of different dish soaps and fruits have on the extraction of DNA.

Introduction

DNA extraction is a process that involves isolating and purifying DNA from cells. The first time DNA was extracted was in 1869 by a Swiss scientist Friedrich Miescher who wanted to study the chemistry of cells, (1869: DNA First Isolated, 2020). Over time DNA extraction has evolved into many different procedures of different efficiencies and purities, for instance, solid-phase extraction, organic extraction and chelex procedure.

As different extraction methods were being observed it was shown that there were three main steps to extracting DNA, the lysis, precipitation and purification, Lysis being the most essential step because if the cell wall was not broken apart the DNA would have been harder to extract, (The Basics of DNA Extraction, 2020). It was shown that dish soap was being used for the lysis step, however, it was quickly realised that different dish soaps have different strengths. Fruits also have different amounts of DNA, so it was decided that the investigation would be based on the effect of different fruits and dish soaps on the amount of DNA extracted. Each element contributed equally to the project, for example, dish soap, dish soap pulls apart the fats and protein from around the cell, once the wall-like membrane is pulled apart the DNA is pulled out. Also, salt is also an important element, salt clumps the DNA together. DNA is invisible to the human eye, so when the salt clumps the DNA together so that it could be observed.

Hypothesis

I believe that the if the dish soap and fruits are changed a different amount of DNA will be produced according to the changes. The stronger the dish soaps are and the more moisture a fruit contains, the more DNA is extracted, as the strength of the dish soaps effect how much of the cell wall is destructed and the moisture of the fruit allows the DNA to be easily extracted as the cell is dilated. I

assume that the more sets of chromosomes a fruit has the more DNA is extracted. I believe that the strawberry will produce the most DNA when extracted with the Earth's Choice dish soap as more natural products are used in Earth's choice dish soap.

Risk Assessment Form:

OSA RISK ASSESSMENT FORM

for all entries in (✓) ☐ Models & Inventions and ☐ Scientific Inquiry

This must be included with your report, log book or entry. One form per entry.

NAME: Ishana Paula ID:

SCHOOL: Emmaus Christian College

Activity: Give a brief outline of what you are planning to do.

The experiment I am conducting is based on the DNA extraction. I was researching different ways to do DNA extraction and I figured that an experiment is conducted with different detergents and different fruits. I quickly noticed that different dish soaps have different lengths. Fruits also have different amounts of DNA, therefore I decided that I would research different fruits and dish soaps on the extraction of DNA.

Are there possible risks? Consider the following:

- Chemical risks: Are you using chemicals? If so, check with your teacher that any chemicals to be used are on the approved list for schools. Check the safety requirements for their use, such as eye protection and eyewash facilities, availability of running water, use of gloves, a well-ventilated area or fume cupboard.
- Thermal risks: Are you heating things? Could you be burnt?
- Biological risks: Are you working with micro-organisms such as mould and bacteria?
- Sharps risks: Are you cutting things, and is there a risk of injury from sharp objects?
- Electrical risks: Are you using mains (240 volt) electricity? How will you make sure that this is safe? Could you use a battery instead?
- Radiation risks: Does your entry use potentially harmful radiation such as UV or lasers?
- Other hazards.

Also, if you are using other people as subjects in an investigation you must get them to sign a note consenting to be part of your experiment.

Risks	How I will control/manage the risk
see attached table.	

(Attach another sheet if needed.)

Risk Assessment indicates that this activity can be safely carried out

RISK ASSESSMENT COMPLETED BY (student name(s)): Ishana Paula

SIGNATURE(S): IP

☐ By ticking this box, I/we state that my/our project adheres to the listed criteria for this Category.

TEACHER'S NAME: Angela Sucker

SIGNATURE: ASucker DATE: 15/3/2020

Risk	How the risks will be controlled/managed
1. Isopropyl Alcohol 2. Broken Glass 3. Fruit allergies 4. Sharp Objects 5. Irritation caused by dish soap	1. If alcohol was spilt anywhere immediately go to the teacher and ask for assistance. 2. If you break any glass **do not** try and pick it up, go ask the teacher for assistance. 3. Investigate prior to the experiment whether anyone has fruit allergies. If an allergic reaction occurs immediately tell the teacher and stop handling the fruit. 4. Do not put sharp objects at the edge of the table as the object may fall and do not wave the object around. 5. If any irritation is caused on the body with the dish soap, tell the teacher or

	thoroughly wash the area, and wash the contaminated clothing before wearing them again. If the dish soap is in your eyes, tell the teacher and rinse your eyes, if wearing contacts, remove if easy to do and continue rinsing.

Variables:

Independent Variable: Fruit and brand of dish soap

Dependent Variable: The amount of DNA extracted

Controlled Variable: The method of extraction, the amount of materials used per batch of the experiment, the amount of fruit extract, the amount of dish soap, the method of weighing, the equipment used to perform the experiment, and the temperature of the ingredients.

How to control controlled variables:

- The method of extraction will be controlled by using the same materials, amount of materials and equipment.
- The amount of materials will be controlled by using a scientific scale, measuring cylinder and beakers.
- The amount of fruit extract will be weighed and measured in a measurement beaker and/or scientific scale.
- The method of weighing will be controlled by using the same scale for all the measurements.
- The equipment will be controlled by using the same equipment but washing and drying them for each fruit and dish soap.
- The amount of dish soap will be both weighed and measured with a measuring cylinder and scientific scale.
- The temperature of the ingredients will be controlled by keeping all the ingredients excluding the isopropyl alcohol, at room temperature. The ingredients will be let to sit, 10 minutes prior to the experiment to ensure that all the ingredients are at room temperature.

Equipment

- 4 pieces of filter paper
- 4 Conical flasks
- 4 Funnels
- 99% Isopropyl Alcohol (25mL of alcohol for each batch)
- 180mL Water (90mL for each batch)
- Two kiwi fruits (Ripe)
- Punnet of Strawberries (Ripe)
- Two different dish soaps: Palmolive and Earth's Choice (10mL of each dish soap for each batch)
- 9 beakers
- 1 teaspoon of Sodium Chloride (salt) (¼ teaspoon of salt for each batch)
- 4 Petri dishes (labelled, with the fruit, dish soap and weight written on it)
- Stirring rods
- Safety Goggles

- Apron
- 2 plastic ziplock bags
- Fine sieve
- Chux cloth
- Spoon
- Scientific Scale
- Knife
- Chopping board
- Gloves (a pair of gloves per fruit, to avoid contamination)
- Masking tape
- Pen
- Measuring cylinder

Method

1. Petri dishes were weighed and labelled with masking tape on the bottom of the respective petri dish, the weight, fruit and dish soap were written on the masking tape.

The petri dishes were weighed and labelled with masking tape

2. Isopropyl alcohol was placed in the freezer.

Isopropyl alcohol was required to be ice cold

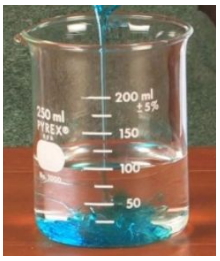
3. It was made sure that gloves were worn.

Gloves were worn throughout the procedure

4. 90ml of water was measured in a measuring cylinder and poured into a beaker.


A measuring cylinder was used to measure the water

5. 10ml of dish soap was poured into the water. The dish soap was slowly mixed into the water with the stirring rod, ensuring that no bubbles were formed.



Dish soap was poured and mixed into the water

6. ¼ teaspoon of salt was poured into the mixture and slowly mixed until the salt was completelty absorbed. This was the extraction mixture.


Salt was measured on a scale

7. Six strawberries were cut on the chopping board and placed in the plastic bag and slowly crushed until a fine pulp.


Strawberry was chopped and crushed into a fine pulp

8. A scale was set up and a beaker was placed on the top of the scale, this scale was used to measure the amount of strawberry juice. The sieve was placed on the top of the beaker and the strawberry pulp was poured onto the sieve.

The mixture was encouraged through the sieve with gloved hands or a spoon

9. The strawberry pulp was crushed against the sieve to extract the juice. After 15 grams of juice was extracted the beaker was removed ready to be added to the extraction liquid. If 15 grams were not extracted the pulp in the sieve was poured into a chux cloth and was futher extracted by applying pressure to the chux cloth.

The mixture was placed in a chux cloth

10. The strawberry juice was added to the extraction mixture.
11. 25ml of ice cold alcohol was measured into a beaker.
12. Both beakers - with alcohol and DNA mixture - were held at eye level, nearly parallel to eachother. The alcohol was slowly poured onto the surface of the DNA mixture. Although alcohol was less dense than the DNA mixture it was important to pour it in onto the top of the mixture to ensure that the DNA would gather onto the top of the alcohol.

The alcohol was poured onto the mixture, they were nearly parallel to eachother.

13. The mixture was left to rest for a few minutes so the DNA was able to gather in the alcohol. It was shown that the DNA gathered in the alcohol but also in the mixture under the alcohol so filter paper was used to gather the DNA.

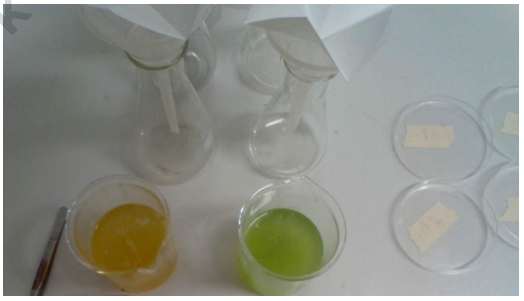
The mixture was left to rest

14. Filter paper was folded horizontally and vertically, each crease was then pulled together and folded to make another crease in between each of the four formed creases, this made a more flexible sieve for the DNA to rest on.

The filter paper was creased and set up with conical flasks and funnels

15. A funnel was placed on top of the conical flask and the filter paper was placed in the funnel.

16. The DNA mixture was slowly poured onto the filter paper until it accepted no more, this process was repeated for the whole beaker of mixture. The filter paper was left to filter the DNA.
17. A petri dish was placed on the weigh and the DNA resting on the filter paper was scraped onto the petri dish with a clean spatula.
18. The same method was used for the other dish soap and fruit, however the skin was removed from the kiwi fruit as it contained too many dead skin cells. All the equipment used except for the salt beaker and dish soap beakers were cleaned and thouroughly dried to use for the following batches.



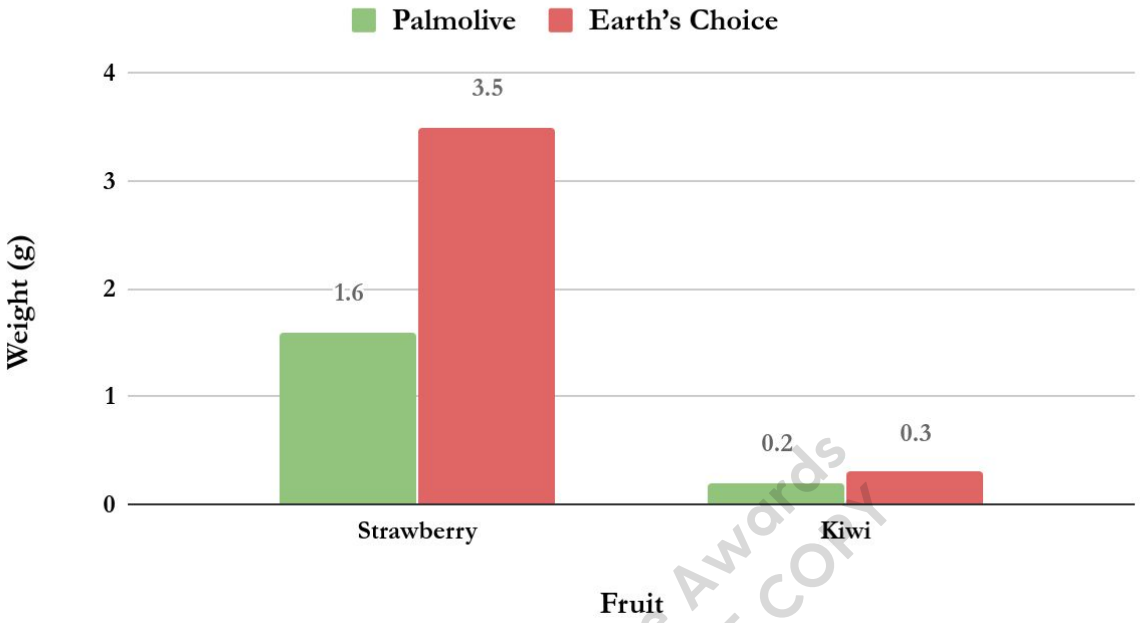
19. The weights of the four produced samples of DNA were compared to see which fruit and dish soap extracted the largest amount of DNA, this information was then recorded into a table.

Results

The amount of DNA extracted with the influence of different dish soaps.

Fruit	**Palmolive (g)**	**Earth's Choice (g)**
Strawberry	1.6	3.5
Kiwi	0.2	0.3

The comparison of DNA extracted with the influence of different dish soaps.



Discussion

The hypothesis stated that the strength of the dish soaps and moisture of the fruits both largely effect the extraction of DNA. It was also stated that the strawberry would produce the most visible DNA when extracted with the Earth's Choice dish soap. This was an accurate prediction as the strawberry and Earth's Chocie dish soap did indeed produce the most visible DNA, 3.5 grams specifically. This result was predicted as strawberry genomes are octoploid genomes, (Strawberry DNA, 2020). This prediction was based on the fact that strawberry genomes are octoploid and a kiwi fruit's genomes are hexaploid which mean there are only 6 copies of each type of DNA per cell. If there are more copies of each types of the DNA the cell would be larger as it needs more space to accomodate all the copies of the DNA.

As the experiment was being conducted subsequent to two trial runs there was a wide variety of results to compare with. There were many elements that contributed to the difference in the results, for instance the ripness of the fruit, contributed largely to how much DNA was produced. Although the results were only collected from the final run, doing three different runs of the experiment gave me the opportunity to test consistency. Each time the experiment was run there a similar outcome with the kiwi fruit, kiwi fruit is a hexaloid genome therefore much DNA was not produced while the strawberry always produced more than a gram of DNA. It had previously been predicted that the Earth's Choice would be the more successful dish soap. The dish soaps varied as they contained different ingredients that contributed to the cleaning element, the cleaning element is what broke down the lipids and proteins surrounding the fruit cell allowing the DNA to be extracted. Palmolive Ultra dish soap contained many more ingredients than Earth's Choice. Earth's Choice only had nine ingredients, majority of which were used as cleaning properties while Palmolive contained fifteen ingredients. The complexity of Palmolive's ingerdients may have effected the purity of the DNA as it was extracted, therefore, effecting the following steps in the extraction process. There are various chemicals used in the dish soaps to enhance the cleaning properties. Palmolive Ultra dish soap

contains Ammonium Laureth Sulfate, Ammonium Lauryl Sulfate, Lauramidopropylamine Oxide and Isodeceth-6, these chemicals were used as cleaning agents. Earth's Choice dish soap contained, Sodium Laureth Sulfate, Sodium Chloride, Coco-Glucoside, Cocamidopropyl Betame as cleaning properties. These chemicals were essential to this experiment as they contributed to breaking down the fats and proteins in the cell wall, this was essential as the dish soap allowed the DNA to be released from the cell.

It has been demonstrated that the moisture and ripness of the fruit was essential to this experiment. The first time the experiment had performed the experiment the fruit were in between raw and ripe and the results were shown to be mediocre, there was not a surpring amount of DNA extracted. The fruit being ripe was essential to the experiment as the ripness allowed the fruit to be pulvirised and ripe fruit contained pectinases and cellulases, enzymes which helped break down the cell walls. However the second time the experiment was performed the fruit were extremely ripe close to the point of spoiling, therfore, the fruit was greatly bruised and fragile, so when the lysis step was carried out- crushing the fruit and breaking the cells open- it was very effective and the results were surprising, there was at least three grams of DNA per batch.

However the ripness of the fruit cannot be fully given the responsibility of the amount of DNA extracted as the moisture of each fruit varied greatly. Strawberry contained a 90% and above moisture rate while the kiwi fruit contained a 80%-84% moisture rate (Farrell and Farrell, 2020) This greatly effects the amount of visible DNA extracted as the more moisture a fruit cell contains the easier it is to break open as it is more swollen and vunerable than a fruit without much moisture as the fruit would be more rigid and grounded.

Each element that was used in the contributed to the extraction of the DNA. There were many ingredients in this experiment, salt, alcohol and dish soap. During the DNA extraction the detergent will cause the cell to pop open or lyse, then the DNA is released into the solution. The salt in the mixture will create an environment where the DNA will clump together so that it is visible, then the alcohol is added to the mixture causing the DNA to precipitate out of the mixture and be visible. These ingredients all played a key role in allowing the DNA to be broken, realeased and precipitated. If these steps had not taken place the DNA would be behind the cell walls in the cell.

Evaluating

One of the many uses of DNA extraction is in criminal investigations, DNA samles can be taken from different cells such as blood, saliva, hair or sweat, these samples can be compared to suspect profiles and the evidence can be used to assess the suspect's involvement. Quite similarly the DNA samples from the fruit can be compared to different samples of other fruits to determine whether the fruit has been altered in anyway. These samples can also be used to discover any changes that can be made to crops to increase appearence, taste or nutrition. These samples of DNA can also be used to purely study to elaborate general knowledge on DNA for students. This procedure also gives the opportunity to learn about what is in a cell and how it reacts with reagents and other ingredients such as ice cold alcohol.

There are many questions this research leads to. For instance, do the type of ingredients used for this experiment impact the DNA extraction or does the order the extraction takes place effect the overall outcome. There are several preferences to which ingredients, such as, sodium lauryl sulfate is an essential ingredient in the dish soap as it helps the lysis step and the alcohol must be ice cold as this allows the DNA to precipitate more efficiently. The extraction method is essentially very very

similar no matter which order it is done, the fundamental aim is so that the ingredients all get access to the cell and DNA so that they can play their role in the extraction.

The investigation could have been improved by using a more accurate method of extraction. The method that was used was very simple and the total amount of DNA may not have been extracted. If there was an opportunity to use a more accurate method such as chelex, or solid phase extraction more pure, accurate samples of DNA may have been produced. The chelex extraction method involves centrifuging, incubating and purifying the DNA sample many times, chelex extraction is very simple, rapid and do not involve many test tube transfers, therefore, it is not prone to contamination, in the rsearch that was done for this project there was a high chance of contamination due to the cross-contamination of equipment such as chopping boards and beakers. Solid-phase extraction is focused on purity of the DNA sample, it involves introducing the sample to an extraction catridge in the shape of a small syringe-shaped container, this container contains a solid-phase (a substance which restrains the DNA's thermal mobility) extracting the DNA. The DNA is then removed from the 'impurities' and is then injected into a HPLC, this supressess DNA transcription making it easier to extract the DNA as it is not replicating itself. Both these methods are focused on the purity of the DNA sample, this was very important for the experiment as there was a high possibility of contamination due to using the same equipment for both the fruits,therefore, in the future it would be made sure that different equipment was used throughout the experiment.

There was also a problem of ripness in the fruit, if the opportunity to re-conduct this experiment was available it would be made sure that the condition of the fruit is so ripe that it is nearly rotten. This is as the fruit would be more bruised and there would be more pectinases and cellulases allowing the cell wall to be broken more efficiently.

Another development was to let the mixture rest for a longer, timed period of time. Allowing the fruit to rest was very important as this would allow the DNA to precipitate into the alcohol, if the DNA was still clustering together and it was filtered there would be a major amount of DNA abandoned in the fruit mixture, this would be terrible for the results as it would have not been a fair test. Timing the amount of time the mixtures are left to rest would also be crucial as it would maximise the fair test element.

In the future using a blender would be a more efficient for the lysis step, this is crucial as the lysis is when the DNA is released from the cell, if the DNA is not effectively released there would be much less DNA obtained from the DNA sample. This experiment was based on the weight of the DNA obtained, therefore, obtaining the maximum amount of DNA would be essential for a fair test.

Conclusion

It was shown that the strength and ingredients of the dish soap as well as the properties of the fruit effect the amount of visible DNA extracted. Earth's Choice dish soap was the more successful dish soap, strawberry also proved to be the fruit with the most extractable DNA.

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