Isaac Cheng 2024 Calgary Youth Science Fair Log Book

Note: This is just a digital version of my log book, my physical log book is more detailed and easier to read

Oct. 24
Started to research biomimicry topics for a school chinese presentation when my mom asked me “what about geckos” so I googled “gecko biomimicry” and found:
https://www.youtube.com/watch?v=vS0TuIPoeBs
-Found the idea interesting
-Decided to research it for the presentation
-Decided that I would keep researching for a science fair topic as a CNC machine seemed hard to get

Oct. 25
Mom found:
https://www.hyunwooyuk.com/research.html
-This was research done by Dr. Hyunwoo Yuk who was the inventor of Sana Heal a bioadhesive used to tape surgery incisions up similar to using duct tape over a leak.
-I didn’t like this topic as I felt as I would not be able to understand this field very well and have fun learning about it

Oct. 26
I continued to research the topic of recreating the adhesion of a gecko's foot and found the video:
https://www.youtube.com/watch?v=vpTX32KdVBQ
-was excited that the video demonstrated a method that would not require any expensive machinery
-Used RTV silicone
-I decided to do this topic as it seemed easy to do and fun

Oct. 27
rewatched:
https://www.youtube.com/watch?v=vS0TuIPoeBs
-They used a PDMS silicone
-Used a CNC machine to make little ridges in a wax block in which they casted the PDMS onto

Nov. 11
I decided to rewatch:
https://www.youtube.com/watch?v=vpTX32KdVBQ
As I wanted to find the brand of silicone he used in the video.

After rewatching it multiple times I still could not find out what brand he used

Nov. 12
Googled “material science science fair” found:
https://www.merriam-webster.com/dictionary/materials%20science#:~:text=%3A%20the%20scientific%20study%20of%20the,metals%2C%20polymers%2C%20and%20composites)
Learned:
-That material science is the study of materials and how we can manipulate then to achieve a purpose

Nov. 18
My mother found:
https://people.eecs.berkeley.edu/~ronf/Gecko/index.html
-This is a giant hub for all the gecko adhesion related research done by UC Berkeley

Drafted an email to the creator of the video: https://www.youtube.com/watch?v=vpTX32KdVBQ
To ask questions about the silicone used in the video

Email draft copy:
https://docs.google.com/document/d/1J_KqygpyuzHoTn62Jugmuzztr9Y8sB9fGePR0X_dJ6Q/edit?usp=sharing

Nov. 19
Emailed thethoughtemporium the creator of the the youtube video:
https://www.youtube.com/watch?v=vpTX32KdVBQ
To ask about the brand of silicone used in the video but received no reply

Nov. 22
Rewatched the video:https://www.youtube.com/watch?v=vpTX32KdVBQ
To see if I could find any silicone mentioned in the video.

Found the video: https://www.youtube.com/watch?v=9XQfYKYO380&t=0s in the description

The video show an unsuccessful attempt of making gecko tape from instructions found on the website:https://nisenet.org/sites/default/files/catalog/uploads/4665/synthetic_gecko_tape_facilitated_activity.pdf

In the instructions they used a RTV silicone just like the video where they casted it onto a diffraction grating sheet.

From the label on the tub of silicone they used it said “TAP Plastics”
So I googled “TAP Plastics” and found:https://www.tapplastics.com/
From there I clicked on “Mold Making/Casting Resin”
And the clicked on “Mold Making Materials and Supplies”

The first product page that was shown was the silicone used in the instructions and the unsuccessful attempt video.

I clicked on the product excited to have possibly found a silicone but was disappointed to learn that the product could only be shipped in the United States.

Because of this I decided to save the website as a possible supplier of another silicone but overall decided to not use the product used in the Instructions and video of failed attempt.

Nov. 24
Rewatched the video: https://www.youtube.com/watch?v=vpTX32KdVBQ
I carefully pieced together the images on the label on the silicone to find out It was made by a company called “IllusEffectsStudios” which is currently out of business.

This meant that this brand of silicone was also out!

Nov. 26
From the article:
https://people.eecs.berkeley.edu/~ronf/Gecko/index.html
Found the article:
https://people.eecs.berkeley.edu/~ronf/Gecko/gecko-compare
-Shows data comparing different materials
-PDMS seemed to be one of the best options I could get my hands on
-Link noted down for future reference
-Decided that for my test I would only be testing shear force as it was the only one I could really do

Dec. 2
Registered on the CYSF platform with the title:
Becoming a Gecko: Synthetically Replicating Gecko Adhesion to Climb on Smooth Surfaces

Dec. 3
First went to:
http://bdml.stanford.edu/Main/AdhesionPublications
On the website found the publication:

Hawkes, E.W., Christensen, D.L., and Cutkosky, M.R., "Vertical Dry Adhesive Climbing with a 100x Bodyweight Payload," IEEE/ICRA 2015 (preprint).
http://bdml.stanford.edu/uploads/Main/MicroTugs/ClimbingMicroTugsICRA2015.pdf

Learned:
- The wedges in the material help attach onto the object
-When placed under shear force the wedges flatten out increasing the surface area

Then re-read
https://people.eecs.berkeley.edu/~ronf/Gecko/gecko-compare.html#Soft_Polymer_Fiber_Arrays

-Saw that PDMS was a viable option that had good results
-Learned that the PDMS used was Sylgard 184
-Remembered from the youtube video: https://www.youtube.com/watch?v=vS0TuIPoeBs
that they were using Sylgard 170 another PDMS silicone
-Googled “Sylgard 170 Silicone” and found:
https://www.ellsworthadhesives.ca/products/by-market/consumer-products/encapsulants/silicone/dow-sylgard-170-silicone-encapsulant-black-0.9-kg-kit/
Decided that it was too expensive for me

-Googled “PDMS silicone Sylgard 184” and found two links that sold it:
https://www.nanofab.ualberta.ca/services/resale-items/pdms-kit/
https://www.ellsworthadhesives.ca/products/by-market/consumer-products/encapsulants/silicone/dow-sylgard-184-silicone-encapsulant-clear-0.5-kg-kit/

Had a coaching session with mother
-Keep a detailed logbook
-Stay strict with the scientific method

Dec. 10
Watched:
https://www.youtube.com/watch?v=zWQTnH79I_8
-Learned from the video that PDMS can trap lots of air bubbles that normally need to be degassed in a vacuum chamber which is a piece of equipment I do not have access to.

Dec. 14
Planned out a script, conversation table, and questions so I could call the University of Alberta Nano fab lab for the products:
https://www.nanofab.ualberta.ca/services/resale-items/pdms-kit/
https://www.nanofab.ualberta.ca/services/resale-items/substrate-4-glass-0211-square/
script:
https://docs.google.com/document/d/1_uAYUZv7PNYFRB9_oY5IwadCAm_UE3J3geskDp0zuUk/edit

Dec. 15
Called the University of Alberta to buy their PDMS kit and 4” glass square but was told that they only sold the materials to students and faculty members as their billing was done through their portal.

Decided to scrap the idea of using PDMS as the only other site selling it was very expensive (https://www.ellsworthadhesives.ca/products/by-market/consumer-products/encapsulants/silicone/dow-sylgard-184-silicone-encapsulant-clear-0.5-kg-kit/)

Decided to use RTV silicone (as shown in the video:https://www.youtube.com/watch?v=vpTX32KdVBQ)instead as RTV silicone is cheaper and easier to work with compared to the expensive and hard to work with PDMS

Decided to use the other RTV silicone listed on the TAP Plastics page as it could be shipped to Canada
Link:https://www.tapplastics.com/product/mold_making_materials/mold_making_supplies/tap_platinum_silicone/494

Dec. 22
Talked with my mother about when we decide to order components and things such as the hypothesis, variables, and method

Dec. 24
-Worked on updating the digital log book
-planned to go with the tap plastics platinum silicone so i spec-ed it out on their website www.tapplastics.com

Dec. 25
-After updating the digital log book I copied it into my physical log book
-Updated “Cost sheet” (https://docs.google.com/spreadsheets/d/1vdA8EPuwfCCQmrNbQ_Bo1_E4PR4mfIlzntdzPHouXqQ/edit?usp=sharing) with new silicone product link

Confirmed budget with mom:

Less than $400 in total with the condition that I have to create a full lab draft before ordering components.

Jan. 4
-Worked on updating Physical log book v0
-my sister gave me a sample chemistry lab to show me how it should be like ex. Method, research, background
Wrote out a rough hypothesis:

If a slab of silicone has micro sized ridges, it will resist more force when pulled in shear than one that is completely flat. This is because the ridges will bend creating an almost perfect contact area.

Jan. 7
Created a timeline
-experiment planning / lab writeup: by Jan 21:
Ordered material : by Jan 26

-ethics form: by Jan 31
-experiment to be done FEB 15-17
-result documentation by: feb.19
-Fill in everything in platform by: feb.14

Jan. 13
-Worked on planning out lab e.g. method, variables.v0
Did some rough calculations to make sure that buying the 473ml kit of silicone was enough
Calculations:
470 because there are 470 ml in each container
12 because there will be 3 samples and 9 final product
X2 because there are two containers that are each 470ml
470/12x2=78.3

Jan. 14
-talk to mother about changes I should make to the lab sheet v0
https://docs.google.com/document/d/18KBeVgIFzdKCyf2eQ0ABSgU13BLb3uVFDS9Wu40Q1VE/edit

Jan. 19
-worked on editing Variables, Method, Hypothesis, and Problem in the v0 lab sheet to include more detail and be more specific-3h
https://docs.google.com/document/d/18KBeVgIFzdKCyf2eQ0ABSgU13BLb3uVFDS9Wu40Q1VE/edit
-Added more things to cost/materials list

Jan .20
-Edited and completed the lab sheet v0 -8h
-completed the background research
-updated the problem statement

Googled “young's modulus” because my mom told me to a long time ago and found that:
https://depts.washington.edu/matseed/mse_resources/Webpage/Biomaterials/young's_modulus.htm

Learned that:
-Young’s modulus is how easy a material can be stretched, pulled or bended
-the amount of stress before the material permanently deforms

Googled “why does tape stick” and found:
https://www.scientificamerican.com/article/what-exactly-is-the-physi/

Learned that:
tape is “viscoelastic” in the sense that the glue acts like a fluid and the backing of the tape give it elasticity and structure

Googled “all about diffraction gratings” and found:
https://www.shimadzu.com/opt/guide/diffraction/02.html#:~:text=1%2D1.-,What%20are%20Diffraction%20Gratings,of%20evenly%20spaced%20parallel%20slits

Learned that:
-diffraction grating have many lines
-in between the lines it lets the light through
-the diffraction grating sheet breaks up white light into the different wavelengths causing the colors to be divided up

Googled “how are diffraction gratings made” and found:
https://www.physics.smu.edu/~scalise/emmanual/diffraction/lab.html#:~:text=BACKGROUND,6%2C000%20lines%2Fcm%20on%20it.

Learned that:
-Diffraction gratings are made by scraping up a piece of see through material e.g. glass or plastic
-the scratches make the sheet opaque in that area

From: https://people.eecs.berkeley.edu/~ronf/Gecko/gecko-biblio.html#2003
Found:
M. Sitti and R.S. Fearing, ``Synthetic Gecko Foot-Hair Micro/Nano-Structures as Dry Adhesives," Journal of Adhesion Science and Technology, vol. 17, no.8, pp. 1055-1074, 2003.
http://www.cs.cmu.edu/afs/cs/academic/class/15398-f04/www/readings/p1055.pdf

Learned that:
-nanomolding is a possible way to make gecko inspired materials
-PDMS had a lot lower of a Young’s modulus adhesion force than polyester and polyimide

Jan. 21
-edited lab/planning sheet v0 with mom (this became v1)-4h
https://docs.google.com/document/d/12nTcEtxCA3r4VV91XRwILNcMmGkSqH8izjddpTtvU5g/edit
learned:
labs need to be written in third person
-looked at what i needed to order

What’s new in Lab v1 (compared to the Lab v0)
- Changed the writing from 1st person to 3rd person
- Revised the amount of silicon to be used in making the 9 samples

Jan. 22
-ordered diffraction grating online:
https://sciedco.ca/diffraction-interference/diffraction-grating-film-1000-lines-mm-15-cm-x-30-cm-sheet/

-ordered silicone online:
https://www.tapplastics.com/product/mold_making_materials/mold_making_supplies/tap_platinum_silicone/494

-ordered acrylic online:
https://www.tapplastics.com/product/plastics/cut_to_size_plastic/recycled-acrylic-sheets-clear

Jan. 26
-bought glass from Ikea:
https://www.ikea.com/ca/en/p/utrusta-shelf-glass-00265613/

Jan. 27
Updated physical log book

Jan. 28
Updated physical log book
Added the titles of the youtube video links in my physical log book
UPS billed my mom for the canadian tariffs / taxes on the shipment from the United States
looked at clamps on the home depot website

Jan. 29
Silicone and acrylic was delivered today but the lid of silicone wasn't properly secured and a quarter of the part a silicone leaked out
We went to home depot and bought clamps:
https://www.homedepot.ca/product/bessey-lm-4-in-capacity-light-weight-clamp-with-die-cast-zinc-jaws-and-2-in-throat-depth/1000817130

and foil tape:
https://www.homedepot.ca/product/nashua-322-series-1-89-inch-x-30-ft-multi-purpose-hvac-foil-tape/1000179072

Updated cost sheet to include the cost of the clamps and foil tape

Jan. 30
Mother called *Scideco* and they told her that the products arrival would be late as it was delayed given the diffraction grating sheets they had in stock had been damaged

Jan. 31
Drafted the responses for the ethics and due care form and reviewed it with mom
Drafted and sent a email to Science is regarding information about the poster board: https://docs.google.com/document/d/1ZCT6evIJ2o4w9OfN8Aqe-SxZukBmQlASnuny8zWsC0M/edit
Added cost sheet

Feb. 1
Got a reply from science is so my mom called owner and scheduled an appointment for 5:30 where we went and picked it up
Submitted ethics and due care form
Made the procedure section of Lab sheet v2 more specific
finalised version 1

Feb. 2
Updated physical log book up to feb.1
Spent an hour making a prototype sample

What happened:
Made a 2" by 3" mold on a piece of acrylic with foil tape and popsicle sticks

I then mixed 20mL of silicone base and 20mL silicone catalyst

Then I started to pour it into the mold where i realized that i had too much silicone(around 10ml)

So I decided create a new lab writeup (v3) that had a new method to make and measure out the silicone
https://docs.google.com/document/d/1rJG7SA4FXaxY7f5UI9T91JX2V_gS-4_v6aKpTM5jUmo/edit

After I turned off the camera i realised that the silicone had lots of bubbles trapped in it so i popped them with a sharp piece of foil

I decided to also add this step to the new lab page

https://docs.google.com/document/d/1rJG7SA4FXaxY7f5UI9T91JX2V_gS-4_v6aKpTM5jUmo/edit

I came back to check on the silicone a few hours later and found that some of the silicone had leaked out of the mold so I spent another hour making another mold made only of foil tape and filled it using a total of 20mL of silicone
The silicone some of the silicone also leaked out of this mold with the corner also being the weak spot

With this problem recurring so often I decided to watch the video again and I saw that he used as little silicone as possible which would explain why so little leaked out for this reason I will reduce the amount of silicone used down to 10mL total

Feb. 3 - 2 hours
What happened:
I de-molded the test piece to see if they had worked

observations:
-great elastic properties(was very stretchy and flexible)
-it could stick to the mirror without falling off(very sticky)
-the shape of the two samples were semi uniform
-I could wash it with water to clean it off

Lessons learned:
-Try to keep the foil tape as smooth as possible because the edges of the samples were not very even
-the mold that used popsicle stick was easier to demold then the one that only used foil
-strengthen the corners because that's where leaks occur the most

Feb. 4
What happened:
Today I spent 30 minutes running a test to see if the silicone would rip when pulled from a single point

Procedure:
I cut a small hole in the test piece number 1. I cut this hole an inch in from the edge of the piece of silicone, I then put a rolled up piece of tape through the hole. I tried to pull on this piece of tape but the silicone ripped. I switched to the other test piece and tried to wrap tape around the piece of silicone but it kept slipping off so I tried using multiple staples to attach a piece of tape that sat an inch from the edge and it worked. So I wrapped the staples up with another piece of tape so the staples wouldn't stick out and poke me.

Then I spent 2 hours editing the lab page v3 to add this method of attaching a handle onto the silicone test piece. I also added pictures to the method.

Spent 3 hours on:
Entered hypothesis into CYSF platform

Lab v3: Adding details to the materials section based on observations from the test pieces i made

Feb. 5
Spent 2 hours making the 6 molds for the slabs that will be casted on glass and acrylic
Note: diffraction gratings had not arrived yet

Feb. 7
-Ethics and due care sheet was approved
-Diffraction grating arrived today

Feb. 8
Spent an hour and a half making the 3 molds for the slabs of silicone that will be casted onto the diffraction grating

Feb. 9

3:00pm-4:30pm
Filled the molds with silicone and noticed that:

- The molds that were made on the smooth surfaces i.e. glass & acrylic leaked more than the ones made on the sheet of diffraction grating

After I labeled the surface beside each sample with a number and a letter

Feb.10
5:00-6:45
I demolded the samples and on their top side wrote the number letter combo that was written beside it yesterday. This was to tell which side was which and also to make sure I didn't confuse samples.

After that I rinsed the samples off with some water to get rid of any leftover silicone or smudges. I then added a backing made of duct tape and staples. (This backing will be used to attach the force scale)

Finally I added the letter-number combination onto the backing as well and bagged the samples up

Observations:
-The silicone casted onto the diffraction grating sheet had the same rainbow effect as the diffraction grating sheet
-the silicone casted onto the glass leaked out a lot more than any other material
-the silicone casted onto the diffraction grating did not leak out at all

Feb. 11
Spent 5 hours editing my research as my sister and mother gave me some feedback on how I could improve my research

Found the article:
https://www.smooth-on.com/support/faq/184/
And learned about the difference between tin-cure and platinum-cure silicone

Finished & printed CYSF lab sheet v3

Sent an email to the science learning leader at my school regarding the possibility of me being able to use school science equipment

https://docs.google.com/document/d/1epGyjZWQsTBgDsWWXOq8ubXw4PSxe3AFQXhIiVNI4Q0/edit
I got a reply so I was able to pick up 3 spring scales at lunch

Feb. 15
9:30-12:15
Tested the samples with the spring scale and all of my samples ripped before losing grip on the sheet of glass

I noticed that they all ripped at the area where the staples were placed so I made 9 new molds to attach backings to

12:35-2:00
Researched ways I could attach a strap to my silicone and found that Stanford used a plastic backing and the diy video used two sheets of silicone and a piece of acrylic. So I combined the two methods and created my own method that works like a sandwich. I also revisited the product sheet to make sure packaging tape would work with my silicone.

I decided on the sandwich style backing design as it looked that strongest and it was something I could do with some simple packaging tape and silicone

While I was making the last mold my mother came and recommended that I should make a test sample first to make sure that this new type of backing would work

Unfortunately I ran out of foil tape so I had to make this extra mold out of masking tape

I mixed up a total of 10 ml of silicone and poured it onto the mold before then adding the packaging tape backing

Added some new pictures to the version 4 lab sheet and printed it out

Feb. 16
Spent 3 hours editing digital log book and inputting it into physical log book
demolded and tested the silicone prototype:

What happened:

I demolded the prototype and noticed that it had a very thin surface layer because the packaging tape backing had pushed the silicone on top of it. Next to test the prototype I hole punched the area where the tape backing had no silicone and laid the sample down onto the counter top. I then attached the spring scale and pulled.

What I noticed:

I was happy to see that the silicone wasn't stretching unlike in the other backing attachment design which is beneficial as stretching would result in tearing. I also noticed that it was purely the adhesiveness of the silicone that was now holding on to the counter top. Lastly I noticed that the silicone was being pulled in a very uniform way thanks to the new backing design.

Made the other nine silicone samples

What happened:

In order to prevent having a very thin bottom section of silicone I adapted my method by splitting it into two different silicone pours. So I mixed up half of the total silicone required and poured 5 ml into each mold. I let the silicone rest in the mold for an hour while I made the backings and mixed up the rest of the silicone. I added the backings on top of the 5 mL of silicone that had been previously poured and then added 5 more mL of silicone on top of the backing. I repeated this step for all nine of the molds, and decided that I would use a piece of masking tape for each of the molds to ensure that the backings would be pushed down enough into the silicone.

What I noticed:

I noticed that the 1 hour of time may not have been enough as the silicone was still very viscous and definitely not cured yet.

Feb. 17
Demolded the 9 silicone samples

What happened:

One of the Diffraction grating ripped around that edge while I was trying to remove it. I revoked the rest of the sample with little to no damage done to the sample.

What I noticed:

I noticed that a few of the samples still had very thin bottom sides. I also noticed that the attachment method of the backing could have been improved as the method I used to attach the backing had a few flaws(hump at the back of the sample). The silicone slabs that were casted

onto the sheet of diffraction grating did not create the rainbow-like look that the other set of samples had. This could mean that the silicone did not take the ridges of the diffraction grating.

Tested the silicone samples:

What happened:

I placed each sample onto the glass sheet and attached a spring scale via the hole in the backing. I then pulled onto the scale in a controlled way until the piece of silicone slid off the testing surface.

What I noticed:

The samples casted onto the glass performed the worst out of the three surfaces; its average pull off force was 1.5 Newtons less than the diffraction grating samples and 4.6 Newtons less than the acrylic samples. In addition the samples that were casted onto the diffraction grating did not perform as expected, these samples had an average pull off force of 14.37 Newtons while the Acrylic had the average pull off force of 17.4 Newtons which is a difference of approximately 3 Newtons. The under performance of the diffraction grating samples combined with the fact that the samples did not create a rainbow effect like the first batch did suggests that it was not a good cast and that the samples did not take the ridges. Feeling disappointed I decided to make another graph, but this time with the best sample for each surface casted on. These results showed that glass was by far the least adhesive surface while the diffraction grating and acrylic samples were closer. These results reflect my expected results much better and when compared to the first table's results we can infer that with casting on a sheet of diffraction grating, the quality of the cast matters more than what material it is casted on.

Results:

Newtons of force each sample was able to withstand in shear

Diffraction grat	Diffraction Grating Info	Glass	Glass info	Acrylic	Acrilic Info	INFO
10		10		18	RIP-MINOR	1
10		15	RIP-MAJOR	15		1
15	Clean	N/A	N/A	14	Clean	1
12		N/A	N/A	11		1
14		N/A	N/A	16		1
12		9		20		2
12		8		20		2
12	Clean	12	Clean	18	Clean	2
8	RIP	9		20		2
N/A	N/A	22		20		2
23		15		20		3
25		15		17		3
20	Clean	14	Clean	21	Clean	3
14		15		15		3
14		10		16		3
201		**154**		**261**		**TOI**
14.371		12.833333...		17.4		MEAN
10-25=15		8-22=14		11-21=10		RANGE

Newtons of force the best sample casted onto each surface

Best Diffraction Grating Sample	Best Diffraction Grating Sample Info	Best Glass Sample	Best Glass Sample Info	Best Acrylic Sample	Best Acrylic Sam	Measure
14	D3-4	10	G3-5	18	A2-3	
14	D3-5	14	G3-3	20		
20	D3-3	15	G3-2	20		
23	D3-1	15	G3-1	20		
25	D3-2	15	G3-4	20		
96		69		98		TOTAL
19.2		13.8		19.6		MEAN

Feb.18
10:00-?
My mother recommended that I do another test to prove my results so I decided to do the upside down adhesion time test where I will place the 2 best slabs (Not 3 because some broke in the last test) onto my window which has been cleaned with a wet paper towel and see how long the stay on for.

What happened:

First I rinsed the surface of the sample that was touching the material I wanted to cast on and then left them to air dry, surface side up. After 4 hours I cut their backings off of them and attached them to the glass test surface and started the test.

What I noticed:
All of the samples stuck really well to the surface.

Results:
Glass 3:
Glass 2:
Acrylic 3:
Acrylic 2:
Diffraction grating 3:
Diffraction grating 2:
Made a chart using each of the tables from yesterday as data sets

Feb. 19
At 9AM I stopped the timer and it was at 18:11:36. I stop the timer as the samples were just sticking and did not look like it was gonna fall any time soon

Feb. 21
Added the participant image to the platform

Feb. 24
Looked at some CWSF & research articles to see how they formatted their project information
Links:
Soft pneumatic grippers embedded with stretchable electroadhesion - IOPscience
https://iopscience.iop.org/article/10.1088/1361-665X/aab579

Understanding the influence of silicone elastomer properties on wedge-shaped microstructured dry adhesives loaded in shear
https://royalsocietypublishing.org/doi/pdf/10.1098/rsif.2018.0551

Characterization of Mechanical and Dielectric Properties of Silicone Rubber
https://tspace.library.utoronto.ca/bitstream/1807/105949/1/polymers-13-01831.pdf

Silicone-based adhesives for long-term skin application: cleaning protocols and their effect on peel strength - IOPscience
https://iopscience.iop.org/article/10.1088/2057-1976/aa91fb

Gecko-Inspired Adhesive Mechanisms and Adhesives for Robots—A Review
https://www.mdpi.com/2218-6581/11/6/143

Mealworms: A Way to Reduce Styrofoam!
https://csfjournal.com/volume-2-issue-4/mealworms

Road Salts: Its Implications and Exploring Agro-Based Alternatives
Road Salts: Its Implications and Exploring Agro-Based Alternatives

Learned:
-There are multiple types of geckos adhesives

Made a version 5 lab sheet in the format of the CYSF platform and added the new silicone casting procedure to it

Feb. 25
Worked on rewriting the basic project information, title, and hypothesis sections

My sister taught me how to cite my sources so I added citations to some of the pictures used on my final/v5 lab sheet

Feb. 26
Entered in the new basic project information and the new hypothesis section to the CYSF platform
Added a banner image to the platform

Mar. 2
Worked on the variables and citations sections and entered them into the CYSF platform

Mar. 3
Worked on and entered the research section into the CYSF platform

Mar. 7
Worked on my acknowledgement section and entered it into the CYSF platform. I also worked on the procedure section

Mar. 9
Worked on observation section

Mar. 10
Worked on observation section

Mar. 11
Worked on observations and sources of possible errors

Mar. 12
Added images and edited the observations section
edited the sources of errors and entered it into the CYSF platform
Attached a project image to the presentation section
Started to work on the application section

Mar. 13
Added more images to the applications sections
Wrote up the analysis section
Did declarations

Mar. 14
Wrote up the conclusion section
Edited analysis and application sections
Went through Observations, Analysis, Conclusion, and Applications with mom
Entered the Observations, Analysis, Conclusion, and Applications into the CYSF platform
Checked off my project on the CYSF platform as ready for judging