

**Aarav Pardeshi and Yatharth Trivedi**  
**CYSF LOGBOOK**

Oct 24, 2023

- Brainstormed science fair topics as a class
- Got a couple of ideas “approved”, however, none were viable or original

Oct 25, 2023

Continued searching for science fair ideas

A couple of ideas we found are:

1. How does the carbon content of steel affect its tensile strength?
2. Solar-powered air conditioning unit
3. How does UV light radiation exposure affect E. coli growth?
4. How are the properties of bone affected by its organic and inorganic components?
5. Hand Crank Phone Charger

Oct 27, 2023

Proposed Goal: finalize a science fair topic by the end of today.

Accomplishment: Decided with the idea of testing UV radiation on Escherichia coli growth.

Oct 27, 2023

Proposed Goal: create a testable question and fill out the science project proposal

Accomplishment: formulated a testable question as we filled out the proposal. Our testable question is, “What is the minimum duration of UV-C exposure required to fully inactivate the cultivation of K12 Escherichia coli?”. We also filled the project proposal with initial ideas.

Oct 27, 2023

Proposed Goal: Determine the materials required for this project

Accomplishment: Here is a list of the materials needed to be purchased (we already have access to a heater and dark room),

[COOSPIDER UV Lamp Ozone Free, UVC Light Bulb Sanitizer, 253.7nm wavelength for Closet/Cabinet/Bathroom, 6W 110V Lamp with on/Off Switch Cord and Plug, CTUV-6 - Amazon.com](#)

[Eyewear Protective Safety Glasses, Bed Goggles Eye Protection UV Laser Protective Glasses IPL Beauty Equipment Glasses for Doctors Nurses and Laser Technicians : Amazon.ca: Tools & Home Improvement](#)

[Nutrient Agar Kit, Includes 20 Sterile Petri Dishes with Lids & 20 Sterile Cotton Swabs : Amazon.ca: Industrial & Scientific](#)

[Merlan Scientific | Escherichia coli K12, Living, Bacteriophage Host](#)

Oct 28, 2023

Proposed Goal: Fill in the Ethics and Due Care 2A form on the CYSF platform as our project involves bacteria/ "animals".

Accomplishment: We have completed the Ethics and Due Care 2A form and have submitted it for review by the CYSF safety committee.

Nov 3, 2023

Proposed Goal: Start background research on UV light

Accomplishment: We have received a background research template in class. That is where we summarized one full article on UV light.

Source link: <https://en.wikipedia.org/wiki/Ultraviolet>

Nov 6, 2023

Proposed Goal: calculate final cost and order materials.

Accomplishment: Calculated final cost for nutrient agar kit, UV-C source, and safety glasses. The final cost is \$105.54 and 50% is \$52.77. Yatharth Trivedi has ordered the materials listed above.

Nov 9, 2023

Proposed Goal: Do background research on DNA and RNA, more specifically research on nucleic acids.

Accomplishment: We read some articles on DNA and RNA. Also, we separately researched nucleic acids to understand the fundamentals. Then, we recorded information in our own words.

Source: <https://biologydictionary.net/nucleic-acid/>

Nov 10, 2023

Proposed Goal: Do some background research on K12 Escherichia coli.

Source: [https://en.wikipedia.org/wiki/Escherichia\\_coli](https://en.wikipedia.org/wiki/Escherichia_coli)

Accomplishment: Read some articles on the toxic and safe subtypes of E. coli. We also discovered that bacteria falls under the domain of prokaryotes. Another concept we included in this research was how prokaryotic cells reproduce.

Nov11, 2023

Proposed Goal: Do some background research on DNA replication and gene expression.

Accomplishment: We learned how DNA replicates, and that gene expression is the process that cells undergo to become translated into amino acids which are required for proteins. In prokaryotes, this occurs in the cytoplasm through two major sequences, transcription and translation.

Source: <https://www.ncbi.nlm.nih.gov/books/NBK26850/>

Nov 12, 2023

Proposed Goal: Do background research on how UV-C affects DNA

We learnt that UV-C can impact DNA by causing the formation of cyclobutane pyrimidine dimers and 6-4 photoproducts. We also learnt that pyrimidine dimers can interfere with DNA and RNA polymerase's ability to interpret and replicate the genetic code, thus leading to potential cell death.

Nov 13, 2023

Proposed Goal: Do background research on nucleotide excision repair mechanism in prokaryotes.

Accomplishment: We learned that NER can fix 6-4 photoproducts and cyclobutane pyrimidine dimers.

However, nucleotide excision repair not being able to keep up with excessive DNA damage can result in the death of the bacterial cell because of incorrect DNA replication. Also, unrepaired DNA damage leads to errors in the transcription process as the DNA sequence of genes cannot be interpreted by RNA polymerase due to pyrimidine dimers.

Nov 14, 2023

Proposed Goal: Format all our references in APA 7th ed format to create a bibliography

Accomplishment: We completed our bibliography by properly citing our sources in APA 7th ed format, and inserting it at the end of the background research document.

Nov 15, 2023

Proposed Goal: Formulate a hypothesis that incorporates the background information.

Accomplishment: We created a hypothesis using our background research. Here is the hypothesis,

**If** we expose K12 Escherichia coli to UV-C for different durations at a distance of 20cm, **then** the minimum amount of time to fully inactivate K12 E. coli cultivation would be 60 seconds, **because** this would be the time at which the nucleotide excision repair mechanism would not be able to keep up with recurring cyclobutane pyrimidine dimers and 6-4 photoproducts, leading to the absence of binary fission due to cell death.

Nov 16, 2023

Proposed Goal: Identify the purpose of this experiment and mention the idea in a paragraph.

Accomplishment: We formulated a solvable problem for this experiment:

Problem: Germicidal lamps have become a common sterilization technique available on the market, especially during the COVID-19 pandemic. Many households use this method to disinfect small areas like closets or bedrooms. Speaking on a larger scale, UV-C radiation is also used in food processing, water treatment, medical systems, etc. However, sometimes during this process, the bacteria is not fully killed due to insufficient UV treatment leading to potential outbreaks or the survival of bacterial colonies. ‘

Nov 17, 2023

After talking with our teacher, we have decided not to buy an incubator because it is too expensive and have instead found a heating pad

Electric Heating Pad

[https://www.amazon.ca/3-Shift-Heating-Electric-Warmer-35%E2%84%83-50%E2%84%83/dp/B078HHGFQ2/ref=sr\\_1\\_12?crd=1KE99EJX15YZE&keywords=electric+heating+pad+small&qid=1700245096&s=hpc&sprefix=electric+heating+pad+small%2Chpc%2C209&sr=1-12](https://www.amazon.ca/3-Shift-Heating-Electric-Warmer-35%E2%84%83-50%E2%84%83/dp/B078HHGFQ2/ref=sr_1_12?crd=1KE99EJX15YZE&keywords=electric+heating+pad+small&qid=1700245096&s=hpc&sprefix=electric+heating+pad+small%2Chpc%2C209&sr=1-12)

Nov 18, 2023

Proposed Goal: Find sellers that ship K12 E. Coli to Canada

Accomplishment: We have found a seller for the E. Coli (Merlan Scientific) which is partnered with Carolina Biological Supply and ships to Canada. Aarav will buy the E. Coli after the UV-C lamp has arrived so as not to mess up the controlled variables.

Nov 22, 2023

Proposed Goal: Create data table for experiment.

Electric heating pad is not working. We are considering using an electric blanket however we need to find the correct temperature setting. We also created data tables to measure two things,

- Number of E. coli Colonies when Exposed to Different Durations of UV-C
- Total Area Covered by E. coli Colonies when Exposed to Different Durations of UV-C

However, after the E. coli has fully grown in the agar plates, we will decide which measurement method will be best to represent. That is because E. coli colonies can vary in size causing them potential misleads in the analysis.

Nov 24, 2023

Proposed Goal: Evaluate the feasibility of using an electric blanket to incubate the E. Coli

Accomplishment: We decided not to use the electric blanket since the 2 hour auto-off feature would not allow us to run it continuously for the 24 hours needed to cultivate the E. Coli. Looking for other heating pads and Aarav will test the temperature using an infrared thermometer

Nov 26, 2023

We have decided not to use a heating pad and are instead going to place the bacteria in a dark room with space heaters. That is because on the E. coli supplier's website, it mentions that this bacteria can grow at room temperatures between 20 and 22 degrees Celsius.

Nov 28, 2023

Proposed Goal: Get infrared thermometer

Accomplishment: Asked to borrow infrared thermometer

Nov 30, 2023

Proposed Goal: Get infrared thermometer

Edited/filled in procedure and variables on the CYSF website. Borrowed infrared thermometer for testing of dark room temperature. Lastly, we ordered K12 Escherichia coli from Merlan Scientific today

Dec 4, 2023

Proposed Goal: Do research on how to store E. Coli.

Accomplishment: We found that E. Coli can be stored at 4°C for up to 3 weeks and at room temperature for 8 days

Dec 5, 2023

E. Coli has arrived in a freeze-dried pellet. We will conduct the experiment on Friday Dec 8, 2023. We also read through CYSF safety guidelines and judging documents.

Dec 6, 2023

We are making preparations for the experiment by fixing our data table to include all our metrics and setting a workable schedule for the experiment which will take 3-5 hrs. We also determined that E. coli can cultivate at room temperatures (20 degrees celsius to 22 degrees celsius) in an enclosed space. Therefore, we modified the procedure and materials by removing space heaters and adding enclosed space like styrofoam box or closet.

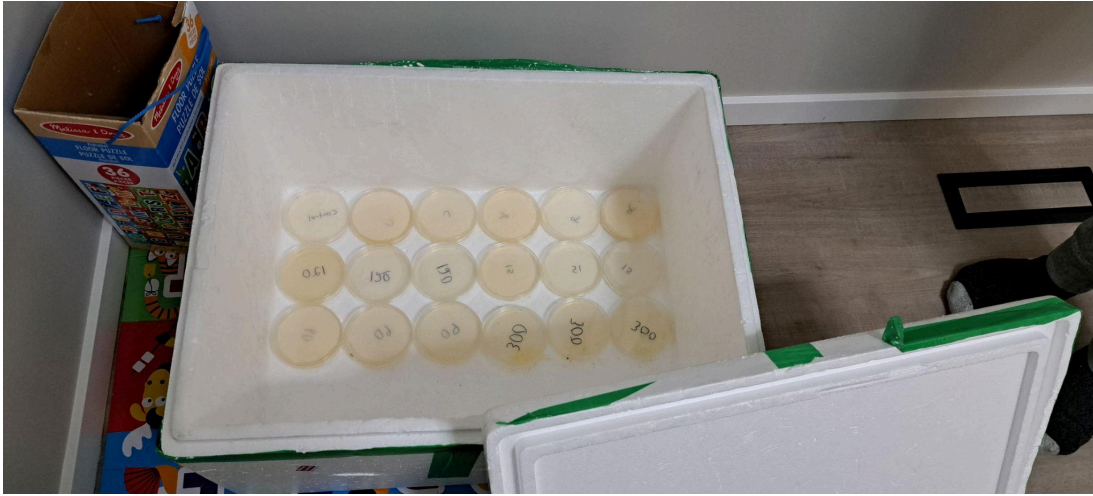
Dec 7, 2023

Proposed Goal: Edit all documents to make sure they are up to date before the experiment

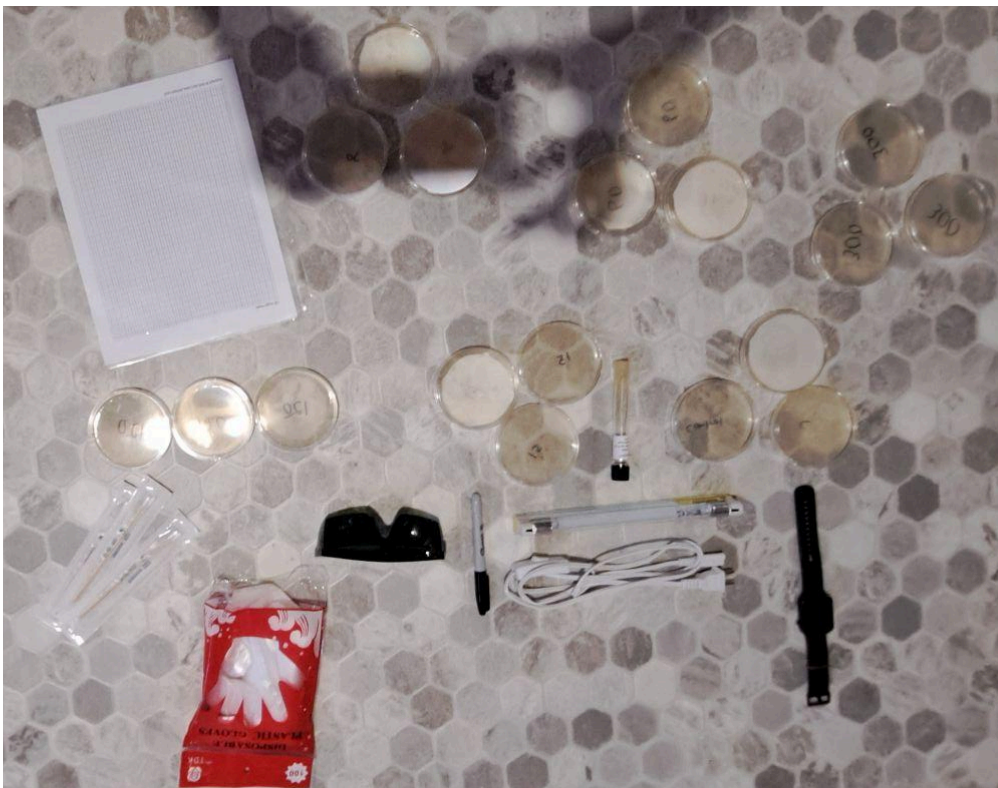
Accomplishment: We have decided to count the amount of colonies per mm<sup>2</sup>, which we will be including in the analysis to represent the data.

Dec 8, 2023

Today we did the experiment and everything went according to plan.



Agar plates in “enclosed space”



Materials used

- Nitrile gloves
- Nutrient agar plates
- UV-C safety goggles
- UV-C source
- Timer
- Sharpie

- Millimeter Grid paper
- Sterile cotton swabs
- K12 Escherichia coli culture in tryptone agar slant

December 9, 2023

Calculating total cost after E. coli arrival.

What Yatharth Trivedi has paid:

UV-C lamp:

Order Summary

Item(s) Subtotal:

USD 18.99

Shipping & Handling:

USD 9.65

Total before tax:

USD 28.64

Estimated tax to be collected:

USD 0.00

Grand Total:

USD 28.64

Payment Grand Total:

CAD 40.57

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Nutrient Agar Kit and Safety Glasses:

Order Summary

Item(s) Subtotal:

\$54.94

Shipping & Handling:

\$7.93

Your Coupon Savings:

-\$1.00

Total before tax:

\$61.87

Estimated GST/HST:

\$3.10

Estimated PST/RST/QST:

\$0.00

Grand Total:

\$64.97

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Total Yatharth Trivedi has paid: \$105.54

Total Aarav Pardeshi has paid: \$79.50

Total Aarav Pardeshi owes Yatharth Trivedi: \$13.02

Dec 10, 2023

We completed the observations and analysis of the nutrient agar plates. Also identified outliers and trends, and compared the data.

Dec 12, 2023

Created and added extension, conclusion, sources of error, and application paragraphs to the analysis document. Also performed a “cleanup” of the Science Fair Folder.

Dec 14, 2023

We completed the presentation and conferenced with our Science teacher. We are making plans to buy a 60” x 96” tri-fold. Also contacted disposal companies. Formatted all the information from proposal to analysis documents and the bibliography into a presentation for the class.

Dec 16, 2023

Yatharth Trivedi has purchased a brand new 60” x 96” tri-fold from Science-Is.

Dec 18, 2023

We sent our analysis to be reviewed by Ms. Ball, a junior high school teacher with experience in microbiology. Feedback was received and incorporated into the analysis and other parts of the conclusion.

Dec 19, 2023

Today we made small edits based on Ms. Ball’s comments and finalized the analysis, conclusion, sources of error, application, and extensions. Afterward, we put these on the CYSF website and in the presentation.

Jan 8, 2024

Today we finished the presentation by reducing the amount of information to be easily readable. We also included a few more images and got them reviewed by our science teacher. We are also making preparations for the oral presentation. Additionally, we added more pictures to our presentation to assist the reader. Also got feedback from a Ph.D. professor in microbiology and incorporated it into our final work.

Jan 10, 2024

Today we finished formatting the lab report and also decided on who would present each slide. We also refined some sections of the presentation including the analysis and citations page.

Jan 11, 2024

Presented our slideshow to the homeroom teacher for feedback. The main advice was to paraphrase our information even more.



Worked on summarizing the information to important bullet points only. Also researched current events associated with our topic such as E. coli outbreaks.

Jan 15, 2024

We continued to paraphrase the presentation by combining and removing unnecessary information. Also removed unimportant background research slides and performed practice presentations to identify weak points and strengthen our speaking skills.

Jan 16, 2024

Today we refined the presentation in Power Up by adding citations for images on our background research slides. We also performed practice presentations in an attempt to bring down our times.

Jan 17, 2024

Presented our slideshow to our homeroom teacher again with the suggested revisions. Some feedback was given and worked into the presentation. Also fixed the scale of our graphs to ensure consistency.

Jan 18, 2024

Today we received feedback from our Power Up Science Fair teacher, Ms. Davis. Suggestions were provided and incorporated into the slideshow.

Jan 19, 2024

Started formatting our documents so that they were ready to go on the tri-fold. We used PowerPoint rather than slides because the text appeared bigger.

Yatharth Trivedi bought materials for tri-fold (eg. colored paper).

Jan 21, 2024

Started to populate our tri-fold. Printed out some documents on large paper, (11" x 17"). It took 4 hours, but in the end, we also glued some letters on poster paper to make an effective title.

Jan 22, 2024

Presented our project in Power Up class and received feedback from the audience.

Jan 23, 2024

Created a separate presentation for our class as we are only allowed 10 minutes. Performed a few practice runs and provided feedback to each other to cut down on our time.

Jan 24, 2024

Presented our “Classroom Presentation” to our Science class. Worked on answering questions and presenting information in a simplified manner.

Feb 2, 2024

Today we presented our tri-fold to the judges at the Louis Riel Science Fair.

Feb 25, 2024

As we heard that we were selected for CYSF, we updated our information on the platform after consulting another microbiology professor. He reviewed our information and instructed us to incorporate sub-topics such as gene expression and DNA replication on the platform as they contribute to the understanding of our project. Hence it was updated and properly formatted on the website.

Feb 29, 2024

Updated CYSF platform specifically focusing on the presentation part. We filled in the sections requiring a header, project, and participant image. However, our next goal is to create a presentation that does not exceed 10 minutes.

Mar 4, 2024

Noticed that the pictures of our observations were not visible on the CYSF platform. Hence, we re-uploaded the images so that they were visible to people viewing our project on the platform. However, we still to create a presentation that does not exceed 10 minutes.

Mar 7, 2024

Recorded a presentation video and uploaded the link to the video on the CYSF platform. All the required sections applicable to our project are completed on the CYSF platform.

Mar 13, 2024

Uploaded this latest version of the project logbook on the CYSF platform.