

THE ACADEMY OF SCIENCE - ST. LOUIS SCIENCE FAIR
AMERICAN ASSOCIATION OF UNIVERSITY WOMEN—
BALLWIN-CHESTERFIELD BRANCH

2024



AWARDEES!

*Inspiring the Next Generation—encouraging a Burgeoning Scientist,
sparking an Emerging Inventor, championing a Young Environmentalist!*

Dear Marcia,

We want to express our heartfelt gratitude for the special awards totaling \$200 that were presented to students at the 2024 Academy of Science - St. Louis Science Fair. The generous support from the American Association of University Women— Ballwin-Chesterfield Branch acknowledges the science fair students' hard work and provides them with invaluable encouragement to pursue their ambitions.

Your scholarships have helped many families to open their very first college savings accounts, making college or trade school a possibility for them! We are truly thankful for your investment in the education and future of St. Louis science fair students.

Science is for everyone, and we appreciate your commitment to working together to make it accessible for all in our community.

I've attached images of the projects and a thank you note from one of the awardees. Please don't hesitate to reach out if you have any questions. Thank you once again for your ongoing support!

With gratitude,

Ashley Newport

Academy of Science - St. Louis
Special Awards Coordinator

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American Association of University Women— Ballwin-Chesterfield Branch Award

Forever Chemicals: PFAS and Their Effect on Aquatic Organisms

Madeline Brand

St. Joseph's Academy

Grade 11

\$100 MOST 529

The Effect of PFAS on Aquatic Organisms

Sequence Number: 2810

Q1: Research Question/Problem & Project Objectives

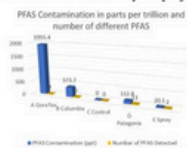
How does PFAS, a human-made chemical, affect different aquatic organisms and their reproduction?

If exposed to water that has soaked everyday clothing fabrics containing PFAS, certain aquatic organisms will multiply less and have less activity. Per- and poly-fluoroalkyl substances (PFAS) are human-made chemicals characterized by their fluorine-carbon bonds, allowing them to resist heat, water, and oil. Therefore, they quickly became a mass-produced and widely used product in industrial processes, found in things ranging from food packaging, coats, shoes, firefighting foam, and makeup. The persistence and stability of PFAS in the environment have raised concerns about their potential adverse effects on human health and ecosystems. This experiment used brine shrimp and *Daphnia* as invertebrate model organisms to gather data on the effect of water samples obtained by soaking water-resistant clothing that has been known to test positive for PFAS on these organisms. As more and more evidence supports the damages that this chemical attributes, people want answers. This small-scale experiment was conducted to observe the effects of PFAS on aquatic organisms, resulting in varied data on the life and reproduction of the organisms. The goal is to contribute to previous scientific understandings to help the sweeping concern regarding a chemical found in almost every product that humankind touches.



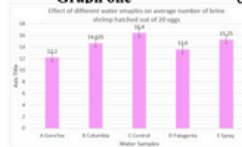
Q3: Data Analysis & Results

•What were the results of your project?



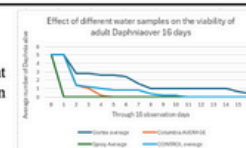
Graph one: The blue columns show the amount of PFAS contamination in each water sample in parts per trillion. The yellow columns show the number of different types of PFAS detected in each sample.

Graph one



Graph Two

Graph Two: The graph shows the total average number of hatched brine shrimp from each water sample



Graph Three

Graph Three: This is the graph of the number of average adult *Daphnia* in each water sample over the sixteen observation days.

Graph Four: This is the graph of the number of average baby *Daphnia* in each water sample over the sixteen observation days.



Graph four

The brine shrimp exhibited a decreased hatching rate when exposed to a PFAS concentration of 1955.4 ppt, highlighting a negative impact as hypothesized. In contrast, *Daphnia* showed an increased reproductive rate in PFAS-contaminated water. The measurable differences in reproduction indicate a significant adverse impact on their survival in PFAS-contaminated water.

Q2: Methodology/Project Design

I observed and collected data on brine shrimp and *Daphnia* over their exposure to PFAS-contaminated waters.

I collected the number of brine shrimp hatched by counting each petri dish out of a maximum of 20. I counted the number of adult *Daphnia* and their offspring over time and additional observations seen through a dissecting microscope.

- I made five water samples by soaking a controlled amount of popular companies' clothing fabrics in spring water for four weeks, A= Gore-Tex, B= Columbia, C= Control, D= Patagonia, E= Impregnation spray.
- Then I tested eight sets of brine shrimp, one set per week. All water samples had five petri dishes.
- Each petri dish consisted of 15 ml of a water sample and 15 ml of saline water. Each dish had 20 brine shrimp eggs.
- I then recorded the number of brine shrimp hatched on day two and listed any additional observations in a logbook.
- For the *Daphnia*, four water samples were used, A = Gore-Tex, B= Columbia, C= Control, and E = impregnation spray. The *Daphnia* were observed over time in glass petri dishes. Each dish contained 200 ml of a water sample and five adult *Daphnia*
- Daphnia* were observed by having five samples of each water type, each with five *Daphnia* in the petri dish
- Over time data was collected on the number of adult *Daphnia* alive, the number of offspring produced, and additional observations.

The control group was the *Daphnia* and brine shrimp in the spring water without clothing pieces.

Independent Variable: type of water with clothing from Patagonia, Gore-Tex, Columbia, and the impregnation spray

Dependent Variable:

One was the number of brine shrimp hatching

The other was the number of *Daphnia* that lived and also reproduced

Q4: Interpretation & Conclusions

This experiment investigated the impact of PFAS on aquatic organisms when exposed to water samples containing PFAS-contaminated fabrics from companies such as Gore-Tex, Columbia, and Patagonia. The organisms under consideration are brine shrimp and *Daphnia*. The data, first, revealed an inverse relationship between brine shrimp hatching rates and PFAS concentration; for example, the lowest average hatch rates appeared at 12.2 in the Gore-Tex water, which had a PFAS concentration of 1955.4 ppt. The brine shrimp data supported the hypothesis of a negative impact on these organisms. In contrast, *Daphnia* exhibited an increased reproductive rate in response to PFAS exposure. Sources of error, such as mold growth in the *Daphnia* control group and interference from the film on top of the impregnation spray, were identified, suggesting potential adjustments for future studies. The experiment's significance lies in advancing knowledge about PFAS effects on aquatic life, with implications for the broader environment, such as PFAS contamination in drinking water, and human health concerns, specifically with hormones like testicular cancer, breast cancer, liver damage, and maternity issues. Advancements for this experiment would be the exploration of mutations associated with PFAS exposure and conducting an AIMS test. Lastly, further research and collaboration with experts with experience with PFAS are recommended for more comprehensive data on PFAS impact. This research advances our knowledge of the effects of PFAS on aquatic organisms, highlighting the need for continued exploration and application of findings on the relationship between PFAS exposure and humans.



Daphnia



Brine Shrimp and unhatched eggs

Thank yous!

“Hello! My name is Celina, and I'm a rising junior at Ladue Horton Watkins High School, which is pretty known for its STEM department. I'm fortunate enough to be in an environment, at Ladue and with two PHD scientists for parents, where, despite the gender disparity that still exists in STEM, I've had a lot of support for my interests and I've also seen support for other girls in STEM grow around me — something which, no doubt, is furthered by foundations like this one which can provide concrete support. This project was mostly inspired by my desire to work towards practical progress in climate change, as well as the synthesis of my two interests in biology and computer science. I didn't really expect to come so far, and I felt a little unprepared compared to everyone else at the fair, but I found the experience itself incredibly fulfilling — I haven't done a science fair since elementary school. I'm incredibly grateful for the experience, which couldn't have existed without you. So, thank you so much for supporting the St. Louis Science Fair, and for the award! :)”

Cheers,
- Celina Z., Grade 10

“Thank you so much for the recognition for my research involving the chemical PFAS and its effect on aquatic organisms. I got interested in the topic because a teacher of mine guided me over the summer to do research with water pollution. What drew my attention to PFAS water pollution was that the side effects hindered human hormones which can lead to breast cancer, testicular cancer, and pregnancy complications. That summer my mom was also diagnosed with a hormone driven breast cancer and that connected my interests to PFAS. This award means so much to me because my research project, while at a high school level, felt like my passion project and I loved my experience. This project changed the course of my future because it encouraged me to pursue a research path in college. I want to go into pre-med with an emphasis in changing the world not only through patient interaction but also with research. Thank you for the award and it means a lot to me as it has helped inspire my future and has encouraged me that I can do good research work in college.”

- Madeline B., Grade 11



The Academy of Science – St. Louis Science Fair

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