2022 Cobb County Crystal-Growing Competition Report

INTRODUCTION

Crystallizing inorganic, organic and macromolecular molecules for structure determination is one of the key strategies for drug discovery. Through growing high-diffraction-quality crystals of nucleic acids and their protein complexes, the structures can be determined, revealing the functions. With the elucidation of their structures and functions, small molecules (such as inhibitors) can be designed to target these macromolecules related with diseases, so that the adverse effects of diseases (such as cancers) can be reduced.

While intricate crystal-growing is used for performing cutting-edge research, crystal-growing can also be used for spurring scientific creativity in the student community, especially in the middle and high schools. There is an inherent beauty in faceted and clear crystals. At STARS (Structural Nucleic Acid Anticancer Research Society), we take advantage of these aesthetic properties to help spur the scientific passion and creativity of K-12th grade and college students. The growth of large and beautiful crystals is rewarding, and we share this enjoyment and love for crystallography with students by hosting the crystal-growing activities and competitions to let them experience, first-handedly, the excitement of crystal-growing.

In the last three years, STARS, in collaboration with local schools, hosted the 2021 Timber Ridge Crystal-Growing Competition, 2022 Cobb County Crystal-Growing Competition, and 2023 Dodgen Crystal-Growing competition. The elementary students were very excited about growing crystals and had so much fun growing colorful salt and sugar crystals. The crystal submissions were outstanding, and we were completely blown away by the quality of the crystals and by the detailedness of the students' crystal journals.

2022 COBB COUNTY CRYSTAL-GROWING COMPETITION

In 2022, we expanded our crystal-growing competition to include middle and high school students as well. All K-12th students were welcome to compete in this competition and submit their crystals and their Crystal Journals to the STARS website. To interact with students in-person and show them how exciting crystal-growing can be, we collaborated with Dodgen Middle School to bring the competition to their classrooms. We gave crystal-growing demonstrations, taught the students the key concepts about crystallography, showed them the beauty of crystal-growing through guided, hands-on activities.

> *The Walton STARS Club came into my high school physical science (HSPS) classes at Dodgen Middle School to share information about their club and the excitement of growing crystals. The Club, represented by 4 -5 students each day, presented a power point with interesting facts about crystals and how they are created. They covered topics that correlate with our HSPS standards on saturated, unsaturated and supersaturated solutions in crystal growing.*
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> *On the second day the club led a lab where students chose a color for their crystals and created their own crystal. Students competed in a Kahoot competition on the presented crystal information for candy prizes and loved it!*

> *Finally, on the third day a week later, the Crystal Club members came in to help students observe their crystals. Students took notes on the process and the size of the crystal. They submitted their data to the 2022 Cobb-County Crystal Growing Competition.*
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> *Overall, my students loved growing crystals. They enjoyed having Walton high school students in the classroom. Some of my students went on to join the Walton Crystal Club this year. The Club also presented the activity for teachers at the Cobb STEM conference over the summer and I was there to sponsor their work.*
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> *– Debbie Amodeo, 8th Grade HSPS Teacher*

The middle school students had so much fun learning about the purpose of crystallography, growing the creative crystals for the competition, and playing Kahoots with king-sized candy bars as prizes.

We showed them the beautiful realm of crystallography, how to introduce highlighter inks into crystals, how to make the crystals glow in the dark, how to grow seed crystals, and how to set up crystal solutions to make crystals grow larger and even larger.

We taught them the central concepts to crystal-growing, such as how to make saturated or supersaturated solutions and how to use them to their advantage to grow very large crystals. We explained to them and led them by example on how to make observations and how to take specific, detailed notes for obtaining replicable results, which are essential skills any scientist or crystallographer would need. We sought to kindle in these students a passion for crystallography.

When asked what aspect of the class activities the students enjoyed the most, they said:

"I enjoyed learning about and making the crystals the most as I have never done anything like that before" ~ Aashritha Kudumula

"I enjoyed creating the crystals and seeing the results even after just a short period of time." ~Natalie Ruth

"I liked how each day, the crystal would grow bigger making it interesting to see how it was at the beginning, middle, and end" ~Hyunsoo Jang

"I enjoyed being able to collaborate with my friends and I enjoyed following the procedures." ~Sahara Shetty

"I enjoyed the instructor's kindness and how they made things fun." ~Wayde Burke

"I liked to observer the growing crystal and loved the kahoots. I loved the most was about growing the creative crystal. It was the best!!!!!!!!!!!!" ~Steven Huang

After the students finished growing their crystals and writing in their Crystal Journals, they submitted their results to the STARS website, and over the summer, we evaluated their crystal submissions. The students' crystals were so colorful and creative, and we were especially impressed by several students' extremely detailed notes and observations. We were extremely

excited by these students' dedication to their work and to their crystals. With the generous sponsorship from the ACA, STARS hosted an award ceremony this year with numerous prizes and awards prepared for the student winners to celebrate their hard work and perseverance in their crystal-growing activities and endeavors.

These last three years, STARS has been encouraging competitors to grow inorganic and organic crystals out of simple, readily available compounds, such as salt and sugar, but as STARS continue hosting crystal-growing competitions, we look to expand crystals materials to encompass macromolecular molecules, such as proteins or nucleic acids to especially challenge high school and college students and introduce them to the field of crystallography. We are also looking to scale up our competition operations overtime with a goal to go nation-wide one day. If you are an impassioned scientist devoted to the scientific education of students (or if you may know someone like this), we would like to invite you (or the person you may know) to apply to become an official STARS branch today. We hope that with our continued efforts in hosting and organizing these crystal-growing activities and competitions, we may further spread our love and passion for crystallography in an informative yet exciting way to more students in our community, both locally and nationally.

This is STARS, inspiring the next generation of scientists and spurring their passion for structural biology and crystallography.

Reported by Susanna Huang

July 2023

STARS activities summary

- Competed in the US Crystal-Growing Competition (USCGC) annually [Fall 2019 – current]
    - 2019 USCGC – Susanna Huang won 2nd place in the clearest crystal category
    - 2020 USCGC – Team members experimented with crystallizing glow-in-the-dark highlighter ink and quinine into crystals
    - 2021 USCGC
    - 2022 USCGC
- Hosted and organized local crystal-growing competitions annually [Spr. 2021 – current]
    - 2021 Timber Ridge Crystal-Growing Competition
    - 2022 Cobb County Crystal-Growing Competition
    - 2023 Dodgen Crystal-Growing Competition
- Hosted and organized local crystal-growing summer camp [Sum. 2021 – current]
    - 2021 STARS Crystal-Growing Summer Camp
    - 2022 STARS Crystal-Growing Summer Camp
- Presented at Cobb County STEM teacher conference [Sum. 2021 – current]
    - 2021 STEMapalooza
    - 2022 STEMapalooza
- Presented at American Crystallographic Association annual conference [Sum. 2023 – current]
    - 2023 ACA conference (Baltimore, Maryland)