

2024 Crystallography Lecture and Crystallization Workshop with STARS Atlanta Branch Report

Introduction and Contextualization

Below follows the introduction and contextualization of the event, as reported by Susanna.

The STARS Mission is to engage and empower students in crystal-growing, crystallography, and structural biology. By providing students with programs, events, and club meetings to show students what wet-lab and dry-lab research is like, we hope to inspire students about the therapeutic applications of structural biology research as well as familiarize students with the necessary tools to bring about this type of research. In the process, we hope to build community through research-invested students and provide these students with the opportunities to interact with research professors, assist on collaboration projects, and present their research and outreach work at national conferences.

To develop student leaders in research and share the importance and excitement of crystallography with fellow students, STARS Atlanta branch hosts bi-semesterly crystallography workshops that encompass (1) presenting to students an important attribute or use-case of crystallography for therapeutic drug discovery, (2) providing the opportunity for students to converse with research professors and post-doctoral students about academia and research projects in general, and (3) guiding students on a hands-on protein crystal-growing experiment so that students have the chance, as a whole, to understand the importance of crystallography, see professionals' perspectives and experience on research, and experience what wet-lab research is like.

The specific crystallography workshop that STARS Atlanta branch hosted and reports on in this document took place on August 24th, 2024 at the Gilbert Hillhouse Boggs Chemistry Building at Georgia Tech for GT students.

2024 Crystallography Lecture and Crystallization Workshop with STARS Atlanta Branch

Below discusses what the event was about, as reported by Maya:

The goal of the STARS crystallography lecture and crystallization workshop was to provide enjoyable and insightful wet lab experiences to STARS members. In addition, the event introduced the GT STARS branch to non-members interested in crystallography. Susanna presented a short lecture on protein crystallography, focusing on x-ray crystallography specifically. Following the presentation, attendees had the opportunity to discuss research and structural biology with researchers at Georgia Tech, including Dr. Bernbeck, Dr. Dipak Walunj, Dr. Debanjan Kundu, and Ryan Kern over lunch. Susanna and the STARS volunteers then led a workshop that taught the

basics of protein crystallography through lysozyme crystallization. The event was hosted in the Gilbert Hillhouse Boggs Building room 1-67 from 10:30am to 3:45pm on Saturday, August 24th, 2024.

Below as follows was the event schedule:

10:00am – 10:30am – Check-in on the main floor of the Boggs building

10:30am – 11:30pm – Lecture by Susanna on x-ray crystallography for proteins (Boggs 1-67)

11:30pm – 1:00pm – “Hot potato” + Lunch (in the check-in commons area outside of the lab)

- During “Hot potato,” students had the chance to move between different tables and talk with Ryan Kern, a 5th year graduate student at the Oyelere Lab, and the post-doctoral researchers Dr. Bernbeck from the La Pierre lab, Dr. Dipak Walunj from the Oyelere Lab, and Dr. Debanjan Kundu from the Das lab.

1:00pm – 3:30pm – Crystallography workshop – Guided lysozyme protein crystallization experiment (Boggs 1-67)

3:30pm – 3:45pm – Wrap up and Closing remarks

Lecture, Lunch, and Workshop

As reported by Susanna:

The goal of the lecture was to provide students with an understanding of how STARS came to be, the importance of crystallography for structure determination, and the creative ways in which structure determination can be used to discover the capabilities of nature, which can be used for structure-based therapeutic drug discovery.

Weaved through the presentation was an exploration of structural biology research through the lens of a newly starting out research student and how experimentation and tenacity, which flowed from a fascination of structural biology, brought about the STARS initiative to organize events and club meetings to share with other students the importance of structural biology as it relates to treating diseases.

The presentation introduced to the students a type of research that can be used to push the frontier of medicine and showed the students how dedication to an initiative such as STARSs can lead to opportunities for the development of oneself and fellow peers.

During the lunch session, students had the opportunity to speak with three post-doctoral students and a 5th year graduate student. Topics of discussion ranged from the research projects each faculty was currently involved in, how to become involved in research on campus, understanding how academia is different from industry, etc.

This lunch session not only provided students with the rare opportunity to speak with, understand, and seek advice from current researchers in academia but also afforded STARS Atlanta Branch with several new faculty connections in research. Fostering a student-faculty research-

focused community as well as forging connections with current researchers in the field not only is advantageous for the professional development of the students but also enables STARS Atlanta branch to form and maintain connections with faculty. Faculty participation in the workshop allows them to recognize that STARS Atlanta Branch is dedicated to sharing the importance of research and providing wet-lab research exposure with fellow students. Their favorable support can be important for possible research projects and collaborations.

During the hands-on crystallography session, students had the chance to learn about the sitting-drop vapor diffusion crystallization technique and to use micropipettes to set up their own protein crystallization trays.

This hands-on experiment provides students who have no wet-lab research experience a chance to see what wet-lab research can be like. This is advantageous to the students because they have the opportunity to experience a key crystal-growth step of therapeutic drug design through wet-lab research without the high barriers of joining a laboratory, having a faculty mentor, having the space to perform the research, and having the time to be taught the material in full. STARS Atlanta branch aims to address the lack of wet-lab research experiments and activities, which the vast majority of science-based research clubs on GT campus do not provide to their membership base. Crystallography workshops like this is one of the avenues that STARS Atlanta branch uses to provide students with a chance to see what real wet-lab research is like.

A variety of materials and equipment were used during the hands-on experiment:

- **Micropipettes** (Boggs Biology Prep Lab)
- **Micropipette tips** (Boggs Biology Prep Lab)
- **Staircase centrifuge tube racks** (Boggs Biology Prep Lab)
- **Crychem M sitting-drop crystallization plates** (Donation from Hampton Research (Spring 2024))
- **Sodium acetate pH buffer (0.625 M)** (pHs: 4.2, 4.4, 4.6, 4.8, 5.0, 5.2, 5.4, 5.6) (sterile-filtered; prepared by Susanna Huang and Adelaide Kindler)
- **NaCl salt solution (3M)** (sterile-filtered, prepared by STARS at GT)
- **NaNO₃ salt solution (3M)** (sterile-filtered; prepared by STARS at GT)
- **DI water** (Boggs Biology Prep Lab)
- **15-minute crystallization reagent** (Donation from Hampton Research (Spring 2024))
- **Lysozyme protein solution (25 mg/ml)** (solubilization buffer: 0.02 M sodium acetate pH 4.6 buffer) (sterile-filtered; prepared by Susanna Huang; lysozyme supplied by STARS at GT)
- **Sealing tape** (Donation from Hampton Research (Spring 2024))
- **Thin Sharpies** (Boggs Biology Prep Lab)
- **Microscopes** (Boggs Biology Prep Lab)

STARS greatly thanks Hampton Research for their in-kind donations as well as thanks Ms. Alison Onstine and the Open Biology Lab for the biology lab resources and space, making this crystallography workshop event possible.

The procedures used to prepare certain buffers and samples are detailed here: [Procedure for preparing needed reagents in a lysozyme crystallization experiment.pdf](#)

The workshop handout that students referenced during the experiment can be found here: [August 24th, 2024 - STARS Crystallography workshop handout.pdf](#)

Preparation and Leadership Development

As reported by Susanna:

On the Wednesday (August 21st, 2024) before the crystallography workshop, STARS Atlanta Branch members met to prepare for the workshop and prepare tasks to ensure that the event ran smoothly for event attendees.

These were the grounds on which STARS Atlanta Branch prepared the event:

STARS Vision: Inspire all students in crystallography and bring up the next generation of student and scientific leaders through outreach and research.

STARS Mission: Engage and empower students in crystal-growing, crystallography, and structural biology.

STARS Core values: Creativity, Leadership, Devotion, and Integrity

STARS collegiate branch Vision: (1) Create a research-focused community of students and (2) foster student-faculty research collaborations on faculty projects.

STARS collegiate branch Mission: Provide club members with the opportunity to grow protein crystals, learn about crystallography, volunteer at STARS crystal-growing competitions and summer camps, and attend and present at the American Crystallographic Association conference.

Purpose of Crystallography Lecture with Susanna Huang (Georgia Tech: Oyelere Group) and Crystallization Workshop with STARS collegiate branch: Provide GT students with the chance to learn about crystallography, provide students with the chance to speak with graduate students and/or professors about research and career opportunities, and teach students the basics of protein crystallography at the guided crystallization workshop.

Aim of the workshop: To organize a professional crystallography lecture and workshop that delivers an enjoyable and insightful experience to STARS members and GT students. Also, to lend more credibility to the STARS branch and introduce the STARS branch to students who may be interested in joining the branch.

Role of organizers: Facilitate the event, ensure all activities are on track as expected, let the event run smoothly, engage with STARS members, non-member students, and faculty, for the aim to make the event a pleasant and memorable educational experience.

The execution of the event: The RSVP form to attend the event was created by the president, gauging the registering students' majors, year at university, and areas of research interest as well as serving as a form for students to assent to being photographed and videotaped for the event. The event flyer with the RSVP QR code was designed and printed by the media chair. Physical flyers were printed and posted around several buildings on the GT campus by the president, vice-president, media chair, secretary, and long-term STARS member. Emails were sent to heads of undergraduate majors by several event organizers to post the event flyer pdf on announcements accompanied by messages sent by the event organizers. Additionally, quick presentations at the beginning of several first-year undergraduate chemistry courses and other biochemistry major courses were given to students by the president, letting them know about the event and encouraging them to sign up to participate. When the RSVPs increased to over 80, a number that is beyond realistic capacity, the president sent emails requesting for confirmation of student participation at the event to cap the event participation at around 25 students. The four faculty guests were invited by the president. Additionally, the media chair also produced individual flyers introducing the four invited faculty on their educational background, research interests, and current research projects to allow student participants to reference the flyers when asking the faculty questions over lunch. The secretary created check-in sheets from the RSVP form to streamline the check-in and lunch payment process for students. The vice-president served as the spokesperson at the workshop and ensured the smooth transition between sessions of the workshop event. The media chair and a volunteer took photos of the event. Welcome and closing emails to the event were sent by the secretary, and the latter email included a feedback form on the event, created by the president. All event organizers contributed to the preparation of the lunch for the students and the writing of this report.

These coordinated actions were only possible through strong communication between event organizers and their dedication to the aim at hand: share the importance of crystallography research with fellow students and give them a chance to interact with researchers in academia and to experience what wet-lab research is like.

By putting these student leaders through the challenge of hosting, organizing, and managing a crystallography workshop event, these students have the opportunity to develop their organization, communication, and leadership skills. They have a chance to learn how to work as a team and how to leverage their own connections, skills, and abilities to enhance the student participants' workshop experience.

For each of the sections below, each event organizer spends some time discussing how they each prepared for their event organizer section, what support from other event organizers did the event organizer in question find useful and helpful, and how the event organizer reflected on the event, as it relates to the aim of the workshop and the STARS mission.

Spokesperson – Event Organizer Addie

As reported by Addie:

The spokesperson role was the assignment given to Addie. This role involved reviewing the event schedule and logistics to ensure all announcements were made clearly. To prepare, she practiced projecting her voice, which was essential given the size of the event. The impact of this clear communication was observed in the smooth transitions between event sections and quick resolutions to unexpected issues, such as the shortage of lab coats. In addition, Addie was able to personally benefit from this event organizer experience by enhancing her speaking skills.

A key strength of this setup was the decision to allocate the spokesperson responsibilities to one person, while allowing others to step in if necessary. This collaboration enabled Addie to assist with food pick-up, lab setup, and addressing individual student questions, enhancing the overall flow of the event. In this way, the position was impactful for all event organizers as it facilitated collaboration and flexibility.

One area for improvement is providing clearer communication about the lunch schedule prior to the break. The most challenging moments arose during the transitions between tables, suggesting that advance notice could help streamline this process for future events. This advance notice would consist of making an announcement just before lunch to explain how the hot potato process will proceed. Specifically, a PowerPoint Slide at the end of the lecture introducing the lunch guests and the schedule would be beneficial.

Overall, the spokesperson role directly connects to the STARS mission and key strategies in several ways. Firstly, clear announcements ensure that students are well-informed about the hands-on experiences, enhancing their understanding and engagement with the subject matter. Secondly, assigning the spokesperson role to a dedicated STARS member not only develops the member's skills but also inspires other students to take initiative in future events by providing an additional fifth role for STARS members to lead as event organizers. Providing an additional platform for students to take on organizer roles can lead to personal growth and greater investment in the organization's mission. For example, engaging in leadership roles can strengthen students' emotional and intellectual commitment to the goals of STARS at GT. As they see the results of their efforts, they become more passionate about the mission and motivated to contribute further to share the experience of crystal growth and the understanding of crystallography research and its importance for therapeutic drug design for the treatment of diseases.

Check-in and Hospitality – Event Organizer Maya:

As reported by Maya:

The Check-in and Hospitality duties were assigned to Maya. Event organizers, Susanna, Addie, Caty, Sara and Maya brought materials to the event (refreshments, snacks, name tags, etc.). Caty's friend, Jessica, attended the event to assist with photography. Lunch was ten dollars per person, consisting of pizza from Papa John's and Chick-fil-A nuggets, in addition to cans of soda, small water bottles, fruits, and vegetables.

Maya created the check-in materials two days before the event based on the preliminary and secondary RSVP forms that were shared with GT students. Because of the large number of students who signed up (approximately 80 students), a secondary RSVP form was sent out by Susanna to confirm the students' attendance. Susanna made both RSVP forms, but Caty, Addie, Maya, and Sara shared them with the undergraduate members of their respective majors. The first 25 students (the maximum capacity for the lab) were able to attend. The check-in materials included an excel spreadsheet with each person who RSVPed (including professors and STARS club members), the portion(s) of the workshop they signed up for, whether they were paying or bringing their own lunch, and their attendance on the day. The actual check-in process involved providing each person with a blank nametag for them to write their name and major (and for the special cases of Dr. Bernbeck and Dr. Wilkinson, a pre-written nametag), checking each person off the roster, accepting the lunch payment if applicable, and handing out flyers (which were designed by and printed out by Caty) that provided background information for the professors present at the event. The lunch payments were accepted in cash, Zelle, and Venmo. There were 3 students who attended the workshop despite not being on the RSVP list because some students who RSVPed did not show up. Maya worked check-in from 9:30 to 11:00am in case guests arrived late for the lecture.

Although I had helped organize crystallography before, this event greatly improved my communication and social skills because a lot more students attended this event, all of whom I did not know. It was the first time I took on a mentoring/supportive role in a laboratory, so this event pushed me to become comfortable speaking and leveraging my experience in a laboratory environment. I found it very helpful that other event organizers were also helping support the workshop because I could consult them for clarification and help when answering students' questions. They have more experience than I do, so I am grateful to be able to defer to them and learn from them alongside the students. This communication between event organizers also ensured that the laboratory experience would be consistent for all attendees, making the workshop a success overall and accomplishing our goal of delivering high-impact crystallography experiences to undergraduate students. The week before the event, I had many unanticipated school and personal responsibilities come up, so my communication with the other event organizers was lacking in the days leading up to the event. Although I completed all my tasks, I should have remembered to let them know that I finished my work to prevent any confusion. Since

the workshop, I have and will continue to work on improving this. As a private person, I can struggle with sharing aspects of my life outside of club affairs, but I realize that if my personal life begins affecting my ability to perform/fulfill expectations, it is best to let people know. Overall, I believe this event has helped me become a more considerate team member and a more confident leader.

Laboratory – Event Organizer Susanna

As reported by Susanna:

Susanna had the opportunity to serve as the laboratory event organizer in addition to serving as the lecturer for the crystallography presentation. She was also involved in the recruitment of faculty for the lunch session and the preparation of RSVP and feedback forms for student participants as well as sharing information about the event broadly through quick presentations at the beginning of science classes and the dissemination of the event information in science class Canvas pages.

Teamwork is important for the success of a large goal. No single person can tackle the entire thing on their own. In my own case, this was most evident from the flyer that our media chair Caty was able to provide us with for the event. The flyer contained the QR code for the RSVP form that I created, and the flyer included all the key information about the event. It is very useful, especially since it can be sent to many students all at once. In fact, it was because our secretary May had sent this flyer and her own message to her fellow BME students that the RSVP form quickly racked up over 80 submissions within days. The flyer was important for both disseminating event information online through emails and Canvas pages as well as for disseminating event information in-person through hard copy fliers and through quick announcements at the beginning of classes about the event. I was able to use Caty's flyer directly as the visual on huge screens while I spoke to hundreds of students at a time in lecture halls about the event. It would be an understatement to say that the flyer was useful for spreading awareness about the event. It was the go-to visual that concisely represented and advocated for the event. I learned from this experience that when dedicated students work together towards a common goal, so much more can be accomplished than by just one dedicated student working on their own. Each student can bring to the table a skill that they have, and the cumulative effect is much stronger and more powerful than just one person's own skills and abilities.

When the 80 RSVP submissions were racking up, us event organizers, at the time, still had no invited faculty members who were available to attend lunch. Since this was the case, I decided to leverage my connection with the Oyelere Lab to see if any of the graduate students or post-doctoral students were available to participate as faculty guests, and indeed we were able to welcome 5th year graduate student Ryan Kern and postdoc Dr. Dipak Walunj as well as Dr. Walunj's postdoc colleague Dr. Debanjan Kundu. This experience taught me that it is important to

maintain the professional connections you have through research, especially since you might never know when you may need to ask them for assistance and when you might be interested in working on collaborations with them through STARS in the future.

I adopted a previous crystallography lecture presentation that I created for a STARS crystallography workshop for high school students for this event. The original idea was to introduce crystallography to the primarily first-year students in a similar fashion to how I had introduced it to the high school students. The idea was there, but it could have been executed better, especially since the original presentation was geared towards high school students, and its contents did not seem to be sophisticated or in-depth enough to the undergraduate student participants. This lack of sophistication and depth for undergraduate students is reflected in two of the students' responses on the RSVP form, which recommended including a "Deeper dive during the lecture into the computational process of crystallography" and having the chance for "Learning more about the theory behind crystallography." One key lesson learned: Always cater your message and presentation with the audience in mind so that you are engaging the students on a level that interest and challenges them. A proposed improvement for a future presentation is to describe the four-step process in crystallography in detail and connect that to the crystal-growing and structure determination practice that STARS Atlanta Branch helps its members perform.

As the Laboratory event organizer, I had the responsibility of ensuring that the lab space and equipment was reserved for the event, which I confirmed with Ms. Alison Onstine, and of ensuring that the protein samples, buffer solutions, and crystallization trays were all available and moved to the reserved lab location. These materials were fresh unused materials we had prepared for the previous crystallography workshop event. I had also revised the experiment handout and Excel spreadsheet handout to make the experiment more streamlined for student participants. Five of the six student respondents in the RSVP form noted that they especially enjoyed the hands-on lab portion of the event. This is great news! We are so happy to know that they enjoyed growing their protein crystals! This is how we leverage the beauty of crystals and the wet-lab portion of crystallography research to share the experience of research with fellow students and inspire them in therapeutic drug discovery.

Photography 1 – Event Organizer Caty

As reported by Caty:

The organization of the event planning for media involved both preliminary and post event planning, including development of advertising flyers, personal flyers and event questions for students, and Instagram posts, which these responsibilities were given to Caty and Sara with assistance from Jessica (a professional photographer). Flyers for advertising the event were developed on Canva and distributed throughout the Georgia Institute of Technology (GT) campus and online via STARS members. Flyers detailing the professional staff invited to lunch portion

were developed on Canva and information was found through their publications and laboratory pages. A Canon T6i camera was rented from GT to be used for this event. Planning and photography were taken by Caty, Sara and Jessica throughout the event encompassing the lecture portion, students discussing with Dr. Wilkinson, Dr. Walunj, Dr. Kundu, and Mr. Kern. Photography also included photos from the laboratory portions, including photos encompassing the laboratory portions planned. Photos after the event were transferred from the canon T6i onto a computer and edited in Adobe Photoshop Lightroom. An Instagram post was developed on Canva and posted to the STARS Instagram on August 28th. For Caty's personal development at the media chair of STARS, she learned more information about accessing photography materials from the campus resources. Additionally, through the assistance of Jessica, higher quality photos were able to be taken of the event.

Photography 2 – Event Organizer Sara

As reported by Sara:

The second photography event organizer role focused on capturing visual material of the crystallography workshop and providing the material afterward. Preparation was done by reviewing standard photography skills such as rule of thirds with Susanna, Jessica, and Caty. The images and videos were taken on an iPhone 11. Photos were taken during the lecture by Susanna, the lunch hot potato, and the wet lab workshop. Most of the media captured the wet lab workshop, including a short timelapse of the students preparing plates. After the event, the images and timelapse were selected and uploaded to the shared OneDrive folder. Outside of the photography role, I contributed to the advertisement of this event and preparation beforehand of each lab station. This role was an opportunity to develop outreaching skills and build a rapport with lab attendees and other event organizers. The outreach included emailing professors and discussing with other students about the event. Throughout the event, attendees and organizers discussed various topics such as classes, student life, and research advice. This developed a relationship amongst the group and between attendees and organizers.

Feedback from the event

Below are the cumulative feedback from the event surveys as reported by Sara.

A post-event survey was conducted, sent out August 24th, 2024 via email. Survey inquiries included name, email, attendance, event enjoyment, likelihood of participating in another event, how informative, organized, and relevant the event was, likelihood of attending a future event, and if they attended an event previously. There were 7 responses to the survey.

Responses towards the survey are found in the appendix (Table 1). The average response was positive towards rating the event overall, organization, duration, communication, event follow

through, response time, likelihood of future attendance, and usefulness of the event. Five out of seven students participated in all sections of the event. However, six out of seven students responded the information was moderately or not applicable to their own areas of interest. Answers to the short answer questions are found in the appendix (Table 2). All students expressed enjoying the event and found the information useful. Specific descriptions included the kindness of STARS representatives, material was valuable, and the variety of activities. All students stated their favorite moment was either the lab portion or the Q&A portion. Improvements included shortening the lunch, having more sources of buffers, or diving deeper into specific topics. The responses will be considered for future events where the timing and depth of material will be adjusted. The feedback from this event will help develop a better event. Providing useful, fun research-related events and then receiving positive feedback promotes an interest in continuing to work towards future event improvement.

Conclusion

The concluding remarks as reported by Addie:

The event organizers are so thankful to Dr. Walunj, Mr. Kern, Dr. Kundu, Dr. Bernbeck, Ms. Onstine, the GT facility, and Hampton Research, Inc. and everyone else who made this event possible. The goal of STARS at GT is to share the experience of crystal growth with students interested in crystallography research so that those students can gain an understanding of crystallography research and its importance for therapeutic drug design for the treatment of diseases. Thanks to everyone involved, this event provided valuable experiences for Georgia Tech students of all skill levels.

The event allowed those new to crystallography to engage in a hands-on crystallization workshop and in enriching discussions with the participating research professionals. In addition, experienced STARS members had the opportunity to explain techniques and answer questions during the workshop, while also gaining valuable insights into structural chemistry during the lunch.

The turnout was impressive with 25 non-STARS students attending the event. This marks one of the largest events hosted by STARS at GT, positioning the club well for future workshops and increased club membership. At least four new students were registered for the club as a result of the event. This illustrates how open events are used not only to inspire students about research but also as a method to increase membership in the club. In addition to regrowing lysozyme crystals, student members will continue to learn about solving diffraction data. Overall, this event offered GT students a strong introduction to crystallography and laid the groundwork for their future work in crystallography research, structural biology, and therapeutic drug design.

Next Steps

As reported by Susanna:

The next steps is to introduce the new members to the club what STARS Atlanta branch is about and teach them in addition to current STARS members how to solve protein structures with electron density map data using PHENIX and Coot during club meetings. Understanding how to use these programs is important for students to have a taste of how the experimental data is worked up and affords students the opportunity to learn this side of crystallography in computational systems.

Additionally, STARS Atlanta will be continuing to have its bi-semesterly crystallography workshop events, with the next workshop event set to take place on Saturday, November 23rd, 2024, where STARS also expects to be able to show students not only how to grow protein crystals but also how to collect diffraction data from the protein crystals at the Berkeley National Laboratory remotely, in real time. This will be especially exciting for students because they will be able to see how the experimental data is actually collected for data processing.

Besides the crystallography workshop events, STARS Atlanta will also be having a skills-building series on how to get into a research position in a lab or in the corporate realm and a lecture-based series showcasing current research that structural biology-related professors currently are working on at Georgia Tech. The first series not only provides GT students with a chance to learn how to cold-email professors, build their resumes, and prepare for an interview but also gives STARS Atlanta a chance to share with students the knowledge of current STARS member undergraduate researchers. This is a net positive for both student leaders and the participating students, and STARS Atlanta is glad to have such an opportunity to be useful for the development of students on both sides. The second series not only provides students the chance to hear about research from structural biology-related fields but also provides opportunities for STARS Atlanta to continue forming connections with faculty for the possibility of invited guest lunches, guest presentations, or research collaborations with STARS Atlanta in the future.

As reported by:

Susanna Huang, Adelaide Kindler, Catherine Lue, Maya Leville, Sara Hunihan

October 2024

Appendix

All event materials:

- **Workshop event STARS meeting topics for event organizers (2024):** [Workshop event STARS meeting topics of discussion.pdf](#)
- Workshop flyer advertisement: [STARS Crystallography Workshop Flyer \(August 24th, 2024\)](#)
- Experiment preparation procedures: [Procedure for preparing needed reagents in a lysozyme crystallization experiment.pdf](#)
- **Crystallography experiment handout:** [August 24th, 2024 - STARS Crystallography workshop handout.pdf](#)
- Crystallography experiment Excel spreadsheet: [August 24th, 2024 - STARS Crystallography workshop.xlsx](#)
- **Crystallography workshop results:** [Crystallization plates_August 28th, 2024.xlsx](#)
- Presentation given by Susanna: [August 24th 2024 - STARS Crystallography Workshop presentation.pptx](#)
- **Recorded presentation of the Susanna Huang's lecture:** <https://youtu.be/pCzaccG3kNg>
- Flyer introducing the professors during the lunch (Dr. Bernbeck): [Bernbeck.pdf](#)
- Flyer introducing the professors during the lunch (Dr. Walanj): [Dr. Dipak Walunj \(1\).pdf](#)
- Flyer introducing the professors during the lunch (Dr. Kundu): [Dr. Debanjan Kundu.pdf](#)
- Flyer introducing the professors during the lunch (Mr. Ryan Kern): [Ryan Kern.pdf](#)
- Survey Feedback form: https://forms.office.com/Pages/DesignPageV2.aspx?subpage=design&FormId=u5ghSHu uJUuLem1_MvqggwoYuzWuIJVLtoZUfbaTaLhUQU9DVEkwMIYyRTZBMUNVNUtHQVg5Slo4OC4u
- Photos of the event: [Photos](#)
- **STARS at GT Instagram page:** <https://www.instagram.com/stars.anticancer.gt/>

Event survey summary:

Table 1. Multiselect Survey Questions (Sara)

Question	Anonymous Response with iD's 1-7
Overall how would you rate the event?	1. Very good 2. Excellent 3. Excellent 4. Very good 5. Very good 6. Very good 7. Excellent
Was this the first time you attended one of our STARS events?	1. Yes 2. Yes 3. Yes 4. Yes 5. Yes 6. Yes 7. Yes
How organized was the event?	1. Very organized 2. Extremely organized 3. Extremely organized 4. Very organized 5. Very organized 6. Extremely organized 7. Extremely organized
Was the event too long or too short?	1. Just right 2. Just right 3. Just right 4. Just right 5. Just right 6. A little bit long 7. Just right
Did you attend the 10:30am-11:30am crystallography and undergraduate research lecture with Susanna Huang (Georgia Tech: Oyelere Group and STARS)	1. Yes 2. Yes 3. Yes 4. Yes 5. Yes 6. Yes 7. Yes
Did you attend the 11:30pm-1:00pm lunch with GT professional research staff?	1. No 2. No 3. Yes 4. Yes 5. Yes 6. Yes

	7. Yes
Did you attend the 1:00-3:30pm crystallography workshop with STARS Atlanta Branch?	1. Yes 2. Yes 3. Yes 4. Yes 5. No 6. Yes 7. Yes
On a scale of 1 to 10, please rate the STARS branch in the category of event communication, with 1 being unsatisfactory and 10 being exceptional:	1. 8/10 (Passives) 2. 8/10 (Passives) 3. 10/10 (Promoters) 4. 10/10 (Promoters) 5. 8/10 (Passives) 6. 7/10 (Passives) 7. 10/10 (Promoters)
On a scale of 1 to 10, please rate the STARS nonprofit in the category of event follow through, with 1 being unsatisfactory and 10 being exceptional:	1. 9/10 (Promoters) 2. 10/10 (Promoters) 3. 8/10 (Passives) 4. 10/10 (Promoters) 5. 8/10 (Passives) 6. 8/10 (Passives) 7. 10/10 (Promoters)
On a scale of 1 to 10, please rate the STARS nonprofit in the category of response time, with 1 being unsatisfactory and 10 being exceptional:	1. 9/10 (Promoters) 2. 10/10 (Promoters) 3. 10/10 (Passives) 4. 10/10 (Promoters) 5. 9/10 (Promoters) 6. 9/10 (Promoters) 7. 10/10 (Promoters)
On a scale of 1 to 10, how likely would you attend another event like this one?	1. 10/10 (Promoters) 2. 10/10 (Promoters) 3. 10/10 (Passives) 4. 10/10 (Promoters) 5. 9/10 (Promoters) 6. 7/10 (Passives) 7. 8/10 (Promoters)
On a scale of 1 to 10, how informative or useful did you find this event to be?	1. 10/10 (Promoters) 2. 9/10 (Promoters) 3. 10/10 (Promoters) 4. 9/10 (Promoters) 5. 8/10 (Passives) 6. 8/10 (Passives) 7. 8/10 (Passives)
On a scale of 1 to 10, how applicable did you find the information from the event to be to your own areas of interest?	1. 10/10 (Promoters) 2. 6/10 (Detractors) 3. 8/10 (Passives)

	<ul style="list-style-type: none"> 4. 7/10 (Passives) 5. 7/10 (Passives) 6. 8/10 (Passives) 7. 7/10 (Passives)
On a scale of 1 to 10, how interested are you in learning more about the STARS collegiate branch?	<ul style="list-style-type: none"> 1. 10/10 (Promoters) 2. 8/10 (Passives) 3. 10/10 (Promoters) 4. 8/10 (Passives) 5. 8/10 (Passives) 6. 6/10 (Detractors) 7. 8/10 (Passives)
On a scale of 1 to 10, how likely would you recommend a friend to attend an event like this in the future?	<ul style="list-style-type: none"> 1. 8/10 (Passives) 2. 10/10 (Promoters) 3. 10/10 (Promoters) 4. 9/10 (Promoters) 5. 8/10 (Passives) 6. 7/10 (Passives) 7. 10/10 (Passives)

Table 2. Short Answer Feedback Questions

Question	Anony mous iDs	Corresponding Short Answer Response
Did you enjoy attending the event? Please describe why or why not.	1-7	<ul style="list-style-type: none"> 1. Yes. I love doing bio labs and this was a really new and interesting. I might want to look into it again later. 2. I thoroughly enjoyed the event. As someone who loves biology and its applications this was an extremely satisfying lab. The leaders were very kind and knowledgeable and I felt very comfortable even being inexperienced. 3. Yes. It was fun and I learned a lot. 4. Yes, I enjoyed attending this event. There was a nice variety of activities. 5. Yes, I attended the event, enjoyed it, and the students were excited. 6. Yes, I liked the event since it was informative and the material was interesting. 7. I enjoyed meeting many people and it was very informative!
Please describe your favorite experience or moment of the event.	1-7	<ul style="list-style-type: none"> 1. I loved the whole lab part! 2. Asking questions about research 3. I enjoyed the workshop. 4. The proteins getting stuck to the pipette tips. 5. "It's a very useful and good platform for undergraduate students." 6. I enjoyed the actual workshop part the most. 7. I enjoyed all sections, especially the lab.

What are some recommendations you may have for improving similar events in the future?	1-7	<ol style="list-style-type: none">1. Maybe use a mic so we can hear the presenter better and also send info about what to bring in the first email.2. Deeper dive during the lecture into the computational process of crystallography3. Don't know.4. Learning more about the theory behind crystallography.5. "Yes, definitely, I will provide an encore for new students."6. There weren't enough pH buffers.7. I felt like lunch could be a little bit more brief.
Any other comments or questions?	1-4	<ol style="list-style-type: none">1. N/A2. None!3. N/A4. Thank you for an incredible opportunity!!

List of event attendees (Maya)

List of the number of participants for the lecture, for the lunch, for the workshop, along with their affiliations and classification status. Total number of attendees: 33. Four STARS Atlanta Branch members; 25 GT non-member students; four invited faculty. As reported by Maya.

Name	A t t e n d a n c e	Affilia tion	Lectur e	Lunch	Pay or Bring	Payme nt Metho d	Lab	Notes
Carlos Marrufo	X	Non-STAR S	Yes	Yes	Bringi ng		Yes	leave and came back during lunch
Arjun Ghosh	X	Non-STAR S	Yes	Yes	N/A		No	only for lecture
Navya Naresh Shenoy	X	Non-STAR S	Yes	Yes	Bringi ng		Yes	
Sara Dixon	X	Non-STAR S	Yes	Yes	Bringi ng		Yes	
Patrick Pan	X	Non-STAR S	Yes	Yes	Purcha sing	Venmo	Yes	borrowed lab coat
Nishadh Naik	X	Non-STAR S	Yes	Yes	Bringi ng		Yes	
Ruthie Fowler	X	Non-STAR S	Yes	Yes	Purcha sing	Venmo	Yes	
Olivia Uko	X	Non-STAR S	Yes	Yes	Bringi ng		Yes	
Krithi Iyer	X	Non-STAR S	Yes	Yes	Purcha sing	cash	Yes	
Tvishi Ahluwalia	X	Non-STAR S	Yes	Yes	Purcha sing	cash	Yes	

Dylan Brank	X	Non-STAR S	Yes	No	N/A	N/A	Yes	-left and came back for pants -borrowed lab coat
Annika Valluru	X	Non-STAR S	Yes	No	N/A	N/A	Yes	-leave during lunch. needs to bring pants -borrowed lab coat
Tvisha Thorat	X	Non-STAR S	Yes	No	N/A	N/A	Yes	
Kristina Siju	X	Non-STAR S	Yes	Yes	Purchasing	cash	Yes	
Erin (Yunhee) Choi	X	Non-STAR S	Yes	Yes	Bringing		Yes	
Aayush Maniar	X	Non-STAR S	Yes	No	N/A	N/A	No	
Anirudh Kumar	X	Non-STAR S	Yes	Yes	Purchasing	Venmo	Yes	
Sara Takagi	X	Non-STAR S	Yes	Yes	Bringing		Yes	
Syon Schlecht	X	Non-STAR S	Yes	Yes	Bringing		Yes	
guests not originally on the confirmed list								
Henry Seegers	X	Non-STAR S	Yes	Yes	Purchasing	Zelle	Yes	
Katie Tran	X	Non-STAR S	No	No	N/A	N/A	Yes	
Nicholas Ryan	X	Non-STAR S	Yes	Yes	Purchasing	cash	Yes	
Gurnoor Hayer	X	Non-STAR S	Yes	Yes	Purchasing	cash	Yes	borrowed lab coat

Tyler Bothwell	X	Non-STAR S	No	Yes	Purchasing	Venmo	Yes	did RSVP form morning of
Jayce Levy	X	Non-STAR S	No	No	N/A	N/A	Yes	arrived during lab borrowed lab coat
Ryan Kern	X	Guest	No	Yes	Provided	N/A	No	
Dr. Max Bernbeck	X	Guest	No	Yes	Provided	N/A	No	
Dr. Dipak Walunj	X	Guest	Yes	Yes	Provided	N/A		
Dr. Debanjan Kundu	X	Guest	Yes	Yes	Provided	N/A		
Susanna Huang	X	STAR S	Yes	Yes	Provided	N/A		
Addie Kindler	X	STAR S	Yes	Yes	Provided	N/A	Yes	
Sara Hunihan	X	STAR S	Yes	Yes	Provided	N/A	Yes	
Maya Leveille	X	STAR S	Yes	Yes	Provided	N/A	Yes	
Caty Lue	X	STAR S	Yes	Yes	Provided	N/A	Yes	

Totals: 25 students, 4 event organizers, 4 guests

Total Attendance: 33 people

Representative Crystallization plates results:

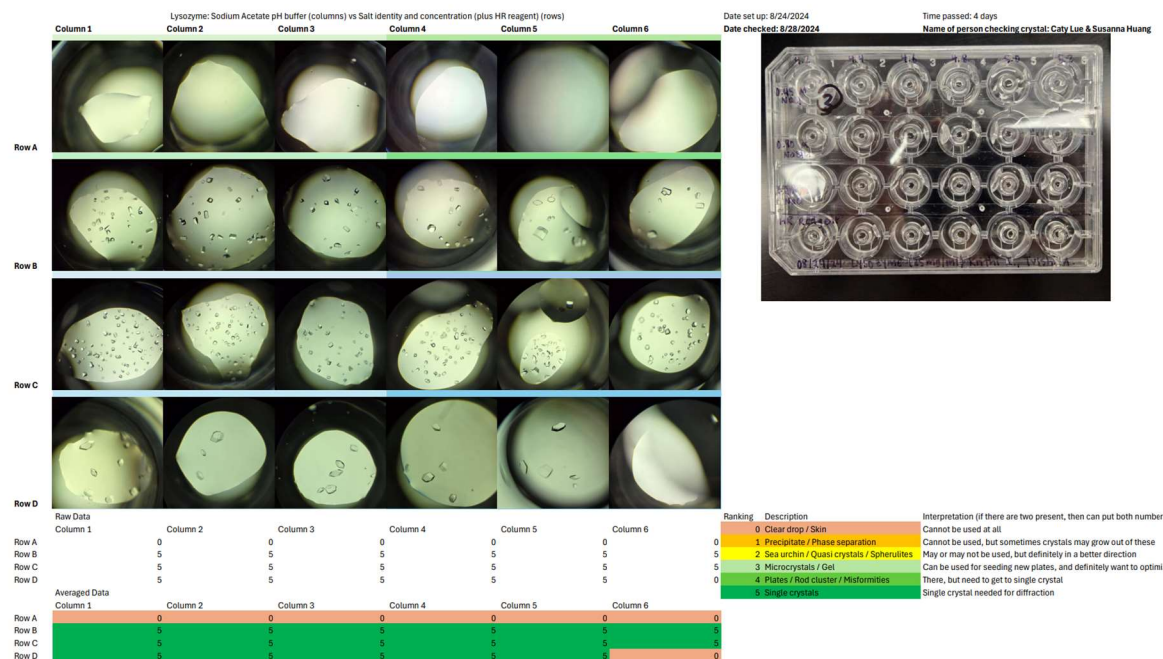


Figure 1. The total crystallization results for Plate 3 (Krithi I and Tvishi A), who used sodium acetate at pH 4.2 / 4.4 / 4.6 / 4.8 / 5.0 / 5.2 (columns) vs NaCl salt concentration at 0.45 M / 0.9 M / 1.20 M (rows) and Hampton Research crystallization reagent in Row D.

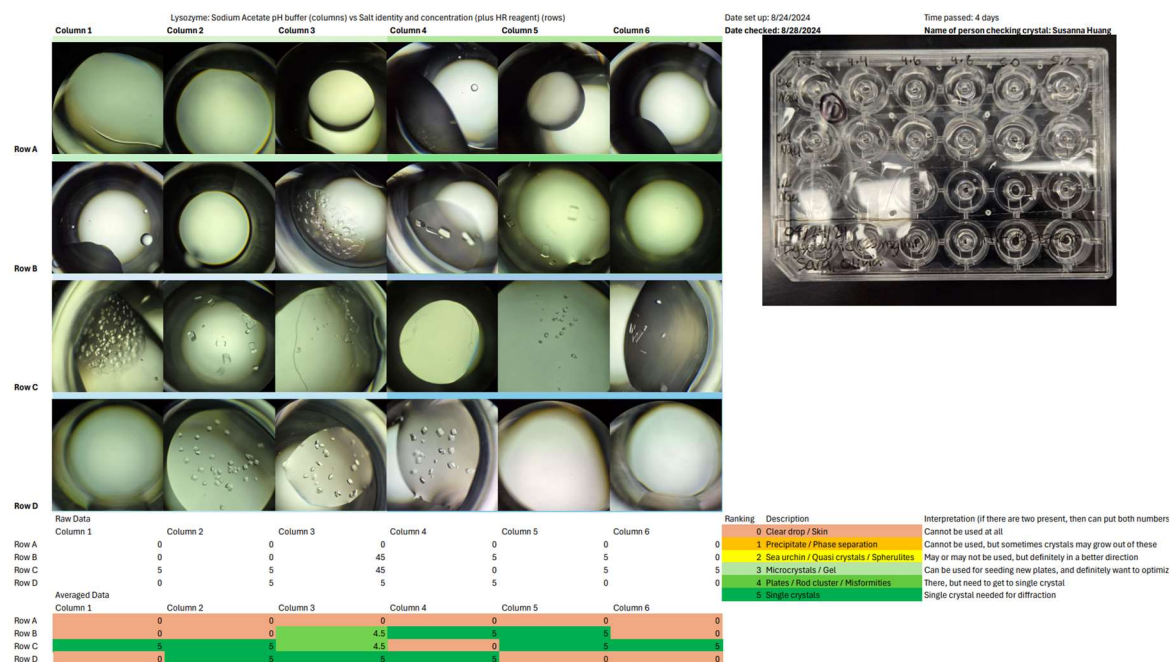


Figure 2. The total crystallization results for Plate 10 (Sara and Olivia), who used sodium acetate at pH 4.2 / 4.4 / 4.6 / 4.8 / 5.0 / 5.2 (columns) vs NaCl salt concentration at 0.6 M / 0.9 M / 1.2 M (rows) and Hampton Research crystallization reagent in Row D.

Representative Crystal Growth results:

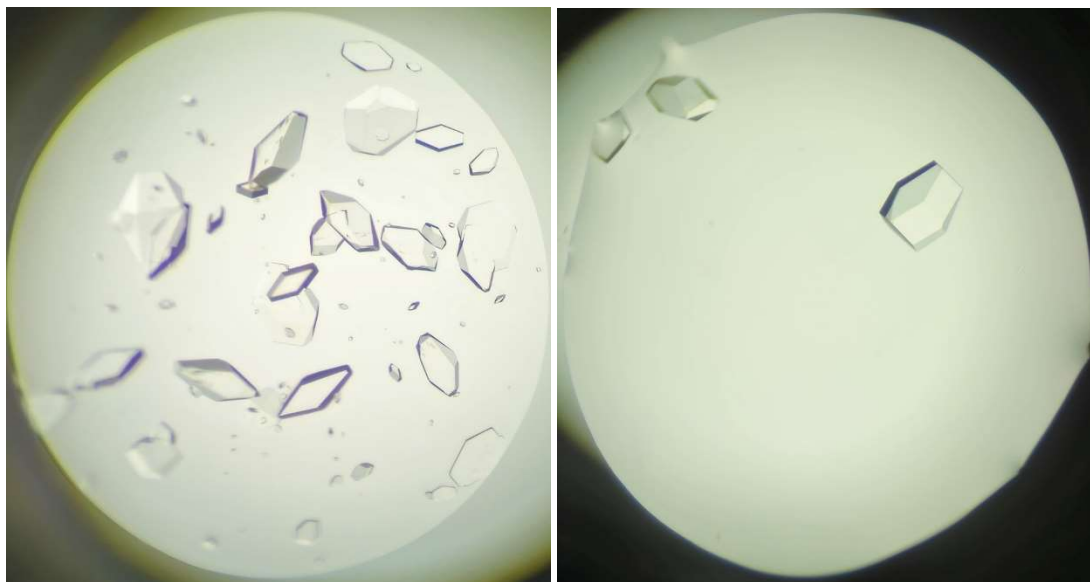


Figure 3. B5 and D4 of crystallization plate 1 (Nischal Bhattarai and Anirudh Kumar)

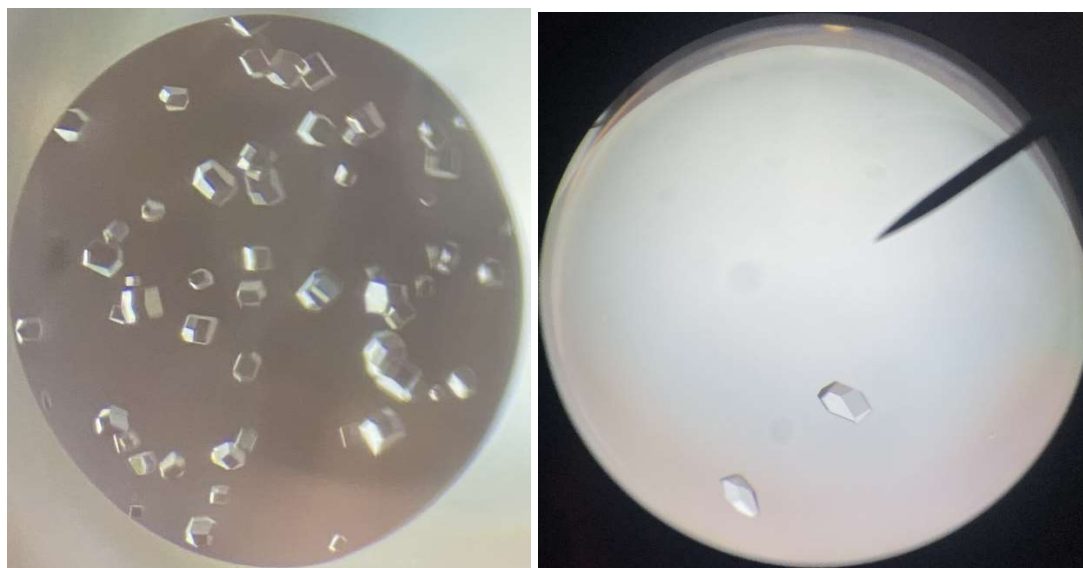


Figure 4. C4 and D4 of crystallization plate 2 (Annika V and Patrick)

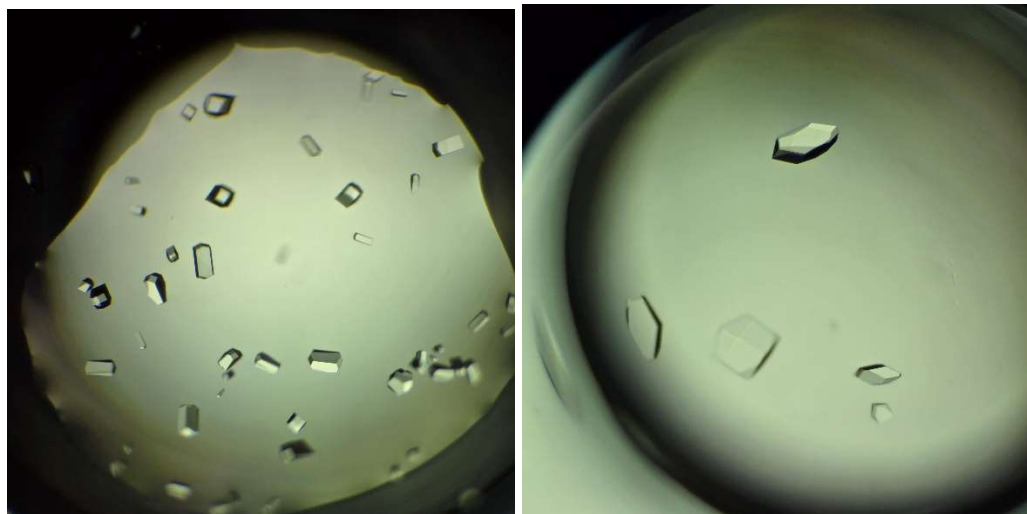


Figure 5. B2 and D5 of crystallization plate 3 (Krithi I and Tvishi A)

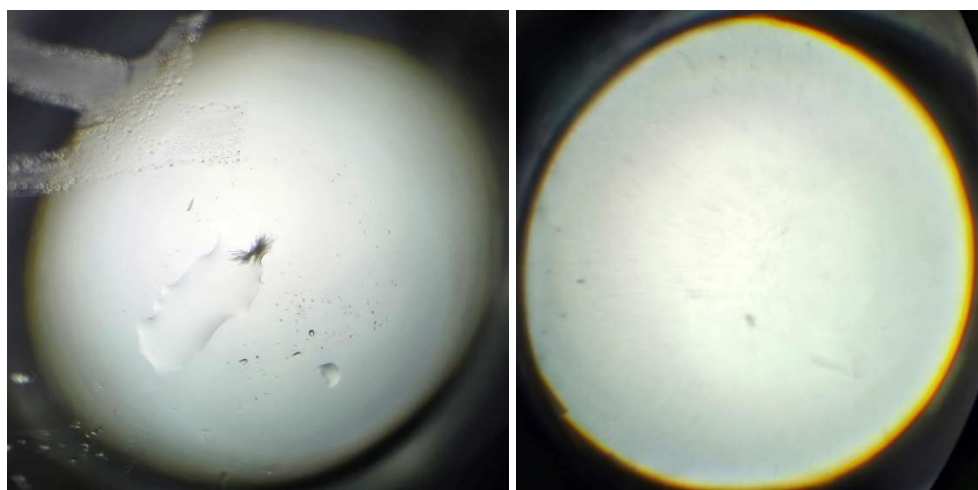


Figure 6. A2 and D2 of crystallization plate 4 (Dylan and Joyce)

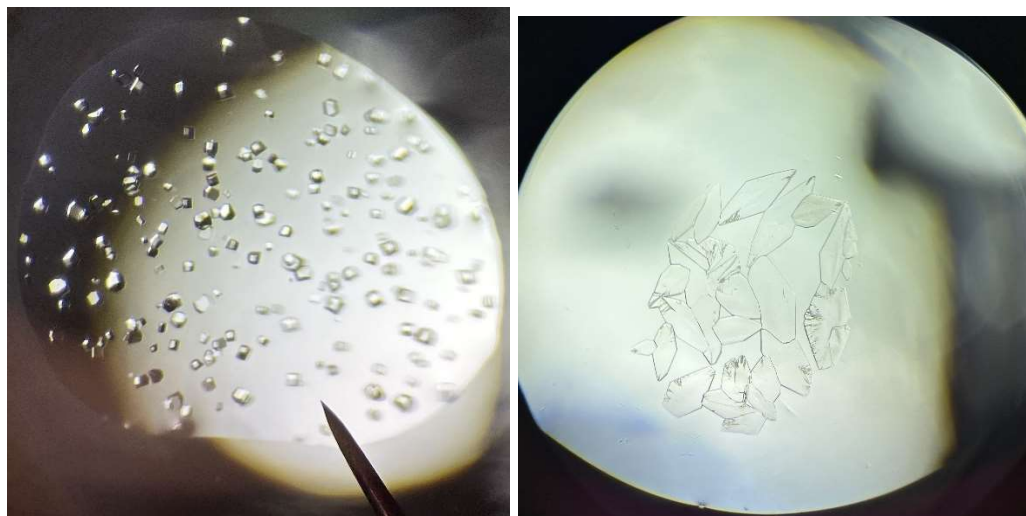


Figure 7. C1 and C6 of crystallization plate 5 (Nish Naik and Tvisha Thorat)

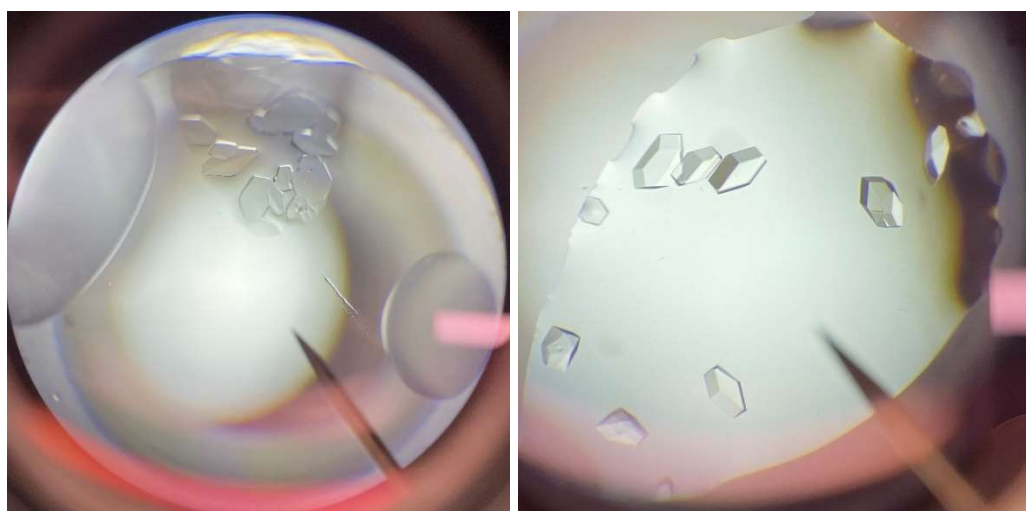


Figure 8. C3 and D3 of crystallization plate 6 (Tyler B and Nicholas R)

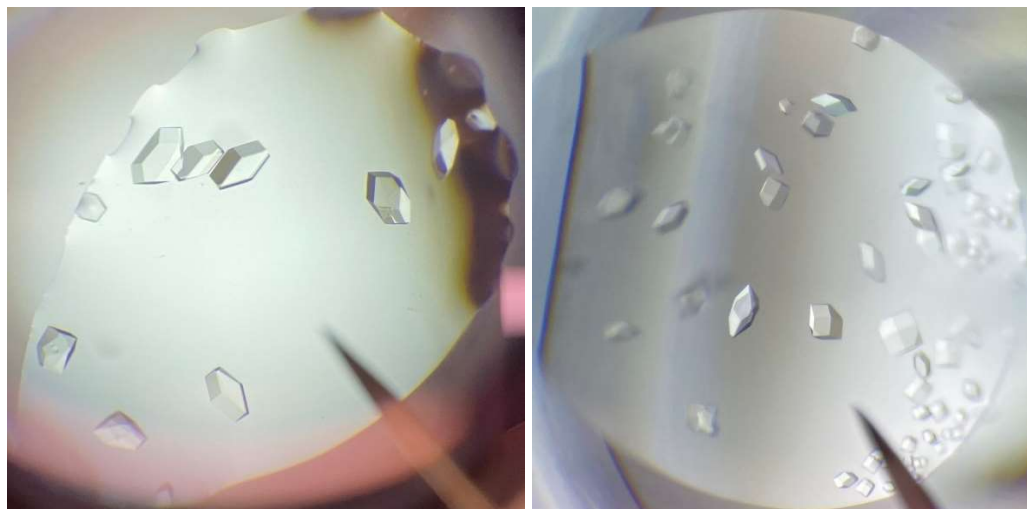


Figure 9. A3 and D1 of crystallization plate 7 (Syon and Ruthi F.)



Figure 10. A5 and D1 of crystallization plate 8 (Henry S and Gurnoor H)

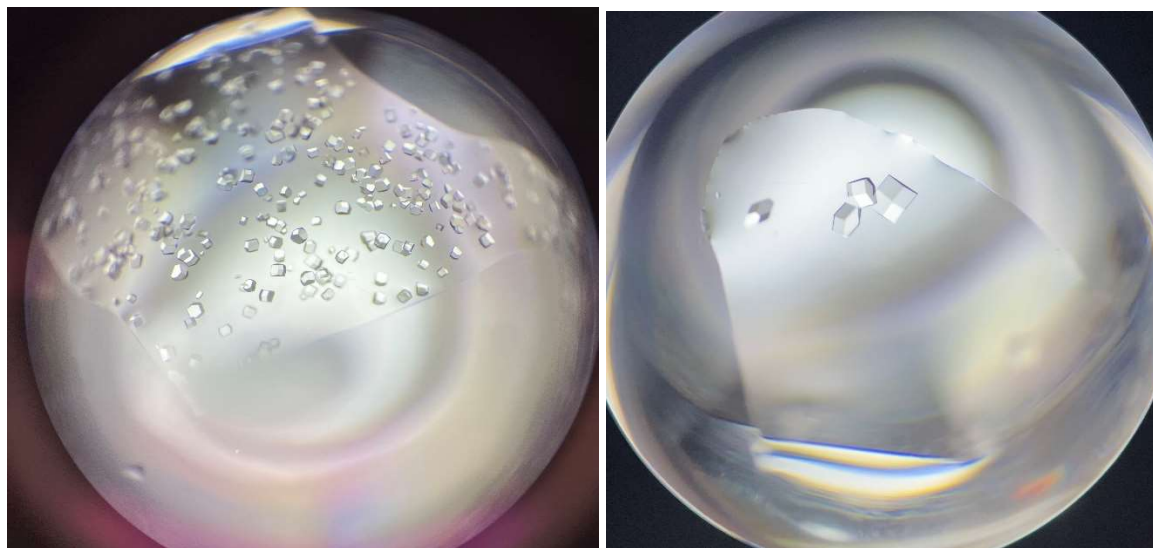


Figure 11. B5 and D6 of crystallization plate 9 (Sara Dixon and Kristina)

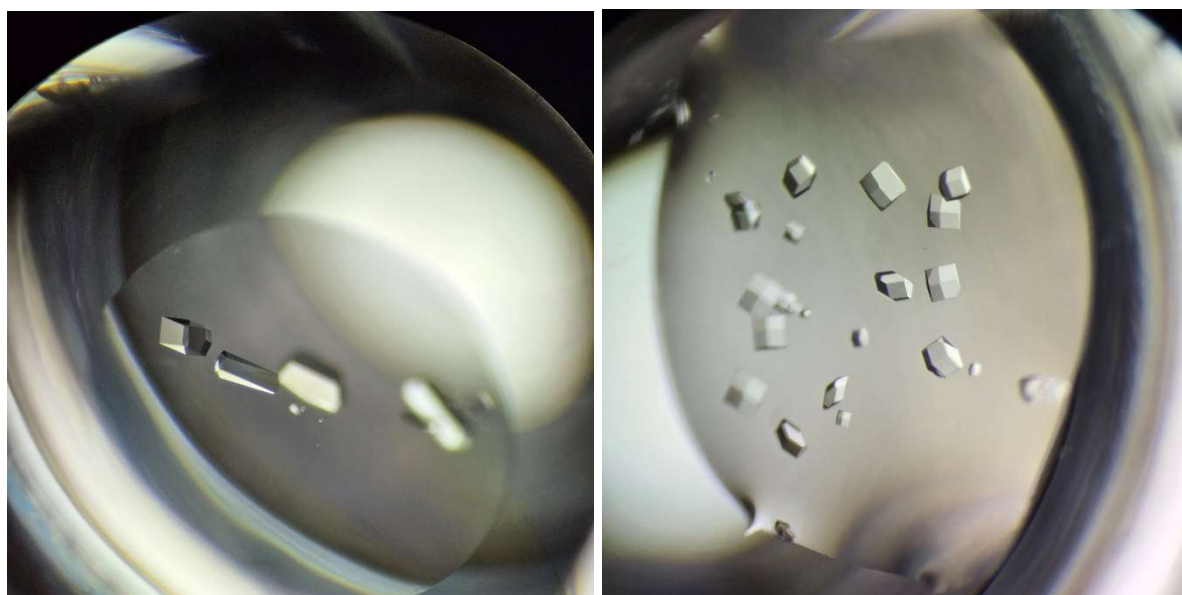


Figure 12. B4 and D4 of crystallization plate 10 (Sara and Olivia)

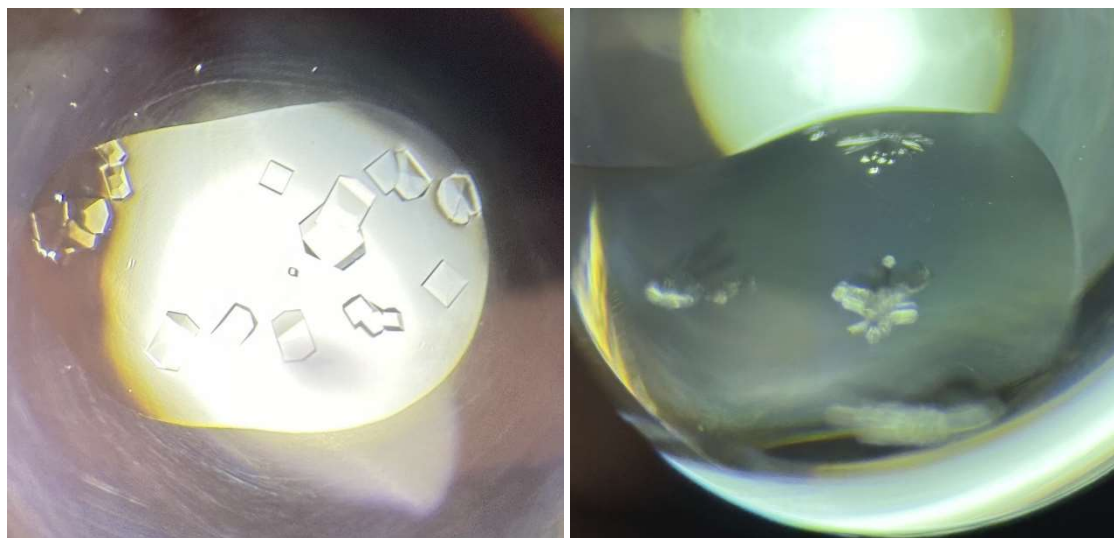


Figure 13. A2 and B6 of crystallization plate 11 (Katie Tran and Navya Shenoy)

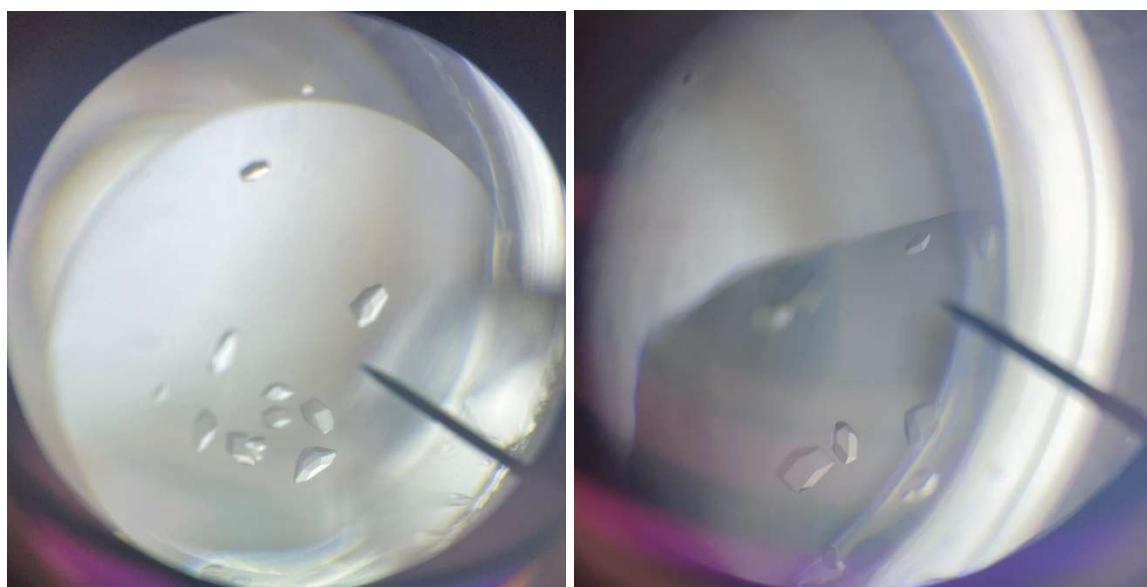


Figure 14. D5 and D6 of crystallization plate 12 (Carlos and Erin)

Photos (Cathy)

I WILL DO PHOTOS, i got angry at it not translating over so ill do it in the morning.



A student listening to lecture portion of STARS workshop.



Student listening to lecture portion of STARS workshop.



Students talking to Dr. Kundu during hot potato portion of workshop.



Students talking to Dr. Bernbeck during hot potato portion of workshop.



STARS officer members with special guests.



Students listening to pre-laboratory instruction.



Students having fun figuring out what concentrations to use for experiment.



Micropipette used in the laboratory.



Sample lysozyme for students to use during the experiment.



Student administering solutions into well plates.



A master at work.



A student is getting serious about the laboratory.



Group photo of students after workshop ended.

STARS nonprofit activities summary

- Competed in the US Crystal-Growing Competition (USCGC) annually [Fall 2019 – current]
 - o 2019 USCGC – Susanna Huang won 2nd place in the clearest crystal category (Walton STARS branch; Acting president: Susanna Huang)
 - o 2020 USCGC – Team members experimented with crystallizing glow-in-the-dark highlighter ink and quinine into crystals (Walton STARS branch; Acting president: Susanna Huang)
 - o 2021 USCGC – Walton STARS branch (Acting president: Susanna Huang)
 - o 2022 USCGC – Walton STARS branch (Acting president: Selina Huang)
 - o 2023 USCGC – Walton STARS branch (Acting president: Selina Huang)
- Hosted and organized local crystal-growing competitions annually [Spr. 2021 – current]
 - o 2021 Timber Ridge Crystal-Growing Competition
 - o 2022 Cobb County Crystal-Growing Competition
 - o 2023 Dodgen Crystal-Growing Competition
- Hosted and organized local crystal-growing summer camp [Sum. 2021 – current]
 - o 2021 STARS Crystal-Growing Summer Camp
 - o 2022 STARS Crystal-Growing Summer Camp
 - o 2024 STARS Crystal-Growing Summer Camp
- Presented at Cobb County STEM teacher conference [Sum. 2021 – Sum. 2022]
 - o 2021 STEMpalooza STEM teacher conference
 - o 2022 STEMpalooza STEM teacher conference
- Presented at American Crystallographic Association annual conference [Sum. 2023 – current]
 - o 2023 ACA conference (Baltimore, Maryland)
 - o 2024 ACA conference (Denver, Colorado)
- Hosted and organized crystallography workshops [Spring 2024 – current]
 - o 2024 Crystallography Lecture and Crystallization Workshop with Dr. Liu – STARS at GT branch (Acting president: Susanna Huang)
 - o 2024 Crystallography Lecture with Dr. Max Bernbeck (Georgia Tech: La Pierre Group) and Crystallization Workshop with STARS at GT branch (Acting president: Susanna Huang)
 - o 2024 Crystallography Lecture with Susanna Huang (Georgia Tech: Oyelere Group) and Crystallization Workshop with STARS at GT branch, for Walton HS students
 - o 2024 Crystallography Lecture and Workshop with STARS Atlanta Branch for Georgia Tech students
 - o 2024 Oak Ridge National Laboratory Trip