

Alice Y. Hu

EDUCATION

C. Leon King High School IB Program, Tampa, FL

Aug 2022 – May 2026

GPA 4.0/4.0 (unweighted); 7.2 (weighted); **Rank:** top 1%; **ACT:** 34

HONORS AND AWARDS

2025

Music

- Frances Blaisdell Scholarship, National Flute Association (NFA) (for the first time in the NFA's history, the organization has awarded this Scholarships to a high school student)
<https://www.nfaonline.org/about/about-the-nfa/nfa-news-updates/2025/07/02/frances-blaisdell-convention-scholarship-awarded-to-alice-hu-and-nathan-anderson>
- Invited Speaker, the Life Member and Donor Appreciation Reception, National Flute Association 53rd Annual Convention, Atlanta, GA
- Boston University Tanglewood Institute Scholarship
- Flutist 1, Group 1 (total 4 groups), Woodwind Quintet Workshop, Boston University Tanglewood Institute (the only musician from Florida attended this workshop in 2025)
- Invited to perform a solo at Asian American Day, Massachusetts State House, Boston, MA
- Principal Flutist, Tampa Metropolitan Youth Symphony Orchestra
- Finalist, Tampa Metropolitan Youth Orchestra Concert Competition
- Invited to perform at the Boston New Year Grand Musical Ball with the Boston International Symphony Orchestra, Lexington, MA (Jan. 2026)
- Accelerando Scholarships for leadership and volunteer, Do Re Mi Project (<https://www.doremiproject.org/scholarship.html>)
- The Emeritus Fund, Florida Flute Association
- 1st Place, Flute, 11th New York International Music Concours, selected to perform a solo at Winner's Concert at Weill Recital Hall, Carnegie Hall, NY
- 1st Prize, Aspiring Artist II, International Music Competition Salzburg "Grand Prize Virtuoso", invited to perform a solo at Winner's Concert at Solitär Mozarteum in Salzburg, Austria
- Absolute Platinum Medalist, Collegiate Category, Quebec Music Competition
- 2nd Prize, Grade 11-12 Flute-Woodwinds Division, New York Artists Guild International Music Competition, invited to perform solo at Winner's Concert at Bruno Walter Auditorium, Lincoln Center, New York
- Platinum Medalist, Collegiate Category, US-Canadian International Music Competition
- 2nd Place, 2nd American Youth Talent International Music Competition, selected to perform a solo at the 3rd San Francisco International Young Artists Music Festival, San Francisco Conservatory of Music, CA
- Outstanding Achievement Award, Boston International Music Competition
- Accepted, Orford Music Academy Flute Masterclass, typically college-level only
- Flutist 2, Florida Music Education Association (FMEA) All-State Symphonic Orchestra
- Principle Flutist, King High School Band (2022 - present)

- Selected for the Florida Music Education Association (FMEA) All-State Band/Orchestra every year from 2021 to 2026; the only flutist in Florida to be accepted into All-State Band/Orchestra consecutively for 6 years.
- Accepted to the New England Conservatory Summer Orchestra Institute, Boston, MA
- Invited to submit photos and a biography for personalized 2025 Icon Story digital mini-magazine (World Online Music Competitions Organization website)

ACADEMIC ACHIEVEMENTS

- National Mu Alpha Theta Convention, Statistics Division, Team (captain), 9th Place; Hustle: 7th Place; Sweepstakes, 8th Place; Statistics Ciphering, 20th Place
- Florida Association of Mu Alpha Theta (FAMAT) State Competition: Statistics Division, Team (captain), 7th Place; Hustle: 8th Place; Sweepstakes, 10th Place
- FAMAT Statewide: Statistic Team (captain), 7th Place; Sweepstakes, 5th Place
- FAMAT March Regional: Statistics Division, Team (captain), 2nd Place
- FAMAT February Regional: Statistic Individual, 5th Place; Statistics Division, Team (captain), 2nd Place
- FAMAT January Regional: Statistic Individual, 9th Place; Statistics Division, Team (captain), 3rd Place
- Eligible and registered to attend the 2026 Mu Alpha Theta National Convention, Frisco, TX
- AP Scholar with Distinction
- Garcia Summer Research Scholars, Garcia Center for Polymers at Engineered Interfaces, Stony Brook University, NY (summer 2025) (I am attending this summer program for the second year in a row, my research project is about DNA) (According to MIT website, this program is one of the competitive-admission summer programs <https://mitadmissions.org/apply/prepare/summer/>)
- Oral presentation, “Ordered DNA Fragmentation over UV-patterned SU-8 Using Tn5 Transposase”, 2025 Garcia Summer Research Symposium, Stony Brook University, NY
- Poster Presentation (Co-first author), “Ordered DNA Fragmentation over UV-patterned SU-8 Using Tn5 Transposase”, Symposium E. Organic and Biological Coatings, International Thin Films Conference, Taipei, Taiwan (October 2025)
- Poster Presentation, American Physical Society Global Physics Summit, Biological Physics II Section Poster (Co-first Author) “A Novel Method for UV Thin-Film Backside Development for Ordered DNA Fragmentation”, and Physics of Disease, Diagnosis and Treatment Section Poster (Co-first Author) “A Novel Approach for Ordered Fragmentation of Mouse DNA Using Tn5 Transposase” Anaheim, CA, (March 2025)
- Honor Roll, C. Leon King High School – Recognized for maintaining a GPA of 4.0 (2022 – Present)

SWIMMING

- Florida High School Athletic Association (FHSAA) 2A State Championships: 400 Yd Free Relay, 21st Place; 200 Yd Free Relay, 24th Place
- Western Conference – National Division: 100 Yd Back, 1st Place; 50 Yd Free, 5th Place; High Points, 5th Place; 400 Free Relay, 1st Place; 200 Medley Relay, 3rd Place; Girl’s Team (Captain), 4th Place
- Florida High School Athletic Association (FHSAA) 2A District 7 Championships: 100 Yd IM, 2nd Place; 100 Yd Backstroke, 4th Place; 200 Yd Free Relay, 2nd Place; 400 Yd Free Relay, 2nd Place;

Girl's Team (Captain), 3rd Place (with the fewest female swimmers in the district's top 3 teams)

- FHSAA 2A Region 3 Championships: 100 Yd IM, 21st Place; 100 Yd Backstroke, 22nd Place; 200 Yd Free Relay, 8th Place; 400 Yd Free Relay, 8th Place; Girl's Team (Captain), 9th Place out of 20 (with the fewest female swimmers in the district's top 10 teams)
- Hillsborough County Swimming Championships: 100 Yd Back, 6th Place; 400 Yd Free Relay, 7th Place; 200 Yd Medley Relay, 8th Place
- City Relay (Tampa): Girls 500 Yd Free Relay Crescendo, 2nd Place; Mixed 400 Yd Medley Relay, 6th Place

2024

MUSIC

- Principal Flutist, Florida Music Education Association (FMEA) All-State Concert Band
- Gold Prize, Season 3, Young Master, London Young Musician
- 1st Prize, Spring 2025, Classical Music Stars Competition
- 1st Prize, Beethoven International Music Competition UK 2025 Season 2
- Special Award and Merit Flutist of the Season, 2025 Season I, Young Artist, Masterful Technique, International Music Leadership
- 1st Prize, Season 4, Winds, Swiss International Music Competition
- 2nd Place, Artists of the year, International Youth Music Competitions (artists of the year), Second Place
- Absolute 1st Prize, Special Venue Music International Competition Awards, selected to perform a solo at Winner's Concert at Vienna Music Society (Wiener Musikverein), Glass Hall and Mirror Hall, Palace Coburg (Palais Coburg), Vienna, Austria
- 2nd Place, First Coast Wind Symphony Concerto Competition, Jacksonville, FL
<http://mail.fcwinds.org/events/past-winners>
- Flutist, National Flute Association High School Flute Choir, San Antonio, TX (one of only 15 high school flutists selected nationwide to perform)
- Finalist, Annual Young Artist Competition, Ocala, FL
<https://www.reillyartscenter.com/people/alice-hu>
- Principal Flutist, Tampa Bay Winds Wind Ensemble
- Flutist 2, Tampa Metropolitan Youth Symphony Orchestra
- Tutor of the month for May, Do Re Mi Project
- President's Volunteer Service Award (Bronze), Do Re Mi Project

ACADEMIC ACHIEVEMENTS

- Garcia Summer Research Scholars, Garcia Center for Polymers at Engineered Interfaces, Stony Brook University, NY (summer 2024)
- Oral presentations, "A Novel Method for UV Thin-Film Backside Development for Ordered DNA Fragmentation" and "A Novel Approach for Ordered Fragmentation of Mouse DNA Using Tn5 Transposase", 2024 Garcia Summer Research Symposium, Stony Brook University, NY
- AP Scholar with Distinction
- FAMAT State Convention, Precalculus Team, 7th Place; Hustle, 3rd place; Sweepstakes, 7th Place
- FAMAT March Regional, Sweepstakes, 1st Place
- FAMAT February Regional, Sweepstakes, 5th Place

- FAMAT January Regional, Precalculus Team, 5th Place; Sweepstakes, 2nd Place
- FAMAT Statewide, Sweepstakes, 7th Place
- Health Occupations Students of America (HOSA) Future Health Professionals: Epidemiology competition (Regional): 5th Place
- Brain Bee competition (Regional): 5th Place

SWIMMING

- Western Conference – National Division: 100 Yd Back, 1st Place; 50 Yd Free, 3rd Place; 200 Free Relay 2nd Place; 400 Free Relay 2nd Place; Girl's Team (Captain) 4th Place
- City Relay (Tampa): Girls 500 Yard Free Replay Crescendo: 6th place; Mixed 400 Yard Relay, 5th Place; Girls 400 Yd Medley Relay, 5th Place
- Florida High School Athletic Association (FHSAA) 2A District 7 Championships: 100 Yd Backstroke: 3rd Place; 50 Yd Free, 5th Place; 200 Yd Free Relay, 3rd Place; 400 Free Relay, 3rd Place; Girl's Team (Captain) 3rd Place
- FHSAA 2A Region 3 Championships: 200 Yd Medley Relay, 3rd Place; 200 Yd Free Relay, 3rd Place 11th Place; 400 Free Relay, 11th Places 50 Free & 100 Back Qualifier
- Hillsborough County Swimming Championships: Women 100 Yd Back, 6th Place; 200 Medley Relay, 8th Place; 400 Free Relay, 6th Place

2023

MUSIC

- 1st Prize, Young Artist Category, Bach International Music Competition UK
- 3rd Place, Do Re Mi International Music Competition
- 1st Prize, Young Artist Category, Vivaldi International Music Competition
- 2nd Place, Senior Performance Woodwind competition, Florida Music Teachers National Association (MTNA)
- Flutist 2, Florida FMEA All-State Concert Orchestra
- Honorable Mention, London International Music Competition
- Flutist 2, Tampa Metropolitan Youth Symphony Orchestra
- Tampa Metropolitan Youth Orchestra Scholarship

ACADEMIC ACHIEVEMENTS

- USA Biology Olympiad, Certificate of Merit Scores
- American Regional Biology Competition, King High School Team Leader, 3rd Place
- Hillsborough County Science Olympics, Problem Resolve, 1st Place; Science Bowl, 2nd Place
- Health Occupations Students of America (HOSA) Future Health Professionals: Epidemiology competition (Regional), 5th Place

SWIMMING

- Florida High School Athletic Association (FHSAA) Class 2A State Championships: 400 Yd Free Relay, 12th Place; 200 Yd Medley Relay, 18th Place

- FHSAA 2A Region 3 Championships: 200 Yd Medley Relay, 3rd Place; 400 Yd Free Relay, 2nd Place; 50 Free Individual, and 100 Yd Backstroke, 8th Place
- Western Conference- National Division, 400 Yd Free Relay, 1st Place; 200 Yd Medley Relay, 1st Place
- Florida Swimming Harry Meisel Championships – West, Girls 15-16, 200 Yd Backstroke, 4th Place; 50 Yd Freestyle, 8th Place; 100 Yd Breaststroke, 6th Place

2022

MUSIC

- Principal Flutist, Florida FMEA All-State Middle School Band
- 2nd Prize, American Protégé International Music Talent Competition, invited to play solo in Carnegie Hall, New York
- Blue Lake's Merit Scholarship
- High School Masterclass winner, Florida Flute Association Convention
- Golden Anniversary Opening Flute Choir; 50th National Flute Association Convention, Chicago
- Flute Summer Camp, Interlochen Center for the Arts
- Flutist 2, Tampa Metropolitan Youth Symphony Orchestra

ACADEMIC ACHIEVEMENTS

- National History Day: Regional Qualifier
- Accepted, Center for Talented Youth (CTY) Summer Program at Johns Hopkins University (program canceled due to COVID-19)

SWIMMING

- FHSAA 2A Region 9 Championships: 100 Yd Back, 7th Place; 50 Yd Free, 2nd Place; 200 Melody 3rd Place; 400 Free Relay, 2nd Place
- Western Conference– National Division: 400 Yd Free Relay, 1st Place; 200 Yd Medley Relay, 1st Place; 200 Yd IM 3rd Place; 100 Yd Free 2nd Place
- City Relay (Tampa): Girls 500 Yd Free Replay Crescendo, 4th Place; Girls 400 Yd Medley Relay, 4th Place; Mixed 400 Yd Relay, 7th Place
- Florida Summer Area 3 Championships: Age 14, 200 Yard Backstroke, 3rd Place

2021

MUSIC

- 1st Place, Age 13-15, Charleston International European Music Competition
<https://charlestoncompetition.com/performer-alice-yaran-hu>
- Principal Flutist, Tampa Metropolitan Youth Philharmonic Orchestra
- Principal Flutist, Hillsborough All-County Middle School Band

SWIMMING

- Western Conference – National Division: 400 Free Relay, 1st Place; 100 Yd Back, 4th Place; 200 Yd Free, 6th Place; 100 Yd Free, 4th Place

- Hillsborough County Swimming Championship: 400 Free Relay, 6th Place; 200 Medley Relay, 8th Place
- FHSAA 2A Region 3 Championship: 50 Yd Free, 11th Place; 400 Free Relay, 4th Place

RESEARCH PUBLICATIONS

- Hu, A. (Co-First author) et al. A Novel Method for UV Thin-Film Backside Development for Ordered DNA Fragmentation. Poster presented in the Biological Physics II Section, American Physical Society Global Physics Summit, Anaheim, CA. March 2025
- Hu, A. (Co-First author) et al. A Novel Approach for Ordered Fragmentation of Mouse DNA Using Tn5 Transposase. Poster presented in the Physics of Disease, Diagnosis and Treatment Section, American Physical Society Global Physics Summit, Anaheim, CA. March 2025
- Hu, A. (Co-First author) et al. Ordered DNA Fragmentation over UV-patterned SU-8 Using Tn5 Transposase. Poster presented in the Symposium E. Organic and Biological Coatings, International Thin Films Conference, Taipei, Taiwan. October 2025

LEADERSHIP

- National Senior Recruitment Director and Tutor for the Do Re Mi Project (<https://www.doremiproject.org/>), a platform dedicated to offering online music lessons for young musicians in communities all over the world. I provided 350 free online flute lessons for students in underserved communities in Florida, New York, Maryland and Washington DC.
- Regional Director, American Regional Biology Competition
- President, Science National Honor Society, King High School
- Co-vice President and Statistics Coach, Mu Alpha Theta Math Team, King High School
- President, Tri-M Music Honor Society, King High School
- Co-captain, Girls Varsity Swim Team, King High School
- Captain, American Regional Biology Competition Team, King High School
- Captain, Statistics Team, King High School
- Vice President, The Lion's Yarn Den Club, King High School

VOLUNTEER

- Tutors for the Do Re Mi Project, providing free online flute lessons weekly for students from underserved communities in Florida, New York, Maryland and Washington DC
- Mentor for the Tampa Metropolitan Youth Orchestra (TMYO) Mentorship Program, Mentoring Philharmonic Orchestra
- Volunteer & Door Monitor, National Flute Association Convention 2022, 2024 and 2025
- Summer VolunTeen Program, Moffitt Cancer Center, Tampa, FL
- Playing music for elders and patients in Lutz Senior Center, Tampa, FL

SUMMER PROGRAMS

Garcia Summer Research Scholars, Stony Brook University, NY

Jul 2025 – Aug 2025

Project: *Ordered DNA Fragmentation on UV-patterned SU-8 using Tn5 transposase*

- Selected for the highly competitive Summer Scholars Program at the Garcia Center for Polymers at Engineered Interfaces.
- Engaged in daily lectures explored scientific research across engineering, medicine, and energy, along with its growing connection to AI, machine learning, and computational modeling.
- Independently created and designed the official logo for the Garcia Summer Research Program
- Did experiments patterning SU-8 films by dipping SQ2 wafers in DNA solution and developing in PGMEA to suspend DNA across UV-defined regions.
- Used Tn5 transposase (19-bp recognition site) for controlled DNA binding/cleavage and assessed fragmentation with proteinase K.
- Achieved DNA bridging across ≤ 20 μm gaps at 5.26% enzyme concentration; early PMMA trials also showed promising results. SU-8 films by dipping SQ2 wafers in DNA solution and developing in PGMEA to suspend DNA across defined regions.
- Co-first author oral presented at the 2025 Garcia Summer Research Symposium in NY and 2025 Symposium E. Organic and Biological Coatings in Taiwan

Boston University Tanglewood Institute, Woodwind Quintet Workshop, Lenox, MA

Jun 2025 – Jul 2025

- Selected for one of the nation's top pre-college music programs with acceptance under 10%, the only musician from Florida attended this workshop.
- Studied intensively in chamber performance, technique, arranging, and audience engagement.
- Coached by GRAMMY®-nominated flutist, Prof. Valerie Coleman and Megan Riccio in chamber sessions and solo/ensemble masterclasses.
- Performed contemporary and classical repertoire, including Umoja and Tzigane, in final recital with quintet.

Garcia Summer Research Scholars, Stony Brook University, NY

Jun 2024 – Aug 2024

Project: *Novel Method for Ordered Fragmentation of DNA using Tn5 transposase on UV-patterned PMMA*

- Engaged in daily lectures explored scientific research across engineering, medicine, and energy, along with its growing connection to AI, machine learning, and computational modeling.
- Applied molecular combing to stretch DNA across hydrophobic PMMA surfaces patterned with UV lithography to provide steric clearance for Tn5 binding and cleavage.
- Activated Tn5 for site-specific cutting and performed proteinase K digestion to preserve genetic information.
- Used fluorescence microscopy with SyBr Gold staining; image analysis revealed multiple cleavage points, indicating optimal enzyme concentrations.
- Co-first author oral presented at the 2024 Garcia Summer Research Symposium in NY and 2025 Biological Physics II Section, American Physical Society Global Physics Summit in CA

Flute Intensive Summer Camp, Interlochen Center for the Arts, Interlochen, MI

Jun 2023

- Admitted to Interlochen's highly selective program; studied with renowned flutists Prof. Christina Jennings and Nancy Stagnitta.
- Trained daily in practice techniques, breath control, improvisation sessions, strengthening my tone production and breath control.
- Attended masterclasses focused on tone development, artistry, and stage presence.
- Performed in chamber and solo settings, confidently collaborated in a flute choir and performed live before an audience of 100.

PUBLICATIONS

- **Hu, A. et al. (Co-First author).** *A Novel Approach for Ordered Fragmentation of Mouse DNA Using Tn5 Transposase.* Poster presented in the Physics of Disease, Diagnosis and Treatment Section, American Physical Society Global Physics Summit, Anaheim, CA. March 2025
- **Hu, A. et al. (Co-First author).** *A Novel Method for UV Thin-Film Backside Development for Ordered DNA Fragmentation.* Poster presented in the Biological Physics II Section, American Physical Society Global Physics Summit, Anaheim, CA. March 2025
- **Hu, A. et al. (Co-First author).** *Ordered DNA Fragmentation over UV-patterned SU-8 Using Tn5 Transposase.* Symposium E. Organic and Biological Coatings, International Thin Films Conference, Taipei, Taiwan. October 2025

EXTRACURRICULAR ACTIVITIES

National Senior Recruitment Director & Tutor, Do Re Mi Project

Nov 2022 – Present

- Serve as one of 3 national recruitment directors in a global nonprofit providing 20k+ free music lessons to underserved youth.
- Recruit and mentor ~20 new tutors annually through orientation, weekly zoom meeting and ongoing guidance.
- Deliver free weekly flute lessons (350 lessons) to the 5 students across the U.S. (NYC, FL, MD, DC), including one student later awarded the prestigious Accelerando Scholarship (student).
- Recognized as Accelerando Scholarship (tutor) for outstanding leadership and volunteer service.
- Recognized as Tutor of the Month for teaching excellence.

President (2024-present), member, Tri-M Music Honor Society, C. Leon King High School

Jun 2022 – Present

- Revived an inactive chapter, reestablished it as a cornerstone of the school's music community.
- Organized ensemble visits to senior centers, performing for 20+ elders and patients to foster intergenerational connections.
- Expanded membership by recruiting 20 musicians and leading 2 service projects that used music for community outreach.
- Refresh several of the murals of high school music building and help them look refreshed.

Principle Flutist, Tampa Metropolitan Youth Orchestra (TMYO)

Aug 2021 –Present

- Participate in weekly rehearsals with 60 young musicians.
- Chosen for TMYO's Mentorship Program from 140 musicians to instruct and support junior flutists in rehearsals and sectionals.
- Lead the flute section as Principal Flutist, setting artistic and technical standards for peers.

Co-Vice President & Statistics Coach (2025-present), Officer (2024-2025), member, Mu Alpha Theta Math Club, C. Leon King High School

Aug 2022 – Present

- Designed and led free weekly statistics lessons for 6-10 peers, covering probability, regression, and competition problem-solving.
- Organized local and state-wide Mu Alpha Theta competitions, including organizing award ceremonies for 400+ students, helping raise > \$5,000 to support club activities.
- Helped organize and run the Hillsborough County Middle School Math Bee Competition, hosting over 100 students across 10 events. As a leader of the school's Yarn Den Club, created and donated 5 hand-crocheted bee figurines as awards for the winning teams.
- Mentored 10 underclassmen, guiding them to compete in and succeed at local, state and national-level competitions.
- Responsible for managing the club's social media and scrapbook to promote events, lessons and competitions.

Regional Director, American Regional Biology Competition (ARBC)

Jun 2024 – Present

- Appointed as the sole Regional Director in Florida, responsible for expanding ARBC to Florida.
- Organized the 1st Tampa regional competition in 2025, hosting 20 students across 5 teams from 4 high schools.
- Established a 4-student team from King High School to represent the region in Gainesville, FL in 2024.
- Conducted outreach to 10+ local schools to introduce ARBC as a new academic opportunity.
- Contribute to weekly leadership meetings to shape competition design, outreach strategy, and ARBC's national growth.

President (2025-present), President-in-elect (2024-2025), member, Science National Honor Society Club, C. Leon King High School

Jun 2022 – Present

- Revitalized club participation by recruiting 20 members, including 6 incoming IB students.
- Recruited 8 members into science competitions and Olympiads; led team to earn 2nd place in the county, boosting academic involvement.
- Fostered collaboration among students pursuing biology, chemistry, and physics through group study and projects.

Co-Captain (2024-present), member, Girls Varsity Swim Team, C. Leon King High School

Jun 2022 – Present

- Selected as team captain and recognized as the team's top backstroke swimmer.
- Lead warm-ups and strategy discussions, fostering team spirit during training and competitions.
- Train 4-5 times per week (1.5 hours per session) at school and local swimming clubs, and compete in ~20 swim meets annually, including district, region and state championships.
- learned and applied Tian Ji's horse-racing strategy in swim meet competitions to optimize lineup choices and achieve the best possible results
- Help coaches to organize year-end celebrations and recognition events to build morale and cohesion.

VOLUNTEER

Volunteer, VolunTeen Program, Moffitt Cancer Center, Tampa, FL

Summer 2024

- Selected for the highly competitive VolunTeen Program at one of the nation's leading cancer research and treatment centers.
- Completed professional training in patient care, hospital protocol, and HIPAA confidentiality.
- Provided guidance, free nutritious food and emotional support to oncology patients with treatments.
- Collaborated with nurses and staff to ensure efficient patient flow and enhance patient care.
- Gained firsthand exposure to cancer treatment challenges and the importance of compassionate healthcare.

Flutist & Volunteer, National Flute Association

Aug 2022, Aug 2024, Aug 2025

- Supported event logistics by monitoring session doors, greeting attendees, and ensuring smooth transitions between performances and presentations.
- Flutist, Golden Anniversary Opening Flute Choir; National Flute Association 50th Annual Convention, Chicago, IL
- Flutist, National Flute Association High School Flute Choir, National Flute Association 52nd Annual Convention, San Antonio, TX
- Invited Speaker, the Life Member and Donor Appreciation Reception, National Flute Association 53rd Annual Convention, Atlanta, GA

SCHOLORSHIP

- Frances Blaisdell Convention Scholarship, National Flute Association
- Boston University Tanglewood Institute Scholarship
- The Emeritus Fund Award, Florida Flute Association
- Accelerando Scholarships, Do Re Mi Project
- Tampa Metropolitan Youth Orchestra Scholarship
- Blue Lake's Merit Scholarship, Blue Lake Fine Arts

SKILLS & INTERESTS

Languages: English (Native), Mandarin Chinese (Native), Spanish (Intermediate)**Lab Skills:** DNA handling and staining, Enzymatic reactions, Protein, UV photolithography, Fluorescence microscopy**Computer Science and Data Analysis:** CSA, Statistical testing, DNA data analysis, Image quantification, Data visualization**I independently created and designed the official logo for the Garcia Summer Research Program**https://www.stonybrook.edu/commcms/garcia/_pdf/yearbook_PDFs_compressed/2025-min.pdf



Phoebe Zheng

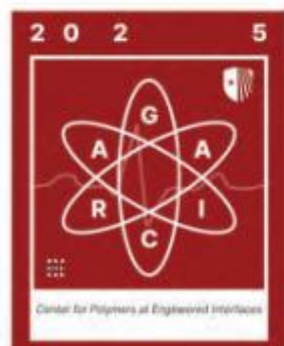


Emily Segall

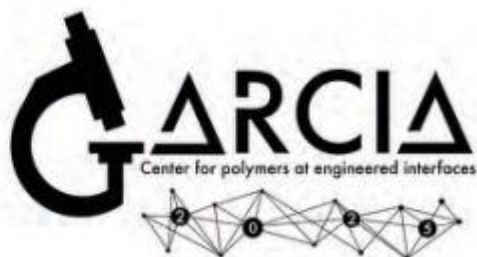


Chujia Yang

Alice Hu



Emily Li



Nathaniel Gao

We gratefully acknowledge the support
of the Louis Morin Charitable Trust

PUBLICATIONS:

Ordered DNA Fragmentation over UV-patterned SU-8 Using Tn5 Transposase

Christian Hackett¹†, Alice Hu²†, Cassidy Kirschenbaum³†, Tiffany Li⁴†, Kevin Zhang⁵†, Selina Zhang⁶†, Christian Saby⁷, Jonathan Sokolov⁷, Miriam Rafailovich⁷

† Authors contributed equally to this work

¹South Side High School, NY, 11570, ²King High School, FL, 33647, ³Brookline High School, MA, 02445, ⁴Shenzhen College of International Education, Shenzhen, China, ⁵North Hantendon High School, NJ, 08801, ⁶Harvard University, MA, 02138, ⁷Stony Brook University, NY, 11794

DNA sequencing is increasingly required for wide applications in medicine, forensics, biology, etc., with a need to sequence large quantities of DNA. Current mainstream methods include Next Generation Sequencing and Whole Genomic Sequencing. Strands must first be fragmented before sequencing and then reassembled via computational means. However, without a complete genome sequence, reconstruction may form chimeric sequences and fragmented contigs. Therefore, either a significant sample of DNA must be present, or the sample must be amplified, which costs resources and incurs replicational error. Ordered DNA fragmentation would mitigate both concerns by preserving sequence.

In our work, we examined the viability of patterning a thin film composed of SU-8. The SU-8 based photoresist SQ2 (film thickness of 2 μm) was selected as the preferred substrate for its negative photoresist properties—enabling rapid crosslinking when exposed to UV light—as well as its consistency and lithographic reproductivity, both of which are required for microfluidic applications. KemLab's SQ2 was spun onto 5.5 mm x 20 mm silicon wafer slivers using KemLab's recommended program [1]. Silicon wafers with SQ2 coating were positioned over a soda-lime glass photomask and exposed to a 365 nm LED (10-15mW output) from a distance of 3 inches, creating a striped pattern of varying widths. UV exposure time of 3 minutes yielded successful patterning.

E. coli transposase Tn5 was utilized for its artificially modified 19-base pair recognition site for DNA binding and cleaving. Its specific binding allows for the attachment of unique barcodes and labels, such as PCR handles, to DNA. These molecular flags in turn can indicate the spatial origin and order, which is essential for accurate post-sequencing genome assembly [2]. Patterned SQ2 wafers were dipped in mouse DNA solution and then developed in propylene glycol methyl ether acetate for 1 minute, leaving DNA suspended across any patterned regions to reduce steric hindrance. The DNA solution was composed of 5 μL Novagen mouse DNA solution (1 mg/mL), 5 μL of 10x diluted SYBR Gold dye (1.24 mM [3]), and 1390 μL DNase reaction buffer (NEB). Droplets of 3 μL of 5.26% loaded Diagenode Tn5 transposase solution (prepared using 4 μL 2 mg/mL Tn5, 36 μL 2x tagmentation buffer, and 36 μL water) were deposited onto samples. The samples were heated at 55°C for 7 minutes (in a low-volume space so as to prevent evaporation) to initiate DNA cleaving. Tn5 was finally digested for 20 minutes in 15 μL Proteinase K solution diluted in 985 μL of DNase buffer. Fluorescence microscopy was employed to gauge the efficacy of Tn5 cutting and Proteinase K digestion.

Overall, tests demonstrated successful DNA bridging, particularly over gaps less than 20 μm , with moderate efficiency of DNA fragmentation. Our studies show that 5.26% Tn5 concentrations proved to be effective for DNA cutting (Fig. 1B). Initial experiments with positive photoresist polymethyl methacrylate have shown some promise, suggesting that further investigation is warranted. Future directions of work also include optimizing Tn5 scission of the DNA and proteinase (or SDS) digestion of the Tn5 as well as selective removal of the DNA.

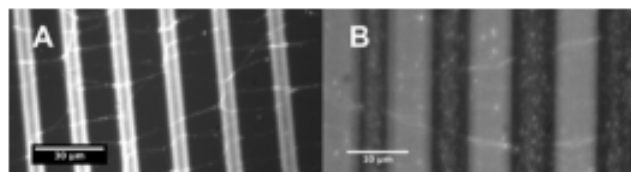


Figure 1. Leica confocal microscope imaging. A) Mouse DNA stretched over 3-minute UV-patterned SQ2. B) Sample from A) after Tn5 and Proteinase K treatment; mouse DNA is cut.

[1] KemLab. (2021). *HARE SQ™*. https://www.kemlab.com/_files/ugd/5b8579_2d82cd4d3986446fb7d22ce6f1be67c9.pdf

[2] Li, N., Jin, K., Bai, Y., Fu, H., Liu, L., & Liu, B. (2020). Tn5 Transposase Applied in Genomics Research. *International journal of molecular sciences*, 21(21), 8329. <https://doi.org/10.3390/ijms21218329>

[3] Kolbeck, P.J., Vanderlinden, W., Gemmecker, G., Gebhardt, C., Lehmann, M., Lak, A., Nicolaus, T., Cordes, T., & Lipfert, J. (2021). Molecular structure, DNA binding mode, photophysical properties and recommendations for use of SYBR Gold. *Nucleic Acids Research*, 49(9), 5143-5158. <https://doi.org/10.1093/nar/gkab265>

A Novel Approach for Ordered Fragmentation of Mouse DNA Using Tn5 Transposase

Alice Hu^{1,†}, Aditi Kiran^{2,†}, Kevin Lee^{3,†}, Elena Mingorance^{4,†}, Stella Song^{5,†}, Kevin Zhang^{6,†}, Navya Gautam^{7,†}, Patrick Lewis^{8,†}, Danielle Liu^{9,†}, Jonathan Sokolov⁸, Miriam Rafailovich⁸

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Genome reassembly has posed an enormous computational challenge to Next-Generation Sequencing (NGS) and Whole-Genome Sequencing (WGS) due to the formation of chimeric sequences and fragmented contigs without a complete reference genome. To address this, the project utilizes the *E. coli* transposase Tn5, which has an artificially modified 19-base pair recognition site for DNA binding and cleaving [1]. This allows for the attachment of unique barcodes and labels, such as PCR handles, to DNA, indicating each fragment's spatial origin and order, which is essential for accurate post-sequencing genome assembly. Thus, we hypothesize that ordered fragmentation can be achieved by stretching Tn5-bound DNA over UV-patterned polymethylmethacrylate (PMMA) surfaces (Fig. 1), activating Tn5 for cleavage, and then using proteinase K to digest the Tn5 with minimal disturbance.



Fig.1 Tn5-bound DNA stretched over pre-developed PMMA grid.

Molecular combing was used to stretch DNA across a hydrophobic PMMA surface with developed UV patterns that provide steric clearance for Tn5 binding and cleaving while limiting loss of genetic information. Such surfaces were created by spin casting 996K PMMA dissolved in 25 to 100 mg/mL of toluene on clean silicon wafer squares at 2500 rpm. PMMA was chosen for its compatibility with DNA and ability to serve as a positive photoresist under UV exposure of wavelength 254 nm. UV patterns were created using 1000 or 2000 mesh copper grids of various shapes and then developed in solutions of 7:3 isopropyl alcohol:water. During development, the shorter-chained, exposed PMMA was washed away, leaving "wells" over which Tn5-bound DNA can stretch. To find the optimal conditions for DNA cleaving, the Tn5-DNA solutions were prepared using various concentrations of mouse DNA (2, 4, and 8uL) mixed with 10uL of Tn5. Solutions were then heated to 55°C for 7 minutes to activate the Tn5 cleaving of target DNA sequences. Using a stepper motor with a linear stage, we dipped the predeveloped patterned PMMA-coated silicon wafer into the activated Tn5-DNA solutions to stretch the DNA across the grid. After cutting, a 1.41% V/V proteinase K solution in DNase I buffer was used to digest the Tn5 from the stretched DNA [2].

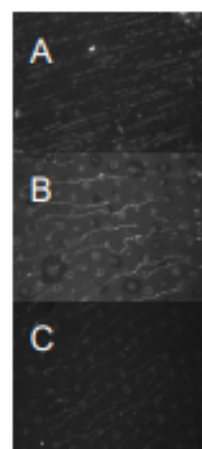


Fig. 2 A) Control 0.5% DNA post-digestion B) 8uL Tn5-bound DNA pre-digestion C) B post-digestion

Fluorescence microscopy, with SyBr Gold dye staining of DNA, was performed to test the efficacy of Tn5-DNA solutions and proteinase K for ordered fragmentation. A control sample with stretched DNA without Tn5 was run, which confirmed that the presence of proteinase K does not disturb the DNA (Fig. 2A). Then, a comparison of a marked location on the patterned PMMA pre- and post-proteinase K deposition was imaged using samples with either 2, 4, or 8uL Tn5-bound DNA. Post-proteinase K deposition, the 8uL sample showed notably successful Tn5 cleaving of DNA. However, a dimming of DNA strands was observed, which was likely due to the weakening of dye or the lifting off of dye molecules (see Fig. 2B vs. Fig. 2C). Image analysis shows several cleave sites along singular DNA strands, suggesting that future studies may investigate the optimal proteinase K concentration for Tn5 digestion and the optimal fragmentation density.

[1] Li, N., Jin, K., Bai, Y., Fu, H., Liu, L., & Liu, B. (2020). Tn5 Transposase Applied in Genomics Research. *International journal of molecular sciences*, 21(21), 8329. <https://doi.org/10.3390/ijms21218329>

[2] Righini, M., Costa, J., & Zhou, W. (2021). DNA bridges: A novel platform for single-molecule sequencing and other DNA-protein interaction applications. *PloS one*, 16(11), e0260428. <https://doi.org/10.1371/journal.pone.0260428>

A Novel Method for UV Thin-Film Backside Development for Ordered DNA Fragmentation

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Alternative DNA sequencing methods are necessary to overcome shortcomings specific to conventional sequencing methodologies—most critically, these methods are unable to sequence long sections of DNA due to the loss of order of DNA fragments during PCR. The *E. coli* compound transposon Tn5 was chosen to investigate cutting of mouse DNA because of its ability to add unique barcodes to target sequences, which facilitates ordered DNA fragmentation and accurate genome assembly. However, the transposase is unable to dimerize when DNA is fixed to the polymer surface [1]. Thus, DNA bridging, which is the process of suspending singular strands of DNA across wells on a patterned polymer surface, was used to create steric clearance for Tn5 adsorption [2]. UV radiation was used to create wells on thin poly(methyl methacrylate) (PMMA) films spun on silicon wafers. Samples were dipped in mouse DNA for molecular combing, then developed in a 7:3 isopropyl alcohol (IPA):water solution, followed by a water bath, to wash away exposed PMMA regions. However, fluorescence microscopy pre- and post-development showed that IPA significantly disturbs DNA deposition, likely due to DNA precipitation. Therefore, we aim to optimize a novel “backside” development method to minimize such disturbance, as the developer would ideally never come into prolonged contact with DNA.

To prepare for backside development, a 0.5” x 0.5” silicon wafer square was coated with a bottom layer of 4% polyvinyl alcohol (PVA) and a top layer of 996K PMMA. The wafer was submerged in distilled water to dissolve the PVA layer, allowing for the remnant PMMA to “float” off onto the water’s surface. Then, the floating PMMA layer was deposited onto a separate silicon wafer with a 3mm hole in the center, which allows IPA to develop exposed PMMA from below. Varying concentrations of PMMA (20, 50, and 100 mg/mL) were used to determine the optimal conditions for floating. Afterward, a copper mesh grid was placed onto the PMMA thin film and developed under a UV light source of 100mW for a varying number of hours (3 hr, 4 hr, 4.5 hr, 5 hr, 6 hr). The samples were then dipped and developed.

Initial trials used PMMA at a concentration of 20 mg/mL. However, the films proved to be too thin and tore under all UV light exposure times due to the copper grids sticking to the film. Thus, higher concentrations of PMMA with 50 mg/mL solutions were used. Imaging demonstrated that visible grid patterns were achievable with all UV light exposure times, except for 6 hours, where the PMMA thin film tore (Fig. 1). However, the majority of the 50 mg/mL PMMA thin films advanced to the dipping but collapsed or tore at the developing stage. Current trials of 100 mg/mL concentration PMMA thin films have been exposed for 4.5 hours and have remained viable up to the dipping stage.

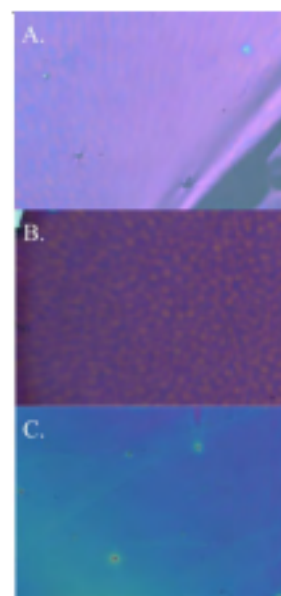


Fig. 1. A) Floated 996K PMMA 3 hour exposure 1000 hex mesh. B) Floated 996K PMMA 4 hour exposure 2000 square mesh. C) Floated 996K PMMA 5 hour exposure 2000 square mesh

[1] Li, N., Jin, K., Bai, Y., Fu, H., Liu, L., & Liu, B. (2020). Tn5 Transposase Applied in Genomics Research. *International journal of molecular sciences*, 21(21), 8329. <https://doi.org/10.3390/ijms21218329>

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