Infinite Possibilities: Profiles of Summer Research from The Gatton Academy of Mathematics and Science in Kentucky

Volume Eleven - Summer 2022

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THE GATTON ACADEMY of Mathematics and Science

Infinite Possibilities:
Profiles of Summer Research from
The Gatton Academy of Mathematics and Science in Kentucky

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ANYTIME
FITNESS



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About the Gatton Research Internship Grant Program

The Gatton Academy of Mathematics and Science in Kentucky created the Gatton Research Internship Grant in 2010. Made possible from a gift from Mr. Carol Martin "Bill" Gatton, the program offers grants to Gatton Academy students between their junior and senior years to support summer research internships across the Commonwealth, the USA, and the world. By providing funding, the program directly creates research internships that otherwise would not have existed for Gatton Academy students. In its first 13 years, the program has created 196 research internships for Gatton Academy students to study STEM problems in their areas of interest in devoted, full-time research settings.

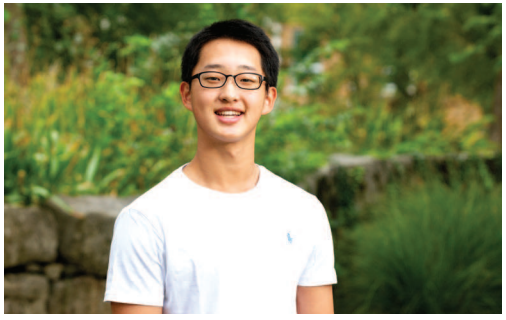
Each year, the research funded by the Gatton Research Internship Grant program yields significant outcomes for recipients. All 16 2022 recipients successfully completed their RIGs in various locations; WKU; Brown University in Providence, R.I.; Icahn Medical School at Mount Sinai in Manhattan, N.Y.; and Franciscan University in Steubenville, Ohio. Each has plans for submitting their research to competitions, conferences, and/or disciplinary-appropriate journals for publications.

From our 2021 cohort, Isabel Ocegueda presented her research about creating a robotic training program in virtual reality at the Association for Computing Machinery Mid-Southeast Chapter in the Fall of 2021 in Gatlinburg, TN. Andrew Park's research about a circular form of RNA was presented at the National Junior Science and Humanities Symposium in Albuquerque, NM. Samirah Salifu's and Nathan Turlington's paper, "Performance Profiling of Load Balancing Algorithms in a Cloud Architecture," was accepted for presentation at the IEEE Cloud Summit in October 2021 and for publication in its proceedings, and Sahil Chhabra presented his research on the bacteriophage MooMoo at the virtual meeting of the KY-TN American Society for Microbiology. Our students also present internationally, if virtually, as Arivumani Srivastava did. His work on legislative changes on the road system in The Gambia and their impact on the local community was presented virtually to the Committee on Health at The Gambia National Assembly, The Gambia Association of Public Health Officers Lecture Series, the University of The Gambia Medical School, and on KING 94.7 FM: Focus on Health with Sarja Jarjusey.

This year the Gatton Research Internship Grant program funded 16 rising high school seniors during the summer of 2022. The following pages feature these students.

Sahil Chhabra

Isabel Ocegueda



Andrew Park

Samirah Salifu

Arivumani Srivastava

Nathan Turlington

Summer research experiences are invaluable to Gatton Academy students. Students thrive when they focus on narrow topics, contributing to greater knowledge in the discipline and making progress toward solutions. These experiences benefit the student as well as Kentucky and beyond.

Sixteen Gatton Academy students participated in faculty-mentored research this summer thanks to the generosity of Mr. Gatton and other donors. Gatton Research Internship Grants provided support for laboratory materials, as well as student housing and living expenses. Students explored a wide variety of areas including virtual reality applications, producing polymers for specific uses, mathematical modeling of chain reactions, financial literacy, and machine learning in biology.

These summer experiences built on those offered at The Gatton Academy during the school year. Fifteen graduating classes of students have grown and developed in our specially designed environment. Our students explore their infinite possibilities through study abroad, research, and a rigorous course load at Western Kentucky University, all within a community of peers.

Our students and staff are grateful for Mr. Gatton's commitment to building bridges for Kentucky's young people through education and for the continued support of the Kentucky Legislature. We are grateful for the support of WKU faculty and staff and for the mentors who have welcomed Gatton students into their laboratories and classrooms.

With deepest gratitude,

Lynette Breedlove, Ph.D.
Director


KENTUCKY
SCIENCE CENTER

Chezney Boothe
Hazard, Kentucky (Perry County)

Dear Gatton RIG Supporter,

My name is Chezney Boothe, and I have lived in a small mountain town called Hazard in Perry County for my entire life. As much as I love Appalachia, it can be very limiting, especially in terms of educational opportunities. Therefore, as soon as I heard of the Gatton Academy, I started the application process. Gatton has afforded me many of the opportunities that I didn't even know I needed in my first two years of high school, and I will forever be grateful to those who have made it possible.

Ever since I was young in rural Appalachian Kentucky, I remember watching helplessly as diseases like cancer and pneumoconiosis claimed the lives of countless friends, family, and community members. Since then I have wanted to be a doctor and work to give back to my community. However, at the time, I had no idea how I could get there. I had very little in-depth STEM experience, even in the STEM-related classes I took, and didn't even know how much my knowledge was lacking until I began a college-level STEM curriculum through Gatton. The most intensive scientific education I received, though, was from my Research Internship Grant, where I gained an understanding of molecular biology and biochemistry in ways I may not have gotten in class. Not only that, I learned how to truly think like a scientist, a skill that will no doubt help further my future career. The RIG has been instrumental in helping me prepare for my future professional education and career, and I will forever be thankful to everyone who made it possible.

Thank you so much,
Chezney Boothe

Chezney Boothe

Home High School:
Hazard High School

Research Area:
Biochemistry and Engineering

Research Topic:
Chezney Boothe and Hadley Jones are working with specialized binding proteins used as biomarkers for diagnoses and investigation.

Career Goal:
Oncologist

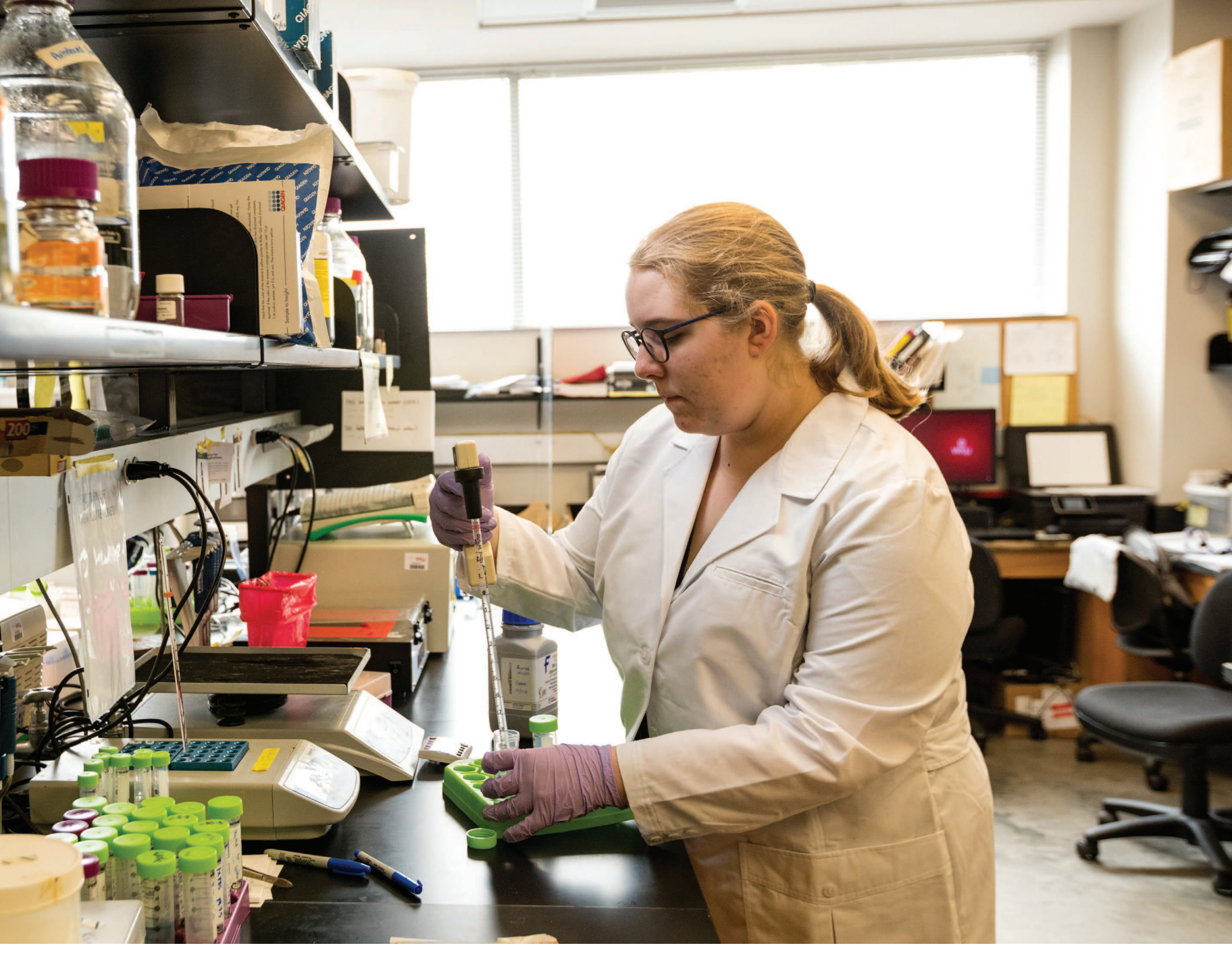
Research Mentor:
Dr. Moon-Soo Kim
WKU Department of Chemistry

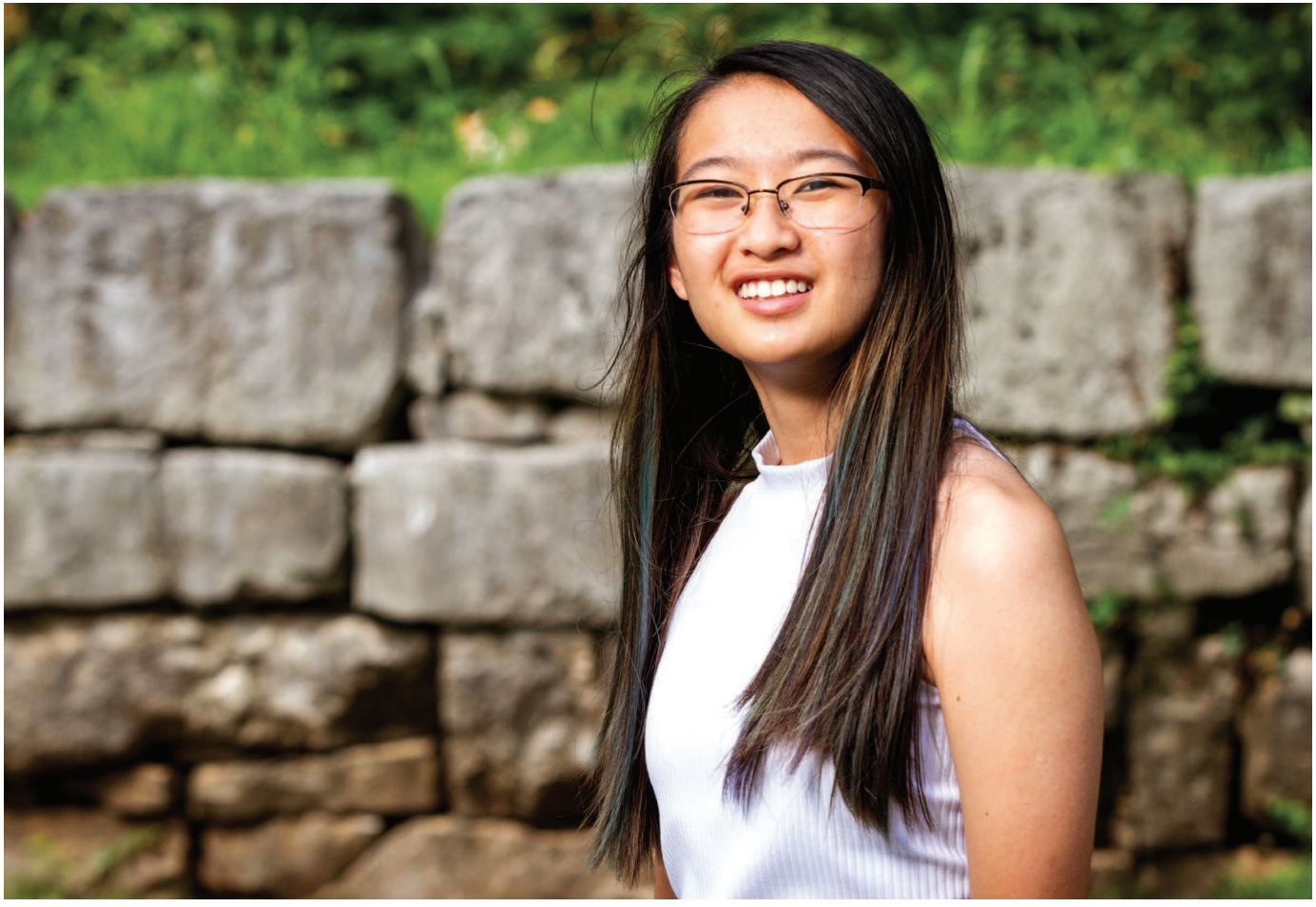
Extracurricular Activities:
Appalachian Career Training in Oncology Program, Hazard High School Academic Team, Project Unite, and Gatton Academy Medical Association

"Some of my favorite moments at Gatton to date have been spending time with my friends. My entire sophomore year of high school was virtual, so I kind of forgot what it was like to spend time with several friends at a time. I never really knew what it was like to be with like-minded people until I came here."

"I haven't always known STEM was what I wanted in terms of my future career, but I have always been interested, so it feels unreal that I get to participate in actual research at 17. I would have never imagined this incredible opportunity for myself as a freshman or even as a sophomore when I was applying for Gatton, and I am so thankful it is an option for me."

"The biggest challenge I will have to face in my research is my lack of experience. I have done wet lab work before, but I've never really had to troubleshoot why something didn't work or alter my protocol. I am very excited to take on the challenge, however."





Jiali Graham
Winchester, Kentucky (Clark County)

Dear Gatton RIG Supporter,

When I came to Gatton, I never planned on participating in RIG, but I'm so glad I made the decision to ask my professor about RIG and see where it took me. After all, my parents have taught me to seize opportunities, and Gatton has only encouraged that. My professor is Dr. Farley Norman of the WKU Department of Psychological Sciences, and he was more than happy to assist me in a research project this summer. My research has been about how aging affects the perception of common fate. Common fate can be seen when objects all move in the same direction and at the same speed, for instance, a dotted line. Working on this project over the summer has been amazing!

I cannot be more thankful that I was able to get this opportunity. I have been able to write a manuscript, learn to code statistics in C, and grow closer with my co-workers. Not only has the research experience made me more excited to return to my lab this Fall, but I have also been able to truly experience life as a college student with my roommate. All the experiences and memories RIG has given will stick with me for life.

Sincerely,
Jiali Graham

Jiali Graham

Home High School:
Model Laboratory High School

Research Area:
Aging and the visual perception of motion

Research Topic:
Jiali Graham is investigating the effect of aging upon the visual perception of object size.

Career Goal:
Prosthetist/Neuroscientist

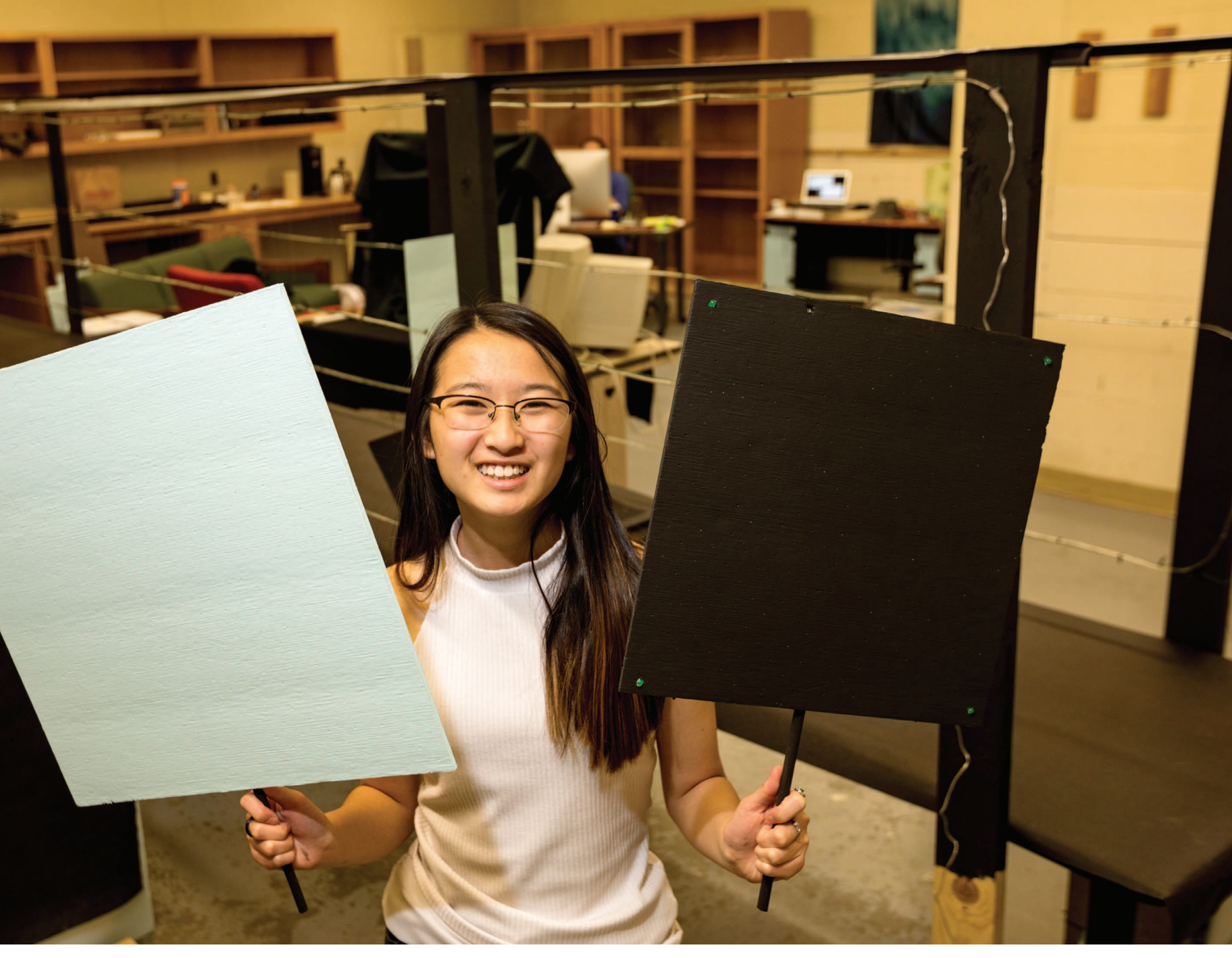
Research Mentor:
Dr. Farley Norman
WKU Department of Psychological Sciences

Extracurricular Activities:
International Club, Y-Club, Paint Club, and The Green

"Research is an incredible opportunity for me. It allows me to diversify my knowledge and really be able to picture myself continuing research--or maybe not continuing research. Either way, it gives me the experience I need to see if I should continue exploring this field or look to another STEM field."

"The biggest change I've had to face at Gatton is socializing. At home, I usually kept to myself and only talked to a few friends, but here I've found myself hanging out with a lot more people. Even if I don't talk to everyone, it still feels like I could say 'Hi!' at any time."

"My favorite memory at Gatton has to be the quiet moments, like walking back after dinner and just seeing my friends laugh or watching a sunset quietly out a window. There's just something about quiet moments, where I don't need to say anything, I just need to exist and enjoy."



Hank Helmers
Danville, Kentucky (Boyle County)

Dear Gatton RIG Supporter,

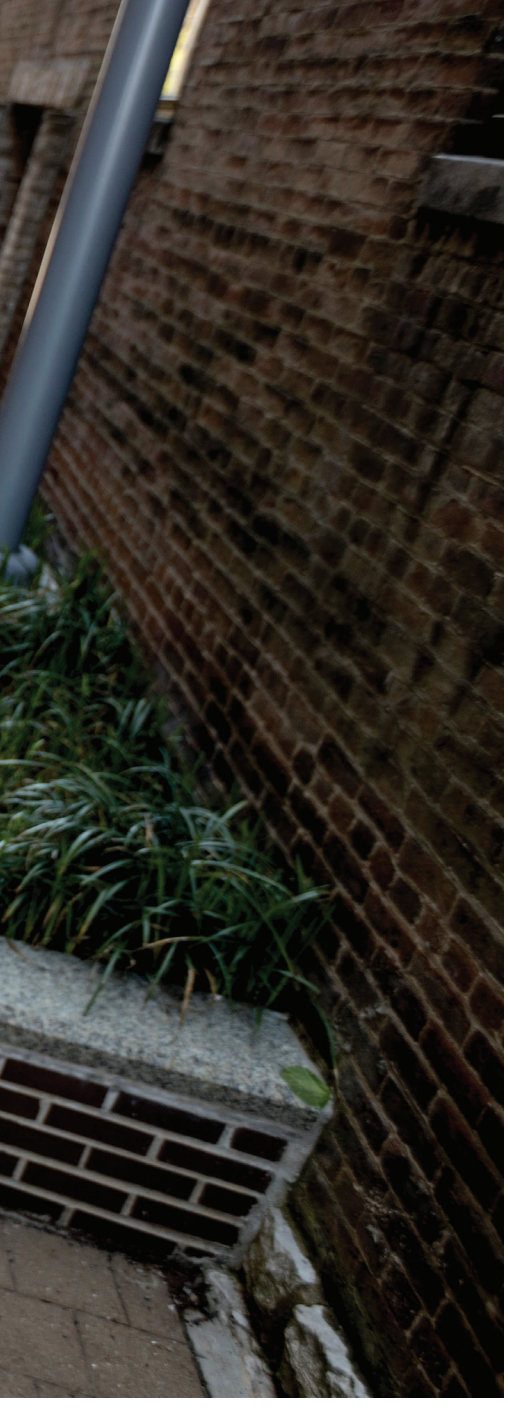
Before coming to Gatton, I wandered aimlessly through the halls of my school. The familiar walls and the monotonous drone of familiar information left my stomach turning at the thought of another day. Day in and day out, I fiddled with the same small programs to pass the time. The next three years of high school seemed dreadful with little left to offer me. Then I learned about Gatton at the end of my freshman year, and I was sold. It was a hard pill for my parents to swallow, but after our first visit, they were sold too.

Thankfully, I was accepted, and even in our first week, I was exposed to more possibilities than I thought conceivable. One of those opportunities was the RIG. Conducting research while at Gatton with the help of the RIG has been one of the most rewarding experiences of my time here. It has allowed me to passionately explore a multitude of my interests, from computer science to social behavior. Research has focused my aimless fiddling on solving concrete problems within our world today. It satisfies my ever-increasing curiosity and allows me to appreciate the world with fresh eyes.

At Gatton the walls are energized with possibilities and the air vibrant with ideas. No longer does my stomach turn at the thought of another day at school; instead, I walk through the halls, thrilled to take on another day.

I will never be able to fully express my gratitude for the total transformation of my life, so all I can say is thank you. Thank you for providing me with a method of expressing my curiosity, providing aim to my aimlessness, and reigniting my passion for exploring untold possibilities.

My deepest appreciation,
Hank Helmers



"This research fits into my educational goals because it gives me the opportunity to experience the entire research process. Research is the foundation of discovery, and it has always been a dream of mine to be able to contribute to that, even if it is small."

"The biggest adjustment with coming to Gatton has been daily life without my family. As the youngest of four siblings, this has been my first experience outside of the energized home environment I am used to."

"The nerd moment that made me realize that STEM was my passion was when I first successfully created a website on my own. It was my first introduction to programming, and it opened my eyes to the possibilities that technology can unlock. Though this summer I am not researching computer science, which is my strong area, I am excited to explore the social effects that technologies like social media have on how we function fundamentally."

Hank Helmers

Home High School:
Danville High School

Research Area:
Financial Responsibility in Social Media Influencers

Research Topic:
Hank Helmers is conducting an empirical study on financial literacy and social media users.

Career Goal:
Software Engineer

Research Mentor:
Dr. Jonathan Handy
WKU Department of Finance

Extracurricular Activities:
Philosophy Club, T-Paint Club, Computer Science Club, International Club, Danville E-Sports, and Danville Academic Team

Siheon Im
Bowling Green, Kentucky (Warren County)

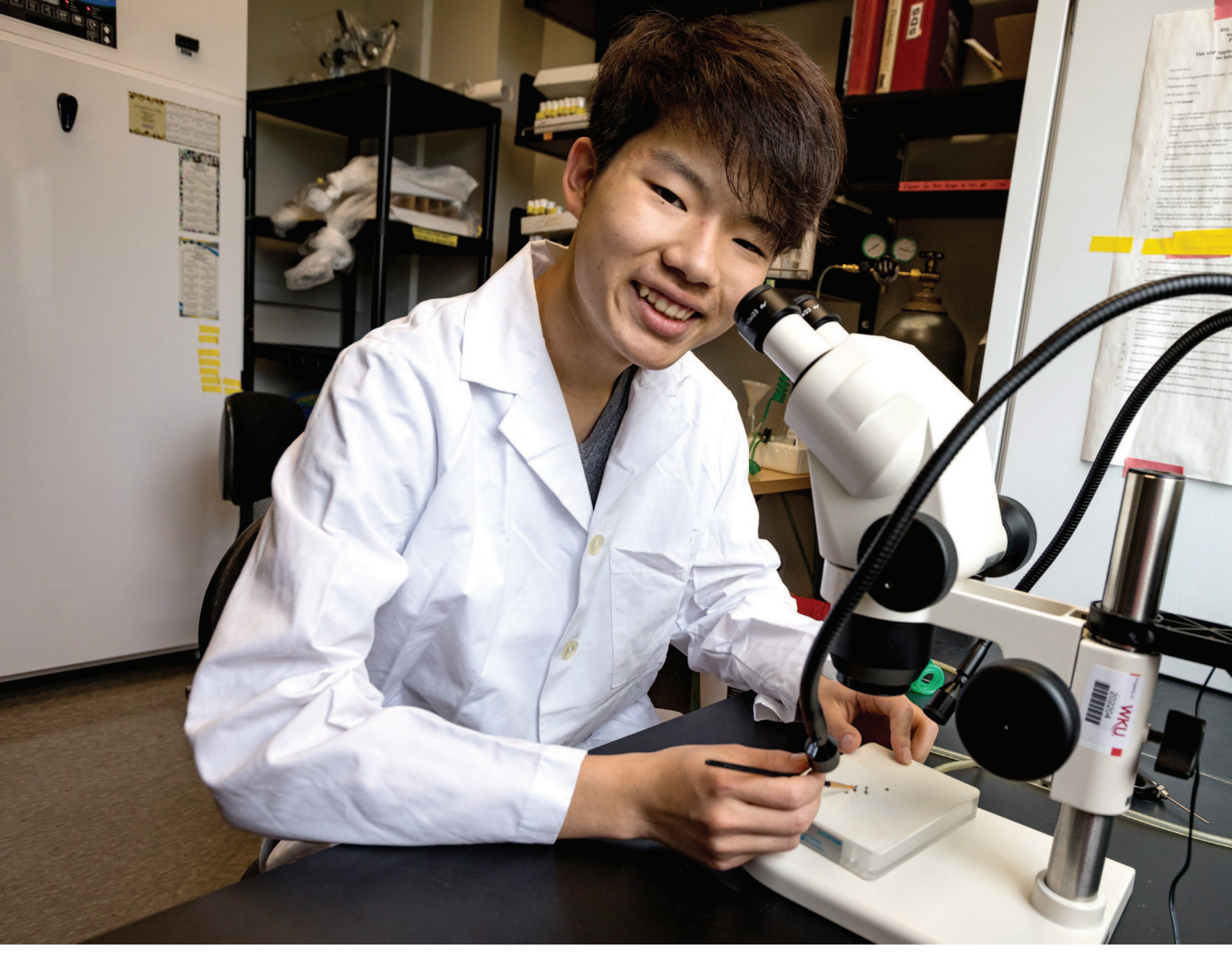
Dear Gatton RIG supporter,

I am so very thankful for this opportunity to completely immerse myself in my topic of interest for the summer. Under the mentorship of Dr. Ajay Srivastava, I used the fruit fly as a model organism to observe the downregulation of V-ATPase, an enzyme that assists with cell construction. A structure of the fruit fly, called the wing imaginal disc, was dissected and observed under a scanning electron microscope to see whether the lack of V-ATPase will prevent the air sac primordium from invading the wing imaginal disc. Because the way V-ATPase destroys cell structures is similar to how tumors metastasize, conclusions about how to prevent metastasis can be made through this study.

Going into my junior year of high school, I had no clue what "doing research" meant. However, through RIG, I have now learned what it really means to do "research," including staying focused and committed, learning through trials and errors, mastering essential skills for completing laboratory tasks (e.g., dissecting, using the scanning electron microscope), and building critical thinking skills. This summer has allowed me to enter and take my first steps in the "professional world."

Once again, I truly appreciate your support!

Sincerely,
Siheon Im


WKU

"My favorite Gatton Academy memory is most definitely going out to eat with all my friends for their birthdays. Although this may seem a bit boring, I enjoy these bonding moments with my friends."

"The biggest challenge in my research will be dissecting the air sac primordium from the imaginal disk of a fruit fly. The sheer volume of flies I will be working with will make this the biggest challenge."

"To me, research means I have more freedom to study what I want. It is very different from just taking a class about a certain subject. Research focuses on a narrower topic and allows a more in-depth understanding of that topic."

Siheon Im

Home High School:
South Warren High School

Research Area:
Genetics

Research Topic:
Siheon Im is looking at ATP(ase) effects on *Drosophila* air sac primordium.

Career Goal:
"Simply, I want a career I enjoy doing. Other factors like money will come to me naturally if I really like my job and work hard."

Research Mentor:
Dr. Ajay Srivastava
WKU Department of Biology

Extracurricular Activities:
International Club, Badminton Club, and CS Club

Hadley Jones
Upton, Kentucky (Hardin County)

Dear Gatton RIG Supporter,

Thank you so much for the funding to make this wonderful experience possible. Over the summer I have been given the chance to engage in high-level research and live independently, both of which have equipped me early on with valuable life skills. In Dr. Kim's lab I have learned more this summer than I have ever learned in a class, from basic experimental procedure, such as PCR, to high-level trouble-shooting.

The culmination of my efforts has resulted in an in-progress project to find the binding affinity of a protein (dCas9) to a target gene in *Staphylococcus aureus*, a bacteria that causes infections. By identifying the relationship between the protein and target gene, the binding affinity can then be analyzed to determine how to reduce infections. My mentors, Dr. Moon-Soo Kim and Jihye Kang, have worked closely with me in developing my background knowledge in biochemistry and my ability to apply that to problem solving, which will prove fruitful further in my academic career.

Most importantly, the RIG has allowed me to work in a lab where I am surrounded by individuals with wisdom and drive. They have advised me by sharing their experiences as undergraduates, working through difficult questions, and deciphering career paths. I appreciate the time I was able to spend with them in the lab, which was all made possible through the RIG.

Sincerely,
Hadley Jones

Hadley Jones

Home High School:
Central Hardin High School

Research Area:
Biochemistry

Research Topic:
Chezney Boothe and Hadley Jones are working with specialized binding proteins used as biomarkers for diagnoses and investigation.

Career Goal:
Orthopedic Oncology and Surgery (Pediatric)

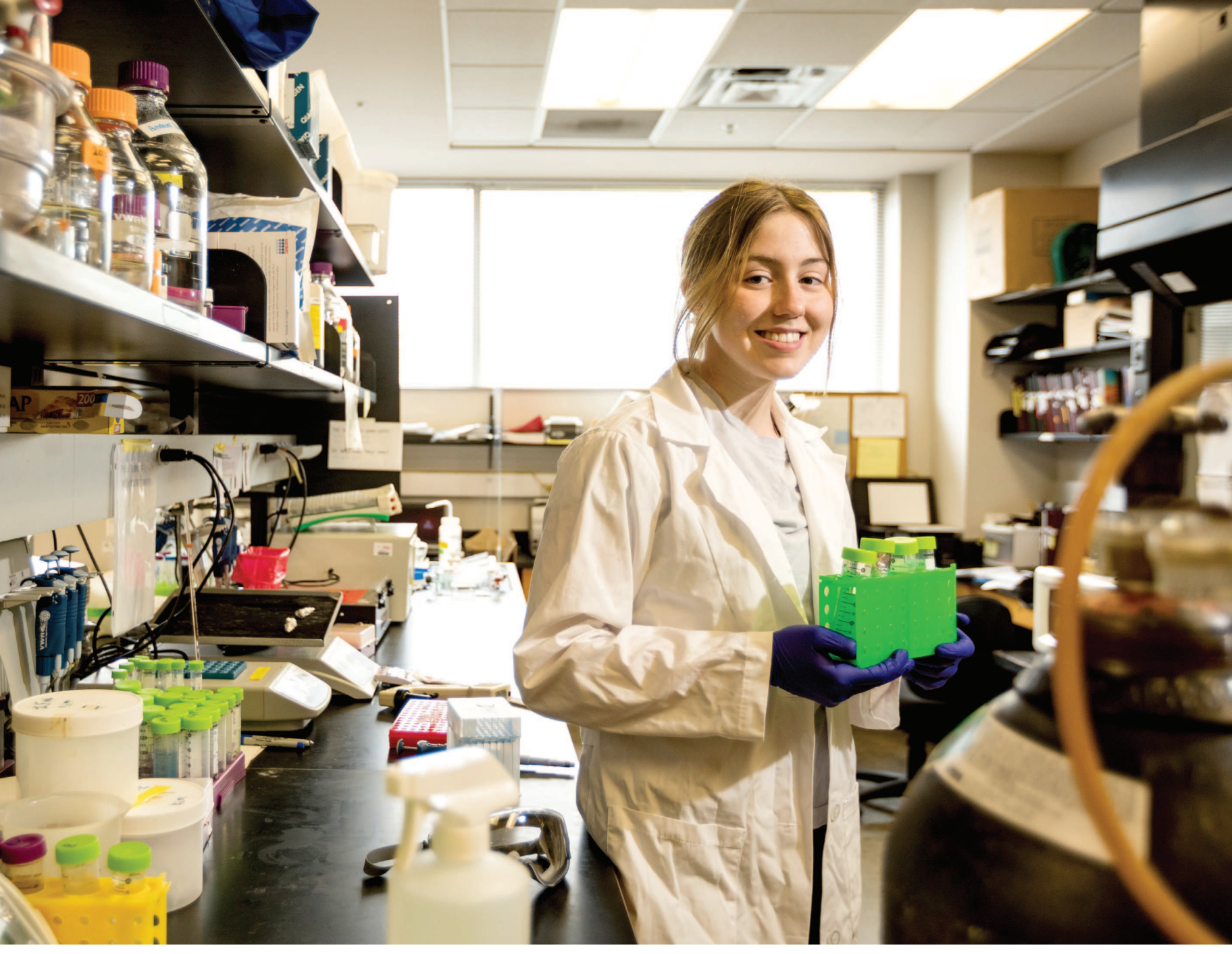
Research Mentor:
Dr. Moon-Soo Kim
WKU Department of Chemistry

Extracurricular Activities:
Gatton Academy Medical Association, WKU Tennis Club, Microbiology Club, and Buddy House

"When I was in robotics in middle school and began joking about different drive configurations and wire management, I knew that STEM was my passion. I may be doing something different now, but that same excitement and curiosity has stuck with me."

"This research experience helps with my career goals, as I want to pursue an M.D./Ph.D. and to engage in oncology research in the realm of utilizing gene editing with special proteins like cas9. My current research lab deals directly with specializing proteins for biomarking and other purposes, which is a stepping stone to what I want to do in the future."

"My biggest challenge has been deciding what I want to do or set my goals on. When I headed into the year, I was set on epidemiology, but after looking into the research and careers it would lead to, I decided it wasn't for me. It took some shadowing and investigation for me to decide what I want to work toward."



Sean Korner
Louisville, Kentucky (Jefferson County)

Dear Gatton RIG Supporter.

I became interested in Metal Organic Frameworks for two main reasons. The first is that I really enjoyed chemistry and felt I could read about the topic forever. The second was my interest in using chemistry to make positive impacts. While I was in school in Louisville, the opportunity to work hands-on with chemical concepts, figuring out how to use them, seemed so far away. But after being accepted into the Gatton Academy, I have been able to figure out so many things for the future.

Through the course of this project, there were many obstacles, and I still have a lot more I need to learn; however, I truly believe the RIG experience was a big reason I was able to take the first steps. Going forward, I now have the ability to approach programming without the intimidation it once gave me. While I still have so much more I want to follow through with and continue studying in these upcoming semesters, because of the time I got to spend focusing on this project, I now have a newfound confidence in these topics.

Sincerely,
Sean Korner

Sean Korner

Home High School:
duPont Manual High School

Research Area:
Chemistry, Machine Learning, and Physics

Research Topic:
Sean Korner and Gabriel Nowaskie are using machine learning to find a specific metal organic framework which can be used to convert carbon dioxide into water.

Career Goal:
To start my own business with my inventions.

Research Mentor:
Dr. Bangbo Yan
WKU Department of Chemistry

Extracurricular Activities:
Fencing Club, Chess Club, and Science Olympiad

"The coolest thing about summer research is being able to take your ideas from theory into reality. This summer I am most looking forward to increasing my knowledge of metal-organic frameworks and potentially trying to apply them. It's just very cool to me, and it makes me extremely excited."

"My biggest challenge has been focusing my ambition on a singular goal and not getting burnt out trying to do too much at once. Enjoying the process and making sure I am passionate about the fields I am learning has really helped with this."

"As a young person interested in STEM, research means I have my foot through the door to making true scientific discoveries in STEM, letting me experience the processes that can help many and expand our knowledge as a whole. It is an amazing opportunity that I will treasure forever."

Hannah Laney
Ashland, Kentucky (Boyd County)

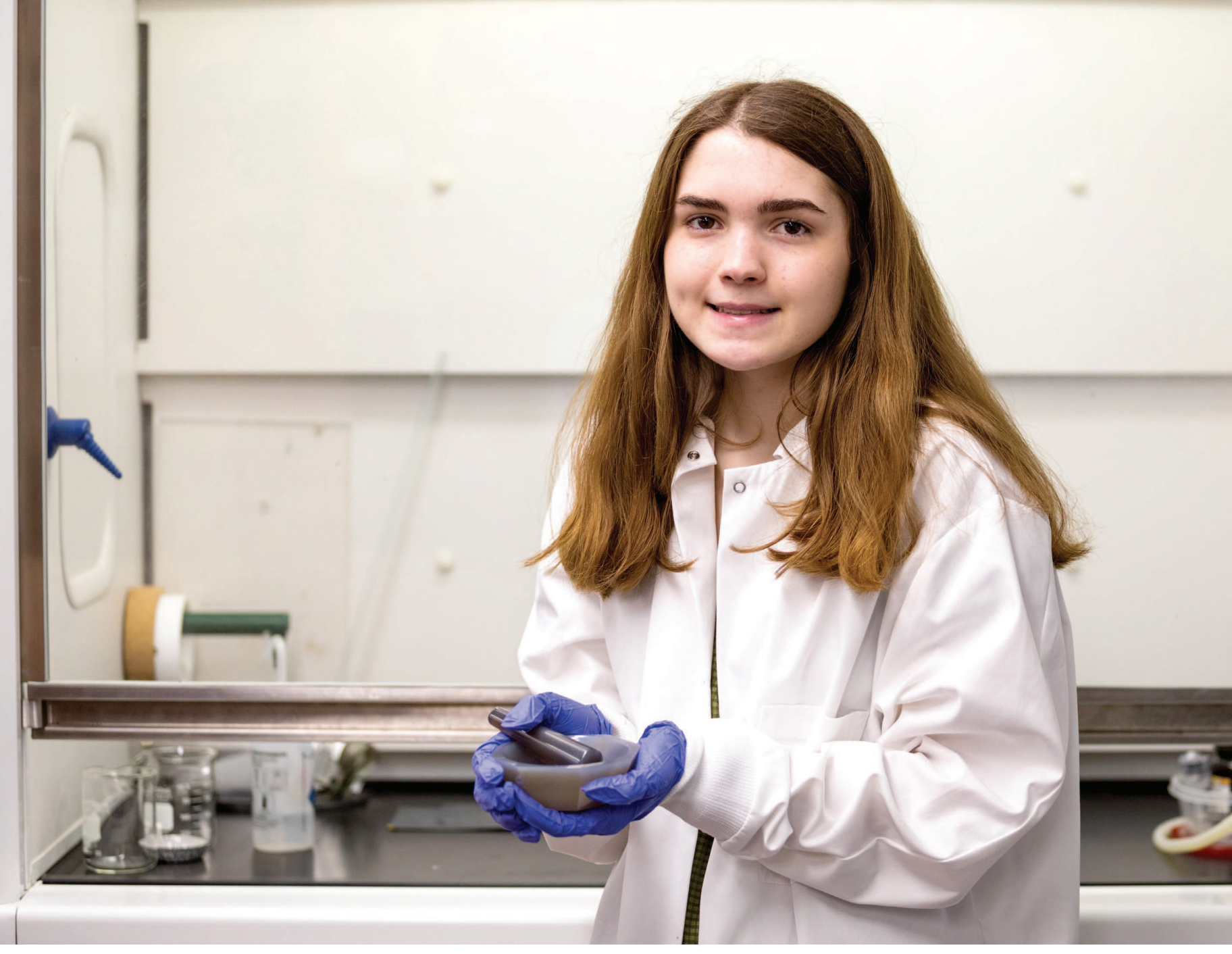
Dear Gatton RIG supporter,

As a teenager from eastern Kentucky, my educational opportunities were limited. Although my home school, Paul G. Blazer High School, is one of the most rigorous in my area, I started running out of math and science classes to take. By the end of my sophomore year of high school, I had taken all of the AP math and most of the AP science classes my school offered. I needed a challenge, and I couldn't get one by staying in Ashland.

That's why the Gatton Academy appealed to me when I first heard about it in seventh grade. It was a place where I could go to grow as a student and engage with other bright students who think like me. Although this was reason enough to attend, one of my main hopes in going to school here was to engage in undergraduate research. I wanted to contribute to the academic world, and I felt that research would be the perfect way to do that.

Thanks to your generous gift, my dreams have come true. I have not only been challenged in the classroom, but I've been able to explore my passion for physics through the internship you funded. I have learned so much through studying *4d*- and *5d*-element based transition metal oxides with Dr. Jasminka Terzic, and I've been given opportunities (like entering the Regeneron competition) that wouldn't have been available to me back home. For these things, I am extremely grateful. Thank you so much for your kindness towards me, and I hope to pay it forward by leaving an impact on others.

Sincerely,
Hannah Laney



"My best super-nerd moment when I first realized that STEM was my passion was when I was reading about traveling at the speed of light in the third grade. I was so fascinated to discover that time travel into the future could theoretically be possible if you were moving fast enough. This moment really sparked a love of science in me and fueled my desire to learn as much about it as I possibly could."

"I plan on earning a doctorate in chemical engineering once I graduate from Gatton. Therefore, this research will help me build a hands-on foundation in both chemistry and physics that will help me later with my doctoral research."

"The best piece of advice my mentor has given me so far is that it doesn't matter where you go to school or what opportunities you can afford—it's what you do with the opportunities you've been given that matters. I've really taken this to heart and decided I will make the most of my time here at Gatton by continuing to study hard and do research in the Fall in order to not let the amazing opportunities I've been given slip away."

Hannah Laney

Home High School:
Paul G. Blazer High School

Research Area:
Physics and Chemistry

Research Topic:
Hannah Laney is working on the synthesis of *4d*- and *5d*-element based transition metal oxides.

Career Goal:
Chemical Engineer

Research Mentor:
Dr. Jasminka Terzic
WKU Department of Physics and Astronomy

Extracurricular Activities:
Science Bowl, Math Club, International Club, Gatton Bible Study, and Academic Team

Caden Lucas
Westview, Kentucky (Breckinridge County)

Dear Gatton RIG Supporter,

All my life I've lived in the same place with the same people and the same things. I know the backroads of Breckinridge County like the back of my hand, and growing up there has shown me the importance of hard work, supportive relationships, and a loving community. Regardless of my deep roots to my hometown and the youthful idealisms I formed there, it was obvious to most that I wasn't being challenged academically. My school's renderings of educational experiences, critical-thinking projects, and advanced learning opportunities always left me hungry, and while I enjoyed them, they didn't provide the mental sustenance I needed. After spending a decade in this constant tussle for scholastic equilibrium, I decided I needed a change. Luckily, the opportunity to attend the Gatton Academy presented itself, and thankfully, I took it.

Now, as I'm about to begin my final year of the program, I can see what a blessing it has been. It has provided me with a plethora of unparalleled opportunities and has shown me the potential I possess to make impactful change in this world. In my most recent experience, my research has allowed me to develop methods to better understand how generational differences impact the socially responsible behaviors of small businesses. These findings have been proven to be essential for the survival of those establishments.

Before leaving Breckinridge County, I was heavily involved in sports, community activities, and was unashamedly attached to the beauty of my hometown. Thus, my transition to the Gatton Academy was far beyond drastic. Yet opportunities like these help me see that Gatton is where I belong. I've learned that if you can't appreciate where you are, and especially where you came from, then you'll never be able to appreciate where you're going. Opportunities like the Research Internship Grant have shown me the importance of that, and for your contribution to my personal and academic furtherance, I am eternally grateful.

With sincere appreciation,
Caden Lucas

Caden Lucas

Home High School:
Breckinridge County High School

Research Area:
Management

Research Topic:
Caden Lucas is investigating the generational differences in how small businesses and family firms manage their socially-responsible behaviors.

Career Goal:
Entrepreneur, Public Servant, and Business Practitioner

Research Mentor:
Dr. Whitney Peake
WKU Department of Management

Extracurricular Activities:
Gatton Academy Entrepreneurs Association, Kentucky YMCA Youth Association Youth Governor, WKU Dynamic Leadership Institute, Gatton Bible Study, Student Y Club, Academic Team, and Archery Team

"Since I want to advance my entrepreneurial qualities into my educational and professional goals, I believe pursuing this research will help me gain a better grasp of the foundational aspects of the research process. It will also help me discover future projects I may want to pursue."

"With research, there are many challenges to overcome, and for me, I believe my biggest challenge will be completing my research project with no collaboration. As an extrovert, I thrive off of the success, energy, and collaboration of others, so being alone in my research project will be a challenge I must overcome."

"During my first year here at the Gatton Academy, the biggest change I experienced was the simultaneous opening and closing of doors. When I got here, countless doors with infinite possibilities inside came flying open, but doors behind me that I wasn't ready to close, closed. Learning to live in a completely different environment than where I came from was certainly a struggle, and therefore, the transition was drastic."

Divya Naidugari
Florence, Kentucky (Boone County)

Dear Gatton RIG Supporter,

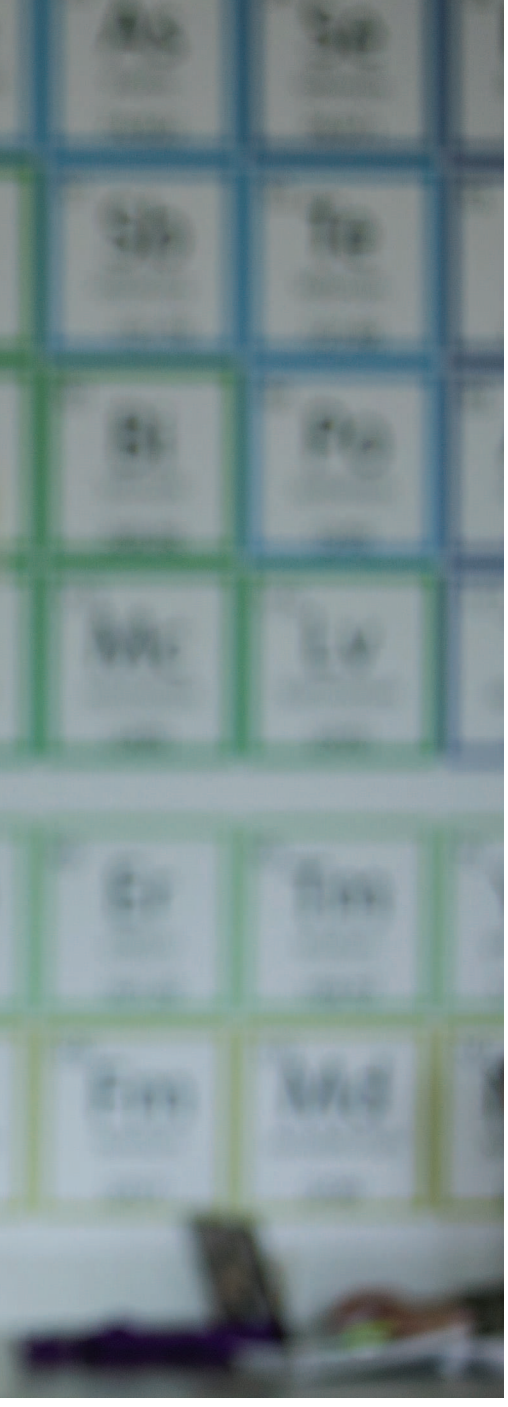
I am extremely honored to be allowed to perform research on behalf of the Gatton Academy RIG Program. Because of the RIG, I was able to spend four weeks at Icahn School of Medicine at Mount Sinai, N.Y., a Top Ten medical institution I have looked up to since I was fourteen years old. I was also able to perform research with the Dean of the Stem Cell Institute, Dr. Sarah Millar, in the Black Family organization, creating hair follicles in hairy developed skin at the loss of specific genes using mouse models. Icahn's work on follicle regeneration is one of the leading research projects in finding a cure for alopecia. I am incredibly grateful to be a part of that journey.

This summer research relates to my future aspirations and goals, as I plan to pursue a career in medicine with a specialty in surgery. My summer research benefitted me because I was able to perform embryo extraction, live mouse dissections, and personally delete/add genes to my own mice.

At my sending school, Randall K. Cooper High School, I was class president and a varsity swimmer; however, I was not challenged in my academics or coursework. During the first few days of my Gatton journey, I knew it was the place for me because I was now around other like-minded peers with similar goals.

I want to thank you again for allowing me to perform real-world research that I know will have an impact. As a first-generation immigrant, the idea of dedication and hard work has been instilled in me at a young age, and I am so honored to be a part of the Gatton Academy to fulfill them.

Sincerely,
Divya Naidugari



"Research is the first step to becoming the 'future Divya' I want to become. One trait I will always have with me is my curiosity. Research excites that flame and can make it even brighter, ultimately igniting my future path."

"The biggest change I have experienced while being at the Gatton Academy was developing a closer relationship with my professors. In high school, your teacher is only there to help regarding school and will most likely never cross paths with you afterwards. The relationships I have built with some of my professors at WKU are long-lasting and have also helped me fall in love with my education even more."

"My favorite Gatton memory is move-in day. After we all moved in, I and around 10 people I had just met took our first walk around campus. We didn't know each other's names, how to get back to Gatton, or anything about WKU, but I had the strongest feeling that the next few years would be unforgettable."

Divya Naidugari

Home High School:
Randall K. Cooper High School

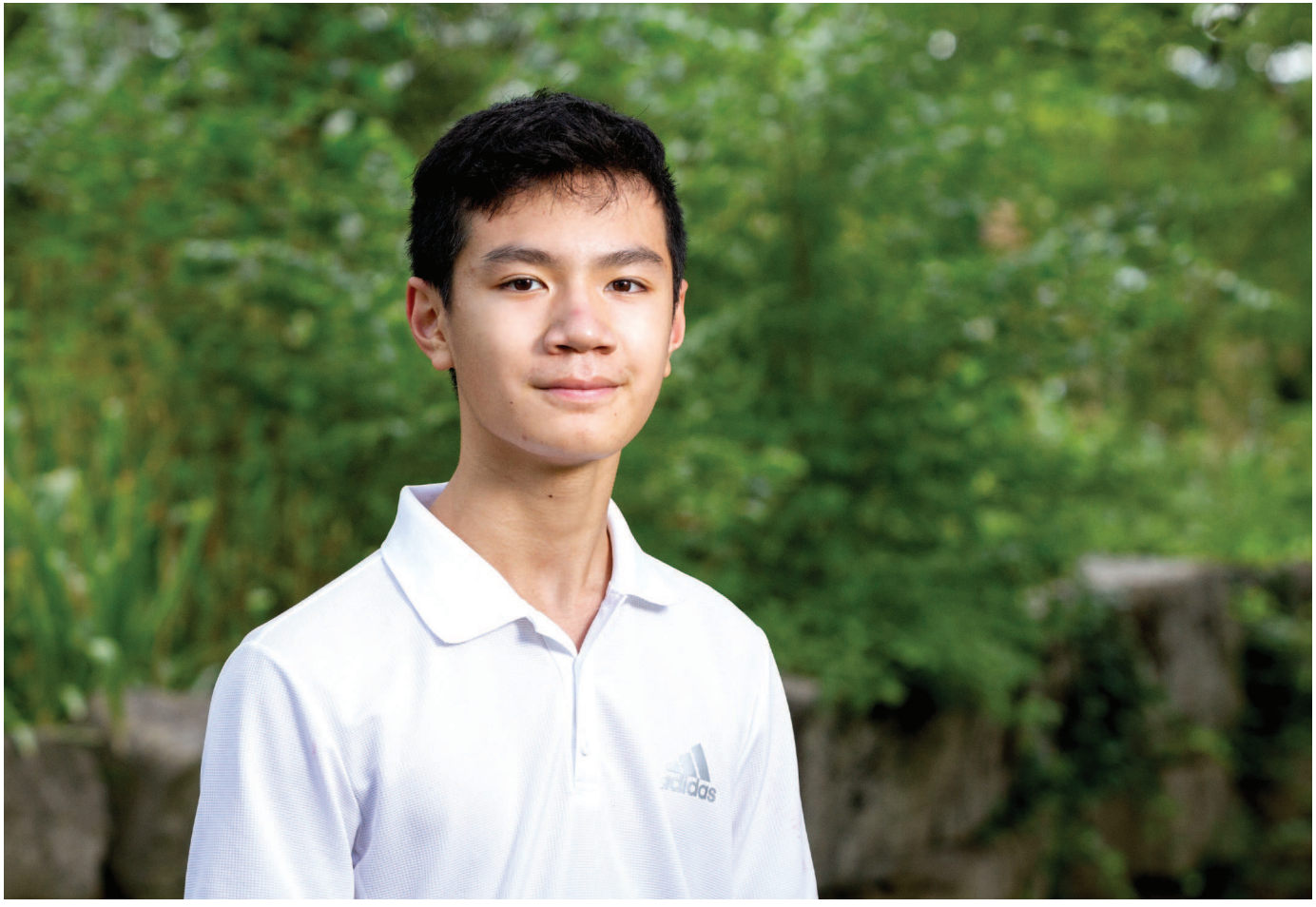
Research Area:
Hair Follicle Regeneration Growth

Research Topic:
Divya Naidugari is looking at regenerative biology in the context of follicle regeneration.

Career Goal:
Surgeon

Research Mentor:
Dr. Sarah Millar
Icahn School of Medicine
at Mount Sinai Health System
in Manhattan, N.Y.

Extracurricular Activities:
AHEC Future Healthcare Professionals, AHEC Healthcare Investigators, Gatton Academy Medical Association, WKU Tri Beta, and Cancer for Kids



Brian Nguyen
Bowling Green, Kentucky (Warren County)

Dear Gatton RIG Supporter,

Thank you. It is through your efforts and patronage that I was given the opportunity to work on research during this summer. My project is designing chemical reaction networks (CRNs). CRNs are best described as a set of chemical reactions and their corresponding chemical species and appear in many critical biological and chemical processes, e.g., the cell cycle. Previous work has been developed to allow us to fully rationalize the behavior of a single chemical reaction, but the behavior for multiple reactions is less transparent and significantly harder to find. The primary focus of my work is on developing mathematical machinery to better elucidate such behavior, which would help provide insight into how to experimentally realize "programming" our chemical reactions. Through your funding, I was able to use the computational software and tools that were vital to this project.

Overall, your actions prove to be incredibly beneficial to not just to me, but also for students to come. The opportunity to work with Brown University is rare and was only achieved through a newly formed partnership with the Gatton Academy. Your donations have served to pioneer Gatton research projects at Brown University and solidified the potential for future Gatton Academy students to collaborate with Brown as well.

On a more personal note, I'd like to thank you for providing me with the experience. A goal of mine is to attend university on the East Coast, but I have never had the chance to visit. The project, taking place at Brown University, allowed me to fully immerse myself and learn more about the social and academic culture of the university, and I've realized that such a place is exactly where I want to be. Through you, I was able to strengthen my choices.

Sincerely,
Brian Nguyen

Brian Nguyen

Home High School:
South Warren High School

Research Area:
Differential Modeling of Catalytic Reactions

Research Topic:
Brian Nguyen is devising a differential mathematical model determining the best method to chain specific reactions together.

Career Goal:
Applied/Pure Maths Researcher

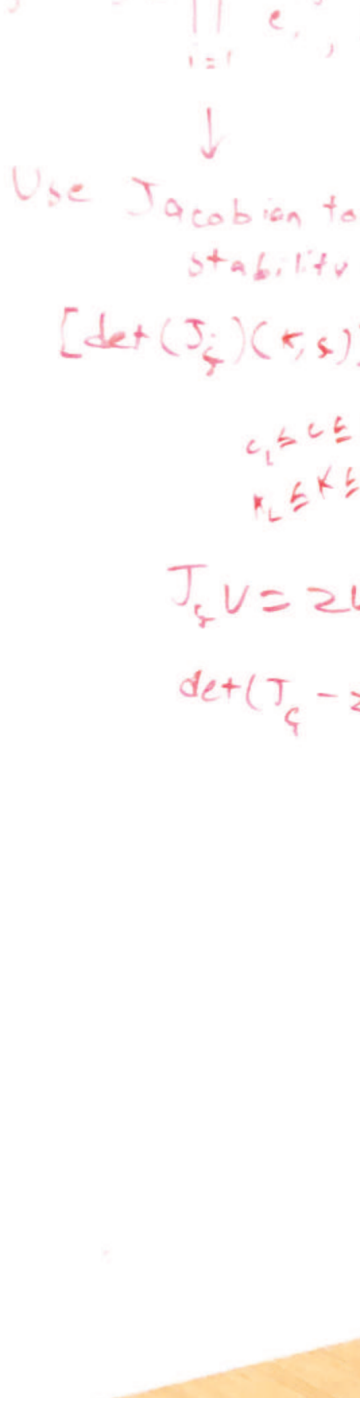
Research Mentor:
Dr. Brenda Rubenstein
Brown University Department of Chemistry in Providence, R.I.

Extracurricular Activities:
Math Club, Chemistry Club, and Badminton Club

"My favorite Gatton memory is probably my first day of classes. When learning about the program, I was surprised how we were all provided the same benefits as an undergraduate yet did not have to pay tuition. Being in class for the first time reminded me of this and gave me a deeper appreciation for what Gatton has to offer."

"To me, research means a way to contribute. For much of my life as a student, I've spent many years thriving in an academic environment with a lot of freedom. Research provides an opportunity to apply what I have learned from STEM to give back to the world that has given so much to me."

"I realized my passion for STEM when I got my first electrical kit. I had learned about the concept of electricity before, but being able to toy around with each component allowed me to experience it. That event led to me being more curious about the world and my interest in science."



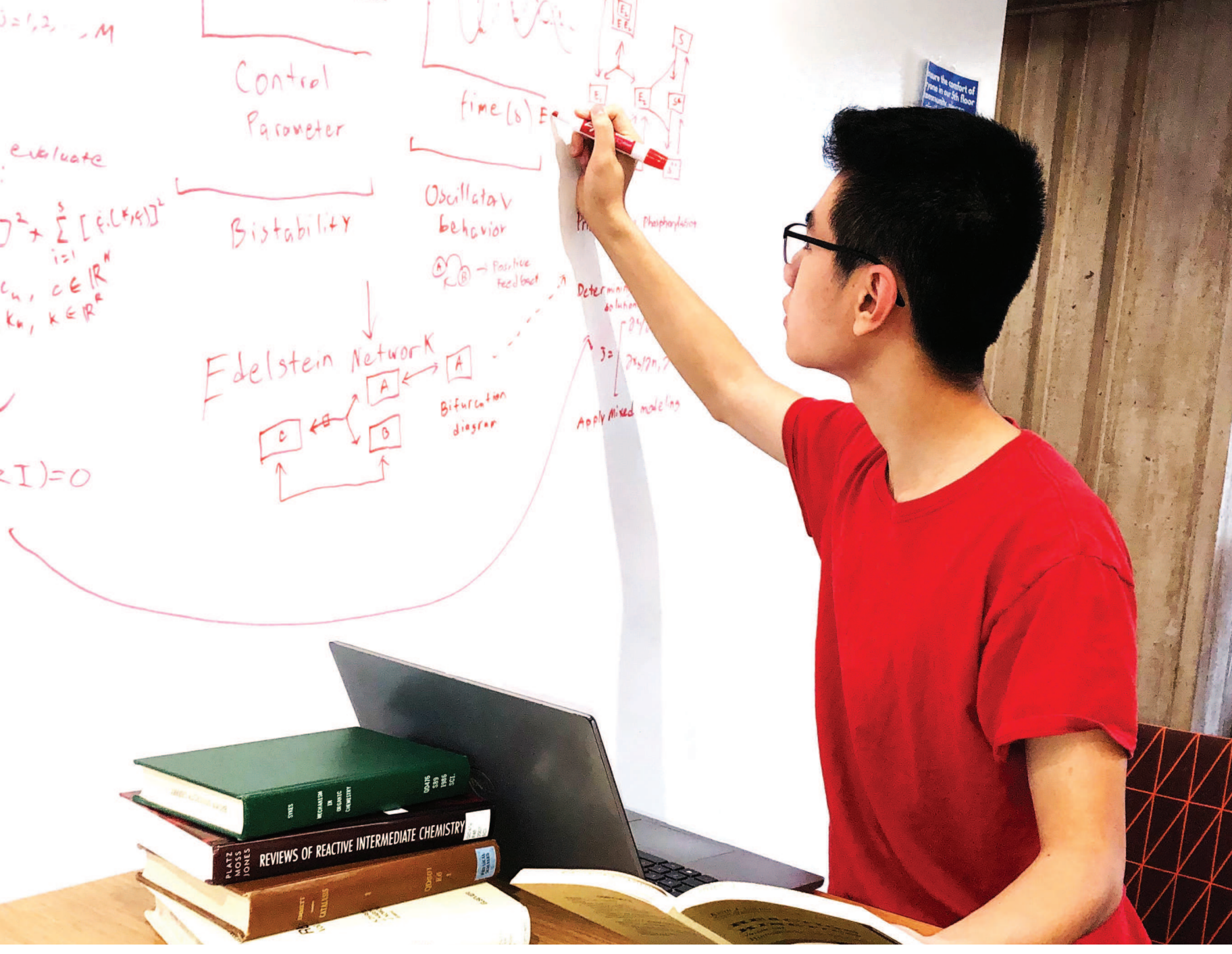

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diagram
Apply Mixed modeling
REVIEWS OF REACTIVE INTERMEDIATE CHEMISTRY
PLATZ
MOSS
JONES

Gabriel Nowaskie
Bardstown, Kentucky (Hardin County)

Dear Gatton RIG Supporter,

The Nowaskie Knob is spectacular. Six acres of hills and woodlands with people far and thin. This is my home. But living in rural Hardin County, I don't go out or see people around. So, I had to improvise. Climbing trees, chucking sticks, and carving spears helped my boredom. It was never enough, but it was all I had until the day I was given an iPad. Since there was never much to do, I always watched YouTube. Don't get me wrong, I know this sounds like an electronics addiction in the making. But something kept hooking me—science videos. I became absolutely obsessed. As I continued down this rabbit hole, I found in 6th grade that there are lecture videos online from actual colleges. The first one I watched was "Stanford University College Physics Lecture 1." From there I fell into the pool of knowledge and have never looked back, getting textbooks for Christmas, painting all the walls in my room with chalkboard paint, and tinkering with electronics in my garage.

Unfortunately, this all happened a long time after my school would choose kids for the gifted program, and I became shackled to what "normal people in my grade should be taking" for years until I found the Gatton Academy. I am finally free to learn and explore to my heart's content. I can jump into the deep end to new worlds of vast marvels. "Your most recent marvel" you may ask? I am using programming to find molecules that take carbon dioxide out of the atmosphere. But there's another marvel in this; *you*. *You* are opening the gate to this new world. *You* are allowing me to learn. *You* give me the facilities to be me.

And so I say: Thank *YOU*.

Sincerely,
Gabriel Nowaskie

Gabriel Nowaskie

Home High School:
Bardstown High School

Research Area:
Machine Learning to find Metal Organic Frameworks

Research Topic:
Sean Korner and Gabriel Nowaskie are using machine learning to find a specific metal organic framework which can be used to convert carbon dioxide into water.

Career Goal:
Develop machine learning skills for future projects

Research Mentor:
Dr. Bangbo Yan
WKU Department of Chemistry

Extracurricular Activities:
Crocheting, playing banjo and piano, and throwing discus

"The part of summer research I most look forward to is writing the paper for my research. It just feels good compiling all your work into one final document, like a composer and his symphony. It's where all your hard work can come to light and finally shine."

"Research is not only a way to dip my toes into the fountain of knowledge, but also a way to contribute to the overall body of knowledge that I am participating in. It's a way for me to show the world what I can do and give to something bigger than myself."

"This research experience fits into my goals because I get to develop my capabilities in machine learning, which I can apply to other research areas, specifically physics. Using the knowledge from this summer, I want to create algorithms to solve complicated systems in theoretical physics. Then I can use both the theoretical and computational skills, an important tool for research in any field."


ANYTIME FITNESS

Kareena Pansuria
Bowling Green, Kentucky (Warren County)

Dear Gatton RIG Supporter,

My parents are the most hard-working people I know. My dad works in finance, while my mom is a physician in Bowling Green. Throughout my childhood, they instilled in me that no matter what discipline you work in, hard work is the key factor to success. Since I live only 15 minutes away from Gatton, I've known about it since elementary school and have heard countless success stories about students, specifically in research. Thus, when my junior year at Gatton started, I hit the ground running and involved myself in all things chemistry.

While Gatton has certainly proved its challenges, I look back at my experiences with gratitude. Gatton has allowed me to further pursue my interest in chemistry in ways I wouldn't have been able to do before. At WKU, I've been able to conduct chemistry research pertaining to the automation of titration systems. This summer, through the support and 'infinite possibilities,' I have had the opportunity to conduct my RIG at Brown University, utilizing synthetic polymer chemistry and electrostatic forces to create underwater adhesives. My future involves medical school and a career as a physician. I can envision myself using the skills, knowledge, and connections gained in my research experiences to assist me in other projects or endeavors in the future. This opportunity has been invaluable for my future, and for that I cannot thank you enough.

Sincerely,
Kareena Pansuria

"The biggest change I have experienced in my first year at the Gatton Academy is being surrounded by high achieving peers. The people you surround yourself with truly do affect you as a person. Due to the hard-working people at Gatton, I personally believe my work ethic and drive to pursue my educational interests has increased. I am looking forward to strengthening my knowledge in chemistry and other sciences while at Gatton."

"The biggest challenge in my research that I will have to overcome is the learning curve that comes with investigating an area of chemistry with which I am not completely familiar. With the help of my mentor and scholarly articles, I will be able to learn more about polymer chemistry and its applications for detecting and preventing pollution."

"The coolest thing about summer research is being able to put all your time into a topic that interests you without worrying about grades or assignments. You also to get work with accomplished professors and individuals who understand the subject matter deeply."

Kareena Pansuria

Home High School:
South Warren High School

Research Area:
Synthetic Polymer Chemistry

Research Topic:
Kareena Pansuria is developing an underwater adhesive.

Career Goal:
Physician

Research Mentor:
Dr. Benjamin McDonald
Brown University Department of Chemistry in Providence, R.I.

Extracurricular Activities:
Chemistry Club, Biology Club, Paint Club, Gatton Peer Tutor in Chemistry, and Medical Center Teen Volunteer

Kellen Patterson
Bowling Green, Kentucky (Warren County)

Dear Gatton RIG Supporter,

As a Bowling Green, Ky., native, I first heard about the Gatton Academy in elementary school. It was clear to me that the Gatton Academy was a prestigious opportunity and held in high regard by parents and students alike. Even at that age, I took my education seriously and always had a knack for math and the sciences. Ironically, I remember thinking to myself at the time, "maybe I will make it to Gatton someday." Throughout middle school and early high school, athletics became my priority, but the Academy doesn't allow participation in KHSAA sports, so the idea of applying fell from my radar. Despite this, I continued doing well in school and pursued as many AP classes as I could. When the Covid-19 pandemic began, sports moved to the backburner, and I was encouraged by my AP chemistry teacher, Mr. Patel, to apply for Gatton. I'm incredibly grateful I decided to apply because during my time at the Academy, I have been presented with many opportunities that aren't available to the typical high school student, one of them being the Research Internship Grant (RIG).

I want to thank you for supporting the Gatton Academy RIG program, which has allowed me to research the synthesis of polymer beads with integrated photocatalyst capable of breaking down organic pollutants. The research I have done has many applications, including efficient cleanup of massive oil spills. During my final year at Gatton, I plan to continue making progress on this project. In the future, I hope to major in chemistry and perhaps work as a materials scientist to develop additional solutions for cleaning up our planet. The RIG opportunity has been such a valuable experience for me, and what I have learned will undoubtedly help me achieve my present and future goals. Many thanks for this wonderful opportunity.

Sincerely,
Kellen Patterson

"As a young person interested in STEM, research is an amazing opportunity I wouldn't have had at my sending high school. It has allowed me to have great experiences in the lab and with my research mentor. Overall, I think research at Gatton has further developed my learning of chemistry and further developed my passion for science."

"I have been working on this research project since the beginning of my time at the Gatton Academy, so during this summer research period, I am most excited for the opportunity to dedicate my time solely to the project and making significant progress on it."

"The biggest change I have experienced in my first year at the Gatton Academy has been the level of independence I have. There is plenty of help offered at Gatton; however, there isn't anyone there to do the work for you, so it is expected that you stay on top of things. Taking care of yourself, submitting your assignments on time, and doing your laundry all take a high level of independence and responsibility."

Kellen Patterson

Home High School:
South Warren High School

Research Area:
Chemistry

Research Topic:
Kellen Patterson is producing polymer beads incorporated with photocatalysts, which degrade pollutants in aquatic environments.

Career Goal:
Chemical Engineer

Research Mentor:
Dr. Matthew Nee
WKU Department of Chemistry

Extracurricular Activities:
Chemistry Club

Maria Pfeifer
Owensboro, Kentucky (Daviess County)

Dear Gatton RIG Supporter,

To answer the question I've been asked since I was in Kindergarten, I want to work in women's health when I grow up. The Gatton Academy has helped me discover and hone this passion. In my first year, I was able to conduct research on college-aged women's beliefs and knowledge of their reproductive health. From here, I knew I wanted more, and I knew there was a gap in the current research that I could help fill. Because of your generosity, I was able to conduct research this summer on how women's use of contraception affects behavior regulated by the front of the brain. It was amazing to be able to conduct my own research project that I feel will help me towards my goal of supporting women in all facets of life.

This summer research experience has expanded my understanding of learning. We do not have to be in a classroom to learn. Beyond the purely academic side of what I learned this summer, I learned so much about myself and gained a deeper understanding of the world. I learned about the amount of work that goes into research done with integrity and thus gained a deeper level of respect for researchers. I learned about the importance of silence, conversation, and living comfortably in both. I also learned how to budget, behave in a professional setting, and make friends with people I didn't go to school with. This was a huge blessing, and thanks to your help, I now feel more prepared for the "real world."

With gratitude,
Maria Pfeifer

Maria Pfeifer

Home High School:
Owensboro Catholic High School

Research Area:
Hormonal Contraceptive Use

Research Topic:
Maria Pfeifer is comparing the executive function of women 18+ who are and are not on birth control.

Career Goal:
Holistic Gynecologist

Research Mentor:
Dr. Stephen Sammut
Franciscan University Department of Psychology in Steubenville, Ohio

Extracurricular Activities:
Girls Who Code, Russian Club, Biology Club, Bible Study, Intramural Soccer, and Prom Team

"The moment I realized STEM was my passion was when I began studying plants over quarantine. I kept a journal to record my observations, questions, and crude drawings of the plant I was studying. This helped me look at the world from a different angle while challenging my analytical mind."

"This research experience will help me better understand if I enjoy working in the research side of holistic medicine or being a medical doctor. Before Gatton, I was sure I wanted to be a doctor, but the opportunities I have been presented with have opened me up to the idea of staying in the research field. Thankfully, the scientific community is dynamic, so I may not have to choose."

"As a young person in STEM, research has opened doors to what I always thought science should look like. My educational setting has been expanded beyond the classroom and into the lab. This will be one of my first steps into the professional world."

Jonathon Reilly
Elizabethtown, Kentucky (Hardin County)

Dear Gatton RIG Supporter,

Thank you very much for your generous support that allows students like me to take part in summer research. The opportunity I had this summer to work with both virtual reality hardware and environment-development software was invaluable. One reason I'm so grateful is that this research will greatly help me in my pursuit of a computer engineering management career. I feel that having hands-on experience within both of these fields will grant me more understanding when it comes to the position I am pursuing.

I am from Elizabethtown, Ky. While there are more opportunities for higher learning within high school between our community college and early college programs than the more rural areas of Kentucky, there are still absolutely no opportunities for doing research like I was able to do over this summer. In general, I found that coming to the Gatton Academy gave me an experience I honestly needed. I wasn't feeling challenged in any of my classes, and due to where I lived, it was hard to hang-out with friends face-to-face outside of school on a regular basis. Gatton changed all that. Now I get to live with my friends and take classes where I'm learning new and important information the entire time. All in all, both my RIG and Gatton experiences have greatly impacted me for the better, and I am extremely grateful for being given such opportunities.

Sincerely,
Jonathon Reilly

Jonathon Reilly

Home High School:
Central Hardin High School

Research Area:
Extended Reality

Research Topic:
Jonathon Reilly and Carolina Wheeler are developing a WKU campus virtual reality experience for WKU's website.

Career Goal:
Doctor, Lawyer, or Engineer

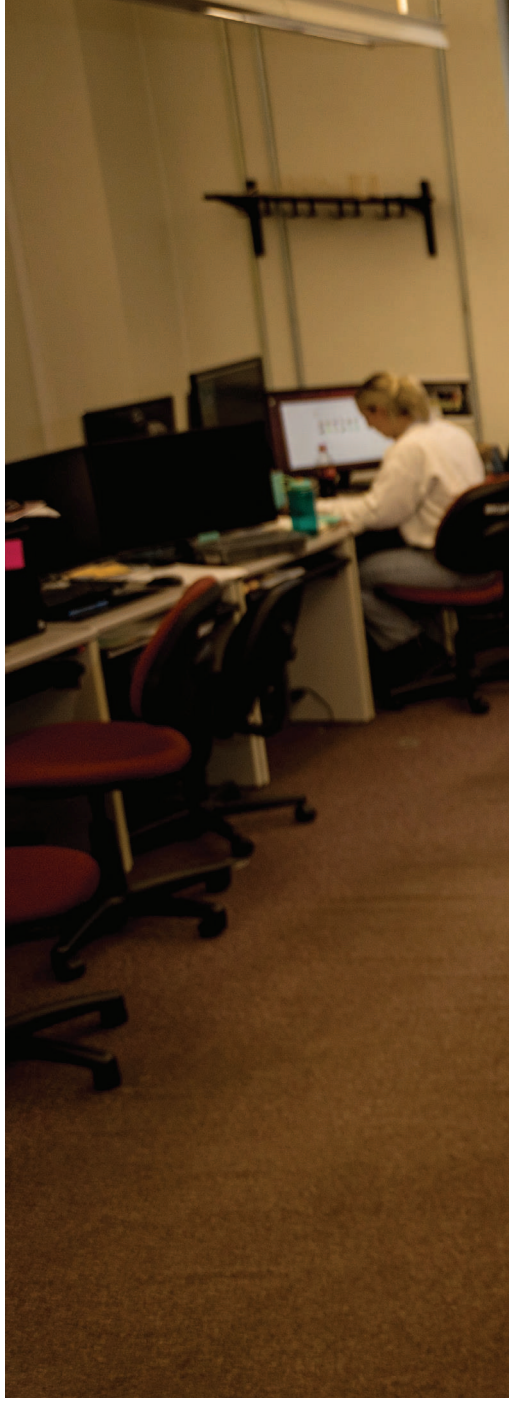
Research Mentor:
Dr. Jeffrey Galloway
WKU Department of Computer Science

Extracurricular Activities:
South Asian Secondary School Youth Club, Computer Science Club, Party Club (political club), Central Hardin High School Academic Team, and Boy Scouts of America Troop 829

"I realized that STEM was my passion during my fourth-grade science fair. My project was analyzing the relationship between the percentage of mass due to water and conductance of different produce. Even though my project did not place, I still enjoyed doing the work, and I was proud of how my project turned out."

"I am deeply passionate about computer science, and a large part of developing extended reality research is computer science. Extended reality is also a rapidly growing sector of the tech industry, meaning this research will make me a more desirable candidate professionally."

"To me research means being able to get my hands on practical experience in a field I am passionate about. If I were still at my sending school, I would never have gotten the opportunity to study computer science, let alone work on in-depth problems that do not already have existing solutions. That is the most important aspect of research to me, the fact that I am doing something that matters outside of my own personal development."



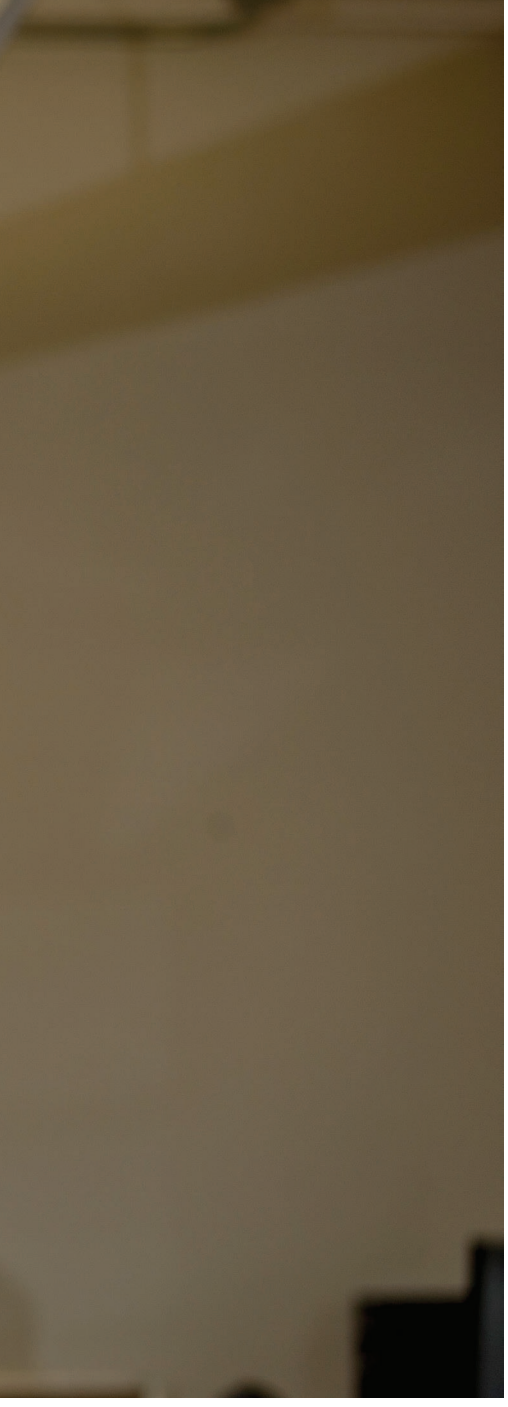
Carolina Wheeler
Scottsville, Kentucky (Allen County)

Dear Gatton RIG Supporter,

I have never been a person who could choose just one thing to be interested in. My entire life, I've wanted to pursue so many different subjects. In fact, I can be quoted in the second grade as saying I wanted to be a scientist, artist, author, *and* secret agent when I grew up. While my grasp on realistic career expectations has definitely improved with age, my multi-passionate heart has remained. Gatton has encouraged and supported this in more ways than I can count.

I came to Gatton knowing nothing about computer science and assuming I wouldn't like it because of its daunting appearance. After being required to take CS 180, however, I realized that I loved it and couldn't wait to learn how to code bigger and better projects. Without the endless opportunities to explore and learn about new things offered to me at Gatton, I never would have gotten involved in computer science. This summer, I've been able to combine my newfound love for computer science with other interests like art and social studies in my work creating a virtual reality campus tour of WKU from the present day to its founding in 1906. The experience has been an incredibly powerful one for me, showing me that interdisciplinary research is not only possible, but very necessary. This summer I have learned more than I ever could have imagined, and for that I am beyond grateful.

Sincerely,
Carolina Wheeler



"My best super-nerd moment was spending hours coding a CS lab that didn't count for a grade instead of studying for my other classes because I couldn't stop until I got it right. All my friends thought I was crazy, but I had so much fun with it, and it made me realize just how much I liked computer science."

"This research fits into my goal of double majoring in computer science and biology because I'm not only developing my computer science skills, I'm also learning how computer science can come together with other fields to create something amazing. It's a great opportunity to gain experience and get a feel for what I want to do as a career later on."

"The biggest change I experienced during my first year at Gatton was the sense of community. It was stunning to me to go from a school of twelve hundred people, where I didn't even know everyone in my class, to a place like Gatton, where everyone knows and cares about each other. I love how there's a sense that we're all in it together. I never much understood 'school spirit' before coming here, but I definitely get it now."

Carolina Wheeler

Home High School:
Greenwood High School

Research Area:
Computer Science and Virtual Reality

Research Topic:
Jonathon Reilly and Carolina Wheeler are developing a WKU campus virtual reality experience for WKU's website.

Career Goal:
Computer Science and Biology

Research Mentor:
Dr. Jeffrey Galloway
WKU Department of Computer Science

Extracurricular Activities:
Biology Club, Girls Who Code, and Sunrise Club


AROL MARTIN GATTON
THEMATICS & SCIENCE IN KENTUCKY


Thank you, Gatton RIG Supporters!
Maria K. Pfeifer
Hannah Laney
Jonathon Reilly
THE GATTON ACADEMY
of Mathematics and Science

"*One piece of advice my mentor has given me is to never feel embarrassed to ask for an opportunity you want to participate in. You would be surprised how many people are willing to lend a hand if you are willing to ask for it.*"

- Divya Naidugari with her mentor, Dr. Sarah Millar

"*The best piece of advice my mentor has given me so far is that it doesn't matter where you go to school or what opportunities you can afford—it's what you do with the opportunities you've been given that matters. I've really taken this to heart and decided I will make the most of my time here at Gatton by continuing to study hard and do research in the Fall in order to not let the amazing opportunities I've been given slip away.*"

- Hannah Laney with her mentor, Dr. Jasminka Terzic

"*The best piece of advice my mentor has given me is to be patient. He always reminds me to keep myself focused, but to recognize I have plenty of time to achieve my goals.*"

- Kellen Patterson with his mentor, Dr. Matthew Nee

"*The largest challenge I face in my research is adapting to a different format of end-product. In my current computer science experience, I have not engaged with more complex systems such as virtual environments or graphical outputs.*"

- Jonathon Reilly with his mentor, Dr. Jeffrey Galloway

"*The best thing my mentor has told me is that he has my back. I am going to be living in a new environment for six weeks where the only people I know are my mentors. He has been very instrumental in my understanding that I will not be alone over the summer.*"

- Maria Pfeifer with her mentor, Dr. Stephen Sammut

"*My research over the summer fits into my professional goal to become a pediatrician. I will be observing fruit flies in order to, hopefully, uncover valuable information about cancer and ways to prevent it.*"

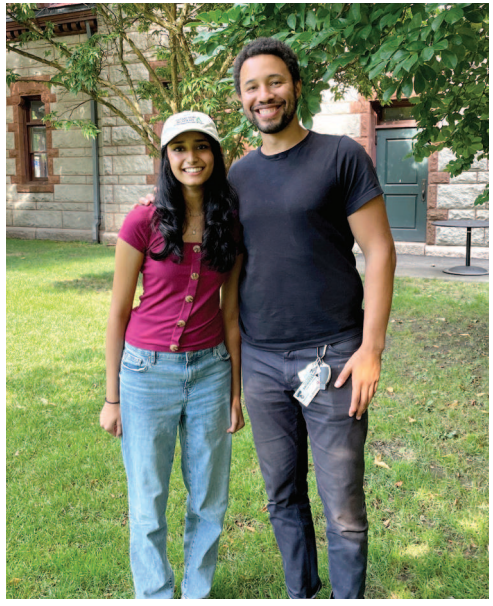
- Siheon Im with his mentor, Dr. Ajay Srivastava

"*The best advice my mentor has given me is to always be kind to other people. There's no need to be unkind to others.*"

- Jiali Graham with her mentor, Dr. Farley Norman

"*The best piece of advice my mentor has given me is to have fun on the journey. At the beginning of research, the end goal may be clear, but it may become foggy as the research continues. Road bumps may even cause you to change your end goal entirely. It is best to enjoy the journey instead of worrying about achieving the expected results.*"

- Kareena Pansuria with her mentor, Dr. Benjamin McDonald




WKU


EMPYRE