

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

Volume Three - Summer 2013



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About the Gattton Research Internship Grant Program

The Gattton Academy of Mathematics and Science in Kentucky created the Gattton Research Internship Grant program in 2010. Made possible by a gift from Mr. Carol Martin “Bill” Gattton, the program offers grants to Gattton Academy students between their junior and senior years to support summer research internships across the Commonwealth and the USA. By providing a funding mechanism, the program directly creates research internships that otherwise would not have existed for Gattton Academy students. In its first four years, the program has already made possible 55 research internships for Gattton Academy students to study STEM issues in their area of interest in a devoted, full-time research setting.

In the summer of 2013, the program is funding 20 rising high school seniors who attend the Gattton Academy—its largest class of summer researchers yet. Performing research in mobile device application development, cancer research, water analysis in a local cave, and facial recognition patterns of infants, just to name a few, these students’ findings are pushing the boundaries of what is known in science. The following pages feature the summer of 2013 Gattton Research Internship Grant recipients.



Dear Mr. Gatton,

As we begin our 7th year here at the Gatton Academy, I want to thank you for all that you have done to help us be successful. Your investment in this program has created incredible opportunities. As this book will highlight, our students have had unprecedented experiences that have changed their lives. On a recent trip with a group of our students to the National Consortium for Specialized Secondary Schools of Mathematics, Science, and Technology Student Research Conference, we interacted with students from all across the United States. Young men and women shared their research ranging from mapping genomes from bacteria viruses to explorations in making better solar cells. The Gatton students' work was among the top of this outstanding group. A large part of our students' success is due to the research opportunities available to our students during the summer. This is fully made possible by the funds generated by your endowment.

With your help, we have become one of the best college preparatory schools in the nation. Our students are able to stand shoulder-to-shoulder with any student in the country. Your support has enabled us to rise to exemplary levels that would never have been possible otherwise. On behalf of all the students and staff of the Gatton Academy, we wish to express our gratitude to you for sharing your resources so that we might be a beacon of excellence for Kentucky and the nation.

Sincerely,

Tim Gott, Ed. D.





Corbin Allender
Bardstown, KY (Nelson County)

Dear Mr. Gatton,

Hello, my name is Corbin Allender, and I am a recipient of the Gatton Academy Research Internship Grant. What originally drew me to the Gatton Academy was a desire to expand my potential and experience new and exciting things that I would never have otherwise. Needless to say, the Academy did not disappoint. Since then, it has provided the necessary challenge and freedom - resulting in interminable and unbridled personal and academic growth – and led me all across the state and even (on occasion) the world.

It's incredible what I have accomplished in such a short period of time. A year ago, I would have never thought my summer job would include working in a state-of-the-art laboratory. Now, as I'm studying carcinogens in tobacco and testing soy-based chemopreventive agents, it's hard not to be reflective and grateful for the opportunities I've been provided.

I cannot adequately express my gratitude for your generous contribution; it's much more than a monetary donation - it's an investment in Kentucky's next generation of bright and curious minds. It funds more than what you can read in an abstract or see in a lab, rather it funds inspiration, learning, networking, and discovery in each and every one of us.

Thank you again,

Corbin Allender

Getting to Know Corbin

What I am most excited about this summer is the actual work I'll get to do and the amazing facilities where I'll get to do it! From working with mice, to growing and treating cancer cell lines with experimental drugs - it's not your typical summer job! This is truly an experience that I will not forget.

I've learned that to maintain good academic standing I must be communicating with professors, utilizing the resources provided, and searching for additional resources to study.

The thing I love the most about the Gatton Academy is undoubtedly the community. Without trying to sound overly cheesy, the people here truly become your adopted family. You eat together, you study and learn together, you live together, and you grow together. Without their constant love and support, my experience would not be near the same.

Research Topic: Effects of Combinations of Anacardic Acid and Lunasin on the Proliferation of Non-small Cell Lung Cancer Cells

Research Area: Pharmacology and Toxicology/Cancer Biology

Research Location: James Graham Brown Cancer Center at the University of Louisville

Research Mentor: Dr. Keith Davis

Career Goal: Medical Professional (specialty undecided)

Home High School: Bardstown High School



The best piece of advice given to me by my mentor is, ironically, very common. Perhaps this is the beauty of it, as it has never personally held more truth than exemplified by my time spent in his lab. He said, "Remember, there is no such thing as a stupid question."



Upon my arrival at the Gatton Academy, I was apprehensive, hesitant, and unsure about the situation I had delved into. After just one year here at Gatton, that feeling has been transformed into one of confidence, preparedness, and purpose when it comes to education, research, and its applications.



Tucker Baker
Lawrenceburg, KY (Anderson County)

Dear Mr. Gatton,

First of all, I would like to thank you for the opportunity to have two years of higher education during high school. Before attending the Academy, I grew up outside the small town of Lawrenceburg, KY, which is just west of Lexington. Until last year, I did not know what living in a city was like.

I have lived on a horse farm all my life. Sometimes I hated all of the work that my father wanted me to do, but now that I have spent a year in the city, I realize how much fun it was to rake hay, feed horses, rick firewood, hoe the garden, fix fences and bust rock. I was—and still am—blessed to have the opportunity to perform these tasks and continue a way of life unknown to most. That’s why, though it may seem strange at first, my favorite Gatton Academy memory involves cleaning. My hall mates and I always seem to find something to tinker with. When I had to teach some of my hall mates how to clean a toilet and use a screw driver, I knew I wasn’t in Anderson County anymore.

The part of summer research that I am most enjoying is having time to visit my friends and family who live in Bowling Green. I am staying with my Aunt and Uncle, which means that I get to see four of my cousins every day. I just wanted to say thank you again for the opportunity you have given me and your cheerful giving.

Thanks,

Tucker Baker

Getting to Know Tucker

My biggest Gatton Academy accomplishment is getting accepted. After the interview, I was notified that I was not accepted. Fast forward to early August and I am talking to Tim Gott about an opening in the class. I think that waiting period where I didn't think I was going helped me not to back down from academic challenges.

The biggest challenge I had to overcome to be able to perform research this summer was to obtain my intermediate license so I could drive to work in the mornings. The pressure was on and I only had two chances to be able to take the test. Thankfully, I passed.

In the next 10 years of my life I would like to continue my schooling at WKU. I feel that not having college loans will help me start living life solely on my dime, as well as raising a family.

Research Topic: Ionic Properties of Titanium and Hafnium Crystals

Research Area: Geochemistry

Research Location: WKU Department of Geology

Research Mentor: Dr. Aaron Celestian

Career Goal: Civil Engineer

Home High School: Anderson County High School



The biggest change I have faced in coming to the Gatton Academy has been the lack of true outdoor experiences. Where I grew up I could drive five minutes from the city and be where there wasn't a soul for roughly a mile. Now, it's challenging to get to places where I can experience true isolation.



The best advice my mentor has given me is to always be safe and that any level of success is not worth your life or the lives of others.



Aaron Brzowski
Owensboro, KY (Daviness County)

Dear Mr. Gatton,

When you look upon today's generation of students, what do you see? I see high school students with ambition, but no means to act. I see students who want to make a change, but don't have the resources to do so, and so that ambition fades as does their will to explore new territory. You have saved us from that fate, Mr. Gatton.

Your gift offers a lifeboat to a generation, and I will be eternally grateful. I understand these letters are intended to be light hearted and fun for both of us, but the gravity of the situation we students are in is understated. I see high school students, old friends of mine in fact, who are cutting classes, missing days, and dropping out of school completely due to the fact that they have nothing driving them forward. It's an incredibly disappointing thing to see because I know these students could have been great. That is why I truly would like to extend my utmost gratitude. That could have been a lot of our fates if not invited to attend your Academy.

Now, we become leaders. By preparing us in ways that give us competitive advantages, we can now forge our own paths through this world and it's all because of you.

Thanks,

Aaron Bryowski

Getting to Know Aaron

My proudest moment at the Academy was a day when I was tutoring a student at Dishman McGinnis Elementary School. I was just about to leave when my student (fourth grade) approached me with a question. He asked if not only he could remain my student, but if I could become his mentor in a mentoring system the school has in place. I was almost speechless, but I managed to stutter out that of course I would. That single moment of a child asking me to be there for him is one of the greatest achievements I could ever ask for.

Research Topic: Timelike Geodesics for a Modified Warp Drive

Research Area: Theoretical Physics

Research Location: WKU Dept. of Physics and Astronomy

Research Mentor: Dr. Keith Andrew

Career Goal: United States Senator

Home High School: Daviess County High School



The best piece of advice my mentor has given me was, "If we knew the outcome, we'd be wasting our time, wouldn't we?"

The most appealing thing about summer research is that there have been a plethora of opportunities opened to me. The possibility of furthering this research is what motivates me.

Failure doesn't bother me. It pushes me further ahead. As Richard Feynman once said, "We are trying to prove ourselves wrong as quickly as possible, because only in that way can we find progress."



*My most difficult challenge I've overcome is the idea of challenge itself.
The mind of a researcher must take every unknown pocket of knowledge as a challenge.*



Tori Buckley
Glasgow, KY (Barren County)

Dear Mr. Gatton,

I want to thank you for giving me the opportunity to continue my biochemistry research over the summer. Without your grant, I would not have had this opportunity. This research gives me such an amazing experience. As I will be continuing my studies in pre-medicine, my research is very important to me. The educational benefits of the summer research project are tremendous. This opportunity will allow me to apply math and science knowledge and skills. I also hope to present my findings at multiple research conferences. I am so excited for the future opportunities that will come from my research.

I have loved my first year at the Academy. As soon as I visited the Academy, I knew I wanted to apply. I knew the Gatton Academy was the place for me to finish my last two years of high school. I have loved my experience so far at the Gatton Academy, and I am looking forward to next year. I am involved in many extra-curricular activities, I have traveled abroad with the Gatton Academy, and I am planning on starting a new club for students who are interested in the medical field next school year.

After the Gatton Academy, I plan on attending a university to study pre-medicine with plans of becoming a surgeon. I know the Gatton Academy has prepared me for whatever I choose to do. Thank you again for giving me such an incredible opportunity.

Thank you,

Tori Buckley

Getting to Know Tori

The thing that I love most about the Gatton Academy is the challenge it provides. At my home high school, I did not have the option to take courses that were interesting and still challenging. At the Gatton Academy, I take those types of courses along with research, traveling abroad, living in a residence hall, and so many other amazing opportunities.

In my second year at the Academy, I am most looking forward to spending time with friends, taking new and challenging courses, and continuing my research. As amazing as my first year at the Academy was, I feel like my second year will be even better.

My research investigates how a protein is affected by long term antibiotic usage. This research could change the way people think about medical drug usage.

The coolest thing about summer research is getting to discover things that have yet to be discovered.

Research Topic: Molecular Level Interaction of Human Fibroblast Growth Factor-1 (hFGF-1) with Anti-biotic Drugs

Research Area: Biochemistry

Research Location: WKU Department of Chemistry

Research Mentor: Dr. Rajalingam Dakshinamurthy

Career Goal: Surgeon

Home High School: Barren County High School



I am most looking forward to getting to spend time in the research lab with my friends. I get to learn new, interesting things with people that have similar interests. I love what I am researching and who I am doing it with! It is such an incredible opportunity.



The biggest challenge in research is learning and mastering the equipment I use and the procedures to follow. As I have never been involved in research before, the equipment can be a challenge. If I miss one step in a procedure the entire process can be ruined and will have to be repeated. This can cause much frustration, but when it is done right it's very satisfying.



Fenil Chavda
Hopkinsville, KY (Christian County)

Dear Mr. Gatton,

I've lived in the state of Kentucky for twelve years now. Six years ago, my parents told me about the initiation of the Gatton Academy. The emphasis on STEM studies with a curriculum much more academically rigorous than regular high school really appealed to me. From the moment I heard about the Gatton Academy, I realized that this was the school I had always dreamed of. Knowing this would be a once-in-a-lifetime opportunity, I began to prepare for the Academy. I started by taking higher level courses in math and expanding my knowledge of science outside of school. Then, I focused on not only academics, but my extracurricular activities, as well. However, I was not initially accepted as part of the Class of 2014. At last, my parents received a phone call informing them a spot had opened up in the Academy for me.

I am very thankful for this opportunity and, after completing one year at the Academy, I have acquired much more knowledge without at all quenching my thirst for it. In fact, my desire for knowledge has expanded after coming to the Academy. I've been exposed to many new experiences in the STEM subjects and research. For example, before coming to the Academy, I had no idea whatsoever about computer science and programming, and after having a year of Computer Science classes it's become one my favorite subjects. I am also very thankful for the opportunity to be able to take part in undergraduate research at WKU. Currently, I am part of a lab that is studying the effects of capping antibiotics onto the surface of gold nanoparticles. If it wasn't for the Gatton Academy's RIG grant which, as I understand, comes from your donations, I would not have been able to stay at WKU over the summer to continue my research. Thank you for making all of this possible, not only for me but for all of the students that have attended the Gatton Academy.

Sincerely,

Fenil Chavda

Getting to Know Fenil

On the first day at the Gatton Academy I felt like I was a stranger. I didn't know most of either the junior class or the senior class.

I had no clue what to expect from my classes or from those living with me. Now, I feel as if I'm living with family, and my classes don't seem as intimidating as they did at the start.

Coming into my second year at the Gatton Academy, I am looking forward to taking non-general education classes in subject areas that I am interested in.

I think my summer researching is different from the way most high school students spend their summers in that instead of enjoying my time off from school at home or on vacation I enjoy my time off by doing research and learning in a field of study that I am interested in.

Research Topic: Biofriendly Synthesis of Maltotriose Gold Nanoparticles and Evaluation of its Antibacterial Activity

Research Area: Biochemistry

Research Location: WKU Department of Chemistry

Research Mentor: Dr. Rajalingam Dakshinamurthy

Career Goal: Medical Doctor



I will be using my research as a starting point for the Siemens Competition and BA and BS/MD program applications since many of the skills I will learn or already have learned in my research will be valuable in those programs.



I plan to go to medical school. Skills and conclusions from this research project will help me with future research projects that I will take part in as a medical school student and after medical school as well.



Nathaniel Clause
Murray, KY (Calloway County)

Dear Mr. Gatton,

I initially heard about the Gatton Academy because my sister went to the Academy graduating in 2012. Since then, I wanted to go to the Academy so that I could challenge myself in STEM fields, particularly mathematics. My transition was fairly smooth since my sister had already gone through the program and gave me many tips, and I also knew many of my peers from various activities we had done together before Gatton such as academic team and science bowl.

The Gatton Academy has allowed me to challenge myself much more than a traditional high school. I have been able to take advanced courses, particularly in mathematics, which I wouldn't have been able to take back home. Also, the Academy gives me the opportunity to get further ahead than other high school students in terms of credits, and I will thus be able to get my undergraduate and then graduate degrees faster because of that. Gatton allows me to push myself in terms of my courses, and I am very thankful for that.

This summer, I am doing research at WKU in mathematics/biology. More specifically, I use math to optimize the amount of oxygen that patients are given during oxygen therapy so that wounds heal the fastest and, simultaneously, have the lowest chance of giving the patient oxygen toxicity. This is research that I started on this spring and will be continuing on into this upcoming school year. This fits right into my goals in life, as I want to go into mathematics and either become a professor or work in applied mathematics.

Sincerely,

Nate Clause

Getting to Know Nate

Research Topic: Optimal Control Theory with the Treatment of Chronic Wounds

Research Area: Mathematics/Biology

Research Location: WKU Department of Mathematics

Research Mentor: Dr. Richard Schugart

Career Goal: Mathematician and/or Professor

Home High School: Calloway County High School

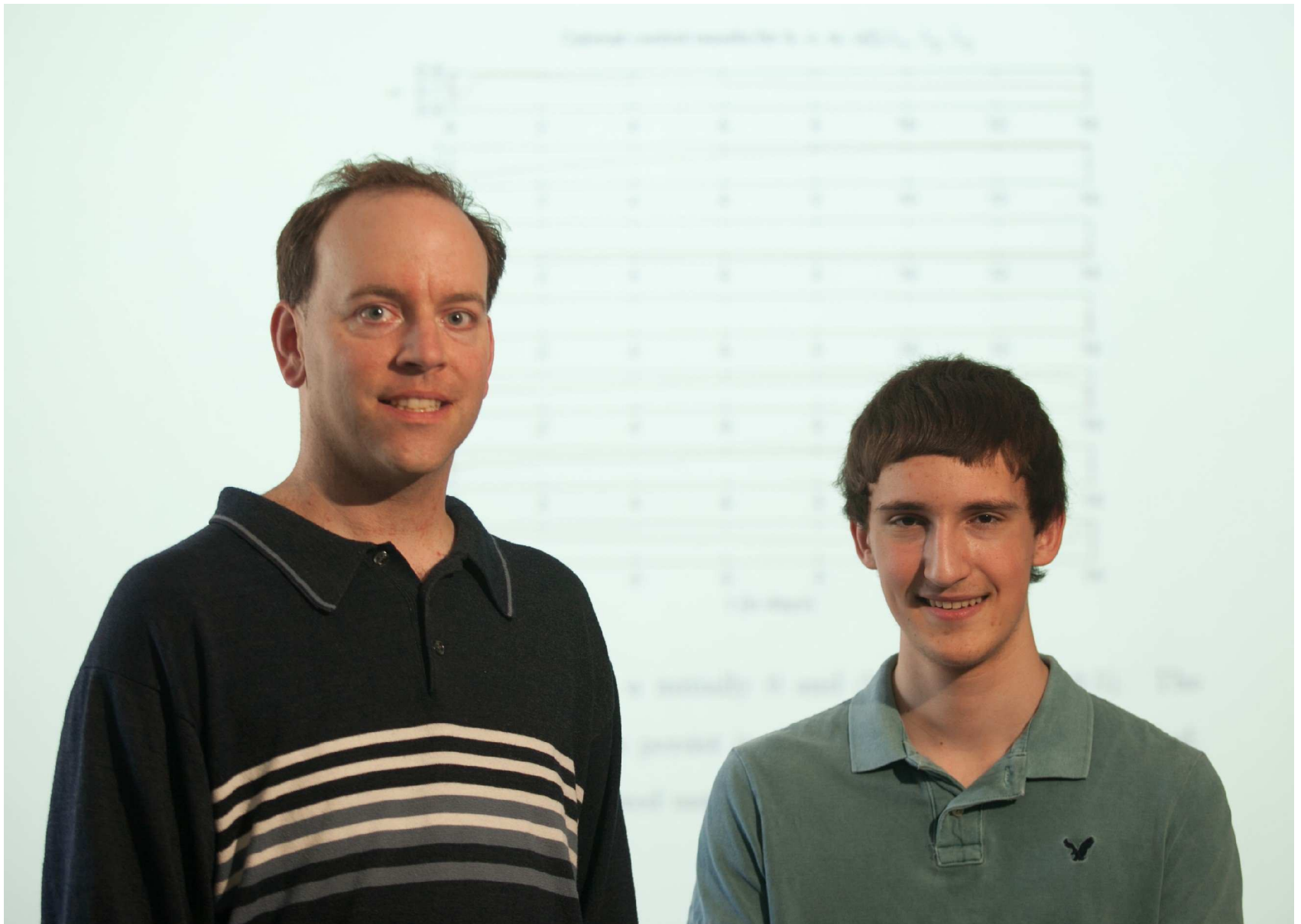
The thing that I love the most about the Academy is the community that we have. You can just walk up to people and start intellectual conversations, and you won't even be looked at weirdly. It's such a tight-knit community because you know everyone and it's just so easy to form lasting friendships with the brightest leaders of the future.

This summer, I am traveling to Harlaxton, England. I have been in other countries, but none of them across water. I am looking forward to this trip to broaden my horizons, and because I think it will be very interesting to see where some famous authors grew up and got the motivations for their novels.

In the next 10 years, I hope to have gone to either Cal-Tech or Harvard University for undergrad, and then go somewhere for a graduate program. Ten years from now, I want to have my doctorate in mathematics and have a job at a university.



On my first day at the Gatton Academy I was fairly nervous because I had left all my friends behind. I wasn't sure how I would be at making new friends and building relationships because I had been with the same group of friends my entire life. Now, I am very glad that I did come to the Academy because I have made friends and developed relationships that are stronger than any I could have had back home.



I will be using this research to write a research report which I will use for multiple scholarships including the Intel Science Talent Search and the Siemens Competition. I will also definitely be putting this research on my college resume, and I will use this research to present at at least one conference over the coming year.



John Andrew Cliburn
Cloverport, KY (Breckinridge County)

Dear Mr. Gatton,

This summer I'm staying on campus to continue the math research I started with Dr. Lan Nguyen last semester. Our research applies calculus to approximate norms in infinite dimensional space.

Math has always been a passion of mine and becoming a mathematician is something I've long thought about, so working one-on-one with a talented professor is an amazing experience.

There are many things I love about the Gatton Academy such as the chance to do research, take advanced and rigorous coursework, and study abroad, but what I love most is the friends I've found here. At the end of the day, we're teenagers who want to have fun and hang out like everyone else, but, unlike most, we're unified by our passion for learning and our desire to contribute something original to the world.

I'm extremely excited about the work we are doing and immeasurably grateful for the opportunity to expand my knowledge in mathematics and gain some truly unique insight into what a career of math is like.

Sincerely,

John Andrew Cliburn

Getting to Know John Andrew

The biggest change between now and when I first stepped foot in the Academy a year ago is that I'm more responsible. I've always been responsible but being at the Academy, the extra independence makes you really take charge of your life from staying on top of your classes, to doing laundry when your hamper's overflowing, to deciding when you should play Ultimate Frisbee, and when you have to finish a CPS assignment instead.

Research Topic: Rediscovering Banach Space and its Applications

Research Area: Mathematics

Research Location: WKU Department of Mathematics

Research Mentor: Dr. Lan Nguyen

Career Goal: PhD in Mathematics

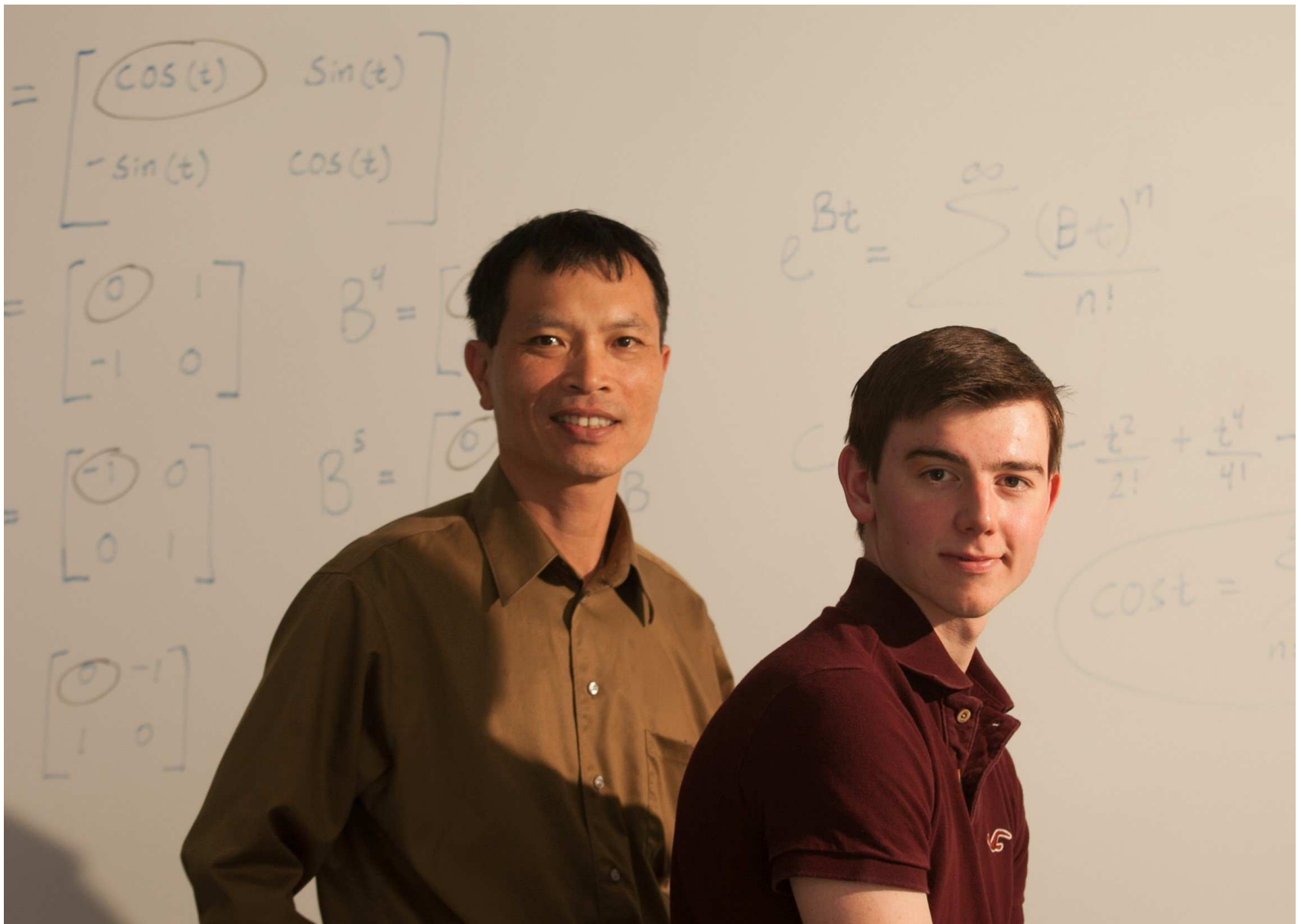
Home High School: Frederick Fraize High School

In my second year at the Academy, I'm most looking forward to continuing to expand my research, starting up some athletic extracurricular clubs and intramural teams, deciding on a college, and being a senior with my friends.

In the next 10 years, I see myself doing pioneering research in math. Also, I hope to be doing some screenwriting on the side, maybe have published a novel, and have finally learned how to play the guitar so I can play Jimmy Page's "Stairway to Heaven" solo. If I could have invented the light saber, that would be nice as well.



If I could be on any magazine cover, I'd be on TIME. Since I was a kid, we've received issues of the magazine at my house, and I read up on the likes of Einstein and Lincoln. TIME places people in their magazine who have done something of worldly and historical importance, and that's exactly what I want to do with my life's work: explore the frontiers of human knowledge and contribute something truly lasting.



The research I'm doing this summer is helpful both educationally and professionally because it serves as fantastic preparation for both classes to come and my goal of attaining a PhD. My work delves into a branch of mathematics called real analysis, which is really the next transitional step for a math student after calculus, and teaches how actual mathematicians approach problems through techniques in proof and application.



Ajit Deshpande
La Grange, KY (Oldham County)

Dear Mr. Gatton,

My name is Ajit Deshpande, and I want to sincerely thank you for all you have done for us here at the Academy. I am originally from Wisconsin, but two years ago I moved to La Grange, Kentucky. I am the eldest son of a first generation Asian family. My parents met in college at Western Michigan. My dad is from India and my mom is from Malaysia. They chose to stay in the United States because they valued the education and opportunities they felt America gives. I believe that the best part of the experience the Academy offers is the unique opportunities that are not available in traditional school settings.

One of the biggest opportunities is the ability to conduct research. My favorite subject is biology, but in my previous schools, the only way to learn biology was take one or two classes. At the Academy, I have been fortunate enough to be involved in biology research, first with the Genome Discovery and Exploration Program, and now with summer research working in plant biotechnology under the mentorship of Dr. Shivendra Sahi. I have achieved accomplishments this year that two years ago would have astounded me. I have discovered my own virus, I have been a co-author on a scientific publication, and I have a summer job synthesizing nanoparticles.

My long term goal is to be a doctor, but whether I will be in a clinic half a world away or in a hospital in a major city, I'm not sure yet. All I know is that as long as I am helping others live better lives, I am doing something positive with my own, and my time at the Gatton Academy has given me a great start towards this path.

Sincerely,

Ajit Deshpande

Getting to Know Ajit

Talking with my friends, I realize how fortunate I am to be able to do research over the summer. While others are working at fast food restaurants or sitting at home playing videogames, I get to work in an amazing environment learning new things every day.

My first day at the Academy was a blur of introductions, orientation lectures, and changes in perspective. I was surrounded by my talented classmates, who not only were smart, but also active, social, and friendly. Now, after a year at the Academy, I feel changed.

My research is something that I hope will set me apart in college applications. I also will apply to several competitions and participate in conferences to share my research findings. Hopefully this will lead to scholarships in the future.

Research Topic: Comparison of Antimicrobial Properties between Biologically and Chemically Synthesized Silver Nanoparticles

Research Area: Biology

Research Location: WKU Department of Biology

Research Mentor: Dr. Shivendra Sahi

Career Goal: Doctor

Home High School: Oldham County High School



I want to become a surgeon, but before I settle down, I want to travel to an underdeveloped area of the world and work at a free clinic for a few years. I feel that I've been given the opportunity to pursue my dreams at an accelerated pace, and I want to invest that time into something worthwhile.



Research for me is a different way to learn. Rather than simply reading about a biological process, I can discover the mechanics behind the process by performing experiments that include it. It then becomes more than a memorized fact, but a lived experience.



Samantha Dinga
La Grange, KY (Oldham County)

Dear Mr. Gatton,

Hi, my name is Samantha Dinga, and I'd like to thank you for giving me the opportunity to do research this summer. I'm from Oldham County, and my sending school was more than ten times the size of the Academy, so coming here was a bit of a change. But, I really didn't mind it once I met all of the people here. In my free time, I typically read, go on the Internet, sing, and hang out with my friends. Often times at the Academy, we spend a lot of our free time de-stressing by playing cards, video games, or chess, and by watching movies. I'm so glad that I've gained all of these new friends here at school, because they're more like one big family than anything else, and it's great to have this big extended family who you know will always be there to help you out.

I focus on biology in school, but another one of my passions is psychology, so I'm excited that I got to do this research. My internship is all about babies and how they think. We're looking at facial processing and word-object pairing, and it's given me a good insight as to how people young and old process the world around them. I'm excited to get to use eye-tracking software by the end of the summer, and I hope that this lab experience, along with my Genome lab experience, will help me get into good programs for medical school and that I will be able to continue doing things like this when I get older.

Thank you,

Samantha Dinga

Getting to Know Samantha

Before coming to the Academy, I didn't see my future in Kentucky. But now, I see that the state has hope and that people here can really make a difference in the world, no matter where they come from. It's all a matter of if you put your mind to it.

Out of everything here, I definitely love the people in the Academy the most. From the new "family" I've made with my friends to the RCs and Staff, everyone is amazing.

My favorite Gatton Academy memories are the days when no one had any big tests coming up, and we could all sit around stress-free playing cards and joking with each other.

One thing that I'm most proud of that I've achieved while being at the Academy is being admitted into MENSA, thanks to the test that was offered to Academy students.

I know a lot of high school students who wouldn't think of getting up early every morning of their summer to go and do science, but I really enjoy it.

Research Topic: The Effect of Inversion on Adult Attention Disengagement from Faces

Research Area: Psychology

Research Location: University of Louisville's Infant Cognition Laboratory

Research Mentor: Dr. Cara Cashon

Career Goal: Doctor, Neurologist or Oncologist

Home High School: Oldham County High School



The research experience I'm most looking forward to this summer is when I am fully able to work the eye-tracking equipment and can run tests by myself. The coolest things about summer research is getting to learn more about how the brain works, and getting to do it with fun lab mates.



Research means an opportunity to learn something that no one has ever learned about before and to be able to share that with the world.



Ethan Gill
Bowling Green, KY (Warren County)

Dear Mr. Gatton,

I hope you know what you're responsible for! Since last fall, I've earned over 30 hours of college credit, maintained a GPA over 3.9, and presented research multiple times. I could have never imagined the many opportunities I have been granted through the Gatton Academy, and I sincerely thank you for making them possible.

I've lived in Bowling Green since middle school, so I naturally became interested in Gatton in 9th grade because of its many learning experiences unavailable at any other high school. Gatton, to me, seemed like a dream school, and I eagerly applied when applications opened for the class of 2014. Through luck (or possibly fate), I was accepted from the waitlist before my Junior year began. Over the first few weeks in the Academy, I became acclimated to the college life. I greatly enjoy running and exercising, as well as reading and games, so I quickly fit in with many other students who shared these hobbies. My biggest career interest is programming, and I plan to major in Computer Science before working for a company whose technology I use daily. A main goal of mine is to create software that is used by millions around the world.

This summer, I am working with Dr. James Gary at WKU for 8 weeks to research how to easily control 3-D graphics on smartphones and tablets. Through this project, I will gain a plethora of experience in programming languages I would have never had access to if not for your generous gift. At the end of the project, I plan to release my work as an open-source application programming interface for other programmers to use, greatly multiplying my career portfolio. I thank you from the bottom of my heart for making this possible.

Sincerely,

Ethan Gill

Getting to Know Ethan

The biggest change I've experienced since coming to Gatton is a shift in responsibility.

It's up to me to make sure I'm getting up and going to class, eating healthily, and exercising. Gatton has helped me become a much better person.

I plan to submit my research to the Intel Science Talent Search, Dept. of Defense S.M.A.R.T. Scholarship, and Siemens Competition, as well as any other competitions with a focus on computer science. I also intend to use this research on my resume. I applied to Apple Corporation's Worldwide Developers Conference 2013 and was accepted, in large part due to mentioning this experience in the application.

In 10 years, I see myself working for a company where I can impact millions of people's lives through useful technology. This could be a large company, such as Apple, or a startup founded by me or someone else, but I am confident that my work will be meaningful in other people's lives.

The coolest thing about summer research is the amount of knowledge I'll learn in just 8 weeks!

Research Topic: 3-D Objects on iPhone and Android using OpenGL ES 2.0

Research Area: Computer Science/Graphics

Research Location: WKU. Department of Computer Science

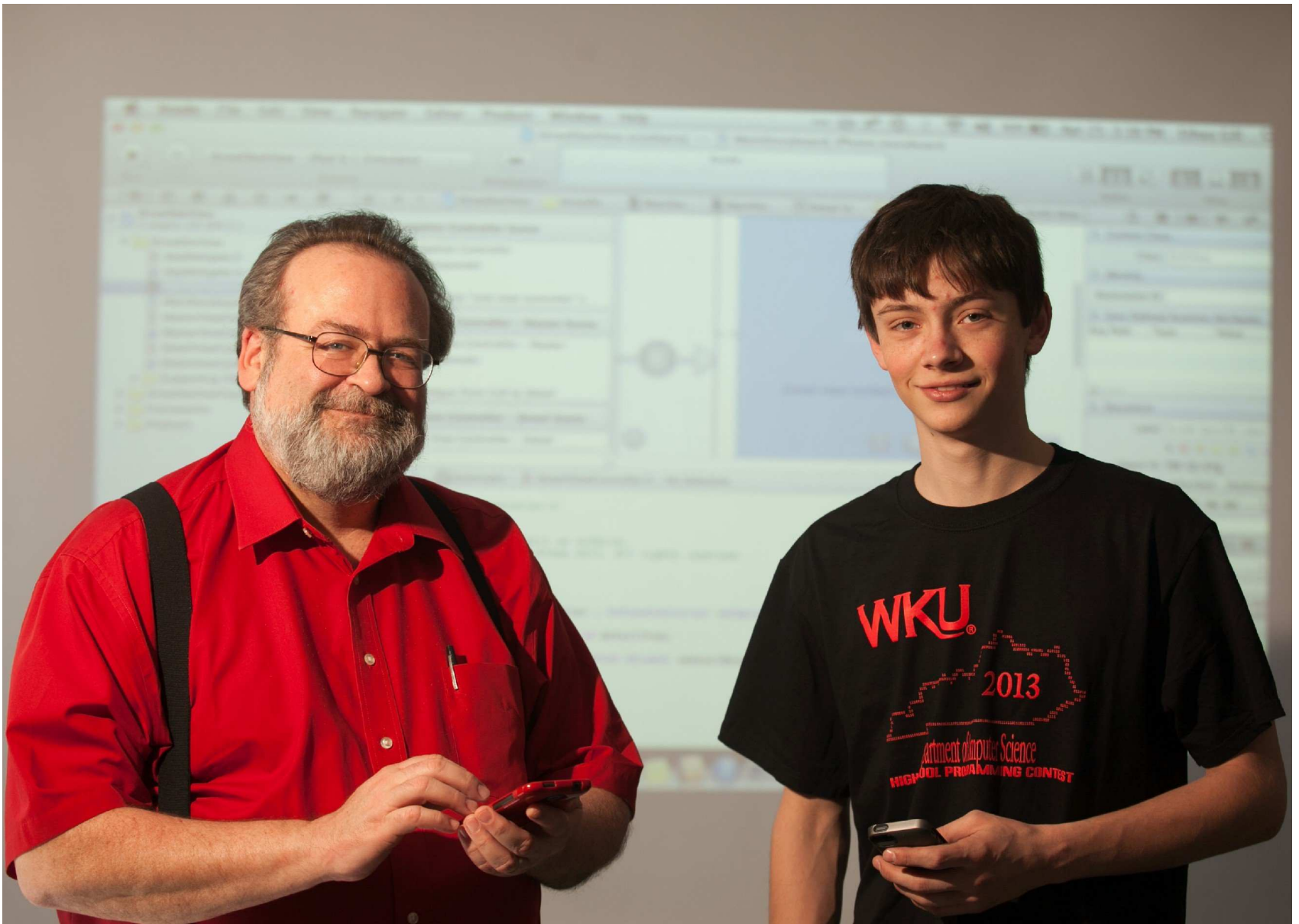
Research Mentor: Dr. James Gary

Career Goal: Computer Science Major/Computer Engineer

Home High School: South Warren High School



This project will help me achieve my life goals by giving me an opportunity to learn about fundamental features in iOS and Android. If my work is published, others will use it, creating a name for me in the developer community.



About a week into my research this summer, my computer crashed, forcing me to replicate my work from scratch. This taught me to always keep backups of everything, but it also ironically helped me to work more efficiently; since I had to redo previous work, I became more familiar with the programs I had to use.



Hannah Graff
Alexandria, KY (Campbell County)

Dear Mr. Gatton,

My name is Hannah Graff, and I am from Alexandria, Kentucky. Before Gatton, I was homeschooled for most of my academic career. Homeschooling was the best option for me then, but once I found out about the Academy, it became clearly evident that Gatton would be where I could expand my knowledge the most and mold into the person I was destined to be. Gatton has opened so many new and exciting opportunities for me. I had never imagined I would be participating in research at my age. Honestly, I didn't even really know what research was, but after researching bacteriophage with the Genome Discovery Exploration Program and researching *Heliconia* plants and leatherback turtles in Costa Rica, I have gained many valuable skills that I will be able to use now and later on.

In the future I hope to become a pediatric surgeon, and Gatton has allowed me to focus in on my goals. Everything that I have done and will do at Gatton is paving the way to reaching my dreams. I want to make a difference in this world, and I thank you for allowing Gatton to make a difference in my world. I would not be the same person if it were not for the wonderful opportunities you have provided for me. This summer, I am researching the spread of cancer. Thank you so much for this and all of the opportunities that you have given to me, previous students, and all of the future students.

Sincerely,

Hannah Graff

Getting to Know Hannah

Research means that I can further expand my knowledge while my brain is like a sponge. By researching now, I am able to continuously grow in my knowledge and create my own ideas. It is very important that young students, especially those interested in STEM, be challenged to think of new and innovative ideas so that we can implement those now and in the future.

I love the community at the Academy. Gatton is a place where you can be yourself and not have to worry about people judging you. Everyone at the Academy has common goals and motivation and this helps to make an extremely strong bond between us.

My mentor told me that everyone has their own techniques and little ways of performing various procedures, and, while she could tell me the exact way that it “should” be done, she will only tell me what she does, but in order for good science to happen, I have to perform the procedures the way that is most comfortable to me.

I aspire to become a pediatric surgeon and change lives. I really hope to go work with Doctors Without Borders so that I can help people all over the world.

Research Topic: The Effects of Receptor Status on Protein Expression in Metastatic Breast Cancer Cells

Research Area: Biology

Research Location: Wood Hudson Cancer Research Laboratory

Research Mentor: Dr. Heather Christensen

Career Goal: Pediatric Surgeon

Home High School: Homeschool



What I am looking forward to most about my second year at the Academy is further immersing myself in new knowledge, further strengthening the relationships I have made, and further developing myself and my ideas.



This summer, I have the opportunity to change lives. Cancer research has the potential to make medical breakthroughs. The fact that I am able to help with this research allows me to start making an impact at an early stage in my life.



Isaac Kresse
Louisville, KY (Jefferson County)

Dear Mr. Gatton,

I believe that the Academy's purpose is to provide opportunities that would not otherwise be available to its students. Though I came from a good school with many academic opportunities, DuPont Manual High School, I have found the Gatton Academy to offer opportunities that are available nowhere else.

The Gatton Academy allows its students to pursue their areas of interests as far as their abilities will let them. This past semester, I took Quantitative Analysis and by the end of my time at the Academy I hope to be well on my way towards a degree in Chemistry. This summer I am working on designing and creating a photocatalytic reactor which could be used to monitor the degradation of harmful pollutants in wastewater. Even non-academic opportunities, like the badminton class that I took, aren't available at my home school.

One of the aspects that I value the most about the Academy is the community that it creates. Due to its rigorous nature and the STEM-focused opportunities that it offers, the Academy's students tend to be like-minded. A community of intellectually driven people is formed, where our shared passions strengthen our bonds. I remember on my first visit to the Academy, I met some students and when talking to them I felt as if I had known them for years. This community is something I could not have found anywhere else.

Mr. Gatton, the opportunities that have been given to my friends and me are all due to you. Thank you for giving us these opportunities.

Sincerely,

Isaac Kresse

Getting to Know Isaac

On my first day at Gatton, I'll admit I was nervous. I was apprehensive about starting my academic career at the highest rated high school in the nation. Now, I feel truly at home in the Academy. I feel a part of a community unlike any I had back home.

The Gatton Academy takes students who enjoy being intellectually stimulated and who share a curiosity about the world around them and puts them in an environment where they have the opportunity to pursue their interests and further themselves intellectually. The community that is formed by these people coming together is what I treasure the most about the Academy.

When working to design a photocatalytic reactor, I need to exercise my creativity. This is something that I often struggle with, so designing instrumentation is difficult for me.

The lab that I am working in is a physical chemistry lab. It will give me experience working in a lab, which will likely help me earn more lab positions in the future.

Research Topic: A Photocatalytic Reactor for Use with Raman Spectroscopy to Analyze Photocatalytic Degradation of Iodinated X-ray Contrast Media

Research Area: Physical Chemistry

Research Location: WKU Department of Chemistry

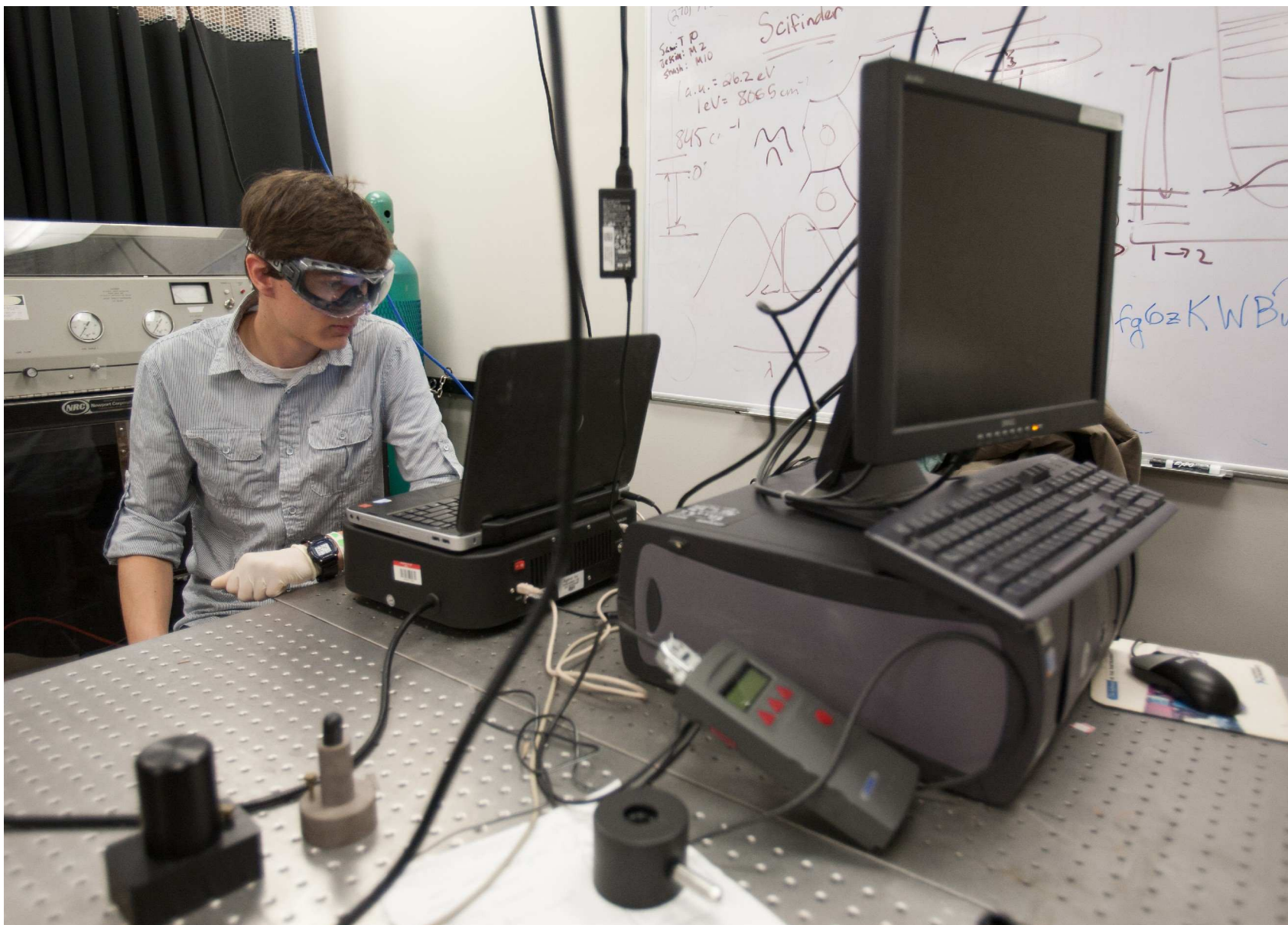
Research Mentor: Dr. Matthew Nee

Career Goal: Research position and possibly a collegiate teaching position in chemistry and perhaps environmental chemistry.

Home High School: DuPont Manual High School



When discussing chemical spills, my mentor says, "If something goes wrong, hear my voice in your head: 'Get naked.'" Dr. Nee also says, "If you start to smell searing flesh, turn off the laser."



Until you begin research, everything you learn in school was discovered by someone else. You don't truly learn anything completely new. Research gives you the opportunity to learn something that no one else has done before. No matter how small the discovery, you are its discoverer.



Nitin Krishna
Corbin, KY (Knox County)

Dear Mr. Gatton,

First and foremost, on behalf of all recipients of the Gatton Academy Research Internship Grant, past and present, I would like to thank you for your endowment to support advancements in the STEM disciplines. Your support is one of the many characteristics of the Academy that students and alumni have thrived on to make their experiences here more enjoyable and productive. As for me, a 16-year-old from small-town Corbin, Kentucky, I am using my award to fund a 7-week long mathematics research project titled “A Mathematical Model for the Interaction of the Proteins MMPs, TIMPs, and ECM in a Wound.” This project aims to model specific proteins and cells in a diabetic foot ulcer to predict healing responses of specific patients, ultimately to optimize treatment strategies.

Before coming to the Academy, I was afraid that a traditional school setting would make me fall behind. At the research fair during orientation week, I was introduced to the concept of high school students and undergraduates making significant advances in their fields of interest. Soon, I was immersed in a world where I could finally apply my math and computer science knowledge to the extent of saving lives. A research opportunity like this would have never come at Corbin High School, and now I know that a Ph.D. in Applied Mathematics is the right route for me. Mr. Gatton, I can assure you that your philanthropy is for a fruitful endeavor and once again reminds us why your namesake school is America’s top public high school.

Thank you,

Nitin Krishna

Getting to Know Nitin

My first day at the Gatton Academy was one marked by trepidation and yet a small bit of excitement. I honestly didn't know what to expect in the next several months. Now, I am a completely different person, one influenced – directly and indirectly – by supportive classmates, friendly staff, and inspiring teachers.

Since I have been at the Gatton Academy, I have learned to be more open-minded to people's thoughts and opinions. Before coming to the Academy, I was not always appreciative of what other people had to say, but since then I have come a long way. I have come to realize that the best way to understand something is to see it from multiple viewpoints.

This fall, I look forward to meeting over 70 unfamiliar people eager to take on the Gatton Academy challenge.

It is an amusing thought of going from feelings of apprehension with my research to presenting my work at a national conference a few months later.

Research Topic: A Mathematical Model for the Interaction of the Proteins MMPs, TIMPs, and ECM in a Wound

Research Area: Mathematics

Research Location: WKU Department of Mathematics

Research Mentor: Dr. Richard Schugart

Career Goal: Ph.D. in Mathematics

Home High School: Corbin High School



Mathematics has always been my favorite subject, and practically applying it to something that could be helpful in the medical field is an exciting feeling. I hope to use the skills I am garnering through research at the Gatton Academy in my pursuit for a doctorate in mathematics.



Quantifying Parameters in a Mathematical Model on the Interaction of Matrix Metalloproteinases and Their Inhibitors in a Wound

Nitin Krishna¹, Hannah Pennington¹, Dr. Richard Schugart²
¹Gatton Academy of Mathematics and Science in Kentucky, Western Kentucky University
²Department of Mathematics, Western Kentucky University



Abstract

For this research, we aim to quantify parameters for a mathematical model describing interactions among proteins in a diabetic wound, including matrix metalloproteinases (MMPs) and their inhibitors (TIMPs), the extracellular matrix (ECM), and fibroblasts in a diabetic wound. By comparing the data taken from Muller *et al.*, we created a functional which minimizes the sum of the squares of the error. Using MATLAB's "globalsearch" and "fmincon" functions, we minimized the functional by selecting an initial set of parameter values and having MATLAB identify a local minimum value. MATLAB's "globalsearch" algorithmically selected additional parameter values and either identified a local minimum for the selection or tested another set of parameter values if the results were not improved with the selection. The smallest of the local minimum values was used to identify the optimal parameter values. A sensitivity analysis was then conducted to measure to what degree the equations were affected by slight changes in the model. The sensitivity analysis aided in identifying the effect of a particular treatment on each of the considered protein levels.

Introduction

The focus of this research is on the healing process of a diabetic foot ulcer and how levels of these proteins can predict healing responses. Data was taken from a study from Muller *et al.* (2007). This study concentrated on levels of MMPs and TIMPs and their interactions in a diabetic healing. Concentrations of MMPs and TIMPs in the study were determined through a collection of wound fluid from ulcers of 16 patients at regular intervals over a 12-week period. ECM levels can be used as an indicator of how well a patient's wound is healing. ECM levels are responsible for the synthesis of the ECM, and the degradation of ECM is a sign of measuring the healing progress. Data were divided into two groups: good healers, defined by a reduction of at least 52% in the wound area, and poor healers, defined by less than 52% decrease in the wound area. The two sets of data were then modeled and compared.

Materials and Methods

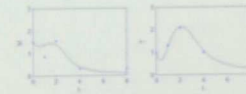
Good and bad healers' protein levels were modeled using a system of four differential equations. The protein levels were nondimensionalized. MMPs, TIMPs, ECM, and fibroblasts were modeled using a system of four differential equations. MATLAB was used to numerically solve for the parameters. The optimization toolbox feature in MATLAB was used to define the objective function, the differences between modeled solutions and experimental data, and to constrain the parameters to be between 0 and 200, creating a global search space. For each parameter, a range of values was given, and MATLAB was used to search for the best values and tested to see if a local minimum was found. The global search algorithm was used to find the best values.

Equations

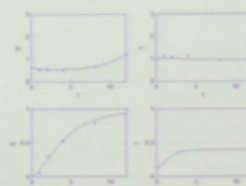
$$\begin{aligned} \text{(MMP)} \quad \frac{dM}{dt} &= \frac{k_1 M^n f}{k_2^n + M^n} - k_3 M - k_4 M T \\ \text{(TIMP)} \quad \frac{dT}{dt} &= \frac{k_5 T^n f M}{k_6^n + T^n} - k_7 T - k_4 M T \\ \text{(ECM)} \quad \frac{dE}{dt} &= k_8 f(1 - E) - k_9 M E - k_{10} E \\ \text{(Fibroblast)} \quad \frac{df}{dt} &= k_{11} f(1 - f) - k_{12} f \end{aligned}$$

*Note: Analysis in previous research showed the value of n to be 1.

Results and Analysis



*Modelled graphs for good healers. From the upper left, clockwise, are graphs for MMPs, TIMPs, Fibroblasts, and ECM levels.



*Modelled graphs for bad healers.

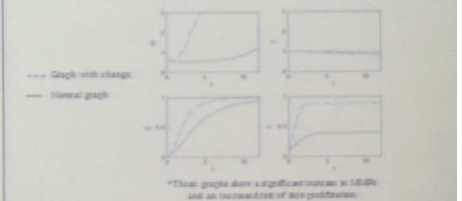
Parameter	Good Healers	Bad Healers
k_1	21.718	1.997
k_2	3.813	0.828
k_3	0.062	0.028
k_4	0.452	0.009
k_5	0.728	20.841
k_6	0.027	18.973
k_7	1.011	0.002
k_8	1.282	0.489
k_9	0.240	0.182
k_{10}	0.313	0.002
k_{11}	0.489	0.029
k_{12}	0.987	1.927

Sensitivity analysis results

Good Healers			Bad Healers		
Parameter	Factor	Sum of Errors	Parameter	Factor	Sum
k_1	5	4255.542	k_1	5	29
	0.1	42.717		k_1	0.1
k_2	5	6.486	k_2		5
	0.1	281.282		k_2	0.1
k_3	5	18.970	k_3		5
	0.1	750.582		k_3	0.1
k_4	5	47.389	k_4		5
	0.1	2018.207		k_4	0.1
k_5	5	124.827	k_5		5
	0.1	2129.217		k_5	0.1
k_6	5	3.056	k_6		5
	0.1	0.021		k_6	0.1
k_7	5	642.170	k_7		5
	0.1	41.146		k_7	0.1
k_8	5	9.939	k_8		5
	0.1	27.286		k_8	0.1
k_9	5	10.022	k_9		5
	0.1	5.491		k_9	0.1
k_{10}	5	2.175	k_{10}		5
	0.1	0.246		k_{10}	0.1
k_{11}	5	20.546	k_{11}		5
	0.1	102.216		k_{11}	0.1
k_{12}	5	12.283	k_{12}		5
	0.1	6.480		k_{12}	0.1

*Factor indicates by how much the parameter was multiplied by. Sum of errors gives numerical measure of how the model with the new parameter fits the model with normal parameters. Generally, the smaller the sum of errors, the better the model fits the data.

The sensitivity analysis can also give us theoretical results. For example, in one of the k_1 factor was multiplied by 0.1, levels of MMPs increased, and levels of ECM factor than before. This interpretation could lead to potential medicinal options: treatment can manipulate the k_1 factor, bad healers could receive better treatment.



*These graphs show a significant increase in MMPs and an increase in ECM production.

Conclusion

Using MATLAB, we have established a mathematical model for interactions among MMPs and fibroblasts in a diabetic foot ulcer. Although there could be more accurate (smaller J -value), our algorithm found better J -values than other methods did. The sensitivity analysis allowed us to see biological implications of change parameter. We can see the effects on certain protein levels and consider potential options based on these results.

Further Research

Because the fibroblast equation is almost completely decoupled from the other solving for f with elementary methods like separation of variables and partial decomposition and substitution into the other equations would theoretically be

Research is my way of feeling satisfied with what I learn and accomplish in math. It is an amazing feeling to use the tools taught in the classroom and apply them to a useful project. Going to conferences allows me to see the endless possibilities with not only applied mathematics, but also the human mind.



Suhaib Mahmood
Crestwood, KY (Oldham County)

Dear Mr. Gatton,

I only moved to the state of Kentucky a little over a year and a half ago. I did not even know what the Gatton Academy was up until a few days before the application was due! When I learned about it, I figured I may as well apply to the school for it could not hurt. I did not get accepted with the rest of the class of 2014. This led me to make the decision to graduate from high school a year in advance. Consequently, I was almost a second semester senior when Dr. Tim Gott informed me of an available spot for the current junior class.

I was torn. If I accepted the invitation, I would have to relinquish not only my status as top in the class of 2013, but the six AP classes I was enrolled in and the semester's worth of work I had finished. I realized the opportunity I was being offered was a once-in-a-lifetime chance, and so I decided to take it. I have been at the Academy for only a semester, but I love it more than words can express. The environment is wonderful, from both a social and educational aspect. We are provided with opportunities, such as the research we are doing right now, that we would be oblivious of in regular high school. My research is focused on finding a way to improve chemotherapy treatment, a project that I deemed an impossible goal before graduate school. The academic rigor of a college campus is also incomparable to previous studies, and the motivation from administration and like-minded peers is an unprecedented luxury. This has proven to be a decision that I will never regret, and I thank you for the wonderful opportunity you have helped provide for the students of the state of Kentucky.

Sincerely,

Muhammad Suhail Mahmood

Getting to Know Suhailb

The Gatton Academy is a wonderful program, but my favorite aspect about it is the college experience it emulates. The students have the opportunity to conduct research like undergraduate students and we take classes alongside other college students. The Academy serves as a supervised transition into the real world, an opportunity few others are ever presented.

There are two decades of research already conducted in my field of study. The literature already published in the study of platinum drugs is vast and detailed. Learning the necessary background in order to understand what my research entailed was definitely the biggest challenge I had to overcome in order to conduct my research.

I anticipate specializing in the medical field in addition to acquiring a major in Chemistry. The study of platinum drugs from a chemical perspective intended to increase the understanding of the interactions between cancer afflicted cells and drugs used for treatment is an introduction to both fields.

Research Topic: The Unorthodox Effects of Various N-heterocyclic Ligands on the Reaction Rates of Chemotherapeutic Platinum Analogs with 5' Guanosine Monophosphate and N-acetyl Methionine

Research Area: Chemistry

Research Location: WKU Department of Chemistry

Research Mentor: Dr. Kevin Williams

Career Goal: Neurologist

Home High School: South Oldham High School



I plan to use my research experience to construct an application for the national Siemens Competition. In addition, it will provide me with more opportunities as there are many research internships that prefer, or even require, past research experience.



Research is the gateway to many possibilities for it gives me a glimpse at what a career in my field of interest entails. Not only is it a wonderful introductory experience, but it also makes it easier to determine which field of study an individual is compatible, or incompatible, with.



Logan Mitchell
Hebron, KY (Boone County)

Dear Mr. Gatton,

The first time that I heard of the Gatton Academy was from my home high school's principal my freshman year. He sent out emails to those that he believed were qualified to attend the Academy, myself included. I then attended the Gatton Academy regional admission event at NKU, where I learned what the Academy was all about, and I instantly loved the idea. What initially interested me was the way that high school students could take college classes with people exactly like them; I just couldn't believe that such a fantastic idea was real!

For me, another great thing about the Academy was the coursework. I am unsure what I want to do for a living, even now, but I know that it is in the Environmental Sciences. What is great about the Academy is that this next year will allow me to take courses across the expansive environmental science fields to determine which one is for me. I also am taking numerous Chinese language classes while at the Academy, and I have sprouted a love for the language.

I would like to thank you for all that you've done to create this grand Academy. I know that without your funding, this project could never have taken root. Additionally, I wouldn't be able to take Chinese, take other advanced courses, and I could never have found such social interaction with like-minded peers. For all of these reasons, and countless more, I thank you for improving my life.

Sincerely Yours,

Logan Mitchell

Getting to Know Logan

The thing I look forward to most about my second year is that I will be able to take classes in the fields that interest me. I plan on taking classes in Astronomy, Geology, and Meteorology so I can get a feeling for which science better fits me for a career. I also look forward to meeting a new class of juniors!

In the next 10 years, I plan on attending a university in pursuit of a doctorate degree after I determine the science that is right for me. I then hope to find a well-paying job in that field and search for a soul mate, in hopes of starting a new family and raising children.

The part of my summer experience that I most enjoy is working in Crumps Cave. Like most other local caves, its temperature is always about 54^o F to 57^o F, so I remain nice and cool during the hot summer months. Crumps Cave also has many medium-sized rocks that dot the cave floor, making it fun and slightly challenging to traverse.

Research Topic: A Hydrologic Budget of Crumps Cave

Research Area: Hydrology

Research Location: WKU Hoffman Environmental Research Institute

Research Mentor: Dr. Chris Groves

Career Goal: Environmental Science

Home High School: Conner High School



What I love the most about the Gatton Academy is how I get to live among like-minded peers. At my home high school, I felt that I was surrounded by people who lacked my same motivation to learn, but at the Academy, everyone has the same academic drive that I have.



To me, STEM research means changing the world for the better. I hope to have findings that can be applied to the entire Pennyroyal Plateau geological region of Kentucky. This would help government organizations find a balance between environmental, social, economic, and political concerns so that they can best serve the region.



Hannah Rodgers
Verona, KY (Boone County)

Dear Mr. Gatton,

I want to start out by thanking you for the opportunity you've provided me not just in summer research, but in the Gatton Academy as well. A lot of people don't know this about me, but while I've always wanted to be a doctor, I have an appreciation for theatre and once planned on being an actor. Theatre rehearsals overlapped with Cross Country season, and in a conversation with one of my most trusted mentors, my coach, I mentioned this new passion. I'll never forget his response. After a chuckle for a good minute or two, he looked at me and said, "Hannah, honey, don't be an actor. You're too smart for that. The world needs your brain for something useful! And who knows, you might save my life one day..." This conversation sticks for a number of reasons, the main one being it was one of our last. Just concluding the season in December of 2011, my coach was diagnosed with a brain tumor. He died just three days later, and I had missed my chance. I decided then to apply to the Academy, unable to let another life slip through my fingers.

Being accepted into the Gatton Academy has been the most positive thing to happen in my educational career. At my old school, I would be asked, "Why?" Here, I am asked, "Why not?" Even when I say something seemingly insane, like "I want to change the world," there is someone behind me saying, "I know you can." I do research with nanoparticles, something now being explored in cancer treatment, and something I would have only imagined. I am now one step closer to my dream of curing cancer. Thank you for giving me the chance to make something constructive out of my grief. It is so much easier to heal when you work to heal others at the same time.

Sincerely,

Hannah Rodgers

Getting to Know Hannah

The Gatton Academy provides a chance for Kentucky students to excel beyond what their current situation would allow. They go out, achieve their dreams, and reach their potential. With this system, students will return to this state to give back and help train the next generation of achievers.

In the coming years, I hope to have graduated from medical school and began my journeys as a travelling doctor. It's my goal to travel around the world to study and practice medicine.

One day, it would be great to be on the cover of Time Magazine as a winner of the Nobel Prize for Medicine who travels to provide healthcare to those who would otherwise be left neglected.

The coolest thing about summer research is the independence I have in both my research and residential life.

Research Topic: Single Step Antibiotic Mediated Synthesis of Gold Nanoparticles with Potent Antimicrobial Activity

Research Area: Chemistry

Research Location: WKU Department of Chemistry

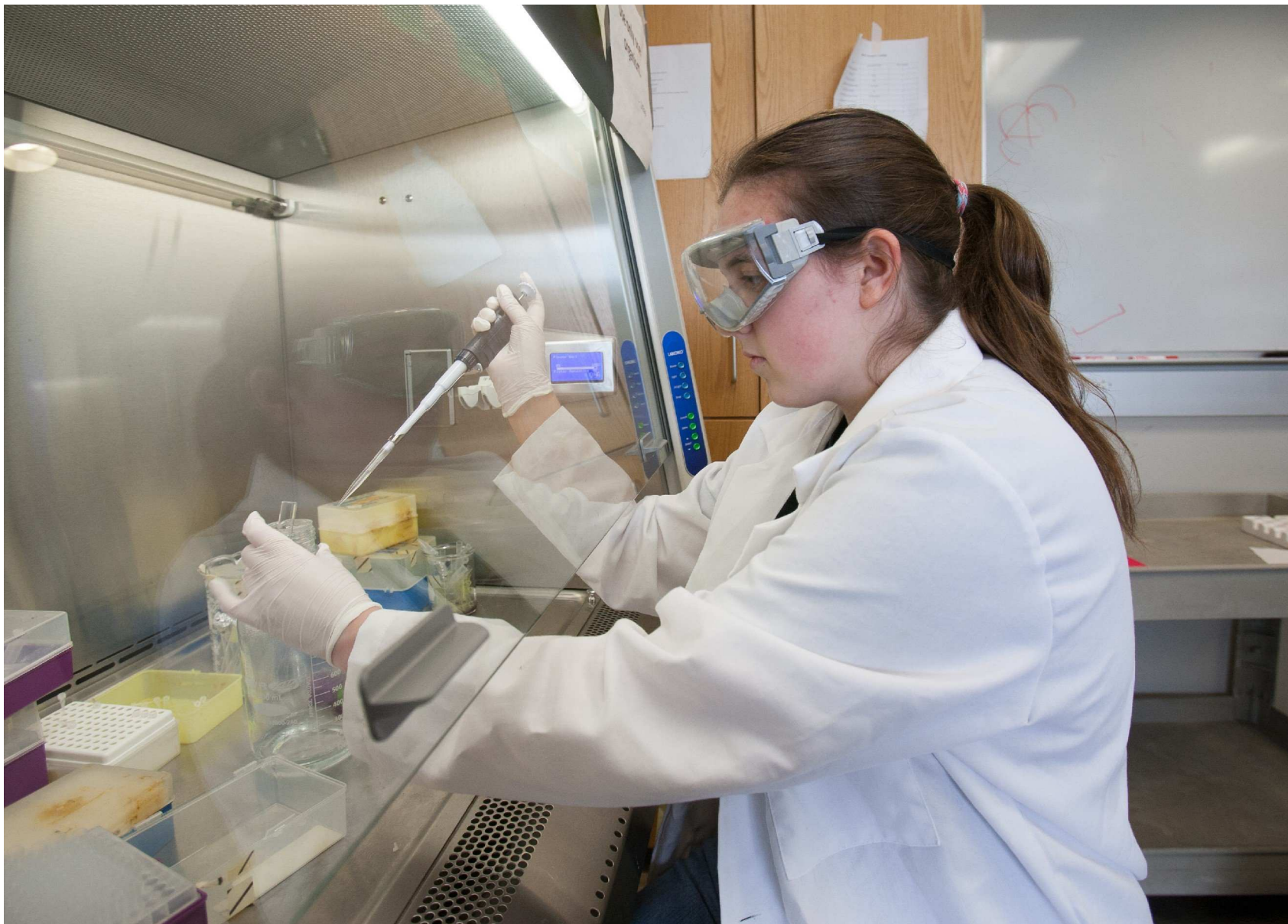
Research Mentor: Dr. Rajalingam Dakshinamurthy

Career Goal: M.D./Ph.D.

Home High School: Walton-Verona High School



I am blessed to have been placed in a research lab, doing work that I wish to continue as a career. My research experience this summer is giving me the skills I need to be prepared for my future as a medical researcher.



Coming to the Academy has ultimately put me in charge of my future. Here at Gatton, I've never heard, "That's impossible," no matter how true it may seem. This is the first time that I've really felt empowered to pursue my goals and assured that I could go as far as I wished.



Vishnu Tirumala
Corbin, KY (Laurel County)

Dear Mr. Gatton,

My name is Vishnu Tirumala, and I just finished my junior year at the Gatton Academy. I'm from Corbin, Kentucky. My small town is known for being the location where Colonel Sanders discovered the recipe to his famous Kentucky Fried Chicken. We're about an hour away from Lexington and an hour away from Knoxville. I was born in New Brunswick, New Jersey but moved here in the 7th Grade. About two and half years later, I first heard about the Gatton Academy. I visited the website and was immediately interested in the Academy. My parents weren't so sure, but after attending a preview weekend everyone was on board. Several long months later I was ecstatic to learn that I would be attending America's Number One Public High School in the fall.

When I was young, I dreamed of being a paleontologist. Later I considered being an engineer, like my father. Finally, about five years ago, I decided that being a doctor was what truly interested me. I discovered this by shadowing some local physicians and seeing the difference they made in their patients' lives. Thus, eager to get started in Biology, I participated in the Genome Discovery and Exploration Program (GDEP) where I learned the basic skills necessary to work in a lab. I would come in almost daily, often staying long hours. Now, working in another lab over the summer, I've come to appreciate the hard work I put in in GDEP. I'm currently working with mismatch repair in DNA at the University of Kentucky's College of Pharmacy.

Since my arrival at Gatton, I've learned a lot of things. Alongside the academic knowledge, I've also gained a better understanding of myself. I've formed great friendships and am part of an amazing community. Thank you for all that you've done for me and my peers, Mr. Gatton. I genuinely appreciate it.

Sincerely,

Vishnu Tirumala

Getting to Know Vishnu

Over the past year, I've become a lot more efficient with my work. I'm able to do a lot more in a lot less time while sacrificing less in terms of quality.

I plan on doing research for the majority of my undergraduate years, and the RIG is a great way for me to get comfortable with doing research for long periods of time. I also plan on becoming a medical doctor so it's necessary for me to understand the science behind the medicine I use, which a lab experience provides.

In the next 10 years, I hope to become a fully practicing clinical doctor. I'd also like to partake in public policy regarding healthcare.

The coolest thing about summer research is working with state-of-the-art equipment in a real laboratory setting. I've learned about how your body reacts to DNA mismatches and PCNA, but I've learned even more about how an actual lab works.

Research Topic: Expression and Purification of PCNA Isoforms to Study Protein-protein Interactions

Research Area: Biology

Research Location: University of Kentucky's Markey Cancer Center

Research Mentor: Dr. Guo-Min Li

Career Goal: Medical Doctor

Home High School: Corbin High School



On my first day at Gatton I was nervous, eager, excited and confused. Today, I know a lot more about the opportunities available to me and am confident in being able to get a great education to help the Commonwealth. I'm more comfortable with myself at the Academy and am learning things I couldn't have imagined.



In my opinion, research is the best way for young people to get into a STEM field. While doing research, you gain experience in your field of choice, while learning at the same time. You learn the practicalities of research and learn useful skills that can be applied in other subjects.



Connor VanMeter
Lexington, KY (Fayette County)

Dear Mr. Gatton,

I am a rising senior from Lexington, Kentucky. Up until high school, I was not sure if I wanted to pursue a career in math or science. I spent middle school in an arts program called School for the Creative and Performing Arts. I had a focus on writing and piano. It was in 7th grade when I visited Western Kentucky University for the Duke TIP recognition ceremony that I first heard about the Gatton Academy. That was the moment I first considered going into STEM. The Gatton Academy appealed to me because it was a place where motivated individuals could come together and pursue their interests at an accelerated level.

This summer I am researching gene expression with Dr. Rodney A. King at Western Kentucky University. I am able to do this because of the Research Internship Grant. I will continue researching with Dr. King into my senior year. I will major in biology after graduation and plan to get a Ph.D. in microbial genetics. None of this would be possible without your continued support of the Carol Martin Gatton Academy of Mathematics and Science in Kentucky. In only a year, this place has made a significant impact on me. The impact will continue to show in the years to come.

Sincerely,

Connor VanMeter

Getting to Know Connor

My favorite Gatton Academy memories are how random interactions lead to memorable situations. I know a spontaneous picnic, a video game duel, or a study session is moments away.

I am looking forward to being a Community Developer (CD) during my second year at the Academy. As a CD, I will be an older sibling figure that offers guidance and support as the incoming junior class adjusts to Gatton. I am looking forward to meeting my new floor mates.

The part of my summer experience I enjoy most is the easygoing pace. My focus has shifted from classes and coursework to research. I have found more free time to write and play piano.

The wackiest advice my mentor gave me is "if it looks eukaryotic, throw it out."

Research Topic: Characterization of Put-like Antiterminator Sequences Located in Bacterial Genomes

Research Area: Biology

Research Location: WKU Department of Biology

Research Mentor: Dr. Rodney King

Career Goal: Ph.D. in Microbiology or Genetics; Conduct research in microbial genetics and teach at the university level.

Home High School: Paul Laurence Dunbar High School



In the next 10 years, I want to study abroad in France and complete my Ph.D. The plans are broad because I am leaving room for adventure.



The biggest challenge that I have had to overcome is my clumsiness. When I first started research, a day would not pass by where something went wrong because of being clumsy. Now, I can go a week without breaking glass!



Gretchen Walch
Alexandria, KY (Campbell County)

Dear Mr. Gatton,

After watching my sister attend Gatton, I applied, not simply for the academic challenge, but for the boundless opportunities the Academy has the potential to unlock. I saw through my sister that the Academy offered me the opportunity to travel abroad and conduct research, the opportunity to discover my academic interests and pursue my passion for science. Like many Academy students I have an elaborate dream. I desire to work as a humanitarian to improve medical care in third-world countries, specifically regarding mental and genetic diseases. The Gatton Research Internship Grant has offered students, such as me, the opportunity to work towards their dream. The recipients of this grant are propelled to the cutting edge of their field; here, they enrich their understanding of classroom topics as they explore unknown territory.

During the summer of 2013, I am conducting research at the University of Southern Maine under the mentorship of a welcoming Dr. Clare Bates Congdon. My research is in the field of Bioinformatics, in which I use online databases and computer programs to study a gene. This experience has medical applications to the disease Cystic Fibrosis and thus propels me to the cutting edge of my field of interest.

Experiences like these are not stumbled upon, but rather they are ambitiously sought out and well planned. It is the research experience and the preparation the grant requires, which causes this to be a wonderful learning experience. To prepare for the grant, students write proposals, network with professors, and work out travel and housing plans, as well as calculate expenses for such. You have not only funded research, Mr. Gatton, but you have begun the transformation of students from lab apprentices into lab colleagues. You have encouraged me to be ambitious with my dream, and I can now plan a path towards making it happen. Thank you.

Sincerely,

Gretchen Walch

Getting to Know Gretchen

What I love most about the Academy is Seminar because it encompasses our community and puts it to work. This activity is the kick start to our excitement for research, travel, and classes and it teaches us to use our greatest resource: networking. The Academy staff host Seminar and are the core reason why our dreams become ambitions, which become realities.

Many students watch summer fly by with the freedom of no deadlines or requirements. In contrast, my summer has many due dates. However, in result, my summer researching is opening the doors for more educational opportunities which will lead me to a career I am passionate about.

Learning the skills of traveling on my own here in Maine gives me invaluable experience with the logistics and social skills needed while traveling.

Research Topic: A Bioinformatics Investigation into Candidate Regulatory Elements for the Cystic Fibrosis Transmembrane Conductance Regulator Gene

Research Area: Bioinformatics

Research Location: University of Southern Maine's Department of Computer Science

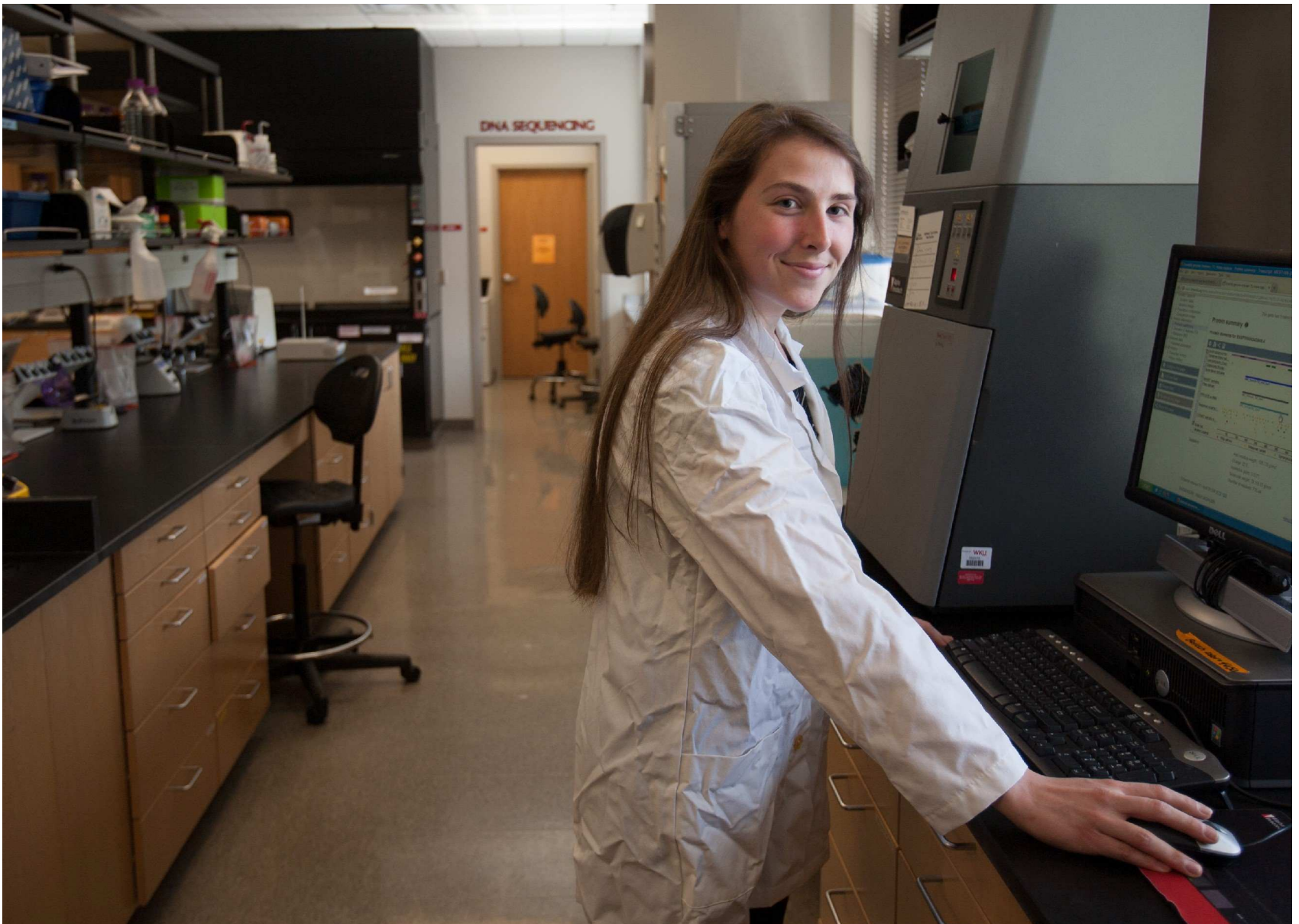
Research Mentor: Dr. Clare Bates Congdon

Career Goal: Medical Humanitarian

Home High School: Campbell County High School



The unknown is what makes an experience exciting. I look forward to the unknowns of this summer whether it is the unplanned trips to the Maine coast, unexpected friendships, research data, or learning new bioinformatics software. In research especially, I hope to be enlightened by new knowledge and come across many challenges throughout the entire summer.



As students learn invaluable study, research, and networking skills, they share this knowledge at home in nearly all of Kentucky's counties. The Academy is educating a generation, and its individual students are cultivating a diversity of cultural and technical experiences which bring a diversity of problem-solving and leadership styles to Kentucky's future leaders.



Kevin Ziegler
Bowling Green, KY (Warren County)

Dear Mr. Gatton,

Biology has always fascinated me since I was a child. One summer in Germany, I remember looking at my grandparent's pond for an hour and seeing boatman, water striders, snails, damselflies, dragonflies, great diving beetles, aquatic larva, newts, frogs with tiny tails, and turtles. I could stay outside for hours looking into that pool of water. Observing all those tiny creatures made me realize that I love biology. I needed to know how they worked; why were they like that? After that summer in Germany, I created two ponds at home in the front yard. Over the past years I have stocked the ponds with diverse plants and organisms. I observed things all I wanted, but I could never get "Science-y" about it.

This is why the Gatton Academy appeals to me so much. I have found a way to become involved in biology much quicker. Here at WKU, there are so many more things to do with biology, mainly researching with a knowledgeable professor/mentor who has gotten me involved in a study. Other exciting opportunities include the Upper Green River Biological Preserve that WKU owns where students can start a research project and the array of upper-level biological classes offered. I want to thank you for giving me the opportunity to further my interest in a field of study I love.

Sincerely,

Kevin Ziegler

Getting to Know Kevin

I love the people at the Gatton Academy the most: the staff, students, and the cleaning ladies. Everyone is so open and receptive to whoever you truly are, and they have awesome personalities.

The biggest challenge I have had to overcome is calling random owners of golf courses and parks asking them if I can swab frogs in their ponds. Such a random question is very hard for a normally shy kid to ask.

The best advice I got from my mentor is, "When you see a frog shine your light right into their eyes until they glow white. Then, pounce."

If I could be on any magazine cover in the future I'd pick National Geographic for conservation work with leatherback turtles, rainforests, coral reefs, or the everglades.

The coolest thing about summer research is catching frogs in the middle of the night.

Research Topic: The Prevalence of Chytrid Fungus in Bullfrog Populations of South Central Kentucky

Research Area: Biology

Research Location: WKU Department of Biology

Research Mentor: Dr. Jarrett Johnson

Career Goal: Ecologist/ Evolutionary Biologist

Home High School: Bowling Green High School



I believe that the research project that I am currently doing represents a lot of what I will be doing when I complete my career training as a biologist. Getting first-hand experience of what my future job will be like is very important to me.



I look forward to the results of the study we are conducting. What we are doing has never been attempted in this region. That novel chance of discovering something that no one knows excites me.



Thank you, Mr. Gatton!



John
Andrew
Cliburn

Kevin

Connor Allen
Gretchen Walch

Quayle

Hannah Graff

Connor VanMeter
Nate Clause

Sahib Mahmood

Sumant Dixit

Justin

Brian

Hamish Polym

Logan Mitchell
Nishan

Tirumala

Emil Chanda

Shawn

Frankie

Tori Buckley

Shan S. Hill

Arjun



