

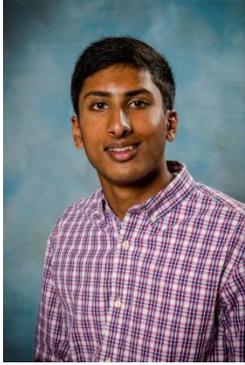
2016 SIEMENS COMPETITION IN MATH, SCIENCE & TECHNOLOGY
National Finalists

INDIVIDUAL WINNERS:

- Vineet Edupuganti -- Senior, Oregon Episcopal School in Portland, OR, resides in Portland
Project: "Development of a High-Performance Biodegradable Battery for Transient Electronics"
- Blake Hord – Senior from Dobbs Ferry High School in Dobbs Ferry, NY, resides in Dobbs Ferry
Project: "High Mass Planet Spiral Shocks as a Source of Infrared Emission in Protoplanetary Disks"
- Prateek Kalakuntla -- Senior from Texas Academy of Math and Science in Denton, TX, resides in Plano
Project: "Luminescent Heavy Metal Sensors"
- Alexander Kirov -- Senior from Greenbrier High School in Evans, GA, resides in Evans
Project: "Exosomes in Amyloid Aggregates Promote Neuronal Damage: A Mechanism of Alzheimer's Pathology"
- Manan Shah -- Senior from Harker Upper School in San Jose, CA, resides in Los Altos
Project: "Deep Learning Assessment of Tumor Proliferation in Histopathological Images for Categorical and Molecular Breast Cancer Severity and Diagnosis"
- Pranav Sivakumar -- Senior from the Illinois Mathematics and Science Academy in Aurora, IL, resides in Tower Lakes
Project: "Searches for Almost Dark Galaxies in Blank Sky Fields with the Sloan Digital Sky Survey"

TEAM WINNERS:

- Adhya Beesam -- Junior at Plano East Senior High School in Plano, TX residing in Richardson and Shriya Beesam -- Junior at Plano East Senior High School in Plano, TX residing in Richardson
Project: "Linked Neuro-Fuzzy Inference System: A Novel Approach to Schizophrenia Diagnosis"
- Katherine Cao -- Senior at Homestead High School in Mequon, of Mequon, WI residing in Mequon, William Hu -- Senior at Saratoga High School in Saratoga, CA residing in Saratoga and Alice Wu -- Senior at Half Hollow Hills High School West in Dix Hills, NY; residing in Dix Hills
Project: "Characterizing Novel, Spun-Cast PLA/Polystyrene Substrates of Differential Nanoscale Surface Topographies and Optimizing Cell-Plating Density to Promote Dental Pulp Stem Cell Proliferation and Differentiation in vitro"
- Nikhil Cheerla -- Senior at Monta Vista High School in Cupertino, CA and Anika Cheerla -- Sophomore at Monta Vista High School in Cupertino, CA, both residing in Cupertino.
Project: "Mitosis Detection and Tumor Grading Using Deep Convolutional Neural Networks"
- Jasmin Gao -- Senior at Northview High School in Johns Creek, GA., residing in Suwanee, GA and Rose Hong -- Junior at Del Norte High School in San Diego, CA residing in San Diego
Project: "Effects of Fibrin Gel Scaffolds and Dexamethasone on the Differentiation of Human Dental Pulp Stem Cells for Applications in Regenerative Endodontics"
- Louis Golowich -- Junior at Lexington High School in Lexington, MA residing in Lexington and Richard Zhou -- Junior at Lexington High School residing in Lexington
Project: "Maximum Size of a Family of Pairwise Graph-Different Permutations"
- Yoshihiro Saito -- Sophomore at Marriotts Ridge High School in Marriottsville, MD residing in Ellicott City, MD and Lauryn Wu -- Sophomore at Thomas Jefferson High School for Science and Technology in Alexandria, VA residing in McLean, VA
Project: "New Discovery of Large Bulk Band Gap Topological Insulators in Chemically Functionalized Two-Dimensional Compounds"



VINEET EDUPUGANTI

SCHOOL: Oregon Episcopal School, Portland, OR

YEAR: Senior

HOMETOWN: Portland, OR

PROJECT: "Development of a High-Performance Biodegradable Battery for Transient Electronics"

FIELD: Engineering

MENTOR: Raj Solanki, Professor, Physics, Portland State University

"I admire Leonardo da Vinci because he was a polymath, learning about and attaining success in several distinct disciplines. His quote "simplicity is the ultimate sophistication" is a reminder that even in an age where things are becoming highly complex, creative, intuitive solutions are often best."

Vineet developed a biodegradable battery that can dissolve after a period of useful operation. This technology can be used to power ingestible medical devices and environmental sensors, among many other applications.

As a young child, Vineet spent many weekends at the local science museum, which is where he first developed an interest in how things worked. But it was his first 6th grade science project where he became fascinated with materials, the powerful interactions between them, and their applications. After learning about the newly-emerging field of transient - biodegradable - electronics, he was captivated by the technology's counter-intuitiveness (in contrast to the current focus on durable, long-lasting devices) and its potential to affect change in a wide array of industries—some of which we do not even know about yet.

Vineet speaks Spanish and has played classical piano since he was in first grade and also plays guitar and has been on his school's varsity tennis team since he was a freshman. He is the leader of his school's Intercultural Student Association and he also works with disadvantaged kids from local public schools, tutoring math and reading in Spanish. Vineet received a 3rd place grand award at the Intel International Science and Engineering Fair (ISEF) in 2015 and 2016 and also received the special award for Best Project in Chemistry from the American Chemical Society (ACS) at the same competition.

He's a huge fan of his hometown NBA team the Portland Trailblazers. And when he gets to college, he plans on majoring in either materials science or electrical engineering and hopes to find real world applications for research that he can eventually take to market as an entrepreneur.



BLAKE HORD

SCHOOL: Dobbs Ferry High School, Dobbs Ferry, NY

YEAR: Senior

HOMETOWN: Dobbs Ferry, NY

PROJECT: "High Mass Planet Spiral Shocks as a Source of Infrared Emission in Protoplanetary Disks"

FIELD: Physics

MENTOR: Wladimir Lyra, Assistant Professor, Physics and Astronomy, California State University – Northridge

"To study our origins, one must study the general origins of all planets. Once we understand where other planets came from, we can infer how we came to be and the specific processes that formed us and our planet."

For his project, Blake improved on a computer simulation of a planet in formation. The results from this new model matched a previous observation of the gas and dust around a star

He has been interested in space for as long as he can remember even though his family's only connection to professional science is his paternal grandfather, who had worked for NASA at one point, before pursuing medical illustration. What fascinates Blake about science is the intense desire to discover the unknown.

Blake is most passionate about the future of space exploration, which may eventually save the human race from extinction. He says it is essential for us to become a multi-planetary species in order to provide a safety net in case another mass extinction event (either human caused or not) occurs in the near future.

Blake is a member of the National Honor Society and a National Merit Semifinalist. He plays volleyball on his high school team. His proudest accomplishment is becoming an Eagle Scout and teaching himself how to code C. He likes reading Kurt Vonnegut books because of his witty humor and social commentary. Blake says that Elon Musk is his role model because of Musk's desire to mix technology with business in a way that benefits the entire human race, and the ability to do it extraordinarily well.

He looks forward to pursuing a career in science and/or physics someday.



PRATEEK KALAKUNTLA

SCHOOL: Texas Academy of Math and Science, Denton, TX

YEAR: Senior

HOMETOWN: Plano, TX

PROJECT: "Luminescent Heavy Metal Sensors"

FIELD: Chemistry

MENTOR: Dr. Mohammad Omary, PhD, Department of Chemistry, University of North Texas

"I see my research helping the millions of people who are at risk of being poisoned by this toxic metal mercury and in honor of those who have lost their lives to mercury poisoning."

Prateek developed a low-cost sensor that can sense small amounts of mercury – a lethal neurotoxin – in air, water, and soil. This sensor can be used by rural communities to help avoid mercury poisoning.

Prateek was inspired to pursue his research on his mercury sensor once he realized how many people are impacted by mercury-related illnesses each year. Mercury seeps into the environment through a variety of ways including fuels, raw materials, or uses in industrial processes. It contaminates the air, soil, water and by extension the foods we eat that grow and live in the contaminated media, like produce and sea life. Mercury poisoning can cause a range of health issues for nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes.

As a child, Prateek always loved watching shows about science - ranging from Steve Irwin's "crocodile hunter" to nature documentaries. His favorite subject is chemistry and he chalks it up to his chemistry teacher's creative style of turning the subject into a game, each molecule a new puzzle to unravel.

Prateek is a member of his Quiz bowl team which gave him a competitive avenue to use his knowledge of obscure facts. Volunteering has always been a big part of his life, and this year, in his position as Mu Alpha Theta volunteering coordinator, he launched an initiative to tutor kids at local elementary and middle schools who are struggling in math.

Prateek says he had always fit the mold of the "STEM kid": really good at math and science, but not as good at sports. So it was a huge accomplishment for him to make his school's Intramural Ultimate Frisbee team. Prateek is also the captain and cofounder of his schools Whiz Quiz team and plays first chair All-Region Tenor Saxophone.

Born in Ohio, Prateek remains a true Ohio State University Buckeyes fan. He also enjoys the Game of Thrones series.



ALEXANDER KIROV

SCHOOL: Greenbrier High School, Evans, GA

YEAR: Senior

HOMETOWN: Evans, GA

PROJECT: "Exosomes in Amyloid Aggregates Promote Neuronal Damage: A Mechanism of Alzheimer's Pathology"

FIELD: Biology

MENTOR: Erhard Bieberich, PhD, Department of Neuroscience and Regenerative Medicine, Medical College of Georgia at Augusta University

"Over 5 million Americans have Alzheimer's Disease, and in less than 10 years, there is expected to be a 40% increase in Alzheimer's patients. Very little is known about its development, and I feel that my work has contributed to scientific knowledge by pinpointing a place where its progression can be interrupted."

Alexander Kirov's research aims to uncover the mechanism of the progression of Alzheimer's Disease. Not only is the disease already quite prevalent in the elderly, but the number of Alzheimer's patients is rising at an astounding rate. Today, one out of 10 Americans age 65 and older is diagnosed with Alzheimer's Disease. Alexander hopes his research can contribute to reversing this trend.

As captain of his school's Science Bowl and math teams, Alexander sees himself as a leader in STEM activities. Most recently, his teams were selected as Regional Runner-Up and 3rd place in the Science Bowl. And last year, Alexander competed in the US National Chemistry Olympiad as a top 9 scorer in his region of over 300 participants. Alexander is also a member of his school's chapter of the Mu Alpha Theta Mathematics Honor Society, where he tutors younger students in math and physics.

Outside of his academic pursuits, Alexander plays number 1 for the varsity tennis team, and volunteers at tennis camps and school clubs to teach rising players to enjoy the sport. Alexander's favorite professional tennis players are Serena Williams and Stan Wawrinka, who he tries to learn from when he watches them play. His favorite book is "Siddhartha" by Herman Hesse, and he enjoys listening to the German metal band, Scorpions.

One day, Alexander hopes to study in an MD/PhD program and help advance research in the Biomedical Sciences.



MANAN SHAH

SCHOOL: Harker Upper School, San Jose, CA

YEAR: Senior

HOMETOWN: Los Altos, CA

PROJECT: Deep Learning Assessment of Tumor Proliferation in Histopathological Images for Categorical and Molecular Breast Cancer Severity Diagnosis

FIELD: Computer Science

MENTOR: Dayong Wang, Research mentor, Beth Israel Deaconess Medical Center, Department of Pathology

Manan Shah, born in Philadelphia and raised in the Silicon Valley area, is an aspiring computer scientist and applied mathematician interested in how big data analytics and machine learning can accelerate scientists' ability to solve complex medical problems.

For his project, he developed a computational model that used tissue images of breast tumors to rapidly and accurately assess the severity of breast cancer tumor growth and spread. His model could help speed diagnostics, improve the molecular understanding of the growth of breast cancer, and help determine more accurate treatments and diagnosis. His model is a major improvement over the current inefficient, expensive, and laborious tumor grading systems. Tools like the one Manan created are critical to the future of disease diagnosis and prevention.

Manan hopes to become a research scientist, using his interdisciplinary knowledge in physics, math, and computer science (his favorite subject) to better predict the behavior of complex systems like cancer development.

He has published in the Journal of Machine Learning Research and has given research presentations at many of the major professional international research conferences. He is also a tennis player, fan of the musical band Coldplay, and is a Golden State Warriors fan - local pride!



PRANAV SIVAKUMAR

SCHOOL: Illinois Mathematics and Science Academy, Aurora, IL

YEAR: Senior

HOMETOWN: Tower Lakes, IL

PROJECT: Searches for Almost Dark Galaxies in Blank Sky Fields with the Sloan Digital Sky Survey

FIELD: Physics

MENTOR: Dr. Donald York, Horace B. Horton Professor Emeritus, Department of Astronomy and Astrophysics, University of Chicago

"Pursuing research, whether in STEM or any other field, is like solving a jigsaw puzzle: there is a great amount of satisfaction when the pieces start fitting together. However, the satisfaction is far greater when you see that your mentorship has opened the door for others to have the same Zen experience."

Pranav Sivakumar's research aims to decipher one of the major mysteries of physics: dark matter. This elusive matter gets its name because it can neither absorb nor emit light. Though astronomers cannot observe dark matter directly, they strongly suspect that it exists. Pranav has been studying Almost Dark Galaxies, masses that are mainly composed of dark matter, in hopes of learning more about this substance and the history of the universe.

Pranav's passion for science started at a young age. When he was six, he would watch video lectures of MIT professor and astrophysicist Walter Lewin, and developed what he calls "a sheer joy for learning physics." Pranav also loved to watch the night sky and spent many hours memorizing stars and constellations.

In 2015, Pranav won Google Science Fair's Virgin Galactic Pioneer Award and was later recognized by President Obama at the White House Astronomy Night for his research. Additionally, Illinois Governor Pat Quinn declared June 7th, 2014 "Pranav Sivakumar Day" in recognition of his performance in the National Spelling Bee over a three-year period.

Pranav is a member of his high school Quizbowl Team, and is active in Zooniverse and other citizen science projects. He is an avid reader and his favorite book is *Hitchhiker's Guide to The Galaxy*.

Pranav hopes to one day pursue a career as an astrophysicist and continue deciphering the mysteries of the universe. He is grateful for the mentorship and guidance of a broad cross-section of scientists, and looks forward to sharing his enthusiasm for STEM with new generations of students – igniting what he hopes is a similar passion for science and mathematics.

TEAM COMPETITORS

ADHYA BEESAM, Plano East Senior High School, Plano, TX

SHRIYA BEESAM, Plano East Senior High School, Plano, TX

PROJECT: "Linked Neuro-Fuzzy Inference System: A Novel Approach to Schizophrenia Diagnosis"

FIELD: Computer Science

MENTOR: Julie Baker, Biology Department, Plano East Senior High School

Adhya and Shriya developed a predictive model for diagnosing schizophrenia based on patient MRI data and psychiatric assessments.



ADHYA BEESAM

YEAR: Junior

HOMETOWN: Richardson, TX

"As a child, I always wanted to be a scientist or an inventor, basically someone who was at the forefront of innovation."

Adhya and her teammate, Shriya, are sisters who were inspired to research schizophrenia after their uncle started showing signs of mental illness. Over the years, he was in and out of hospitals, and misdiagnosed with bipolar disorder and depression. By the time doctors treated him for schizophrenia, his illness had become so severe that he ended his life a year later.

Adhya hopes her team's project will help patients like her uncle who did not have easily diagnosable schizophrenia – and ultimately save lives.

In school, her favorite subject is English and she plays cello in orchestra. She speaks Telugu and Spanish. Adhya's favorite book is *The Hitchhiker's Guide to the Galaxy* and she enjoys the singer Halsey's music. Passionate about using STEM to solve real-world problems, Adhya hopes to pursue a career in scientific innovation.



SHRIYA BEESAM
YEAR: Junior
HOMETOWN: Richardson, TX

"The aspect of STEM that I love the most is the fact that it is constantly changing and adapting. Science today is something completely different from science tomorrow, which means that it's a subject that will always be fascinating and never grow old."

Shriya and her sister, Adhya, were inspired to research schizophrenia after their uncle tragically committed suicide following his diagnosis with this mental illness. They believe that if he were diagnosed earlier, he would have been able to receive the help he needed in time.

Shriya has wanted to be a scientist for as long as she can remember. One of her earliest memories of conducting research was in her third grade science fair. She did a simple project with magnets, but to her it was the most interesting idea in the world.

Outside of the classroom, Shriya enjoys playing the violin. Her favorite books are *The Chronicles of Narnia* series by C.S. Lewis and her favorite athlete is tennis player, Serena Williams.

TEAM COMPETITORS

KATHERINE CAO, Homestead High School, Mequon, WI

WILLIAM HU, Saratoga High School, Saratoga, CA

ALICE WU, Half Hollow Hills High School, Dix Hills, NY

PROJECT: "Characterizing Novel, Spun-Cast PLA/Polystyrene Substrates of Differential Nanoscale Surface Topographies and Optimizing Cell-Plating Density to Promote Dental Pulp Stem Cell Proliferation and Differentiation in vitro"

FIELD: Materials Science

MENTOR: Dr. Miriam Rafailovich, Distinguished Professor of Materials Science & Engineering, Stony Brook University

Katherine, William, and Alice developed a novel technique for growing dental pulp stem cells, which could potentially improve bone and teeth regeneration.



KATHERINE CAO

YEAR: Senior

HOMETOWN: Mequon, WI

"I think that what makes science great is not just that it demystifies the universe, but that it wields the power to craft a solution for every problem that is discovered."

When Katherine first met her teammates, they connected through a mutual desire to use materials science to help improve the field of medicine. As they thought about potential problems they could solve together, bone and dental disease stood out personally for Katherine. Her parents, both immigrants, have rapidly decaying teeth due to poor childhood care, and their options for treatment are limited to teeth removal and dental implants. Katherine sees the rising field of dental pulp stem cell research as an amazing opportunity for patients with tooth decay, osteoporosis and many other conditions.

Katherine's favorite subject in school is chemistry and she credits it for helping her build an understanding of the natural world. Outside of the classroom, Katherine is president of student government and a member of the National Honors Society. She is varsity captain of the debate team, president of her school's service club, and a pre-professional dancer.

Katherine hopes to one day start a career as an entrepreneur in the life sciences. Her favorite author is Charles Dickens.



WILLIAM HU
YEAR: Senior
HOMETOWN: Saratoga, CA

"I find myself most enamored by the inherent creativity in STEM. Each problem requires an innovative approach, and discovering this approach is what makes me excited."

William has always had a bias towards the STEM subjects, even as a child. From building with Legos to marveling at the fifth graders' science fair projects, he was amazed by the possibilities with science, technology, engineering, and math. As he entered high school, William's interest became more solidified and he applied what he had learned to compete in local and national competitions and became eager to explore more. William found himself enamored by the inherent creativity in STEM. Each problem requires an innovative approach, and discovering this approach is what makes him excited.

After meeting his teammates through the Garcia Summer Program, they instantly connected through a passion for utilizing materials science in biomedical applications. William was interested in the junction of polymers and stem cells, and using previous research as a guide, they managed to come up with a topic for dental pulp stem cells. Having suffered from slight dental decay himself, he remembers the excruciating pain of having a tooth extracted from his mouth. In addition to his personal experiences, William's father suffers from periodontal disease and his mother has slight problems with her teeth as well. William personally believes that the rising field of regenerative medicine holds amazing potential in developing solutions to these problems. Dental pulp stem cells are pivotal to bone and dental therapy and researching the control of critical cell behaviors can shed light on the possibilities in this field.

In his free time, William volunteers for Second Harvest Food Bank, plays on the varsity volleyball team and plays tennis. He also received the Bausch + Lomb Honorary Science Award and the USACO Gold Division. William would like to be an engineer one day.



ALICE WU
YEAR: Senior
HOMETOWN: Dix Hills, NY

"Bone and tissue engineering are the future. Organ regeneration, wound healing, biomaterials... discoveries are made every day in these two fields, and it feels as if I am in the midst of a revolution."

Alice Wu is excited to be contributing to the field of bioengineering through her team's research, and is hopeful that bone cell and teeth regeneration will one day become available to patients in our lifetime.

She is a proud student ambassador of Millennial Ambition, an initiative launched by the Women's Fund of Long Island to develop the next generation of young women leaders and promote youth philanthropy. Through this program, Alice leads workshops for young girls in self-esteem, networking, and feminism. She is also a four-year varsity athlete and captain of the cross country, winter track, and badminton teams at her school.

Alice hopes to study computer science in college. Her favorite author is Philip K. Dick, and her favorite song is "The Scientist" by Coldplay. It reminds her of summers spent conducting research, and is one of the songs she loves listening to in the lab.

TEAM COMPETITORS

NIKHIL CHEERLA, Monta Vista High School, Cupertino, CA

ANIKA CHEERLA, Monta Vista High School, Cupertino, CA

PROJECT: Mitosis Detection and Tumor Grading Using Deep Convolutional Neural Networks

FIELD: Computer Science

MENTOR: Andrew Beck, Beth Israel Deaconess Medical Center, Harvard Medical School

Nikhil and Anika are a brother and sister team who set out to save pathologists time in the diagnosis of tumors by automating how tumor growth is measured.



NIKHIL CHEERLA

YEAR: Senior

HOMETOWN: Cupertino, CA

"My role model is Elon Musk because he's managed to revolutionize three completely unrelated industries with just determination."

When Nikhil grows up he hopes to be an entrepreneur working on artificial intelligence. This desire to automate and streamline tasks drove his team's research for the Siemens Competition as well. With his sister Anika, Nikhil developed a tool to count the number of cells that are undergoing division in a biopsy. This work has the potential to save the time of pathologists who currently have to count the cells manually and could help improve the analysis and grading of tumors.

Nikhil has a passion for volunteering and teaching others the skills of coding. Along with a friend, Nikhil founded a nonprofit in his freshman year of high school, called MathAndCoding. This organization has since provided free workshops to teach programming and computer science skills in libraries and community centers. MathAndCoding has reached more than 2700 students in over 500 sessions with a faculty of 50 passionate teen teachers.

Nikhil was a platinum level contestant and finalist in the USA Computing Olympiad (USACO) as well as a Google Science Fair regional finalist and a 2015 Siemens Competition semifinalist. Nikhil is a fan of the band The Strokes and also loves to compose and play his own music. He also likes reading Terry Pratchett's Discworld series.



ANIKA CHEERLA
YEAR: Sophomore
HOMETOWN: Cupertino, CA

“One of my proudest moments was teaching my first student how to code and seeing him come back for harder sessions.”

Anika has a passion for teaching and wide-ranging interests that include literature, science and artificial intelligence. She joined her brother in his research to automate tumor biopsy analysis and helped to expand upon his success and provide a “proliferation” score to help understand a tumor’s behavior and its relation to a patient’s genes.

When Anika grows up, she’d like to be an educator or researcher of computer science, hoping to develop tools or ideas to empower society to overcome social and health issues.

In addition to becoming a Google Science Fair Global Finalist twice, Anika is an officer of the Computer Science club at her school, and a leader and teacher in MathAndCoding, the non-profit started by her brother. She is also a varsity and club water polo player, a 2nd degree black belt in Tae Kwon Do and piano player.

TEAM COMPETITORS

JASMIN GAO, Northview High School, Johns Creek, GA

ROSE HONG, Del Norte High School, San Diego, CA

PROJECT: "Effects of Fibrin Gel Scaffolds and Dexamethasone on the Differentiation of Human Dental Pulp Stem Cells for Applications in Regenerative Endodontics"

FIELD: Materials Science

MENTOR: Dr. Miriam Rafailovich, Distinguished Professor of Materials Science & Engineering, Stony Brook University



JASMIN GAO

YEAR: Senior

HOMETOWN: Suwanee, GA

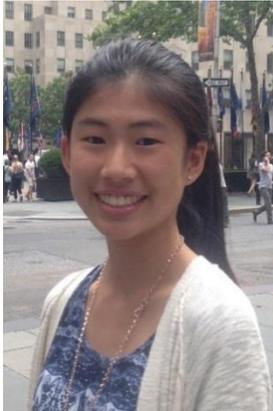
"I relish the thrill of creating something unique and beautiful to change the world."

Jasmin and her teammate discovered a promising step for replacing injured dental tissue and restoring function to a tooth after severe damage. Jasmin became interested in this research after her friend underwent a root canal and described to her the drilling and invasiveness of the procedure. Jasmin began to wonder if there were better ways to save teeth and decided to investigate.

For as long as she can remember, Jasmin has always been curious about how the world works. Some of her earliest memories are of taking machines apart and attempting to put them back together, and pelting her family with questions about almost anything.

At school, Jasmin's favorite subject is science and she is active in student government, mock trial, and the Junior Classical League -- a national group of students interested in ancient Greek and Latin culture. One of Jasmin's proudest achievements to date is founding Girls in STEM, an organization that provides free STEM classes to young girls and empowers them to defy gender roles. What started as a small group has now grown to over 100 participants with two additional branches located around the Atlanta metro area in Georgia for classes.

Jasmin sees herself as a passionate advocate for gender equality in the STEM fields. She hopes to continue helping young women and creating opportunities for them to grow and challenge expectations. Her message to every young girl is that "you can do anything you want!"



ROSE HONG
YEAR: Junior
HOMETOWN: San Diego, CA

"I enjoy STEM because it adds an energizing sense of clarity to the world and helps us explain phenomena that may initially seem unknowable."

Rose's research led her to team to discover a promising step for replacing injured dental tissue and restoring function to teeth after severe damage. Rose first became interested in this science after one of her and her teammate's friends developed a painful tooth infection from a root canal. To her surprise, Rose learned that such invasive procedures can often lead to harmful side effects, especially among younger patients. Her friend's painful experience inspired Rose to research further, and find a better long-term solution for dental trauma.

Outside of school, Rose is vice president of Science Olympiad, Academic League, and Math Club, and she is also a U.S. National Chemistry Olympiad semifinalist. She enjoys playing piano and plays on her school's varsity girls' tennis team.

Every summer, Rose volunteers as a counselor at the Fleet Science Center Camp, where she spends more than 200 hours mentoring younger students and helping them discover their passions in STEM. She is also an avid musician and has played at Carnegie Hall, winning first prize in the 2016 United States International Duo Piano Competition.

One of Rose's favorite books is "The Little Prince" by Antoine de Saint-Exupéry. She hopes to one day become a doctor or engineer.

TEAM COMPETITORS

LOUIS GOLOWICH, Lexington High School, Lexington, MA

RICHARD ZHOU, Lexington High School, Lexington, MA

PROJECT: "Maximum Size of a Family of Pairwise Graph-Different Permutations"

FIELD: Mathematics

MENTOR: Chiheon Kim, Graduate Student in Theoretical Computer Science, Optimization, Combinatorics at Massachusetts Institute of Technology

Louis and Richard's project examines a mathematical problem related to how efficiently messages can be transmitted over a noisy communications network in which the original signal may be corrupted. Their research aims to make progress on a problem in mathematics related to information theory, which explains how fast information can be sent through a channel.



LOUIS GOLOWICH

YEAR: Junior

HOMETOWN: Lexington, MA

"I was inspired to pursue mathematical research by my eighth grade math class. Both making progress in combinatorics research and algorithmic problem solving involve similar types of in-depth creative thought, which I really enjoy."

Louis began competing in math competitions in middle school, and quickly developed an interest in learning mathematics. During his freshman year he began competing in the USA Computing Olympiad which sparked his interest in computer science, and specifically algorithms, so he began learning more advanced algorithms. During Louis' sophomore year he qualified for the USACO finalists' summer training camp, an experience that greatly furthered his interest in computer science. The same year, he also began working on this research project in extremal combinatorics through MIT PRIMES, a program that gives research opportunities to high school students.

Louis is captain of his high school's Computer Science Club, member of his high school Tennis Team and volunteers for middle school math tournaments. He was one of 26 high school students in the US to be selected for the USA Computing Olympiad in 2015-2016. One day he hopes to apply math and computer science to help solve real-world problems.



RICHARD ZHOU
YEAR: Junior
HOMETOWN: Lexington, MA

"Mathematics is inherently beautiful. There's structure in areas which, on the surface, appear completely random. Patterns from seemingly unrelated branches of mathematics occur where they are least expected. And the feeling of solving a problem after struggling with it for long periods of time is unlike any other."

Richard's interest in mathematics began as a middle school student, when his math teacher inspired him to think of math as an exploratory subject rather than a mundane set of tools designed to solve problems from other sciences. Richard's favorite part of math is the feeling of finally solving a difficult problem after struggling with it for a long time. After thinking about a problem for days or even weeks to no avail, the feeling of coming to a sudden realization that finally cracks the problem he feels is extremely rewarding.

Richard's love for math and his ability to see its beauty stems from a quote he read by his role model, Paul Erdos, a 20th century Hungarian mathematician who said, "It's like asking: Why is Beethoven's Ninth Symphony beautiful? If you don't see why, someone can't tell you. I know numbers are beautiful. If they aren't beautiful, nothing is." Richard also admired Erdos' keen eye for tweaking and modifying problems that appeared impossibly difficult until they were still highly nontrivial, but more within reach. This is a strategy that Richard and Louis have found to be extremely valuable to their research, and one that he hopes to employ effectively in future endeavors.

Richard is a wind ensemble concert master, plays the clarinet in the Boston Youth Symphony Orchestra, and volunteers at the Winchester Chinese School.

TEAM COMPETITORS

YOSHIHIRO SAITO, Marriotts Ridge High School, Marriottsville, Maryland

LAURYN WU, Thomas Jefferson High School for Science & Technology, Alexandria, VA

PROJECT: New Discovery of Large Bulk Band Gap Topological Insulators in Chemically Functionalized Two-Dimensional Compounds

FIELD: Physics

MENTOR: Xuan Luo, The National Graphene Research and Development Center

Yoshihiro Saito and Lauryn Wu found a new material that helps quantum computers process quantum information more efficiently and effectively. It allows two-dimensional topological insulators (2D TIs) to be used at room temperature which solves the problem that 2D TIs are only usable at an extremely low temperature. This material could potentially be used as an efficient nanowire or store information in quantum computers.



YOSHIHIRO SAITO

YEAR: Sophomore

HOMETOWN: Ellicott City, MD

"My passion belongs in science and mathematics because I believe it is a universal language for everyone. Throughout history, human lives have been supported by scientific discoveries and breakthrough. I find tremendous value in "standing on the shoulders of giants." Science today has been built by the collaboration of knowledge and discoveries that previous scientists have uncovered. It is our duty to build upon those records and further the understanding for the sake of our generation and the next."

Yoshihiro has been interested in STEM since he was very little and credits his parents' jobs as physicians for sparking the interest but his real interest lies in physics and chemistry which can describe this physical world by rather simplistic equations.

Yoshihiro was first exposed to the wonderful world of physics through a documentary hosted by Neil deGrasse Tyson and was captivated by the idea of physics because of its power to understand the physical world through mathematics. Through venturing the world of physics using online resources and books, he was influenced by many physicists, not only the great Isaac Newton and Einstein, but also contemporary theoretical physicists and astrophysicists, such as Stephen Hawking and Michio Kaku. He likes that there are many things that one physicist can bring to the table to complete a grand picture.

Yoshihiro has competed in the Science Olympiad and received 1st Place in Cell Biology and a 3rd Place award in Astronomy at the regional competition. He has also been a qualifier at the American Invitational Mathematics Examination (AIME) since the 6th grade. He enjoys reading Stephen King novels because of the tension and suspense. A Real Madrid fan, Yoshihiro also plays soccer for his high school team and for a club team as well.

Outside of school, he volunteers for an organization called Social Contract Corporation that helps to gather leftover food from different stores to donate to a local food bank and coordinates events to provide support to those in need.



LAURYN WU
YEAR: Sophomore
HOMETOWN: McLean, VA

"I love science because it's challenging and has practical applications in the real world. Technology has revolutionized modern society and has solved countless real world problems. Technology shapes our world, and computers in particular are essential to people because of their efficiency and productivity."

Lauryn's love of science and math began in elementary school where she began competing and winning in several math competitions, including MathCounts, Math Olympiad, and AMC. She soon began attending math sessions and clubs outside of school. She finds math intriguing because it involves creativity to solve problems and finds it exciting to put together all the pieces of the puzzle to solve a problem.

In Lauryn's research, she found that topological insulators, which allow for electrons to move along the surface of a material, are currently a major field of study in physics and are applied in quantum computers. Since they help quantum information be transported without being degraded - a key to making quantum computers more efficient and powerful, Lauryn wanted to further research them. And she and her teammate Yoshihiro Saito are in good company, as the Nobel Prizes awarded for physics in 2016 recognized achievements in topology.

Lauryn's proudest accomplishments include being a qualifier in the American Invitational Mathematics Exam (AIME) in sixth grade and serving as Vice President of the National Junior Honor Society.

Lauryn plays tennis at a national level and is a top player in the Mid-Atlantic region. She also volunteers for Stop Hunger Now and raised money for it by organizing a 5K run.