

## 2016 SIEMENS COMPETITION IN MATH, SCIENCE & TECHNOLOGY

### Regional Finalists –University of Texas at Austin



**NAME:** 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.



**NAME:** ANKUR KHANNA

**SCHOOL:** Caddo Parish Magnet High School, Shreveport, LA

**YEAR:** Senior

**HOMETOWN:** Shreveport, LA

**PROJECT:** "Shear Heating of Black Hole Accretion Disks"

**FIELD:** Physics

**MENTOR:** Kris Clements, Chemistry and Science Research Teacher, Caddo Parish Magnet High School

*"What I enjoy most about science and math is the rush of finding answers to my questions, especially when those questions can't be answered with a simple Google search."*

Ankur found a potential explanation for why the environment in and around two orbiting black holes reach extremely high temperatures. This discovery will make it easier for scientists to calculate the mass of a black hole, as well as its rotation, which are necessary pieces of information when studying black holes.

Ankur was inspired to pursue his Siemen's Competition project when he read an article discussing the idea that most scientists who study the field of black holes focus only on a single black hole. This got Ankur thinking about what it would be like in space if two black holes were very close to each other. From there, he researched more and more into the idea of a binary system and eventually developed his project.

Ankur has been interested in STEM ever since his first science project in the third grade. His father has a strong interest in physics, and he passed that love for science on to Ankur. Ankur loves science because he enjoys experimentation and the logical thinking that goes into it.

Beyond his love for science, Ankur enjoys working with the Asian Studies Association at multicultural events, he works at a soup kitchen on Thursdays, and he is the president of Mock Trial. He's played the piano for more than six years, is the co-captain of the varsity tennis team, and speaks Hindi and Spanish. One day, Ankur aspires to be an orthopedic surgeon or possibly an ophthalmologist.



**NAME:** KAILASH RAMAN

**SCHOOL:** Sandra Day O'Connor High School, Phoenix, AZ

**YEAR:** Senior

**HOMETOWN:** Phoenix, AZ

**PROJECT:** "Versatile, Efficient, and Facile Functionalization of Poly (p-phenylene oxide) via Azide-Alkyne 'Click' Chemistry"

**FIELD:** Chemistry

**MENTOR:** Joseph Rheinhardt, Graduate Student, Arizona State University

*"I have always loved STEM - especially chemistry - because I love constantly seeing its applications in the world around me. I am excited by development of novel materials for sustainable energy production. This includes the use of polymers and nanomaterials in solar cells, battery technology, and fuel cells."*

Kailash is passionate about the prospects of developing new materials that can be used in the development of more sustainable energy sources, such as solar cells and battery technology. He started his research by looking at the creation of thin membranes that can be used to capture carbon dioxide from fossil fuel consumption (like emissions from cars and coal power plants), but decided that he wanted to also explore the creation of new polymers that can serve as the building blocks of new tools to improve sustainable energy technologies.

Kailash's achievements in chemistry has been recognized both in a Second Place Grand Award in Chemistry at the 2016 Intel International Science and Engineering Fair and by Arizona's Governor Doug Ducey, who awarded Kailash the Future Innovator of the Year Award. Outside of the lab, he is the president of Model United Nations Club, a varsity cross country runner, and performs in his school's Advanced Performance Choir.

Kailash aspires to become an entrepreneur in the engineering field.



**NAME:** KAVITA SELVA

**SCHOOL:** Clear Lake High School, Houston, TX

**YEAR:** Senior

**HOMETOWN:** Houston, TX

**PROJECT:** "From Nano Defects to Mega Power: Zirconium-doped Trapped Field (Gd,Y) BaCuO Superconductor Tapes for High Power Wind Turbine Generators"

**FIELD:** Materials Science

**MENTOR:** Xiao Fen-Li, Department of Mechanical Engineering, University of Houston

*"I have been always interested in problem solving activities starting with jig-saw puzzles. Whenever our family traveled when I was young, the first stop in a new place was usually the science museum. Math competitions that required creative problem solving, science research, and reading books all contributed to my growing interest and involvement in STEM."*

Kavita developed a new type of magnet that could help address the shortage of rare-earth-based magnets used in light-weight, powerful wind turbines to better harness wind energy.

Kavita's interest in magnets was sparked in eighth grade by a National Geographic article about the "rare earth crisis," which was the decreased availability of rare earth materials due to restrictions placed on their exports by countries rich with those materials.

Rare earth materials make up permanent magnets, which are used in a multitude of technological applications, such as wind turbines and electric motors in cars, so there was a worldwide incentive to develop a solution to this problem. This global rare earth crisis made her curious to look into alternatives to rare-earth-based permanent magnets, particularly, thin film superconductor tapes. She had previously studied the repulsive and attractive forces between thin film superconductor tapes and a magnet for her sixth grade science fair and found that at low temperatures, these superconductors could be magnetized to become a magnet themselves. So, she returned to the University of Houston to develop trapped-field superconductor magnets and has been working in this area for the past four years.

Kavita's role model is Conan O'Brien because she finds him intelligent and witty, as well as down-to-earth. As a Houstonian, she is of course a Houston Rockets fan.

Kavita's proudest moments include participating in the White House Science Fair as a Google Science Fair Global Finalist and her acceptance into the Research Science Institute (RSI) program at MIT.

She is most passionate about bringing more women in STEM fields. Her career aspiration is to tackle major societal grand challenges especially in energy, healthcare or security as a Ph.D. researcher.



**NAME:** BYRON XU

**SCHOOL:** Clements High School, Sugar Land, TX

**YEAR:** Senior

**HOMETOWN:** Sugar Land, TX

**PROJECT:** "Direct Determination of Ocean Temperature Profiles from Seismic Oceanography"

**FIELD:** Environmental Science

**MENTOR:** Warren T. Wood, PhD, U.S. Naval Research Laboratory

*"What I like the most about research, and about STEM in general, is the thrill of discovering things. There's a profound joy to the process of learning, and discovering, and creating. In the end, it is with this that we can find appreciation and potential for the knowledge of today and tomorrow."*

Byron has always been interested in STEM because of his drive and curiosity to discover unknowns. Growing up, Byron read a lot of science books in elementary school and participated in math and science competitions in middle school. But it wasn't until Byron vacationed with his family to Maine that sparked his interest in environmental science. He remembers participating in a lobster boat tour where he saw a sonar chart plotter on the boat. It was the first time he saw the actual shape of the sea floor, and it fascinated him. This led to Byron's first research project of sea floor mapping.

Over three research projects in oceanography, his work finally culminated in determining water temperature profiles from seismic data, which was his submission to the Siemens Competition. His work found a new way to use sound waves to determine ocean temperatures for different layers of waters. It can potentially be used together with ocean circulation models to study climate change.

Byron is a three-time USA Junior Mathematical Olympiad qualifier and made the USA Computing Olympiad Platinum division. He has played the violin for more than 10 years and has been a member of his school's orchestra for four years. Byron is in his school's National Honor Society and tutors math. Outside of school, he is a runner and a swimmer and roots for the Houston Rockets.

## 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.



**NAME: 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.



**NAME: 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

**WILLIAM DUKE** Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

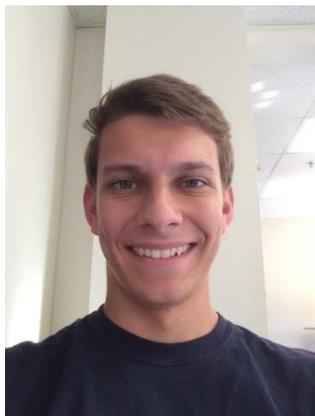
**NICOLAS NAHAS** Arkansas School for Mathematics, Sciences and the Arts, Hot Springs, AR

**PROJECT:** “The Diversity of Coral Species at Coral Gardens, Belize with Video Transects”

**FIELD:** Environmental Science

**MENTOR:** Dr. Lindsey Waddell, Earth Science and Chemistry Instructor, Arkansas School for Mathematics, Sciences and the Arts; Dr. James Engman, Professor of Biology, Biology Department Chair, Henderson State University

William and Nicolas researched the health of corals in Belize to understand ways to save coral reefs and help the people who depend on them.



**NAME:** WILLIAM DUKE

**YEAR:** Senior

**HOMETOWN:** Pine Bluff, AR

*“My dad is fish farmer, and so I grew up around someone whose job involved conducting research and collecting data. Because of this, I have always been pointed in the direction of STEM.”*

STEM has been a part of William’s life for as long as he can remember. He grew up with a keen interest in data collection and scientific research after being introduced to it by his dad, a fish farmer.

When William traveled to Belize with his marine biology class, he was offered the opportunity to study the country’s coral reefs with his teammate. William is hopeful that his research will save coral reefs in Belize and around the world and help the people who depend on them.

Outside of the classroom, William keeps busy as a community leader, student representative for the Student Government Association and co-captain of the volleyball team. He also speaks Spanish and Japanese and plays the oboe and alto and baritone saxophones. In his free time, William enjoys learning about new discoveries in science.

William hopes to start a career as a marine biologist.



**NAME:** NICOLAS NAHAS  
**YEAR:** Senior  
**HOMETOWN:** North Little Rock, AR

*"I have known since I was a child that I wanted to become a Marine Biologist. Instead of having a stuffed animal or blanket, I carried around a plastic shark 24/7."*

Nicolas knew he wanted to become a marine biologist at an early age. Instead of carrying around a stuffed animal or blanket, he carried around a plastic shark.

Along with his teammate, Nicolas studied the health of a coral reef in Belize to compare it to other reefs around the world. Naturally, Nicolas' favorite subject in school is science, and he is particularly interested in biology.

In his spare time, Nicolas plays the guitar and baritone.

## TEAM COMPETITORS

**SANDRA KONG**, Highland Park High School, Dallas, TX

**SAUMYA RAWAT**, School of Science and Engineering at Yvonne A. Ewell Townview Center, Dallas, TX

**PROJECT:** “Electrochemical Characterization of Shape-Memory Polymer-Coated Interdigitated Electrodes in Vitro”

**FIELD:** Materials Science

**MENTOR:** Alexandra Joshi-Imre, PhD, Neural Interfaces Laboratory, Advanced Polymer Research Laboratory Center for Engineering Innovation, University of Texas at Dallas

Sandra and Saumya developed and analyzed a new approach to create implantable medical devices that could be used to study the nervous system and ultimately treat neurological diseases, such as Parkinson’s disease or Alzheimer’s disease.



**NAME: SANDRA KONG**

**YEAR:** Senior

**HOMETOWN:** Dallas, TX

*“Math allows me to seek solutions in a creative manner. A mathematician, like a painter or a poet, is a maker of patterns but instead of colors or rhetoric, the imaginary.”*

Sandra’s passion for STEM has been driven by the number of women in STEM with whom she has worked. But it was learning about the evolution of the design of the stent at a local hospital that focused her interest in the power of implantable technologies. Her research looks at how flexible polymers could be used to make effective implantable devices. Her hope is that this may help advance research of the nervous system to better treat neurodegenerative diseases. Sandra was accepted into the NanoExplorers Research Program, is a member of the University Interscholastic League Number Sense State Champion Team, and is the president of her school’s mathematics honor society, Mu Alpha Theta.

In addition to her work in the lab, Sandra founded and is the president of the Health and Education Largess Program (HELP), which provides free tutoring and health education services to Burmese refugees around Dallas. She is also an artist and plays piano and tennis.

Sandra looks up to Burmese leader Aung San Suu Kyi and says her strength and passion to lead a pro-democracy movement in that country have inspired her to take risks and seek interests outside her comfort zone.



**NAME: SAUMYA RAWAT**

**YEAR:** Junior

**HOMETOWN:** Coppell, TX

*“Marie Curie has always been my role model. She pioneered radiology as a woman. She inspires me to continue working towards new technology and to be proud to be a woman in STEM.”*

Saumya wants to be a doctor so she can make a career out of her passion for helping others. She has volunteered and interned in several hospitals, and it was the recognition that many patients aren't able to receive permanent treatments with today's technology that inspired her interest in research. Her work with her teammate Sandra focused on creating and testing implantable devices that are compatible with the body to one day better understand the nervous system and ultimately develop better treatments for neurological diseases.

Saumya was a runner up in the National Center for Women & Information Technology's (NCWIT) Aspirations in Computing National Competition, is a National AP Scholar, and a self-taught pianist. For more than four years, she has taught special needs kids to swim as a volunteer with the Coppell Special Olympics organization.

Marie Curie inspires Saumya to continue working towards new technology and to be proud to be a woman in STEM.

## TEAM COMPETITORS

**MEGAN LIU**, Highland Park High School, Dallas, TX

**KEVIN ZHOU**, Highland Park High School, Dallas, TX

**PROJECT:** "Activation Mechanism of NAMPT, a Therapeutic Target for Neurodegenerative Diseases"

**FIELD:** Biochemistry

**MENTOR:** Dr. Steve McKnight, PhD, Biochemistry Department, University of Texas Southwestern Medical Center

Megan and Kevin's research found a mode of action of a potential new drug for the treatment of neurodegenerative diseases like Alzheimer's disease.



**NAME: MEGAN LIU**

**YEAR:** Junior

**HOMETOWN:** Dallas, TX

*"I like how science can be applied to everyday life and helps explain the workings of nature and the world."*

Megan's determination to help find a cure for Alzheimer's disease led her to conduct her research for the Siemens Competition on the project. Her grandmother has Alzheimer's, which has taken a toll on her family, and it also means that her father has a genetic risk of getting the disease as well.

Her love of science was sparked when she began watching videos of Bill Nye the Science Guy in elementary and middle school because he was comical and interesting at the same time.

Math is Megan's favorite subject. She also serves as co-president of the American Field Service Club at school, which gives students the opportunity to study abroad for a year or semester. She enjoys performing ballet and traditional Chinese dance and plays piano

Megan wants to become a doctor or a pathologist, as diseases have always fascinated her.



**NAME: KEVIN ZHOU**

**YEAR:** Junior

**HOMETOWN:** Dallas, TX

*“I like the endless possibilities that come with science, as there are almost endless variables that could be manipulated in order to achieve a different, and possibly greater effect.”*

Kevin became interested in science when he saw his older sister's accomplishments in the field. Three years his senior, she has been participating in science competitions and interning in labs since he was in middle school. Kevin's sister has truly become his role model as she has gone on to become a talented scientist who attended Caius College in Cambridge, England. Her accomplishments inspired Kevin to pursue most of his scientific classes and internships and also motivated him to work more diligently in all of his studies and work.

Kevin is passionate about participating in mock trials in the YMCA's Youth and Government Civic Education and Leadership program. He is a member of the National Math Honor Society and the National Science Honor Society and tutors underprivileged Burmese children in math and science. Kevin is a fan swimmer Michael Phelps and enjoys listening to music by The Chainsmokers. He speaks Chinese and some Spanish and also loves reading books by author Rick Riordan, who piqued his interest in mythology. Kevin aspires to have a career in investment banking.

## TEAM COMPETITORS

**SARAH ZHAO**, Vestavia Hills High School, Vestavia Hills, AL

**LANA CHEN**, Vestavia Hills High School, Vestavia Hills, AL

**PROJECT:** “Identification of long non-coding RNA genes important for normal hematopoiesis and leukemogenesis using bioinformatics tools”

**FIELD:** Biology

**MENTOR:** Chris Klug, Microbiology Professor, University of Alabama at Birmingham

Sarah and Lana discovered three long non-coding RNA genes that may play critical roles in leukemia development. These genes may be able to be targeted for future cancer treatment or diagnosis.



**NAME:** SARAH ZHAO

**YEAR:** Junior

**HOMETOWN:** Birmingham, AL

*“After my grandfather passed away from cancer, I became motivated to take a proactive role and delve into action to do my own research to help solve cancer.”*

Sarah first discovered her love of STEM subjects through nonfiction books at the library. She still remembers a detailed canine anatomy book with 3-D features that eventually sparked her interest in human anatomy. Following the death of her grandfather from cancer, she was motivated to do her own research to fight the disease.

She believes having a background in STEM subjects builds a solid foundation from which she can achieve any future goals.

When she is not in the lab, Sara spends time learning Spanish, playing the piano and fencing. She also speaks Mandarin Chinese fluently and is the captain of her school’s Debate Team. Sarah aspires to be a surgeon someday.



**NAME: LANA CHEN**

**YEAR:** Senior

**HOMETOWN:** Birmingham, Alabama

*“With technology there are no boundaries—your imagination can take you anywhere and develop into anything.”*

Lana’s interest in STEM subjects, especially technology, blossomed after she attended a coding camp at Carnegie Mellon. For Lana, technology is the future, and she believes the answer to many of the world’s most pressing issues can be found within a good understanding and application of technology.

Lana knew that she wanted to explore the possibilities of technology in different fields, but it was her curiosity in medical advancements and her partner’s passion for cancer research that led her to their project.

Lana is the president of the French Honor Society, and her favorite subject is macroeconomics. She expects to study computer science in college.