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2016 SIEMENS COMPETITION IN MATH, SCIENCE & TECHNOLOGY

Regional Finalists – California Institute of Technology

NAME: 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.

NAME: KATHY LIU
SCHOOL: West High School, Salt Lake City, UT
YEAR: Senior
HOMETOWN: Sandy, UT
PROJECT: Nature-Based Solid Polymer Electrolytes for Improved Safety, Sustainability, and Efficiency in High-Performance Rechargeable Batteries
FIELD: Materials Science
MENTOR: Dr. Jin Liu, Professor at Central South University in Changsha China

"STEM fields have tremendous power to make improvements in the world, and anyone can dive into them if they really want to."

Kathy Liu is from Utah, a state that claims to have "the greatest snow on earth." For as long as she can remember, snowstorms and the ensuing power outages happened often. As a child, these disruptions made her realize the world's reliance on electricity, and she was fascinated by the flashlights that helped navigate the dark when all else failed. Since then, Kathy has been inspired to study new forms of power and sustainable energy.

In Kathy's research, she developed a novel solid paste to replace the liquids found in all rechargeable batteries. This new compound eliminates flammability concerns, enables more flexible structures for batteries, and opens the route to realizing next-generation battery chemistries.

Kathy was named the 2016 Intel Foundation Young Scientist Award Winner and is a Top 30 Lincoln Douglas Debater in the National Speech and Debate Tournament. Kathy is a violinist in in the Utah Youth Orchestras and Ensembles and also spends her time skiing, running, and playing tennis.

Kathy wants to pursue a career in STEM and hopes for her research to make a difference in people's lives. She loves watching the USA Gymnastics team and her role model is Elon Musk, who inspires her with his fearless pursuit of game-changing technologies.

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NAME: SAGAR MAHESHWARI
SCHOOL: Unionville High School, Kennett Square, PA
YEAR: Senior
HOMETOWN: Chadds Ford, PA
PROJECT: SiteKey: A Novel Binding Site Predictor for Ordered Proteins Interacting with Intrinsically Disordered Proteins
FIELD: Computer Science
MENTOR: Dr. Gil Alterovitz, Harvard Medical School

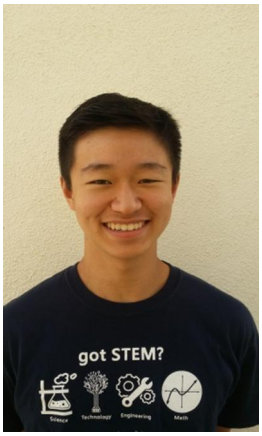
"What I admire most about STEM is its ability to solve the major problems that face our society today."

Sagar Maheshwari developed a computational algorithm that enhances our understanding of intrinsically disordered proteins. These proteins have been linked to a number of diseases – including cancer and diabetes – and Sagar hopes his research will provide new approaches for treating them.

Sagar, a national merit semifinalist and national AP scholar, has been conducting scientific research since 6th grade. What first started as a simple extra credit assignment for the school science fair has evolved into a passion for solving real-world problems. Sagar is particularly interested in the field of bioinformatics, where he hopes to apply his background in computer science and math to better our understanding of biological data.

Outside of school, Sagar is the founder of Mentoring Youth in Science and Technology (MYST), an organization that pairs aspiring student researchers with seasoned mentors that can guide them through the research process. He is also the co-captain of his school's Academic Team, president of his school's Math Club, a varsity tennis player, and a tenor saxophone player in his school's Symphonic Band.

Over the summer, Sagar spent two weeks in Ethiopia teaching math and science to children affected by HIV/AIDS. He won first place in the 2014 and 2015 Delaware Valley Science Fairs for Medicine & Health and Computer Science, respectively. His role model is Bill Gates and he is a fan of the Harry Potter series.



NAME: BRIAN XIA
SCHOOL: Canyon Crest Academy, San Diego, CA
YEAR: Senior
HOMETOWN: San Diego, CA
PROJECT: Transgenerational programming of longevity with a low-protein diet: Animal model, H3K27 trimethylation and early-life epigenetic “immunization” to prevent aging-related diseases
FIELD: Biology
MENTOR: Steven de Belle, Senior Scientist, Associate Director of Biology, and Coordinator of External Research Program, Dart NeuroScience, LLC; Dr. Dustin Schones, Assistant Professor and Dr. Wendong Huang, Associate Professor, City of Hope

“I am most passionate about my biological research on aging-related diseases (ARDs). I feel truly motivated to alleviate the socioeconomic burden of ARDs, which are arguably the greatest challenges for biomedicine in the 21st century.”

Brian got hooked on scientific research when he performed a small investigation to confirm Mendel's law of segregation using the eye color of fruit flies. Brian has been fascinated by two important concepts in scientific literature: transgenerational programming of metabolic status and how nutrition early in life affects how long we live. In his research, Brian combined the two elements of "transgenerational inheritance" and “longevity regulation” into a novel research direction - transgenerational inheritance of nutritional programming of longevity. He established the first animal model to study how early-life nutrition programs longevity across generations and characterized a particular histone modification (H3K27me3) as one underlying mechanism. He also identified a promising clinical drug for the simultaneous prevention of multiple aging-related diseases (ARDs). He then went on to identify the first common signaling pathway among aging and multiple ARDs (including cardiomyopathy, diabetes, dementia, and cancer) in human embryonic stem cells, supporting translational research to develop this novel multi-disease therapy in humans. Brian has had the early stages of his research on this topic published and is the lead author on two peer-reviewed research articles in the scientific journal *Aging*.

Brian is very interested in the growing field of epigenetics, is particularly excited about the current developments in multi-disease therapies and drug repositioning and wants to be a leading expert in the epigenetic research field.

In addition to swimming on his school’s varsity swim team and playing baseball, Brian also plays the piano. He also speaks Chinese and Spanish. He placed 2nd (2015) and 3rd (2016) in category in the Intel International Science and Engineering Fair (ISEF) competition. He serves the Student Advisory Board for the Greater San Diego Science and Engineering Fair (GSDSEF) and enjoys helping organize events to encourage young kids to get into STEM. He is a founding member, Head of Outreach, and Treasurer for his school’s Hunger Awareness club.

NAME: CATHERINE ZENG
SCHOOL: Mission San Jose High School, Fremont, CA
YEAR: Senior
HOMETOWN: Fremont, CA
PROJECT: Investigation of H/D Exchange in Aromatic Compounds with a Heterogeneous Electro-Activated Palladium Catalyst
FIELD: Chemistry
MENTOR: Souful Bhatia and Dr. James Jackson, Department of Chemistry, Michigan State University

"I like learning math and science because the concepts connect logically and the problems are similar to fun riddles, but I'm also interested in STEM's applications and its ability to better the world. I would love a future where the world is a clean, happy place with food and shelter for all."

Catherine has always been interested in science and technology because of her love of science fiction, particularly, Ender's Game and Star Trek. Her participation in her school Science Bowl since 7th grade encouraged her to explore all areas of science. She found a new way to fine tune drug therapies by swapping out the hydrogen atom in a compound for a heavier counterpart – deuterium – a process that could have far-reaching implications in various fields, including making the production of drugs less expensive and more environmentally friendly.

Catherine speaks Mandarin and French and has been a team member on a First Tech Challenge (FTC) Robotics Super Regionals Finalist Alliance team and on a team that earned 3rd place at Technology Students Association, Tests of Engineering Aptitude, Mathematics, and Science team nationals.

Catherine admires Benjamin Franklin for exploring almost all fields of knowledge. She loves new experiences whether that means exploring new subjects or learning in greater depth and detail. And outside of school, she loves traveling, eating at restaurants she hasn't tried before and trying out her friend's skateboard. After learning all the science and math that she can, Catherine would like to be an engineer to create something out of what she's learned.

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.

NAME: 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.

NAME: 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.

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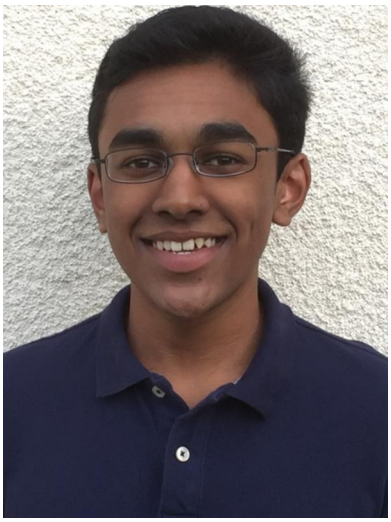
TEAM COMPETITORS
RAJIV MOVVA, The Harker School, San Jose, CA
RANDY ZHAO, The Harker School, San Jose, CA
PROJECT: “Computational Prediction of Synergistic Chemotherapy Combinations Reveals Master Regulators of Efficacy”
FIELD: Biology
MENTOR: Mr. Remzi Celebi, Stanford University

Rajiv and Randy developed a computer model to help identify what cancer treatments, when used together, have the potential treat cancer more effectively.



NAME: RAJIV MOVVA
YEAR: Junior
HOMETOWN: San Jose, CA

"Machine learning and artificial intelligence have recently become some of my favorite scientific topics. I find that applying these techniques to challenging problems in biology is even more rewarding, because such research has the potential to impact lives.”

Rajiv's inspiration to research more effective cancer treatment strategies stemmed from his desire to put his mathematical background to use. Specifically, he worked on finding drug combinations for chemotherapy that synergistically target tumor cells while leaving healthy cells intact. Working with Stanford professor Dr. Michel Dumontier, Rajiv and Randy developed computer models to identify these pairs. Looking forward, Rajiv is excited to join what he calls 'the revolution in contemporary science' powered by the CRISPR genome editing technology.

When not performing research with one of the two labs he's involved with at Stanford, Rajiv competes on his school's varsity Science Bowl team. He also has a passion for teaching, which he fulfills by coaching his middle school math team and mentoring younger research students. He is Platinum-level in the USA Computing Olympiad and was awarded First Place in Mathematics at the Broadcom MASTERS competition, where he had the opportunity to meet President Obama.

NAME: RANDY ZHAO
YEAR: Junior
HOMETOWN: San Jose, CA

"I've always been interested in STEM since both my parents were in the field. Computer science actually hooked me to the field in the beginning because there was so much freedom involved. I felt in control of whatever I wanted to code."

Randy sees cancer as one of the biggest problems people face today, however, he believes that technology has the power to solve them and change the world. In hopes of taking a step closer to curing cancer, he and Rajiv decided to utilize their love for computer science to address the pressing challenge of finding better treatments by combining existing drugs. Randy hopes to take this approach and continue to try to make a difference in the world. He has experimented with making games and applications and plans to advance his involvement in the tech field for he believes the future will rest heavily on it.

He is an active member of the STEM clubs in his school and was a part of the national championship team in the annual TEAMS competition. In addition to his passion for computer science and math, Randy also enjoys being active. He is on both his school's varsity tennis and dance team.

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TEAM COMPETITORS

ARUSHI SAHAI, Menlo School, Atherton, CA
ANDREW SHAO, Lynbrook High School, San Jose, CA
PROJECT: Orphan Globular Clusters in the Virgo Cluster of Galaxies
FIELD: Physics
MENTOR: Dr. Elisa Toloba, UC Berkeley

Arushi and Andrew researched how large galaxies have absorbed smaller galaxies over time to better understand the evolution of the universe. To do this, they studied the clusters of stars in the supergiant galaxy, M87.

NAME: ARUSHI SAHAI
YEAR: Sophomore
HOMETOWN: Los Altos, CA

"The future is a bit of a mystery, but I do know that I will always strive to make a difference for the better."

Arushi Sahai has spent many hours looking at planets, galaxies, and nebulae through a telescope, wondering about her place on Earth in this incredibly vast universe. For her, seeing through a telescope is like watching time wind back thousands, or even millions, of years. In the case of her research, Arushi and her teammate Andrew studied the evolution of galaxies over the span of billions of years, tracing back time to the very beginnings of our universe.

Arushi first developed an interest in astronomy during middle school when she visited the Lick Observatory, operated by the University of California, and learned about research in dark matter, dark energy, and extrasolar planets. She was immediately drawn to the infinite mysteries of space.

Outside of the classroom, Arushi enjoys playing volleyball and role plays as an attorney on the Junior Varsity Mock Trial team, which placed first in County Championships. Arushi also volunteers as an ambassador at a local educational farm, and takes part in her school's theater program.

Arushi is a proud co-leader of M-Best, her school's initiative to cultivate confident leaders in the STEM fields. She is interested in both STEM and the humanities, and is grateful to have parents and teachers who inspired her intrinsic curiosity and love of learning.

NAME: ANDREW SHAO
YEAR: Junior
HOMETOWN: San Jose, CA

"The most interesting thing about STEM subjects is that there is always something new to discover and there will never be an end to what we can create or learn about the world around us."

Andrew Shao has always been interested in STEM. He remembers being in first grade and fascinated by class experiments on the properties of water. Today, Andrew's favorite subject is physics because he can use it to better understand how the world and universe work.

Outside of the classroom, Andrew is a star track and field athlete at his school. He also coaches elementary school track teams, runs cross country, plays piano, and qualified in the American Invitational Mathematics Examination for the past two years.

Andrew is involved in his school's National French Honor Society and Astrophysics Club. His favorite athlete since childhood is Olympic sprinter, Usain Bolt. Andrew is passionate about running and hopes to qualify for the California State meet this year in track.

TEAM COMPETITORS
ANDREW WINNICKI, Punahou School, Honolulu, Hawaii
JOHN WINNICKI, Punahou School, Honolulu, Hawaii
PROJECT: Double Deficiency of Gαi1 and Gαi3 Leads to Chronic Inflammation-Associated Tumorigenesis
FIELD: Biology
MENTOR: Wen-Ming Chu, University of Hawaii Cancer Center

Andrew and John found two proteins to help prevent cancer from forming, which furthers our understanding of the origins of tumors.

NAME: ANDREW WINNICKI
YEAR: Senior
HOMETOWN: Honolulu, Hawaii

"I like the idea that we can explain things that aren't totally obvious to us through science, and for the things that appear obvious, we can explain why they're actually not."

Andrew has always wondered what it was like to know something that few other people understand; to be on the cutting edge of science. He has been interested in science since a very young age and was strongly encouraged by his parents to pursue the subject. However, his love for research was influenced by his curiosity to discover and explore after he started working during his freshman year at his mentor Dr. Weng-Min Chu's lab at University of Hawaii Cancer Center.

Andrew is most passionate about his research to understand the origins of tumors, but aside from that, he enjoys dancing, choreographing and playing the ukulele in his hula group. Andrew is the French Club President, Assistant Art Director of the school yearbook, and founder of the Tech Talks at Arcadia Retirement Residence. He also plays the piano, violin and guitar.

Mahatma Gandhi has always struck Andrew as a remarkably resilient human being. Against staggering odds, he worked tirelessly while promoting nonviolence. The Little Prince by Antoine de Saint-Éxupery is his favorite book. The book inspired a yearning that he's never experienced before. He's also a big fan of deserts and small planets.

NAME: JOHN WINNICKI
YEAR: Senior
HOMETOWN: Honolulu, Hawaii

"What I love about math and science is that it is definite and tangible. It is something that you can point to a reason and say this is why. Everything can be broken down into the smallest of components and make perfect sense. Not only that, but we can apply everything about STEM in the world around us! That's really awesome."

John's interest in science and math began when he received a science encyclopedia at a very young age. He remembers reading the entire encyclopedia with his father and referring back to it whenever he could not remember something. From there, John began learning higher levels of math and science in school and his curiosity really took off.

In the 9th grade, John joined the science bowl team and specialized in biology and math, both his favorite subjects. John loves how applicable biology is everywhere he looks. This passion for biology is what drew him to pursue cancer research. In addition to this, both sides of John's family have had a history of cancer (the most recent case in his grandfather) and so oncology has always intrigued him.

John is the French Club President, yearbook editor, and a science bowl team member – his high school team Punahou won 1st place in the state last year. He spearheaded the 2016 Punahou Carnival with a team of 26 people. The carnival is the largest private carnival in the country and they raised over 2 million dollars for financial aid. John also founded and runs a ukulele lessons program every week for elementary school students, and he's a competitive hula dancer and ukulele musician. In addition, he plays the bass clarinet, piano and guitar.

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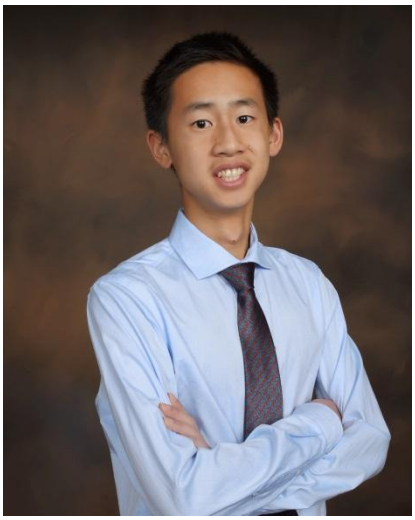
TEAM COMPETITORS
DANIEL ZHANG, Westview High School, San Diego, CA
EDWARD ZHANG, Torrey Pines High School, San Diego, CA
PROJECT: Identification of Novel CpG Biomarkers by Genome-wide Methylation Profiling for Early Diagnosis and Prognosis of Leukemia
FIELD: Biochemistry
MENTOR: Dr. Jie Zhu, Postdoctoral Fellow, University of California – San Diego

Daniel and Edward Zhang discovered a new way to diagnose leukemia at an early stage. Their research can also help to improve overall cancer diagnosis, prognosis and treatment. Daniel Zhang coauthored a paper in the journal Proceedings of the National Academy of Sciences (PNAS).



NAME: DANIEL ZHANG
YEAR: Junior
HOMETOWN: San Diego, California

"I'm most excited about innovations and advancements in science and technology. I love seeing new research that can potentially save lives and improve people's quality of life."

Daniel Zhang's aunt who passed away from leukemia was the inspiration for his scientific research project that resulted in the discovery of a way to diagnose early stage leukemia. He says that during the project when things got tough, he remembered her smiling face and it was a constant support for him.

He aspires to be a doctor or professor, and has been more than curious about science from a very young age, inspired by Bill Nye, and conducting experiments in his basement. He loves the feeling of discovering something new. His scientific role model was late Nobel Prize laureate Roger Tsien, an American biochemist who pioneered a more effective way to peek inside cells and organisms. Daniel is a varsity tennis player, pianist, and president of a start-up called Voyage Creations Custom T-shirt Company.

NAME: EDWARD ZHANG
YEAR: Freshman
HOMETOWN: San Diego, California

"The poor survival rate of leukemia patients and its impact in children made me strive to improve its outcome."

Edward Zhang is a champion swimmer and a medalist in the California Junior Olympics. His heroes are an interesting pair: Michael Phelps for his perseverance, hard work and ambition; and Bill Gates because he is always thinking about helping his fellow human beings. He was always interested in health and science and spent time watching his father treat patients in the clinic and conduct research in the laboratory. He volunteers in a hospital and believes that science, technology engineering and math can have a significant impact on the next generation medical treatments and improve human health. Edward's a fan of the Michael Crichton novel *Jurassic Park* because it demonstrates the amazing power of engineering.