

**2013 SIEMENS COMPETITION IN MATH, SCIENCE & TECHNOLOGY
National Finalists**

INDIVIDUAL COMPETITORS



ARMAN BILGE

Lexington High School, Lexington, MA

HOMETOWN: Lexington, MA

PROJECT: Bayesian Reconstruction of Coevolutionary Histories

FIELD: Computer Science

MENTORS: Yi-Chieh Jessica Wu, Research Assistant/Graduate Student, MIT; Rachel Sealfon, Graduate Student, Broad Institute of Harvard and MIT; Mukul Bansal, Assistant Professor, Department of Computer Science & Engineering, University of Connecticut

"I am always fascinated by the use of mathematical modeling in subjects that we do not normally associate with heavy use of math, such as biology or history. In general, I am excited to see research across all fields becoming more quantitative."

For his project, Arman developed a computer algorithm to reconstruct the linked evolutionary histories of symbiotic organisms. The methodology he used may enable us to predict and prevent the animal to human transmissions of diseases, such as influenza and HIV.

Arman's love of science began at a young age, and his deep interest in supercomputing unknowingly lent support to the largest collection of integrated advanced digital resources and services in the world, Extreme Science and Engineering Discovery Environment (XSEDE), used by scientists to interactively share computing resources, data and expertise. Arman used the database to run analyses on the CIPRES Science Gateway, which is hosted on XSEDE resources. As a result, he was featured in an article about CIPRES that appeared on the homepage of the National Science Foundation. Arman also runs a computational biology club at his school that gives his fellow students the opportunity to use computational methods in their biology research projects, and volunteers at the school's Learning Center, where he tutors students in math and science. He is president of the photography club and an accomplished violinist. Arman aspires to be a professor and principal investigator of a computational evolutionary biology group.



ERIC CHEN

Canyon Crest Academy, San Diego, CA

HOMETOWN: San Diego, CA

PROJECT: Discovery of Novel Influenza Endonuclease Inhibitors to Fight Flu Pandemic

FIELD: Biology

MENTORS: Dr. Rommie Amaro, Assistant Professor, University of California, San Diego; Dr. Gen-Sheng Feng, Professor, University of California, San Diego

"I am most excited by the revolutions in medicine that projects like human genome mapping and brain mapping can bring."

For his project, Eric used computer modeling combined with biological studies to speed up the discovery of new anti-flu medicine. Moreover, Eric identified potent inhibitors, which have the potential to be developed into new anti-flu drugs that will help prepare for pandemic outbreaks and save lives.

Eric is a senior at Canyon Crest Academy and his favorite subject is physics. He was inspired to pursue research on influenza after the swine flu outbreak started in his hometown of San Diego in 2009. Eric earned the Google Science Fair Grand Prize and the Intel International Science and Engineering Fair Grand Prize Award. Eric is the founder and head coach of a summer contest math program for middle school students and helped start Science Fair and Science Olympiad programs in his town's primary and middle schools. He plans to become a college professor or an entrepreneur.



FREDERICK LANG

St. John's School, Houston, TX

HOMETOWN: Houston, TX

PROJECT: Human Bone Marrow Mesenchymal Stem Cells as Biofactories for Exosomes Containing Anti-Glioblastoma miRNA

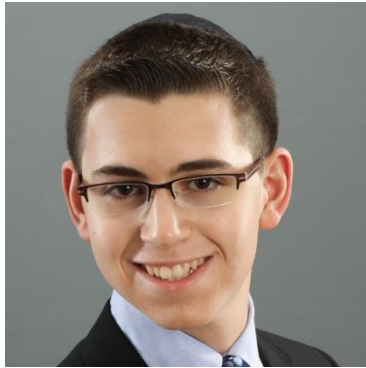
FIELD: Biology

MENTOR: Dr. Anwar Hossain, Senior Research Scientist, MD, Department of Neurosurgery, Anderson Cancer Center

“Science and math allow one to explore the principles underlying nature. Understanding these principles allows one to create technology to manipulate and harness the power of nature. All these aspects of math, science, and technology intrigue me.”

For his research, Frederick identified a potential new treatment for glioblastoma multiforme, the most malignant type of adult brain cancer, using human mesenchymal stem cells to secrete exosomes containing anticancer microRNA. He tested this treatment through in-vitro and proof-of-principle studies. Both of Frederick's parents are physicians in a cancer center; hearing stories of the difficulties that their patients often face is what drove him to pursue research that might contribute to improving outcomes for cancer patients.

Frederick's favorite subject in school is organic chemistry. “Learning about the fundamental molecules that control life is fascinating to me,” he explained. He is also a National Merit Scholar Semifinalist, and a member of the Junior States of America club. In addition to his academic pursuits, Frederick dedicates time to serving his community locally and abroad. He is a two-year participant and “lead teacher” in his school's annual community service trip to Costa Rica, which focuses on providing English lessons to underprivileged students. Frederick is an avid soccer player and is the captain of his school's varsity soccer team. He is currently considering a profession biomedical research or engineering, which would allow him to practically apply both his interests in math and science.



JOSHUA MEIER

Bergen County Academies, Hackensack, NJ

HOMETOWN: Teaneck, NJ

PROJECT: Control of Induced Pluripotent Stem Cell Aging by Modulation of Mitochondrial DNA Deletions

FIELD: Genetics

MENTOR: Dr. David A. Sinclair, Professor, Genetics Department, Harvard Medical School

“Due to the lack of much past research in the field of mitochondrial DNA, I had to design my own genomic screening methods and generate

stem cells myself.”

Joshua’s project focused on developing techniques to control mitochondrial DNA deletion levels in order to force rapid aging in cancer cells (to stop their growth) and slow rapid aging in artificially-generated stem cells. Joshua’s father and sister, who are both obstetrics and gynaecology doctors, inspired him to embark on research to understand why cells possess rapid aging symptoms and whether artificially created stem cells could also be used in clinical settings. He began dissecting pathways of aging and studying mitochondria, an element of stem cell aging that had not been previously studied. His findings have the potential to revolutionize the field of regenerative medicine.

Joshua’s passion for computer science began on his fourth birthday, when he received a computer game called *Pajama Sam*. Captivated by the main character’s adventures, Joshua dreamed of one day designing his own video games, and dove into the world of programming at age eight. Using his programming skills, Joshua has published free applications available in the Apple App Store; developed iPhone software for physicians at Columbia University Medical Center to determine patients’ visibility; and works part time as a computer vision engineer at Canary, a small startup building inexpensive home security devices. He captured second place at the Intel International Science and Engineering Fair in 2012 and was a finalist at the Google Science Fair in 2012. Outside of class, Joshua competes on his school’s debate team and teaches debate skills to homeless and abused youth. Joshua plans to pursue a career in science and combine his diverse interests in research, entrepreneurship and medicine.



GERALD MEIXIONG

Lakeside High School, Evans, GA

HOMETOWN: Evans, GA

PROJECT: Cell-Cycle Regulated Membrane Association of NuMA: A Novel Pathway for Efficient Chromosome Segregation

FIELD: Biochemistry

MENTOR: Dr. Quansheng Du, Associate Professor, Georgia Regents

“The most challenging experience is confronting the unknown. I have never done something in my life where days, even weeks, of work can be spent on a scientific process with there being a possibility for no results.”

Gerald’s research focused on mitosis, the process by which cells divide and sustain life. During mitosis, DNA, the genetic instructions necessary for development of all living organisms, is duplicated to enable cells to grow. To understand how chromosomes are pulled towards opposite ends and what creates this pulling force, Gerald sought to elucidate the mechanism by which the pulling force is generated by using a variety of techniques including cell culture, fluorescence imaging, in vitro lipid binding, and transfection. As a result of his work, Gerald discovered a novel mechanism for efficient chromosome segregation. His study could provide insight into molecular mechanisms of faithful duplication of DNA in mitosis and identify potential targets for the development of therapeutic drugs for cancers, which rely on unbridled cell division.

Inspired by his brother’s exceptional performance in the 2008 National Finals of the Siemens Competition, Gerald decided to pursue research in biochemistry by exploring a deep fascination with the cell and the mitotic spindle. “Learning about how intricate DNA is, let alone one cell, piqued my interest in scientific research,” he said. Gerald enjoys competitive swimming and volunteers as a Junior Volunteer at the University Hospital in Evans, GA, where he assists nurses in helping cancer patients and serves as a clerk. Gerald plans to pursue a career as a researcher or professor.



IVAN PASKOV

Edgemont Junior/Senior High School, Scarsdale, NY

HOMETOWN: Scarsdale, NY

PROJECT: Predicting Cancer Drug Response Using Nuclear Norm Multi-Task Learning

FIELD: Computer Science

MENTOR: Dr. Christina Leslie, Head of Computational Biology Laboratory, Memorial Sloan-Kettering Cancer Center

“My algorithm represents a significant step forward for personalized cancer treatment.”

The future of personalized cancer treatment relies on the existence of computational models that can accurately predict a cancer drug's response when given the genetic makeup of a patient's cancer. The current state-of-the-art algorithm, Elastic Net, is limited by its inherent inability to exploit the complex relationships between drugs. Ivan proposed a novel computational tool inspired by the human brain, which takes full advantage of the important relationships between drugs, to greatly increase the accuracy of drug response predictions. The increase in accuracy of the proposed method is on average 35% and as high as 61% over the current algorithm, providing novel insights into cancer that will lead to computationally driven, personalized cancer treatments.

Ivan's mother was diagnosed with cancer when he was in the fifth grade. He turned his initial shock and fear into a passionate determination to fight cancer by conducting breakthrough research. Ivan is the president of the Edgemont Technology club, a group that attempts to improve the school through technology. He plays the alto saxophone in his high school band and jazz band. Ivan volunteers at the Builders Club, a community service program that provides food and shelter for the homeless. He was a Perfect Scorer and Gold Medalist in the United States Math Talent Search. Additionally, he won both first place and the “Intel Excellence in Computer Science” award at the Westchester Science and Engineering Fair. He hopes to continue his cancer research after college.

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TEAM COMPETITORS

AARON ARGYRES, Clayton High School, Clayton, MO

MINGU KIM, David H. Hickman High School, Columbia, MO

PROJECT: Increasing the Proliferation Rate and Inducing Osteogenic Differentiation of Dental Pulp Stem Cells with Graphene/Poly (4-vinylpyridine) Composite Substrates

FIELD: Bioengineering

MENTOR: Miriam Rafailovich, Distinguished Professor, Garcia MRSEC Lab, Stony Brook University

"We originally thought to study graphene's electrical properties in some way, assuming that it only had potential usages in computer technology, as we had read in popular science magazines. When we read about its potential uses in bioengineering, we were hooked."

For their project, Aaron and Mingu used graphene as a substrate for stem cells derived from dental pulp, and found that the material increases cell viability and induces biomineralization. This technology could potentially be used for bone regenerative therapy, as graphene copolymers can be bioengineered into scaffolds to help adult dental pulp stem cells grow.



AARON ARGYRES

HOMETOWN: Clayton, MO

"I think my interest in science and math was first piqued with my physics class freshman year. Here, I saw WHY we study math and science, and how they are by nature connected."

Aaron is a senior at Clayton High School and his favorite subject is chemistry. Aaron aspires to work at the intersection of business and engineering or as a professor in science and engineering. In particular, he plans to leverage his knowledge of math and the physical sciences and his love for public speaking in his future career. Aaron practices public speaking by performing in multiple shows each year as president of the school Drama Guild.



MINGU KIM

HOMETOWN: Columbia, MO

“Math is my favorite subject; it’s probably because I enjoy the creativity required to solve complex math problems, and it’s thrilling when everything works out! I really enjoy science because of its curiosity to explore the unknown and answer questions with more questions.”

Mingu has had a passion for mathematics since he first started to count. He is now the chapter president of Mu Alpha Theta, a National Mathematics Honor Society, and founder and president of his school's Science Honor Society. He was named a National Merit semifinalist, has been practicing the piano and violin for 11 years, and has played on the Missouri All-State Orchestra for the past three years. He is also a mentor in Stand By Me, an organization that helps low-income and troubled youth in the community.

ALYSSA CHEN, Highland Park High School, Dallas, TX

SHRIYA DAS, The Hockaday School, Dallas, TX

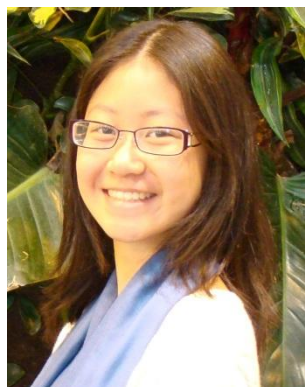
PROJECT: Encapsulation of c-di-GMP adjuvant into pH-tunable micelle-based nanoparticle heightens immune response

FIELD: Materials Science/Nanoscience

MENTOR: Dr. Jinming Gao, Professor, Simmons Comprehensive Cancer Center, University of Texas Southwestern Medical Center at Dallas

“Our primary finding was a nanoparticle that can be used to encapsulate many vaccines. Thus, vaccines that are effective and safe for human use can potentially be made to target different types of difficult-to-cure diseases effectively.”

For their project, Alyssa and Shriya used the application of nanotechnology to formulate a new adjuvant that boosts immune responses and has the potential to be used to develop more effective vaccines for cancer and infectious diseases.



ALYSSA CHEN

HOMETOWN: Dallas, TX

“What I most enjoy about math and science is the fact that it can be proven. I enjoy backing up claims with evidence, especially evidence that I personally worked to come up with.”

Alyssa’s freshman biology teacher sparked her interest in the subject, and her love of science simply expanded from there. When Alyssa was first introduced to the concept of nanotechnology, and the ability to manipulate molecules at microscopic levels, she was immediately fascinated and determined to find some way to experience it first-hand. Alyssa is the secretary and three-time all-region member of the Highlander Strings Orchestra, as well as a Decathlete in Academic Decathlon. She also spent the summer of 2012 as a junior volunteer for the Texas Scottish Rite Hospital for Children. Alyssa plans to pursue a career in biology or chemistry, perhaps as a gastroenterologist.



SHRIYA DAS

HOMETOWN: Plano, TX

“I find it fascinating that in scientific and technological research, the findings and results come with both positive benefits and negative possibilities. Thus we must ensure that we maximize the benefits of the discoveries and the positive impact they can have on society.”

Shriya’s inspiration to compete was piqued in middle school when she first observed presentations by Siemens Competition Regional Finalists. Shriya’s favorite subject is math because it instills in one a systematic and logical approach that is necessary to solve problems efficiently. She is a member of the Madrigals, an honors choir program; tutors students in reading and math; participates in the Hockaday Annual Musical; frequently performs in Indian

classical music and dance performances; and participates in her school's robotics club. She plans to pursue a career in medicine or technology.

NOAH GOLOWICH, Lexington High School, Lexington, MA

KAVISH GANDHI, Newton North High School, Newton, MA

PROJECT: Partition Regularity of Linear Homogeneous Equations and Inequalities

FIELD: Mathematics

MENTOR: Laszlo Miklos Lovasz, Ph.D. candidate, Department of Mathematics, Massachusetts Institute of Technology

"We significantly strengthened current results in Ramsey Theory, a field of mathematics dealing with large systems that could have implications in theoretical computer science, biology, and game theory."

For their project, Noah and Kavish collaborated to significantly strengthen current results in Ramsey Theory, a field of mathematics centered on proving that patterns must emerge in a sufficiently large system. Their research could have implications in theoretical computer science, biology, and game theory.



NOAH GOLOWICH

HOMETOWN: Lexington, MA

"I enjoy the rigor involved in math and science, but also like the creativity required in order to develop new ideas for results."

Noah discovered his love of mathematics after joining a math club in elementary school and finding the problems stimulating. Given his lifelong interest in math and science, he enjoyed the opportunity to pursue mathematical research with his mentor and partner, and found the process of discovering previously unknown results exciting. As a math team captain at his high school, Noah often assists and gives lectures to his teammates. He participates in various community service activities through his membership in the National Honors Society, has received awards for his performance on national French and Spanish exams, and competes on his school's tennis team. He plans to pursue a career in mathematics or science.



KAVISH GANDHI

HOMETOWN: Newton, MA

"My favorite subject is mathematics because of its inherent beauty. Plus, the feeling that I get after I struggle and then finally, the jigsaw pieces snap together, and I solve a math problem, is unmatched in any other subject... Math is the best!"

Kavish became interested in mathematics at a young age, simply from spending time outdoors and taking note of naturally occurring patterns. His passion for math continued to grow and led him to participate in numerous mathematics competitions. Kavish is also a three-time participant in the annual North American Environthon competition. In 2013, he and his team were awarded second place out of nearly 5,000 teams that

competed. Kavish is interested in pursuing a career in mathematics, software engineering, economics or theoretical physics.

ANDREW JIN, The Harker School, San Jose, CA

STEVEN WANG, The Harker School, San Jose, CA

PROJECT: Rational Discovery and Optimization of Synergistic Chemotherapy Combinations: A Novel Framework Integrating Gene Perturbation Analysis and Machine Learning Algorithms

FIELD: Biochemistry

MENTORS: Dr. Andrew Beck, Assistant Professor of Pathology and Director of the Molecular Epidemiology Research Laboratory, Beth Israel Deaconess Medical Center and Harvard Medical School; Dr. Dobrin Dragonov, Post-Doctoral Research Fellow, City of Hope, Cancer Immunotherapeutics & Tumor Immunology; Dr. Peter Lee, Billy and Audrey L. Wilder Professor, Chair of the Department of Cancer Immunotherapeutics & Tumor Immunology, City of Hope

“The goal of our project was to use bioinformatics to predict synergistic chemotherapy combinations and then validate them in actual wet lab experiments.”

Andrew and Steven combined computational screening with wet lab experimentation to speed up the discovery of effective anticancer drug combinations. The novel multicomponent therapeutics they developed can enhance treatment potency, reduce toxicity, prevent resistance and shorten the time it takes pharmaceutical manufacturers to create first-in-class treatments.



ANDREW JIN

HOMETOWN: San Jose, CA

“I love the interdisciplinary nature of the math, science, and technology fields.”

Andrew is an officer in his school’s science research club and teaches younger students best practices for developing research. Andrew also volunteers for the Breakthrough Silicon Valley program, through which he tutors underprivileged high school students in math and science. He is captain of his school’s public forum debate team, serves as an active member of the Boy Scouts, and plays classical piano. He plans to start a company in either the high-tech or health industry, or become a research professor.



STEVEN WANG

HOMETOWN: Los Altos, CA

“Biology is my favorite subject because it beautifully integrates complex and diverse processes to create life.”

Steven was inspired to pursue his research project after his father passed away from colon cancer. In his memory, he hopes to find a cure. Steven earned National Semifinalist distinctions at the Tournament of Champions in Extemporaneous Speaking and was part of the first-place winning team at Technology Students Association Tests of Engineering Aptitude, Math and Science. He participates in speech and debate, volunteers for the American Cancer Society and plays baseball. He plans to pursue a career in medicine or computer programming.

DAVID LU, Mills E. Godwin High School, Henrico, VA

ALLEN LEE, Millburn High School, Millburn, NJ

JASON LEE, Millburn High School, Millburn, NJ

PROJECT: Rationale-based design of a targeted therapy for prostate cancer with SPOP mutations

FIELD: Biochemistry

MENTOR: Dr. Jason Chen, PhD, Virginia Commonwealth University

“By examination of the human genome database, we identified a mechanism for prostate cancer with a special mutation.”

After a close family friend of Allen and Jason was diagnosed with prostate cancer, the team members were surprised by the lack of therapy options available for patients suffering from the disease. To solve this, the team probed the human genome database and conducted numerous PubMed searches to understand which genome sequence was most important in prostate cancer. As a result of their research, they identified a mechanism for treating prostate cancer with a special mutation, which could potentially be used in therapy.

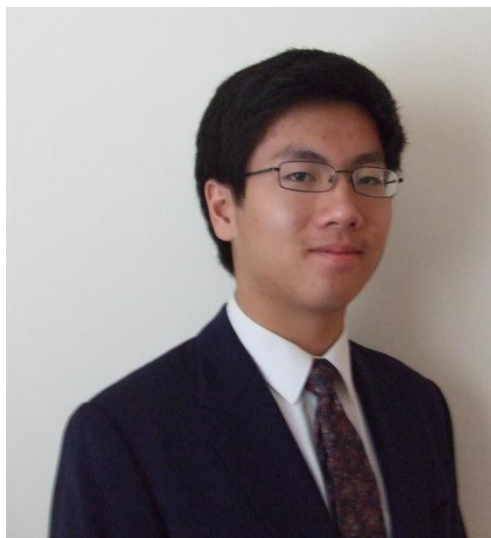


DAVID LU

HOMETOWN: Richmond, VA

“What I like most about science are the advancements in medicine and health.”

David’s deep interest in science began in the seventh grade when he began performing a variety of hands-on science experiments under the leadership of his inspirational, enthusiastic teacher, Ms. Mitchell. Today, his favorite subject is AP Biology. At school, David a member of the debate team, serves as a youth group officer and plays tennis. He hopes to pursue a career in the field of science as a doctor or engineer.



ALLEN LEE

HOMETOWN: Short Hills, NJ

“Science is my favorite subject. I love science because it examines the system in which life and society operates.”

Born in to a family of science and math, Allen started going to his father’s lab at the age of seven and became inherently curious about the world around him. As a sophomore, Allen’s favorite subject is science because it examines the fundamentals of human life and how elements connect in the physical world. Allen was also a Regional Finalist in the 2012 Siemens Competition. He is a member of the debate team and

plays the piano. After college, Allen aspires to become a biochemist.



JASON LEE

HOMETOWN: Short Hills, NJ

“Science is exciting because you can use simple formulas to explain the natural phenomena of the world.”

Jason has a thirst for knowledge and says his favorite subject in school is science because the subject is always evolving and advancing. Like his brother and teammate Allen, Jason credits his interest in the sciences to his parents. Jason competes as a member of the Science Olympiad team, volunteers at a church camp, plays competitive chess and plays tennis. Jason’s fascination with technology and computer science has inspired him to pursue a

career related to bioinformatics.

PRIYANKA WADGAONKAR, George W. Hewlett High School, Hewlett, NY

ZAINAB MAHMOOD, George W. Hewlett High School, Hewlett, NY

JIAWEN PEI, George W. Hewlett High School, Hewlett, NY

PROJECT: The Isolation and Characterization of an Ozone Responsive Stress Related Protein (OZS) in *Ceratopteris richardii*

FIELD: Biology

MENTOR: Dr. Terrence Bissoondial, Biological Research Teacher, George W. Hewlett High School

“We found a correlation between ozone resistance and the copy number of a gene. This gene can potentially make important crops more resistant to various forms of abiotic stress.”

In their study, Priyanka, Zainab and JiaWen found a correlation between ozone resistance and the copy number of a gene. This gene can potentially make important crops more resistant to various forms of abiotic stress such as drought and increasing salinity of soil.



PRIYANKA WADGAONKAR

HOMETOWN: Woodmere, NY

“I like that our very existence can be explained by laws of science and gives me a better understanding of the world around me.”

Priyanka’s parents’ work as a cell biologist and a gastroenterologist has influenced her interest in science. Priyanka is a recipient of the George Eastman Young Leaders Award and chair of the Cabaret Night Business Committee. She aspires to become an emergency room physician.

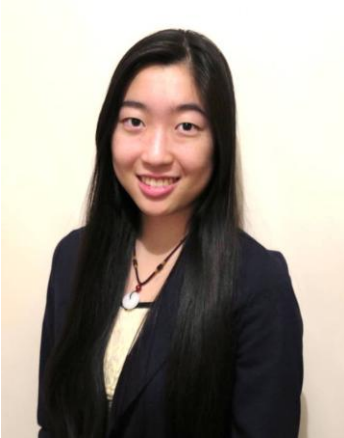


ZAINAB MAHMOOD

HOMETOWN: Hewlett, NY

“Science and technology are always changing – there are new developments every day and each finding is a vital component of a solution to the problems of today.”

Zainab has always been interested in math and science because they are subjects that have practical applications in the real world. Zainab is a member of the National Honor Society, a Euro Challenge Semifinalist, recipient of the United States Army Award, and second-place winner of the Long Island Science and Engineering Fair. She volunteers at the Franklin Early Childhood Center and plays Varsity Lacrosse. Zainab aspires to become an engineer.



JIAWEN PEI

HOMETOWN: Valley Stream, NY

“Science allows us to better understand ourselves and our surroundings.”

JiaWen has been interested in biomedical sciences since a young age, which prompted her interest in the ozone and abiotic stress. She is a member of the National Honors Society and Foreign Language Honors Society. JiaWen volunteers regularly at the Veterans Hospital of New York and tutors students in physics and math. She is the captain of her school’s fencing team and participates in music-related activities such as chorus, orchestra, and piano. She aspires to become a physician.