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2015 SIEMENS COMPETITION IN MATH, SCIENCE & TECHNOLOGY
Regional Finalists – Carnegie Mellon University

NAME: EDRIC CHEN
SCHOOL: The Kew Forest School, Forest Hills, N.Y.
YEAR: Senior
HOMETOWN: Forest Hills, N.Y.
PROJECT: TRIANGLE-FREE 4-CHROMATIC UNIT DISTANCE GRAPHS AND RELATED PROBLEMS
FIELD: Mathematics
MENTOR: Dr. Lousie Grotenhuis, Upper School Principal, Kew Forest School; Professor Dan Ismailescu, Hofstra University

"I like how there is always something new to discover in STEM, and there are always areas to explore and discover."

A fascination with graph theory for Edric began his sophomore year in high school and drove his Siemens Competition project – where he found graphs to help answer the question: What is the minimum number of colors required to color the plane such that no two vertices at distance one from each other have the same color? He found several small triangle-free unit-distance graphs that need a minimum of four colors to color without any adjacent vertices being the same color.

Edric has taken a variety of STEM related Advanced Placement classes such as Chemistry, Physics C, Calculus and Computer Science, and he is currently taking a college level physics course in Light & Heat. He was a National Finalist for the United States National Chemistry Olympiad and recipient of the Advanced Placement Scholar Award. Edric enjoys playing table tennis with friends, and participated in regional competitions as a member of the school team.

Edric speaks English, Chinese and French and looks to Thomas Edison as his role model. Edric would love to speak with Carl Friedrich Gauss, the German Mathematician, to ask him about his methods of how he conceived his ideas and theories.

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NAME: SARAH LEE
SCHOOL: Syosset High School, Syosset, N.Y.
YEAR: Senior
HOMETOWN: Woodbury, N.Y.
PROJECT: Next Generation Fatty Acid Binding Protein Inhibitors: Computer-Aided Drug Design and Synthesis of Novel Truxillic Acid Diesters for Chronic Pain Inhibition
FIELD: Chemistry
MENTOR: Dr. Iwao Ojima, Director, Institute of Chemical Biology and Drug Discovery, Stony Brook University

"All these fields are advancing so quickly. It is exciting to see the progress."

Sarah Lee found new chemical properties that could help a class of compounds bind more effectively to a protein crucial for pain inhibition. Sarah's late father served as her inspiration for this research. He often went on medical missions to developing regions of the world, which she later joined after hearing about his experience. After that, she knew she wanted to ease the pain of people who didn't have sufficient medical care.

Sarah aspires to be a pediatric medical missionary. She anticipates majoring in chemistry in college. Her favorite subjects in school are chemistry and mathematics because she likes how everything feels justified, or in other words, how the theories and postulates are backed by definitive equations.

Outside the lab, Sarah tutors students in chemistry through the National Honor Society at her school. She also serves as President of the Brothers and Sisters in Christ Club, President of the World International Networking Club, President of the Syosset High School Orchestra, Vice President of Promising a Better Society organization, is a teacher volunteer at a non-profit organization called El Centro Comunitario of Education, and interns at the Partners for the Future Program at the Cold Spring Harbor Laboratory during the school year.

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NAME: DOMINICK ROWAN
SCHOOL: Byram Hills High School, Armonk, N.Y.
YEAR: Senior
HOMETOWN: Armonk, N.Y.
PROJECT: Determining the frequency of Jupiter analogs & the announcement of a Jupiter analog orbiting a Sun-like star
FIELD: Physics
MENTOR: Dr. Stefano Meschiari, University of Texas at Austin; Mr. David Keith, Director of Science Research; Mr. James Gulick, Science Research Teacher; Mrs. Stephanie Greenwald Science Research Teacher; Mrs. Megan Salomone, English Teacher, Byram Hills High School

"Having never learned a programming language, developing the skillset to devise my own approach to problems was a challenging, yet rewarding experience."

Dominick found his passion for exoplanet detection in an article he read in *Scientific American*. He became fascinated with other worlds and wanted to explore the topic further. For Dominick's project he detected a new Jupiter-like planet and calculated how many stars host a Jupiter-like planet. His discovery allows the world to evaluate the commonality of the Solar System.

In total, Dominick has taken nine STEM courses in high school. He enjoys the problem solving and independently developing ways to approach problems that STEM courses allow. He is a Cum Laude Society member, the Vice President of a volunteer club and has received the Byram Hills High School Junior Science Research Award.

Dominick plays a variety of instruments: the French horn, piano, guitar and bass guitar. He is also a member of his high school's track team, running in both the winter and spring seasons. Dominick aspires to be a scientific researcher and would enjoy speaking with Johannes Kepler because he created integration between the studies of Astronomy and Physics.

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NAME: KAMERON SEDIGH
SCHOOL: Kings Park High School, Kings Park, N.Y.
YEAR: Senior
HOMETOWN: Kings Park, N.Y.
PROJECT: Structural and Kinetic Analysis of methicillin-resistant Staphylococcus aureus MenE, an acyl-CoA Synthetase of the Bacterial Menaquinone Biosynthesis Pathway as a Novel Antibacterial Target
FIELD: Biochemistry
MENTOR: Ms. Mary Ellen Fay, Science Research Advisor, Kings Park High School; Dr. Peter J. Tonge, Professor of Chemistry, Chemistry Department, Stony Brook University

"Math, science, and technology are always changing; there is always more to learn and more to develop. Thus, research is never finished and that's what makes studying in these fields so interesting and riveting."

Kameron's inspiration for his project came from a newspaper article that highlighted the emergence of "superbugs", which are extremely drug-resistant bacteria. He came across Dr. Tonge's research at Stony Brook and was immediately drawn to antibacterial drug research. Kameron focused on Methicillin-resistant Staphylococcus aureus (MRSA) in part because he had heard of the devastating effects of the disease when there was an outbreak of MRSA in the National Football League and one of his favorite players, former New York Giant Lawrence Tynes was infected with the disease, which ultimately ended his football career. The potential novel antibacterial target developed by Kameron can be used in drug development against diseases like MRSA.

Outside of the laboratory, Kameron is the President of the Science Olympiad Club, the Co-Founder of the Nissequogue River State Park Student Foundation and the Vice President of Kings Park High School Student Council. Kameron also plays on the Varsity Soccer Team and participates in Track and Field during both winter and spring seasons. He also plays the guitar, as well as the trombone in his high school's Jazz Band, Marching Band, and Symphonic Winds ensemble.

Kameron's role model is Emma Watson because of the way she has used her fame for the good of others, as a UN Woman Goodwill Ambassador. Kameron is inspired by Emma's intelligence, humility, and bravery to speak up when others cannot. His dream is to acquire an MD or PhD to work as a professor at an elite university while still performing high-quality research.

NAME: JULIAN UBRIACO
SCHOOL: Kings Park High School, Kings Park, N.Y.
YEAR: Senior
HOMETOWN: Northport, N.Y.
PROJECT: Identification and Characterization of Novel Diagnostic and Therapeutic Targets in Pancreatic Ductal Adenocarcinoma Using an Antibody-based Approach
FIELD: Biology
MENTORS: Tobiloba Oni, PhD Candidate, Cold Spring Harbor Laboratory; Dr. David Tuveson, Professor and Deputy Director, Cold Spring Harbor Laboratory Cancer Center

"As our knowledge grows new questions and advances emerge that not only keeps STEM intriguing but also improves the lives of billions of people."

Julian Ubriaco identified three novel therapeutic and/or diagnostic targets using an antibody-based approach in pancreatic cancer. The discovery of these targets validated the potential of the organoid-based hybridoma and phage display technologies to uncover new biomarkers in malignancy. With his project, the world can possess a mechanism, by which countless drugs and screening tools can be developed against cancer and to better detect and treat pancreatic cancer – helping improve cancer survival using the three novel targets that were identified.

Julian plans to pursue a career in biotechnology, possibly in an enterprise capacity. He anticipates majoring in biological engineering, possibly in conjunction with an economics major. Currently, his favorite subject is biology, and his voracious curiosity as a child first piqued his interest in STEM.

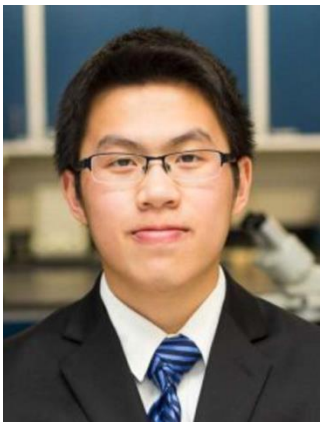
Outside the lab, Julian serves on his School's Student Council and participates in Model UN. He also plays tennis. If Julian could speak with anyone from history it would be Marie Curie.

TEAM COMPETITORS

JUN YAN HE, Manhasset Senior High School, Manhasset, N.Y.
BONGSEOK JUNG, Herricks High School, New Hyde Park, N.Y.
PROJECT: Salicin as a Multipurpose Therapeutic Approach for Colorectal Cancer: Striking a Balance in the Regulation of COX to Maximize Benefits While Minimizing Side Effects
FIELD: Biochemistry
MENTOR: Dr. Patrick Cadet, Senior Research Faculty, College at Old Westbury, State University of New York

Jun Yan He and Bongseok Jung's research suggests that the compound salicin can reduce inflammation, pain, cancer migration, cell immortalization, and the multiplying of cells in colorectal cancer with minimal side effects. This could revolutionize colon cancer treatment. Recording that salicin actually

selectively kills tumor cells was their most surprising result. The development opened up a whole other part of the project: determining the mechanisms behind its selectivity.



JUN YAN HE
YEAR: Senior
HOMETOWN: Manhasset, N.Y.

"Colorectal cancer has always been a huge problem. I wanted to look at homeopathic medicine so I looked at salicin, which has been shown to target COX2, a gene that has recently been linked to colorectal cancer."

Jun Yan aspires to pursue an MD and PhD and be a doctor and researcher. He anticipates majoring in biology when he enters college. His favorite subject is multivariable calculus because it is not about memorizing, but rather applying logic; he appreciated the critical thinking required to excel in it.

Jun Yan believes that in order to encourage more students to pursue STEM, more competitions should be created on a large scale, which would encourage students to participate. Jun Yan's favorite part about STEM is its real world applications – particularly seeing how it advances life and shapes the future. Jun Yan's father is a doctor and introduced him to science at an early age.

Outside of the lab, Jun Yan is a member of the Science Honor Society and a member of Tri-M. He similarly mentored another student's research on multiwall carbon nanotubes in Alzheimer's. He also plays the oboe and piano and enjoys playing tennis. Jun Yan admires Bill Nye the Science Guy.

BONGSEOK JUNG
YEAR: Junior
HOMETOWN: Albertson, N.Y.

"I'm really excited about all the new findings that are coming out every day about cancer. New genes, new pathways, new therapeutic targets that are constantly being discovered are making us one step closer to hopefully "curing" cancer one day."

Bongeseok currently aspires to be an orthopedic surgeon. Even from a young age, Bongseok's father constantly told him fascinating stories about space, atoms, and our body, which all contributed to his current interest in science and biology. Being told that we are just one tiny, insignificant planet out of billions and billions of planets in our enormous universe really got him excited about STEM.

Bongseok believes that in order to encourage more participation in STEM, people should know about the importance that it holds in advancing society. Bongseok's first-hand witness of chemotherapy treatment on his grandmother inspired him to pursue his research.

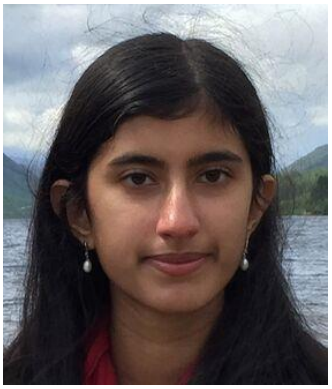
Outside of the lab, Bongseok participates in Science Olympiad, volunteers at North Shore LIJ Hospital, and competes in winter and spring varisty track. He also plays the piano. If Bongseok could speak with anyone from history, it'd be Isaac Newton – he'd want to ask him what exactly was going through his head when he created calculus out of thin air.

TEAM COMPETITORS

ALIA RIZVON, Half Hollow Hills High School East, Dix Hills, N.Y.
VISHAL NYAYAPATHI, Half Hollow Hills High School East, Dix Hills, N.Y.
PROJECT: A Vesicular Interaction Between Basal Body Protein Chibby and CCDC11: Implications for Ciliogenesis and Related Ciliopathies
FIELD: Biology
MENTORS: Dr. Michael Lake,Research Program Director, Half Hollow Hills High School East; Dr. Ken-Ichi Takemaru, Associate Professor, Stony Brook University School of Medicine; Saul Siller, MD/Ph.D student in Pharmacology, Stony Book University School of Medicine

"Our research helps to better understand a crucial interaction between ciliary proteins associated with disorders resulting from defective cilia."

Alia Rizvon and Vishal Nyayapathi confirmed a physical interaction between two ciliary proteins that are associated with ciliopathies, or disorders that come from defective cilia. The research can help to develop treatments for these diseases. Alia and Vishal were interested in pursuing this research topic because of its close relationship with clinical science. Knowing that their research could result in a cure or treatment for a disease that thousands suffer from was a motivating factor.



ALIA RIZVON
YEAR: Junior
HOMETOWN: Dix Hills, N.Y.

Alia Rizvon is fascinated by the interconnection between all processes in the world. She sees human geography and biology as important subjects because they describe how the world came to be and how people relate to each other. She aspires to be an ambassador or neurologist.

Outside of the classroom, Alia plays the violin and viola. She also participates in the Amnesty Club at her high school. She is treasurer of the French Honor Society and participates in the Institute of Creative Problem Solving.

VISHAL NYAYAPATHI
YEAR: Junior
HOMETOWN: Melville, N.Y.

As a career, Vishal would like to pursue either medicine or diplomacy. He was able to pursue both interests on a community service project in India, where he conducted safety workshops for children in government-run schools.

Vishal is vice president of his school's Amnesty Club and is active in the French Honor Society. His favorite subject in school is French because he has a passion for learning languages because it pushes him outside of his comfort zone. Outside of school, he volunteers at the Huntington Hills Rehabilitation Center and enjoys kickboxing.

TEAM COMPETITORS

KEVIN SADHU, Manhasset Senior High School, Manhasset, N.Y.
ARVIND SRIDHAR, Bellarmine College Prep School, San Jose, Calif.
PROJECT: Synthesis and Application of Novel, Cost-Effective, Biomimetic Hydrogels Doped with Nanoscale Graphene Oxide as Scaffolds for Tissue Engineering and Drug Delivery
FIELD: Materials Science
MENTOR: Dr. Miriam Rafailovich, Director of Garcia Center for Polymers at Engineered Interfaces, Stony Brook University

Kevin Sadhu and Arvind Sridhar designed and engineered a novel hydrogel using recently discovered graphene oxide to develop a targeted drug delivery system with capabilities for cancer therapy, tissue engineering, and cell growth. They found that their hydrogels can selectively inhibit cancer cell proliferation, bringing new hope for cancer patients who suffer from ineffective or debilitating chemotherapy. Furthermore, because the graphene hydrogels have the potential to target certain sites and effectively release drugs and growth factors, they could combat a variety of fibrotic diseases and promote the growth of cells and tissue.

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KEVIN SADHU
YEAR: Senior
HOMETOWN: Manhasset, N.Y.

"I like the fact that science and math are limitless."

Kevin aspires to be an engineer, most likely in the field of computer science or biomedicine. He anticipates majoring in computer engineering and/or biomedical engineering.

Winning the Intel International Science and Engineering Fair is Kevin's proudest accomplishment. It was his first international science event, and Kevin earned the second place grand award in the biochemistry category. He was also selected as a finalist in the International Sustainable World Energy, Environmental and Engineering Project Olympiad, invited to Washington D.C. to present at the American Federation for Medical Research Conference and chosen as a state finalist in the New York Science Congress competition. Since a very young age, Kevin assisted his father, an electrical engineer, in building, designing and optimizing circuits and electrical equipment.

Outside of the lab, Kevin is a tutor in his school's Science Honor Society. He conducts lab demonstrations and tutors students in mathematics and science. He is also a peer responder mentor in his school's English department, helping students write research papers. In addition, he is also the president of his school's Math Honor Society, volunteers at North Shore University Hospital, and is an active leader on his school Science Olympiad team. Kevin also participates in many cultural activities at his church and enjoys playing basketball in his free time.

ARVIND SRIDHAR
YEAR: Junior
HOMETOWN: Sunnyvale, Calif.

"I feel that, for more students to get excited in STEM, they need to be able to engage hands-on in activities and discussions in order to believe in themselves that they can make a big contribution."

Arvind aspires to be an entrepreneur in biomedical engineering and/or computer science. Arvind first became interested in STEM when he built a LEGO model of the Mars rover. Also, both of Arvind's parents are engineers at Intel and would take him around the office to show him the atmosphere of a technology company.

Arvind believes that, in order to get more students interested in STEM, they need to be able to engage in hands-on activities and discussions in order to believe that they can make a big contribution to society. He also appreciates that interpersonal skills are becoming more important to STEM, stressing the importance that a scientist must be able to communicate his research to an audience and work with others. He is very excited to join this movement.

Outside of the lab, Arvind is the Founder and President of Geography for Tomorrow, a 510(c)3 nonprofit organization that spreads geo-literacy to and empowers low-income youth to become successful citizens. Furthermore, he serves as the Research Director of his school's Science Club and the Founder and President of his school's Android Club. He also participates at the state level in Speech and Debate as an Original Advocacy Speaker, and is the Editor-in-Chief of his school's political review. In his free time, Arvind loves to bike, read, and play basketball on his intramural basketball team.

TEAM COMPETITORS

KUNAL SHAH, Syosset High School, Syosset, N.Y.
BRIAN RHEE, Half Hollow Hills High School East, Dix Hills, N.Y.
ROSHAN PATEL, Ward Melville Senior High School, East Setauket, N.Y.
PROJECT: Enhanced Power Output and Tolerance to Fuel Impurities Demonstrated in a Polymer Electrolyte Membrane Fuel Cell Utilizing a Graphene Oxide Nanoparticle Coated Nafion Membrane
FIELD: Materials Science
MENTOR: Mr. Hongfei Li, Research Assistant, Stony Brook University;
Dr. Miriam Rafailovich, Distinguished Professor, Stony Brook University

"Our project helps to kick start the clean energy generation."

Kunal Shah, Brian Rhee and Roshan Patel worked together to find a potential new use for a nanoparticle that could help improve the function of hydrogen fuel cells. Their research findings could reduce the cost and improve the power output of the fuel cell, which can ultimately move consumption away from forms of energy that emit petroleum and greenhouse gases. The students were inspired to pursue this research as a way to solve the Earth's energy crisis.

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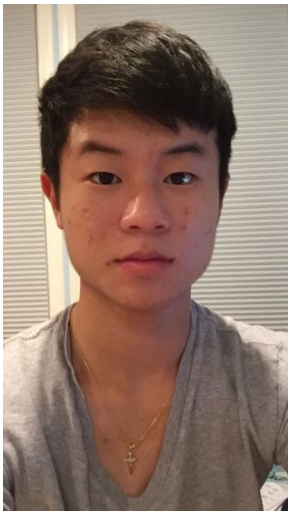
KUNAL SHAH
YEAR: Senior
HOMETOWN: Syosset, N.Y.

Kunal Shah is an aspiring doctor with a passion for mathematics. In his spare time, Kunal volunteers at Stony Brook University Hospital to gain experience in the medical profession. He's interest in STEM because the field works to explain many of the mysteries of the universe.

Outside of the classroom, Kunal is the leader of his high school's South Asian Culture Club. He also privately tutors students on the mathematics portions of the SAT.

If Kunal could speak with any person from history, he would want to debate the philosophy behind nonviolent resistance with Mahatma Gandhi.



BRIAN RHEE
YEAR: Senior
HOMETOWN: Dix Hills, N.Y.

Brian Rhee has been interested in science ever since he was a child, digging for dinosaur bones in his front lawn. Since then, he has developed a passion for STEM as a way to understand the complexities of the universe. He hopes to become a physician and has already done research on how to prevent the onset of Alzheimer's disease.

Brian plays the violin and was named an All-State musician. He is Principal Chair for the New York Laureate Orchestra, which is a nonprofit organization that plays concerts at nursing homes. He also

tutors students in science and mathematics for an organization called Tutor for Donations, which donates the tutoring proceeds to Doctors Without Borders. Brian is Captain of the varsity tennis team.

ROSHAN PATEL
YEAR: Senior
HOMETOWN: South Setauket, N.Y.

Roshan Patel has a passion for physics because of the way the field helped develop his problem solving skills and piqued his intellectual curiosity. He first became interested in science when he saw a documentary about the creation of the universe and realized that studying math and science would help him to better understand the world.

Roshan hopes to study computer science in college and eventually become a software developer for Google.

Outside the classroom, Roshan volunteers at Stony Brook University Hospital and participates in his school's Model United Nations team.

TEAM COMPETITORS

KIMBERLY TE, Manhasset Senior High School, Manhasset, N.Y.
CHRISTINE YOO, Manhasset Senior High School, Manhasset, N.Y.
PROJECT: Natural, Cost-Effective Anodes for Optimized Sediment Microbial Fuel Cells: Engineering a Novel Approach to Harvesting Energy and Cleaning Up Oil Spill Regions
FIELD: Engineering
MENTORS: Alison Huenger and Peter Guastella, Science Educators, Manhasset High School

"The device we created helps to clean up oil pollution and create a cleaner energy source to power remote sensors."

Kimberly and Christine have engineered a device made of natural, sustainable materials that cleans up oil-polluted areas and uses that otherwise unusable oil to generate clean energy to be used to power remote sensors. Kimberly and Christine had previously studied the biological effects of pollution on organisms and wanted to focus their research on cleaning up pollutants, specifically oil. They devised an efficient and cost effective devise that could degrade hydrocarbons, while also producing electricity.

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KIMBERLY TE
YEAR: Senior
HOMETOWN: Manhasset, N.Y.

Kimberly Te hopes to become an environmental engineer to design solutions to our planet's environmental challenges. She hopes to help create new green energy technologies and find ways to sustain the Earth. Kimberly currently has a patent pending for a sustainable, cost-effective microbial fuel cell (MFC) designed for energy production and oil spill remediation.

Outside of the classroom, Kimberly is a staff illustrator and reporter for the Kidsday section of *Newsday*, a New York daily regional newspaper. She is also an assistant at the Science Museum of Long Island, teaching children about STEM.

Kimberly is Editor-in-Chief of her school newspaper and plays varsity tennis.

CHRISTINE YOO
YEAR: Senior
HOMETOWN: Manhasset, N.Y.

Ever since she was in eighth grade and was selected to participate in the Science Research Program at her high school, Christine has been hooked on science. She hopes to become a chemical engineer, or even a professor. She was a finalist for the International Science and Engineering Fair. Christine likes that science is constantly changing because it allows us to continually learn more about how the world works.

Outside of the classroom, Christine participates in Science Olympiad. She is also president of the Breast Cancer Society fundraising group and section leader of her school's marching band. Christine plays the flute, piccolo and piano. She is also a tutor through TASSEL, a program dedicated to teaching English to Cambodian children.