
intel
SCIENCE
TALENT SEARCH
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PUBLIC
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THINK
BEYOND
Intel Science Talent Search
2016 Finalists

2016 Finalists

The Intel Science Talent Search (Intel STS), a program of Society for Science & the Public, is the nation's most prestigious pre-college science competition. Alumni of STS have made extraordinary contributions to science and hold more than 100 of the world's most distinguished science and math honors, including the Nobel Prize and the National Medal of Science. Each year, 300 Intel STS semifinalists and their schools are recognized. From that select pool of semifinalists, 40 student finalists are invited to Washington, DC in March to participate in final judging, display their work to the public, meet with notable scientists, and compete for awards, including three top awards of $150,000.

Intel Science Talent Search 2016

March 10–16, 2016

The 40 finalists of the Intel Science Talent Search 2016, a program of Society for Science & the Public, represent 2.3 percent of entrants to this highly selective and world-renowned scientific competition. These students have been awarded an all-expense paid trip to Washington, DC to attend the Intel Science Talent Institute, where they compete for $1,012,500 in awards.

The 21 young women and 19 young men come from 38 schools in 18 states. Finalists were selected from among 1,750 entrants representing 512 high schools in 43 states, Washington, DC, Puerto Rico and six overseas schools.

Many projects are the product of a research environment in which scientist mentors and teachers dedicate themselves to the intellectual development and technical training of students who participate in the Intel STS. Students are precluded from publicly acknowledging those mentors to avoid any potential for judging bias. Intel STS 2016 finalists, Intel and Society for Science & the Public acknowledge with gratitude the guidance, expertise and patience of the experienced researchers who made many of these projects possible.

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Intel Science Talent Search

History

The Science Talent Search (STS), a program of Society for Science & the Public since its launch in 1942, is the nation's oldest and most highly regarded pre-college science competition. The STS provides an incentive and a forum for U.S. high school seniors to complete an original research project and to be recognized by a national jury of accomplished professional scientists, mathematicians and engineers. The projects are a result of inquiry-based learning methods designed to nurture critical reasoning skills, experience research through the use of the scientific method, and demonstrate how math and science skills are crucial to making sense of today's technological world. Educators, scientists, engineers, and journalists throughout the U.S. have enthusiastically supported this annual program.

Since 1942, the STS has recognized 22,671 finalists and semifinalists who have received $18.9 million in awards as they launch their college careers. Many STS participants have gone on to distinguished careers; alumni of the STS include more than 100 recipients of the world's most distinguished science and math honors, including the Nobel Prize, the National Medal of Science, the MacArthur Foundation Fellowship and the Fields Medal.

In 1998, Intel Corporation was named the title sponsor of this storied competition. Intel reinvigorated the STS, significantly increasing the program's annual awards and visibility. Society for Science & the Public salutes Intel in this 17th year of sponsorship of the Intel Science Talent Search (Intel STS).

The Process

Students submit an extensive written report of their scientific research to demonstrate creativity and interest in science, as well as supporting documents from schools, advisors, and mentors.

While in Washington, DC, finalists meet leading scientists, visit places of historic and political importance, and meet with distinguished national leaders. Students display their research at the National Geographic Society, where they describe their work to visitors. Many of those studying the exhibits are highly motivated younger students who aspire to enter the Intel Science Talent Search in their senior year of high school.

Awards

The Intel STS offers three top awards of $150,000. Medals of Distinction are provided for students who show exceptional scientific potential in three areas: Basic Research, Global Good and Innovation. In addition, three second place awards of $75,000 and three third place awards of $35,000 are given in these areas. Winners are selected by the judging committee and announced at a black-tie gala on March 15, 2016.

Each of the 300 students named a semifinalist in the Intel STS 2016 receives a $1,000 award for their outstanding science research, in addition to any amount that students may win as finalists. Each of their schools receives an award of $1,000 for each semifinalist named in the Intel STS 2016. The award is used to advance excellence in science, math, and/or engineering education at the recipient school.

*Finalist ages are listed as of March 15, 2016, the date of the Intel Science Talent Search Awards Gala.

Andrew Ethridge Amini
Yorktown High School

New York

Andrew Ethridge Amini, 17, of **Yorktown Heights**, created software that predicts the onset and severity of epilepsy seizures for his Intel Science Talent Search **computational biology and bioinformatics** project. Andrew customized tools to analyze electroencephalogram data from 87 patients with seizure disorders. He then designed a low-complexity algorithm that predicts seizures, with 98.7 percent accuracy at least 108 seconds in advance of the seizure start. Current brain monitoring systems, available only in clinical settings, detect but do not accurately predict seizures. The high predictive accuracy and low consumption of computer resources combined in Andrew's technique may lead to development of portable early warning devices, such as embedded scanners or cell phone apps, to safeguard and improve quality of life for people with epilepsy. At **Yorktown High School**, he captains the swim team, plays varsity tennis and co-founded a robotics club. Andrew plays violin and classical guitar and won the Grand Prize in Environment – Health and Disease Prevention at the 2015 International Sustainable World Project Olympiad. The son of Sean and Lisa Amini, he plans to pursue the next generation of nanoscale brain measuring technology.

Katharine Barr Berman
Hastings High School

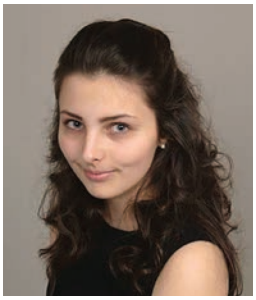
New York

Katharine Barr Berman, 17, of **Hastings-on-Hudson**, focused her Intel Science Talent Search **cellular and molecular biology** project on discovering how mutations of the calreticulin (CALR) protein in bone marrow precursors of blood cells might induce a group of blood diseases called myeloproliferative neoplasms (MPNs) that can lead to leukemia. In all forms of MPNs, these bone marrow precursors proliferate excessively, yielding too many circulating blood cells. Mutations that affect a major pathway involving JAK/MPL/STAT proteins have been implicated in these abnormal proliferations. Kat's research suggests that CALR mutations cause the pathway to become overactive, leading to the excessive cell proliferation associated with MPNs. She believes her research could help to treat a wider range of MPN patients. Kat is on the "Hudsonettes" kickline and captains her varsity tennis team at **Hastings High School**. The daughter of Lisa Barr and Mitchell Berman, Kat played oboe in the Area All-State Band and Orchestra and is a karate instructor. Passionate about cooking, she leads the school's culinary club and works as a line cook at a local restaurant. She also volunteers at a Hebrew school and for Project SHARE.

Paige Brown
Bangor High School

Maine

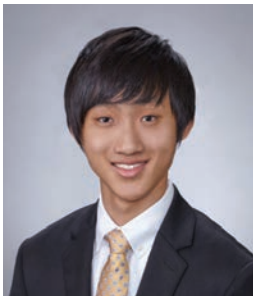
Paige Brown, 17, of **Bangor**, studied the water quality of seven local streams, six of which had been declared environmentally impaired by Maine's Department of Environmental Protection, for her Intel Science Talent Search **environmental science** project. In this phase of her two-year study, Paige determined that all six impaired streams had high levels of *E. coli* contamination, that five had high concentrations of phosphorus, which can cause harmful algal blooms, and one had low dissolved oxygen levels – a danger to fish. She found that these problems significantly increased after storm events, especially in areas with extensive impermeable cover. Paige is now developing a cost effective device that uses a common algae-derived gelling agent and other compounds to remove the phosphorous from water within stormwater systems in her city and beyond. At **Bangor High School**, Paige is co-captain of the math team, and secretary of the school's Key Club. The daughter of Daniel and Heather Brown, Paige helped organize fundraisers for her school and community, including the Bangor Hike for the Homeless. In 2015, Paige's project was awarded the Stockholm Junior Water Prize for her home state.



Claire Bernadette Burch
Mira Loma High School

California

Claire Bernadette Burch, 17, of **Fair Oaks**, sought evidence of new planets near the galactic center for her Intel Science Talent Search project in **space science**. She used data from the Optical Gravitational Lensing Experiment to identify changes in stellar brightness that could be explained by the existence of planets around those distant stars (exoplanets). Gravitational lensing, the warping of light in regions of space-time distorted by the gravity of massive objects, gives astronomers an opportunity to perform such detailed observations. Claire targeted the database with two well-known algorithms for detecting exoplanets and thereby identified 17 candidate exoplanetary systems. This dual approach suggests a new and potentially valuable method for detecting such systems, particularly in regions of high stellar density. Claire attends **Mira Loma High School** in Sacramento, where she is captain of both the Science Bowl and Science Olympiad teams and has played principal flute and piccolo with the honors concert band. She has earned a National Science Olympiad gold medal in Astronomy and cofounded the first U.S. team to compete in the International Olympiad on Astronomy and Astrophysics. Her parents are Michelle and Ronald Burch.



Joshua Choe
St. Mark's School of Texas

Texas

Joshua Choe, 17, of **Richardson**, used his Intel Science Talent Search **cellular and molecular biology** project to identify a diagnostic marker and potential therapeutic target for lung squamous cell carcinoma (SqCC). Joshua performed a series of metabolic assays in four human cancer cell lines to correlate increased expression of GLUT1, a major glucose transporter protein, with established SqCC biomarkers. He then conducted additional assays of the cell lines suggesting that inhibition of the cytosolic metabolism of glucose reduces cellular viability. Joshua's results may contribute both to earlier diagnosis of the disease that accounts for up to 30 percent of all lung cancers, as well as guide investigation of novel treatments. Joshua attends **St. Mark's School of Texas** in Dallas where he runs varsity track and field and represents his school as a violinist in the Texas Private School Music Educators Association All-State Orchestra. He leads the Caduceus Medical Club and as a Wilderness Club sherpa student guide, he led incoming freshmen on a nine-day rite of passage trek through the Pecos Wilderness of New Mexico. The son of David and Yeonsook Choe, Joshua also founded a music therapy program at Methodist Dallas Hospital.

Thomas William Colburn
Oak Ridge High School

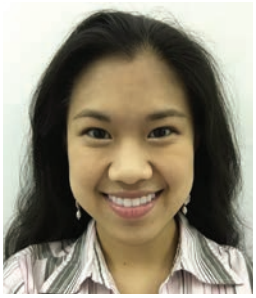
Tennessee

Thomas William Colburn, 17, of **Oak Ridge**, investigated a way to make plastic litter decompose faster in sunlight for his Intel Science Talent Search **chemistry** project. In this latest phase of a two-year polymer project, Thomas found that adding light-sensitive nanoparticles of titanium dioxide to plastics used for shopping bags would cause them to degrade in about six months when exposed to ultraviolet light, or about 90 percent faster than the nearly five years required without the additive. Similarly, a plastic milk jug would decay in about 23 years, instead of almost 270 years. Thomas cautions, however, that additional research is needed to more accurately simulate the spectrum of actual sunlight required to break down the treated plastics and to assess the additive's efficacy in an ocean environment. A dedicated trail runner, his passion for this research is energized every time he sees plastic items littering the foothills of the Smoky Mountains. Thomas, the son of Scott and Julie Colburn, runs cross country and track at **Oak Ridge High School** and plays in the school's marching, jazz and symphonic bands. He has also volunteered at the Children's Museum of Oak Ridge where he received two awards for outstanding exhibit design.

Sanath Devalapurkar
West High School

California

Sanath Devalapurkar, 15, of **Torrance**, worked in the field of algebraic topology for his Intel Science Talent Search **mathematics** project. Despite being a relatively new math discipline, algebraic topology has found uses in numerous fields, including data analytics, computation and artificial intelligence. Sanath's work proved the consistency of a recently developed aspect of algebraic K-theory, generalizing results from ordinary K-theory to higher K-theory. In this way, Sanath was able to verify an important result in one of the fundamental areas of modern pure mathematics. Sanath attends **West High School**, where he helped to organize the school's first annual science fair and is founder and president of the philosophy club. The son of Sachin and Shobharani Devalapurkar, Sanath learned calculus at the age of eight from BBC's Bitesize and MIT's OpenCourseWare websites. He shares his love for math by tutoring others and through starting an after-school club to teach abstract algebra. Sanath is also an active community volunteer, organizing civic and social events with the California Scholarship Federation and Interact club. Sanath hopes to earn a Ph.D. in pure math and move on to research and teaching – two of his greatest passions.



Beverly Ge
Buchholz High School

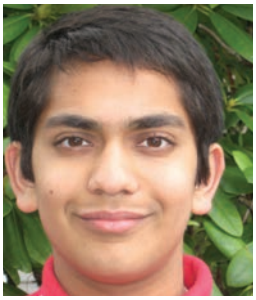
Florida

Beverly Ge, 17, of **Gainesville**, used her Intel Science Talent Search **materials science** project to develop a novel sensor based on her discovery that a new type of shape memory polymer (SMP) changed colors when exposed to various gases. Recognizing that vapor detection is central to human health, both for controlling pollution and in diagnosing disease by breath sampling, Beverly developed an application for the SMP and tested it with five chemicals. Her results showed that each of the different gases changed the thickness of the SMP, causing it to change color in ways she could distinguish with a spectrometer and smartphone app. Among other uses, Beverly's new application could lead to development of an affordable, portable sensor for monitoring surroundings and personal health. Beverly attends **Buchholz High School** where she is president of the Junior Engineering Technical Society and has won numerous regional and statewide awards for debate, poetry and violin performance. The daughter of Jian Ge and Jian Liu, Beverly co-authored a paper in the *Advanced Materials* journal and has applied for a U.S. patent as a co-inventor.

Maria Elena Grimmett
Oxbridge Academy of the Palm Beaches

Florida

Maria Elena Grimmett, 17, of **Jupiter**, used her Intel Science Talent Search **environmental science** project to demonstrate the capacity and kinetics of a commercially available adsorbent to remove an ecosystem-damaging antibiotic, sulfamethazine, from water. Sulfamethazine is representative of several antibiotics routinely fed to livestock that contaminate surface and groundwater worldwide. Beginning at age 10, Maria Elena has worked at home to study the removal of contaminants from water using adsorptive media. Continuing in her home lab, Maria Elena extended that research, simulating a range of relevant aqueous environments while also comparing the performance of various commercial resins. Maria Elena found that Purolite MN250 removed the antibiotic most efficiently. Identifying the drug-removal rate and capacity of an existing, reusable and scalable resin may offer a new, practical solution for water treatment facilities. Maria Elena is sole author of two papers published in the *Journal of Environmental Quality* on this topic. She attends **Oxbridge Academy of the Palm Beaches** where she is a fencing enthusiast and has won awards spanning the fields of math, chemistry and art. The daughter of Michael and Karen Grimmett, Maria Elena volunteers as a mural artist at her former middle school.



Vikul Gupta
Oregon Episcopal School

Oregon

Vikul Gupta, 17, of **Tualatin**, studied the NTRU cryptosystem, a promising alternative to encryption methods currently used to secure data, for his Intel Science Talent Search **computer science** project. Hardware implementations of cryptosystems require that mathematical operations be performed using logic gates on computer chips. Vikul presented a novel algorithm for generating implementations of the “convolution operation” that use significantly fewer gates than conventional approaches. This enables the development of more efficient encryption chips expected to provide higher levels of security. Vikul has been fascinated with cryptography since eighth grade when he first studied the traditional RSA encryption system that is widely used today. He is the son of Sandeep and Prerna Gupta and enjoys competitive swimming. At **Oregon Episcopal School** in Portland, Vikul is a varsity tennis player and heads the speech and debate club. An award winning debater, he is writing an app to organize points and counterpoints to help others train for team competitions. He is sole author of a computer science paper on advanced logic synthesis published in the *International Journal of Computer Engineering and Technology*.

Soon il Junko Higashino
Ossining High School

New York

Soon il Junko Higashino, 18, of **Ossining**, applied her Intel Science Talent Search **animal sciences** project to investigating the impacts of urbanization and habitat types on fungal disease in salamanders, one of many amphibians that serve as indicators of ecosystem health. Soon il collected skin swabs from salamanders in rural, suburban and urban habitats, then isolated and identified dozens of bacterial species in the lab. Testing to find those species that inhibit fungal growth revealed a previously unknown inhibitor. Soon il also found more fungus-inhibiting bacteria in urban as compared with suburban or rural areas, suggesting that, contrary to expectation, human activity may not negatively impact a salamander's susceptibility to infection. Her finding of a novel inhibitor could lead to bioaugmentation strategies to protect at-risk amphibian populations. Soon il attends **Ossining High School** where she plays clarinet and saxophone in school bands, is chief illustrator and staff writer for the school newspaper and competes with the Ultimate Frisbee Club. The daughter of Hiroshi and Kiiko Higashino, Soon il's research was recognized nationally in 2015 with a Young Naturalist award from the American Museum of Natural History.

George Hou
Arcadia High School

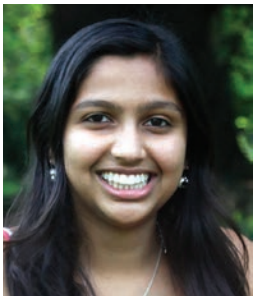
California

George Hou, 17, of **Arcadia**, submitted a **mathematics** project to the Intel Science Talent Search that used signal processing to improve methods of sound separation in noisy environments. Signal processing is the mathematical field concerned with storing, manipulating and improving digital signals, such as audio signals from a hearing aid. While many existing hearing aids amplify all sound including background noise, George's method extracts and separates useful sounds from the background din by treating them as an independent source signal. He also demonstrated his method's accuracy when confronted with possible sources of error in real-world conditions. Inspired by his grandfather's hearing loss, George hopes his findings lead to a new generation of hearing aids that effectively filter sound in noisy environments. At **Arcadia High School** George is president of Model United Nations, co-captain of the speech and debate team, treasurer of the applied engineering club and a member of the varsity tennis team. As president of the local Leo Club, he has coordinated community events benefiting those in need and increased membership in the organization by 125 percent. He is the son of Thomas Hou and Yu-Chung Chang.

Jessica Li Huang
Jericho Senior High School

New York

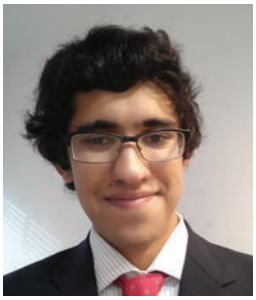
Jessica Li Huang, 17, of **Jericho**, studied fluid intelligence (gF) – the ability to reason through new problems – for her **behavioral and social sciences** Intel Science Talent Search project. While gF is central to human behavior, theories describing its neuroanatomical basis have often been contradictory. Jess analyzed functional MRI scans in an attempt to reconcile two competing theories of gF, minimize the biases of existing studies and verify the brain regions responsible for this advanced cognitive function. She identified the source of inconsistencies between the existing theories and implicated new brain regions in gF. She believes her work could be the foundation for new clinical tools to estimate cognitive decline and provide more comprehensive evaluations of stroke victims and people with disorders such as ADHD and autism. Jess is vice president of her class, co-captain of the varsity cross country team and co-president of the math club at **Jericho Senior High School**. She also captains the Nassau County All-Star Math Team. The daughter of Zhimin Huang and Susan Li, Jess co-authored an article on identifying individuals using brain connectivity patterns published in *Nature Neuroscience*.



Meena Jagadeesan
Phillips Exeter Academy

New Hampshire

Meena Jagadeesan, 17, of **Naperville**, **Illinois,** submitted a **mathematics** project to the Intel Science Talent Search that worked within algebraic combinatorics. She studied the nonnegative Grassmannian, a fundamental object in algebra. Although the Grassmannian is typically of algebraic interest, Meena investigated weakly separated collections, a generalization of triangulations, by using combinatorial arguments. Meena's work shows that there exists an isomorphism, or equivalence, between a class of C-constant graphs and exchange graphs. She attends **Phillips Exeter Academy** in Exeter, N.H. where, in addition to medaling in numerous math competitions, she has won awards in French, religion, history and theater. She is co-head of the school's math club and co-directs its middle school competition. She is a leader in Peer Tutoring at school and volunteers in her community as co-head of the Exeter Social Service Organization's Tutoring for Children club. The daughter of Lalita and Radhakrishnan Jagadeesan, Meena is a recreational pianist and co-author of an article accepted by the journal *Communications in Algebra*.



Milind Jagota
Liberty High School

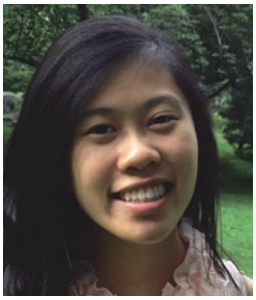
Pennsylvania

Milind Jagota, 18, of **Bethlehem**, focused his Intel Science Talent Search **materials science** project on optimizing the performance of random nanowire networks as a less costly alternative to the transparent conductors now used in touchscreen devices. Observing in his research that slightly restricting the orientation of these highly flexible metal grids had potential to enhance electrical performance without blocking light, Milind developed a computational model to generate random nanowire networks and calculate the impact of array arrangements on conductivity. His model showed that controlling network orientation increased conductivity in one direction by as much as 25 percent without sacrificing the transparency essential to touchscreen technology. His enhanced performance findings may contribute to wider adoption of metal nanowire networks and help accelerate development of novel electronics. At **Liberty High School**, Milind is a saxophone section leader of the marching band, varsity tennis team captain, head programmer of the Vex Robotics team and president of the Pennsylvania Junior Academy of Science club. The son of Sujata and Anand Jagota, he is lead author of a paper published in *Scientific Reports.*

Anjini Karthik
Saint Francis High School

California

Anjini Karthik, 17, of **Sunnyvale**, developed a low-cost, virus-imprinted polymer (VIP) film that captures target viruses and dramatically reduces the time required to detect them for her Intel Science Talent Search **materials science** project. Anjini produced the film by curing a polymer in the presence of a template with the target viruses, in this case Influenza A and Newcastle disease virus, thus creating precise nanoscale cavities in the film's surface. Her resulting polymer film captured the target virus in as little as one minute and distinguished among viruses of similar size and shape. Other virus detection methods rely on laboratory analysis that can take upwards of three days to yield results. When mass produced, Anjini estimates that each VIP film will cost less than one dollar. Anjini is first author of a paper on this subject published in the journal *Nanoscale*. At **Saint Francis High School** in Mountain View, she is co-president of the research and environmental clubs, captain of the Science Bowl team, and founder of an initiative to excite middle schoolers about STEM-based disciplines. An accomplished Indian dancer, Anjini is the daughter of Sukhmeen Kaur and Karthik Srinivasan.



Catherine Jessica Yihui Lai
The Brearley School

New York

Catherine Jessica Yihui Lai, 17, of **New York City**, identified two molecular compounds that may contribute to new treatment options for multi-drug resistant pneumonia for her Intel Science Talent Search **medicine and health** project. Jessica used new descriptions of the structure of a key enzyme in pneumonia bacteria metabolism to screen for therapeutic compounds using software she previously developed. Jessica identified two molecules out of millions of possible compounds with high binding affinity for the enzyme. This may lead to new antibiotics that have not yet been derived from existing treatments. She has published her research results in the *Journal of Computational Methods in Molecular Design* as sole author, and also holds provisional patents on her findings and screening software. At **The Brearley School**, Jessica is co-captain of the varsity cross-country and badminton teams and the varsity dance troupe. She also serves as managing editor of the school newspaper. The daughter of Richard and Elizabeth Lai, Jessica is an accomplished pianist and flautist who performed at Carnegie Hall, and founded a service that matches nursing home guests who value pet companionship with dog owners who need pet sitters.

Michael Yifan Li
James M. Bennett High School

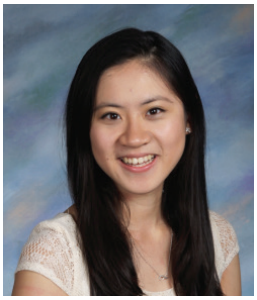
Maryland

Michael Yifan Li, 17, of **Salisbury**, developed a statistical model to study the brain's response to stimulus and behavior variables for his Intel Science Talent Search **computational biology and bioinformatics** project. Michael focused on the posterior parietal cortex (PPC), an area of the brain important for sensory processing linked to numerous brain disorders. Michael's model analyzed neural decision-making activity in response to visual and auditory stimuli. His results suggest that some PPC neurons form functional categories to perform specialized tasks, serving as "experts" that strongly guide decision making based on memory, while other PPC neurons respond to multiple parameters to arrive at decisions during complex tasks. Michael hopes his research may contribute to future treatments for Alzheimer's disease, Parkinsonian disorders and other neurodegenerative conditions. Michael serves as vice president of the Wicomico County Youth Civics Council, and founded the Peer-to-Peer Math Tutoring initiative serving local students. The son of Ming Li and Xiaohong Wang, Michael is co-captain of the academic team and president of National Honor Society at **James M. Bennett High School**.

Allen Liu
Penfield High School

New York

Allen Liu, 16, of **Penfield**, discussed the intersection of combinatorics (i.e., the mathematics of counting) and harmonic analysis for his Intel Science Talent Search **mathematics** project. Harmonic analysis emerges naturally in science and engineering as it is the mathematics of representing a function as a superposition of many simpler sub-functions. An intriguing aspect of Allen's work is that he took a distinctly combinatorial approach to a seemingly algebraic problem and produced useful results about discrete functions. Such functions are important in many scientific fields, including digital signal processing, voice recognition, computer vision and economics. The son of Chuheng Liu and Beilei Xu, Allen attends **Penfield High School** and plays on a travel soccer team that placed second in the Rochester area. He is an International Math Olympiad gold medalist and multiple award winner in physics and computing competitions. He is also an accomplished alpine skier recruited for the Bristol Mountain freestyle team. A violinist from age four, Allen is currently improving his proficiency with the challenging Chinese violin concerto, "Butterfly Lovers."



Helen Liu
Amity Regional High School

Connecticut

Helen Liu, 18, of **Orange**, focused her Intel Science Talent Search **medicine and health** project on finding a potential new treatment for Gaucher Disease, a rare condition that can cause anemia, brittle bones and organ enlargement. Learning that deficiency of the digestive enzyme glucocerebrosidase (GBA) causes Gaucher, and that recent studies link the protein progranulin (PGRN) to therapeutic effects on the disease, Helen sought the mechanism involved. She demonstrated that PGRN binds to and delivers GBA to the cellular structure that contains it. She went on to isolate the fragment essential for the bonding and engineered a PGRN-derived molecule that may become a novel drug candidate for Gaucher Disease. A senior at **Amity Regional High School** in Woodbridge, Helen is student body president and Science Olympiad captain, leading her team to win the 2014 Yale Physics Olympics. She is editor-in-chief of the school yearbook, plays viola and organizes food drives and community volunteers as president of the Leo Club. The daughter of Shuang Yu and Chuanju Liu, Helen is co-author of two journal papers, one published in the peer-reviewed *Protein & Cell* and a second ready for submission.

Jonathan Ma
The Harker School

California

Jonathan Ma, 17, of **San Jose**, developed a novel framework to predict response to individualized chemotherapy for his Intel Science Talent Search **computational biology and bioinformatics** project. Individualized treatment is attractive to cancer researchers because therapies might be made more effective by tailoring them to the individual's genome as well as the underlying cancer pathology. One challenge is predicting which treatments will be most effective. These inferences are made using machine learning algorithms, but the process is confounded by the relatively small amount of training data compiled for individual drugs. Jonathan's approach took advantage of similar mechanisms of action amongst families of drugs, improving predictive accuracy while identifying new biomarkers associated with drug response. Jonathan plans to work in bioinformatics research and hopes his findings contribute to personalized cancer treatments tailored to a person's genome. Jonathan is a student at **The Harker School** and also co-executive editor of a student-run science publication he helped launch in 2015. A 2015 US Physics Team member, his parents are Ding Ma and Wenqiong Zhu.

Yashaswini Makaram
Massachusetts Academy of Math and Science

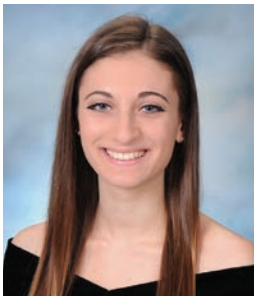
Massachusetts

Yashaswini Makaram, 17, of **Northborough**, developed a biometric cell phone security technique for her Intel Science Talent Search **computer science** project. Yashaswini wrote an app to measure the unique arm and hand motions an individual uses to lift a cell phone from a table by capturing the accelerometer and gyroscope sensor data generated by each person. She then instructed pseudo-attackers, guided by videos, to attempt to copy the phone-lifting motion of the authentic user, which in most cases they could not. In this latest phase of a two-year project, Yashaswini fine-tuned her data analysis so that failed attempts to impersonate the phone's owner further improved the cellphone's security performance, correctly identifying the owner 85 percent of the time and differentiating among people with 93 percent accuracy. She hopes her biometric research may lead to greater personalization of mobile devices. The daughter of Sujatha Iyengar and Raghunandan Makaram, she attends the **Massachusetts Academy of Math and Science** in Worcester, where she captains the math team and writes math challenge questions for fellow students. She also enjoys Indian classical music, band and chorus.

Nathan Charles Marshall
Boise High School

Idaho

Nathan Charles Marshall, 17, of **Boise**, studied a sediment core from a shallow marine site in Maryland and related it to current-day global warming for his Intel Science Talent Search **Earth and planetary science** project. The core Nate studied was composed of sediments deposited before, during and after the most prominent climatic anomaly in Earth's recent history. He looked at how an exceptional amount of carbon dioxide released into the atmosphere triggered a massive warming of the planet at the end of the Paleocene Epoch. Nate observed that there were actually two pulses of carbon dioxide release and that the Earth recovered from the first pulse before the second, larger pulse of carbon dioxide triggered massive climate change that lasted tens of thousands of years. Nate believes this indicates that if humankind can curb carbon dioxide emissions or develop a way to remove carbon dioxide from the atmosphere, then the Earth can recover from present-day climate change. Nate, the son of Shannon and John Marshall, has captained the **Boise High School** Ocean Sciences Bowl team to two consecutive national championships, is varsity team captain in cross country, plays the viola in two school orchestras and serves as Key Club president.



Rachel Mashal
John F. Kennedy High School

New York

Rachel Mashal, 18, of **Merrick**, submitted an **animal sciences** project to the Intel Science Talent Search examining the effects of a restricted diet and caffeine addiction toxicity with manipulation of a nutrient-signaling pathway known as target of rapamycin (TOR). To test her hypotheses, Rachel provided three groups of fruit flies with specific diets and exposed them to varying levels of caffeine throughout their lives to observe its toxicity and their propensity for caffeine addiction. Her results suggest that dietary restriction coupled with genetic manipulation of the TOR pathway impacts the potency of caffeine, which may reduce the likelihood of addiction and overdose. She hopes her work will lead to new treatment options for patients who take numerous drugs, but have atypical diets, such as the elderly. Rachel is a student at **John F. Kennedy High School** in Bellmore, where she is co-president of the women's a capella choir and the science club. She is a member of Rolling Thunder, a running program for children with special needs and leads Tutors for a Cure, a group that contributes twenty percent of its tutoring income to the American Cancer Society. The daughter of Ron and Ilene Mashal, Rachel hopes to pursue a career in psychiatry.

Demetri Maxim
Gould Academy

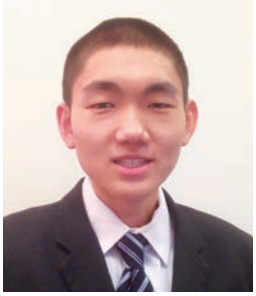
Maine

Demetri Maxim, 18, of **Bethel**, conducted research that may offer an alternative treatment to kidney transplantation for patients with chronic kidney disease for his **bioengineering** Intel Science Talent Search project. Motivated by his mother's life-saving kidney transplant when he was seven and his own diagnosis of polycystic kidney disease, Demetri set about finding a way to grow kidneys from human pluripotent stem cells (hPSCs). Derived from a patient's own skin cells, kidneys grown from hPSCs could eliminate the need for anti-rejection drugs. To turn hPSCs into the various types of cells found in the kidney, Demetri treated them with the same factors they receive in a developing kidney. He then provided the cells with a 3D tissue scaffold to help them organize into functional tissue. He believes his research could one day be the basis for growing complete human kidneys. Demetri plays drums in the concert band at **Gould Academy** and in his own rock band, Fully Torqued. Demetri has also been a competitive alpine ski racer for ten years, and excels in the Super G. The son of Lefki Michael-Maxim and Merritt Maxim, he hopes to study kidney medicine and develop novel treatments for kidney disease.

Shreya Menon
Skyline High School

Michigan

Shreya Menon, 18, of **Ann Arbor**, investigated the mechanism through which commonly used antioxidants such as Vitamin E affect cancer gene expression for her Intel Science Talent Search project in **cellular and molecular biology**. Her four-year research endeavor began with an eighth-grade science project exploring the effect of various factors on an antioxidant enzyme extracted from potatoes. Her interests soon expanded to cancer research and bioinformatics. Using datasets of RNA expression in cells treated with antioxidants, she designed a computational algorithm to identify changes in gene expression and then performed *in vitro* studies using several cancer cell lines to validate her results. Shreya found that antioxidants produce changes in gene expression that are enzyme, cell line and substance dependent. This suggests a novel mechanism for the effects of antioxidants and may become the foundation for future, more detailed investigation. Shreya is a two-time National Piano Guild Audition winner and attends **Skyline High School** where she is president of the student senate and Red Cross club. The daughter of Rajasree and Ram Menon, she is an Academic Games National Hall of Fame inductee and winner of four national titles.



Arnold Mong

Montgomery Blair High School

Maryland

Arnold Mong, 17, of **Potomac**, researched the differences between classical and quantum theories through the Greenberger-Horne-Zeilinger (GHZ) entangled quantum states for his Intel Science Talent Search **physics** project. With the help of a computer program he developed, Arnold examined sets of operators representing measurements on entangled particle systems and recorded their classical value and quantum mechanical values. He then generalized these results adhering to strict criteria to test for entanglement and to differentiate between quantum mechanical and classical systems. His operators, which are generalizable to any number of particles, allow for the characterization of data using GHZ states. Arnold's findings may have applications in security and two-party quantum communication as they provide the means to encrypt and decrypt information, as well as detect whether transmitted information has been tampered with or intercepted. Arnold attends **Montgomery Blair High School** in Silver Spring, where he is captain of the Science Bowl team and competes on other science and physics teams. The son of Kai Mong and Jie Gao, he enjoys puzzle competitions such as Puzzle Palooza and unwinds by playing basketball in his spare time.

Amol Punjabi

Massachusetts Academy of Math and Science

Massachusetts

Amol Punjabi, 17, of **Marlborough**, submitted a **computational biology and bioinformatics** project for the Intel Science Talent Search that sought to more accurately predict targets for designer drug development. He created classification software, ViaPocket, to search for ordered areas of IDPs, or intrinsically disordered proteins. IDPs appear in most cancer and cardiovascular disease pathways, but are challenging to target with designer drug molecules because they lack a fixed three-dimensional structure into which those molecules can fit. Despite this characteristic, IDPs retain regions of recognizable features in their protein chains. Amol hypothesized that he would find ordered, targetable areas near those regions. He showed that ViaPocket was more accurate than current predictors and then located six previously unknown potential binding sites. He attends **Massachusetts Academy of Math and Science** in Worcester where he is lead pianist for the jazz workshop and captains the Science Olympiad team. The son of Dilip and Sangeetha Punjabi, Amol is lead author of a paper on nanoparticles published in *ACS Nano* and co-author of a paper on a related topic in *Nanoscale*.

Kavya Ravichandran
Hathaway Brown School

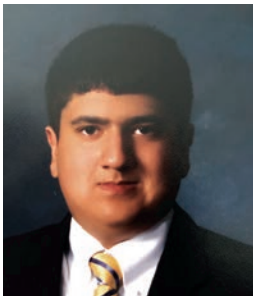
Ohio

Kavya Ravichandran, 17, of **Westlake**, studied the use of nanomedicine to destroy potentially fatal blood clots for her Intel Science Talent Search **bioengineering** project. Kavya's latest work on this three-year project involved developing and testing nanoscale encapsulated clot-busting drugs that target platelets, the blood components that form clots – a primary cause of heart attacks and strokes. By coating her drug-loaded nanoparticles in molecules that bind directly to a clot, she hopes to avoid the serious side effects of current clot-busting therapies. She found that about 80 percent of the targeted clot was eliminated by these particles. Ultimately, the platform will need to be tested in clinical trials. At **Hathaway Brown School** in Shaker Heights, Kavya is founder and president of the Totally Excellent Computer Scientists club and managing editor of the print and online editions of the school newspaper. The daughter of Jayashree Ravichandran and Ravichandran Annaswamy, Kavya has won multiple awards in math, science, debate and Indian classical dance, and is a fellow in the she++ outreach program encouraging diversity in technology studies. Her ultimate goal is "to spend the rest of my life doing research."

Anin Sayana
Bellarmine College Preparatory

California

Anin Sayana, 17, of **Cupertino**, sought an immunotherapy treatment for glioblastoma multiforme (GBM) – an aggressive, incurable form of brain cancer with five-year survival rates below ten percent – for his **medicine and health** Intel Science Talent Search project. Immunotherapy uses malignancy-specific vaccines that train the native immune system to fight cancer. Anin treated immune cells with vaccine variants based on GBM mutations and then used an algorithm he developed to analyze how the immune system processed the treatment. Using this data, Anin was able to identify an optimal vaccine variant. Anin plans to publish his results and file for a patent. The son of Raj and Aparna Sayana, Anin attends **Bellarmine College Preparatory** in San Jose. He is president of the STEM-Med club, which promotes science and research among high school students, and is founder and president of Valley Education Outreach, which works with disadvantaged youth in STEM education. Anin is a black belt in Taekwondo. He recently founded a cancer therapeutics company with the mission of developing personalized treatment options for patients with chemotherapy-resistant cancer.

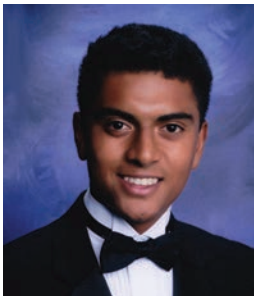


Kunal Shroff

Thomas Jefferson High School for Science and Technology

Virginia

Kunal Shroff, 17, of **Great Falls**, investigated the relationship between huntingtin (HTT), the key protein associated with Huntington's Disease (HD), and genetic instability in affected neurons for his Intel Science Talent Search **cellular and molecular biology** project. In humans these neurons exist primarily in the striatum, a part of the brain responsible for movement control and planning. Accumulation of HTT aggregates is associated with the death of these important striatal cells, resulting in the characteristic symptoms of HD. Early research into HD treatment has focused on the role of these aggregates with limited success. Instead, Kunal examined the role HTT plays in chromosomal recombination. He found that yeast cells with HTT experienced a twofold increase in recombination events and demonstrated that the increase was correlated with cell death. His findings suggest new avenues for research into the neurodegenerative mechanism of HD. Kunal is a top-ranked debater and treasurer of the debate team at **Thomas Jefferson High School for Science and Technology** in Alexandria. The son of Nilesh and Amisha Shroff, he is also a long-time participant in his school's Medical and Neuroscience Societies.



Pranav Srinivas

Monta Vista High School

California

Pranav Srinivas, 17, of **Cupertino**, employed Boolean network modeling strategies to predict cancer cell drug response for his **computational biology and bioinformatics** Intel Science Talent Search project. He developed a computational method for systematically investigating aberrant signaling pathways that cause cells to grow unregulated and acquire drug resistance. Pranav found that his computational pathway signature analysis and acquired resistance predictions are consistent with known experimental results for well-studied lung cancer samples. He believes that his generic algorithms can be adapted for other cancers, and that his work can help doctors determine the best chemotherapy regimen to prescribe for lung cancer treatment. Pranav is on the varsity basketball team at **Monta Vista High School**. He earned a black belt in karate and works as a substitute instructor in his dojo. Pranav is an accomplished pianist who composes and performs his own music. A research intern at Canary Center at Stanford for the past two years, Pranav is the son of Prasanna and Renuka Srinivas. He hopes to conduct research in bioinformatics and contribute to the revolution in computationally designed, personalized medicine.

Augusta Uwamanzu-Nna
Elmont Memorial High School

New York

Augusta Uwamanzu-Nna, 17, of **Elmont**, studied the effect of adding a nanoclay ingredient to cement slurries to improve cement seals that protect undersea oil wells for her Intel Science Talent Search **engineering** project. It appears that a contributing factor to the massive 2010 Gulf oil spill was the poor design of the well's cement mix. Augusta experimented with adding varying amounts of the mineral attapulgite to a cement slurry and then tested the mixtures under high pressure to simulate underwater conditions. She found that adding just 0.3 percent of the nanoclay markedly improved the cement's properties in ways that likely would have helped prevent the fluid migration that caused the oil spill. Her interest in cement began in tenth grade when she learned that its production accounts for seven percent of global man-made carbon emissions. At **Elmont Memorial High School**, Augusta is editor of the newspaper and heads Future Business Leaders of America. The daughter of Tobias and Basillia Nna, Augusta is founder and choreographer of an Igbo cultural dance group that raises funds to benefit development projects in Nigeria. She also sings lead soprano in her church choir, which performs contemporary Igbo songs and classic hymns.

Maya Varma
Presentation High School

California

Maya Varma, 17, of **Cupertino**, focused her Intel Science Talent Search **engineering** project on building an improved spirometer (pulmonary function analyzer), an essential device for the diagnosis and management of chronic lung disease. Maya's interest in pulmonary illness began two years ago when a close friend was hospitalized for asthma. Spirometry provides important data that physicians use to treat complex lung diseases. With $35 worth of hobbyist electronics and free computer-aided design tools, Maya developed a complete spirometry system that diagnoses lung disease as accurately as expensive devices currently used in medical laboratories. She developed her software for Android devices so that testing can be conducted with smartphones and tablets. She hopes her economical invention will make spirometry more accessible globally. Maya's resume includes proficiency in five programming languages, leadership roles in multiple honor societies and science and math clubs, and grand prizes in several prestigious science competitions. She also was featured in the November 2015 issue of *Popular Mechanics*. Maya attends **Presentation High School** in San Jose. Her parents are Anujan and Sobha Varma.

Sreya Vemuri
Carmel High School

Indiana

Sreya Vemuri, 17, of **Carmel**, investigated an aspect of quantum mechanics for her Intel Science Talent Search **physics** project. In this field, a Hamiltonian is defined as an operator that describes the totality of all of the energy within a system. Sreya investigated the effect of time on quantum systems in which parity (P), representing the algebraic sign of a system, and time (T), are each symmetric. Unlike previous research that assumed a time-independent (i.e., static) Hamiltonian, Sreya manipulated the energy and properties of a PT-symmetric system as time passed and observed how the symmetry of the Hamiltonian was affected. This enabled her to outline several conditions that would impact its function. Her findings on the quantum mechanics of open systems may inform laser and optic development as well as quantum computing. Sreya is founder and president of the Bollywood club at **Carmel High School** and volunteers with the North South Foundation to raise money for impoverished children in India. She plays piano and sings South Indian classical music, which she has performed at numerous charity events. Her parents are Gautam and Praveena Vemuri.

Asher Justin Willner
Yeshiva University High School of Los Angeles

California

Asher Justin Willner, 17, of **Los Angeles**, studied “twisted” optical waves traveling through free space and fiber that might be able to carry billions of digital data bits per second for his Intel Science Talent Search **engineering** project. Optical waves typically carry only one binary data bit at a time, either a one or a zero, by toggling the light between on and off. Asher’s project explored the role of “twisting” patterns of light that carry orbital angular momentum and thereby enable data to be encoded using one of four possible spiral patterns. By changing the rate of “twist” and thus the spiral pattern, Asher believes this new technology could allow much larger amounts of data information to be transmitted. He encoded data at 20 billion bits per second, which may, for example, enable the download of ten movies per second. Despite the remaining challenges, he believes that more research could dramatically increase Internet network capacity. He is lead author of a paper about this work published in *OSA’s Optics Letters*. At **Yeshiva University High School of Los Angeles**, Asher is MVP of his mock trial team and editor-in-chief of the academic journal. The son of Alan and Michelle Willner, Asher is a flautist with the Los Angeles Youth Orchestra and traveled with the group to perform at concert halls in Vienna and Prague.

Josephine Jessica Yu
Montgomery Blair High School

Maryland

Josephine Jessica Yu, 17, of **Potomac**, studied bilayer graphene for her Intel Science Talent Search **physics** project. Graphene is a sheet of carbon that is only one atom thick and notable for its strength and conductivity. Using elasticity theory, Josephine developed a theoretical model that explains what occurs when the top layer of two stacked graphene sheets is moved, causing the sheets to stretch and wrinkle. Using her model, she was able to account for what had previously been observed in experiments. Her model correctly showed, for example, the relative sizes of the structures that resulted from this movement. She went on to validate her assumptions in the model by creating a one-dimensional numerical analog that itself was validated by reproducing a phase transition that had been reported by others. Josephine is on the debate team at **Montgomery Blair High School** in Silver Spring. The daughter of Jennifer and Yikuo Yu, she is an accomplished pianist, a creative writing award winner and volunteer teaching assistant at the Rockville Chinese School. One of her future research goals is to enhance prosthetic body parts by integrating a sensitive coating made of conductive materials to allow the wearer once again to experience a sense of touch.

Michael Zhang
Conestoga High School

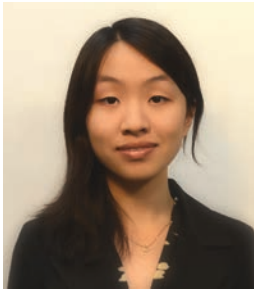
Pennsylvania

Michael Zhang, 18, of **Berwyn**, researched the delivery of genome modifying proteins important for gene therapy using virus-like particles (VLPs) that he engineered for his Intel Science Talent Search **bioengineering** project. Viruses naturally have the ability to deliver a payload – their genetic material – to cells they infect. Building on this principle, Michael devised a method to construct optimized VLPs that incorporate gene-modifying molecular machinery in place of a viral genome. He demonstrated that his VLPs could be used to precisely modify the genome of target cells in a controlled way. His work represents an advance toward the use of gene-editing for medical therapeutics and presents one solution to a significant contemporary problem in gene therapy. At **Conestoga High School**, Michael plays tennis, heads the biology club and directs Project STEAM to promote collaborative research project opportunities in STEM and art fields. His parents are Grace Wang and Kevin Zhang. He was a gold medalist at the state's 2015 Science Olympiad and is the design editor of the school newspaper. Michael hopes to pursue MD/MBA studies for a career in leading biomedical innovation endeavors.

Rachel Zhang
Parkway South High School

Missouri

Rachel Yun Zhang, 17, of **Ballwin**, researched the number of intersections between two curves on a surface for her Intel Science Talent Search **mathematics** project. A surface in two dimensions is the familiar boundary of a three-dimensional object, and a curve on a three-dimensional surface would be like a rubber band stretched around the surface of a ball. Rachel studied a formalization of the following question: Suppose you start with a fixed curve on a surface and then randomly generate another curve. How many times must the two curves intersect as the randomly generated curve becomes very long? She was able to calculate the average, and also wrote a computer program to support her result. Such questions arise in topology, one of the cornerstones of modern mathematics. Rachel's research could be used by space scientists to plot the paths a spacecraft would follow when it moves from one curved orbital path to another. The daughter of Desheng Zhang and Yuefang Zhou, Rachel attends **Parkway South High School** in Manchester where she is co-captain of one of its robotics teams, a tennis player and a seasoned national and international math Olympiad competitor and team organizer.



Clare Zhu
Northwood High School

California

Clare Zhu, 17, of **Irvine**, studied the topography of G-protein-coupled receptors (GPCRs), a cell binding site, for her **biochemistry** project for the Intel Science Talent Search. GPCRs are prime targets for designer therapeutic drugs treating a wide range of conditions, including heart disease, substance addiction, psychosis and potentially many more. To better understand the structural basis of how molecules bind to GPCRs, Clare developed a computational analysis tool able to measure subtle but significant changes to GPCR binding sites during the activation process and distinctions among GPCRs involved in different cellular signaling pathways. She believes that her tool could be used in the future to determine the activation state of binding sites, accelerating the design of new targeted drug therapies. Clare is a varsity debater, president of Math Olympiad and secretary and coordinator of the Speedcubing Club at **Northwood High School**. She is also head MATHCOUNTS coach at Jeffrey Trail Middle School. The daughter of Rong Qi and Zhaobin Zhu, Clare is an accomplished pianist. She hopes to continue her research in drug design and molecular biophysics and make a lasting contribution to improving drug design efficiency.

Intel Science Talent Search 2016
Finalists by State

Intel Science Talent Search 2016

Finalists by Last Name

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