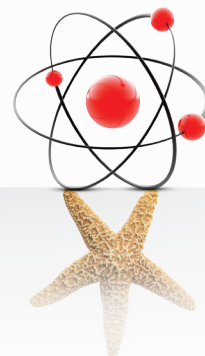INQUIRE. INNOVATE. INSPIRE.

2010 Finalists

Eric Larson
First Place Winner
Intel Science Talent Search 2009

INQUIRE. INNOVATE. INSPIRE.

2010 Finalists

The Intel Science Talent Search (Intel STS) is America'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 coveted science and math honors, including seven Nobel Prizes and three National Medals of Science. The Intel STS recognizes 300 students and their schools as Semifinalists each year—pulling from approximately 1,700 applicants—to compete for $1.25 million in awards. From that select pool, 40 student Finalists are then invited to Washington, D.C. in March to participate in final judging, display their work to the public, meet with notable scientists, and compete for the top award of $100,000.

Intel Science Talent Search 2010

Intel Science Talent Institute 2010
March 11–16, 2010

The 40 Finalists of the Intel Science Talent Search 2010, 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, D.C. to attend the Intel Science Talent Institute, where they are competing for $630,000 in awards.

The 17 young women and 23 young men come from 36 schools in 18 states. Finalists were selected from among 1,736 entries that were received from 45 states, the District of Columbia, Puerto Rico, and four qualifying U.S. schools overseas.

Many projects are the product of a research environment in which scientist mentors dedicate themselves to the intellectual development and technical training of students who participate in the Intel STS. Students are precluded from acknowledging those mentors on their posters to avoid any potential for judging bias. Intel STS 2010 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

Inquire. Innovate. Inspire.

History

The Science Talent Search (STS), a program of Society for Science & the Public since its launch in 1942, is America'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 science 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 enabled this annual event.

The STS has recognized 2,760 Finalists with more than $6 million in awards. Many STS participants have gone on to distinguished careers; alumni of the STS include more than 100 recipients of the world's most coveted science and math honors, including seven Nobel Laureates, three National Medal of Science winners, ten MacArthur Foundation Fellows and two Fields Medalists.

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 12th year of sponsorship of the Intel Science Talent Search (Intel STS).

The Process

Students submit written reports of their scientific research, the extensive official entry form showing evidence of student creativity and interest in science, and supporting documents from schools, advisors and mentors.

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

Awards

The top prize for the Intel Science Talent Search (Intel STS) 2010 is $100,000. The second place Finalist will receive $75,000; Third place is $50,000; Fourth place: $40,000; Fifth place: $30,000; Sixth–Seventh places: $25,000; and Eighth–Tenth places will each receive $20,000. The remaining 30 Finalists will receive $7,500. Winners will be selected by the board of judges and announced at a black-tie gala on March 16, 2010. In addition to monetary awards, each Finalist participating in the Intel Science Talent Institute will receive a laptop computer.

Each of the 300 students named a Semifinalist in the Intel STS 2010 will receive a $1,000 award for their outstanding science research. Each of their schools will receive an award of $1,000 for each Semifinalist named in the Intel STS 2010. The award is used to further support excellence in science, math, or engineering education at the recipient school.

Finalist ages are listed as of March 16, 2010, the date of the Intel Science Talent Search Awards Gala.

Levent Alpoge
Half Hollow Hills High School West

New York

Levent Alpoge, 17, from **Dix Hills,** submitted a **computer science** project to the Intel Science Talent Search investigating the algorithms used to analyze MRI scans on human blood vessels and suggesting significant improvements. According to Levent, current algorithms fail in the area near bifurcations—points where a large vessel splits into two smaller ones. He addresses this problem by using novel geometric methods to improve accuracy while significantly enhancing speed (up to 500 fold) through parallel processing. Levent is first author of a computer science paper on a blood vessel detection method published in *Insight Journal* and, in his spare time, enjoys financial portfolio optimization and derivatives pricing. At **Half Hollow Hills High School West**, Levent has earned six varsity letters in soccer and tennis, heads Mathletes, participates on the varsity winter track team, is vice president of Science Olympiads and scored perfect SATs. The son of Oguz and Simay Alpoge, Levent is fluent in Turkish and hopes to study math at Princeton or Harvard. Ultimately, he plans to become a researcher of number theory—a branch of mathematics that is his foremost passion.

Namrata Anand
*The Harker School*

California

Namrata Anand, 17, of **Los Altos Hills**, used spectral analysis and nearly a decade's worth of data to expose key information about the chemical enrichment history of the Andromeda Galaxy for her Intel Science Talent Search project in **physics & space sciences**. By qualitatively and quantitatively analyzing the chemical spectra of two populations—red giants in the Andromeda Galaxy Field and nearby dwarf spheroidal satellite galaxies—she demonstrated that the Field sample is chemically richer. She believes that chemical analysis projects like hers, focusing on patterns of metallicity, have the potential to identify locations in space with a high probability of extraterrestrial life. Namrata's work will form a major section of a paper being prepared for publication in the *Astrophysical Journal*; she will be a co-author. Active in musical theater at **The Harker School** in San Jose, Namrata has appeared in 17 dance and drama productions and has performed at the Edinburgh Fringe Festival. She also studies Indian classical music (Carnatic) and competes in cross country and on problem-solving and engineering teams. The daughter of R.K. and Nina Anand, she plans to attend Harvard or Stanford.

Eric David Brooks
George W. Hewlett High School

New York

Eric David Brooks, 16, of **Hewlett**, studied the racial genetic factors affecting the metastatic (spread) potential of prostate cancer for his Intel Science Talent Search **bioinformatics & genomics** project. He analyzed copy number variation—differences in the number of identical bases in DNA samples that code for the same gene—across ethnic groups. This data was used to identify which genes affected the cancer's potential to metastasize, either positively or negatively. Candidate genes were found, many of which were observed to play a role in other cancers, implying that racial disparities among cancer victims are the result of numerous genes that control cell structure and growth. Eric is a cellist with the Long Island Youth Orchestra and in the chamber and pit orchestras at **George W. Hewlett High School**, where he is also news editor of the school paper and captain of both the Math Olympiad and Mock Trial teams. The recipient of many awards and honors, he is the son of Bruce Brooks and Ellen Epstein. Eric's desire to attend Yale or Columbia and conduct scientific research is driven by his insatiable desire to explore and improve the world around us.
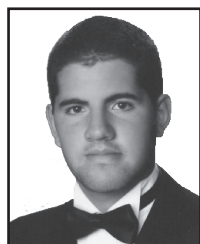
Yuval Yaacov Calev
Ward Melville High School

New York

Yuval Yaacov Calev, 17, of **Setauket**, attempted to characterize the relationship between speech perception, speech production, memory and age for his Intel Science Talent Search project in **behavioral & social sciences**. Two groups of adults were tested—33 retirees over the age of 69 and 41 local university students. Each individual completed three tasks to measure explicit (working) memory, advanced speech planning and perceptual learning (a change in perception after exposure to certain stimuli). Yuval's comparative results suggest that perceptual learning does not rely on working memory, which degenerates with age, but rather is grounded in a cognitive process that remains robust throughout a person's life. His data also indicated relationships between speech planning and perceptual learning, and speech planning with the participant's age. Yuval is a student at **Ward Melville High School** in East Setauket, where he has played varsity tennis for the past four years. He is also active in the school chamber orchestra and has been a violinist since the age of six. The son of Avraham and Gila Calev, he hopes to study psychology at Cornell or the University of Pennsylvania.

John Vincenzo Capodilupo
Catholic Central High School

Michigan

John Vincenzo Capodilupo, 18, of **Grand Rapids**, computed detailed statistics on the clustering of galaxies for the **physics & space sciences** project he submitted to the Intel Science Talent Search. His study anticipates a time when cosmologists will use 21 cm electromagnetic waves, emitted by hydrogen when the universe was young (less than a billion years old), to learn more about the structure and evolution of the early universe. John conducted a cluster analysis of objects observed in a very large-array sky survey that will be useful in removing extragalactic foreground "noise" that would otherwise obscure the signal. His clustering analysis is the first such study conducted in a frequency relevant to the detection of the 21 cm signal, and his findings are reported in a paper he co-authored, "Clustering at 74MHz," which has been submitted to *Monthly Notices of the Royal Astronomical Society*. John is first in his class of 187 at **Catholic Central High School**, where he plays intramural basketball, competes on the varsity quiz bowl team and captains the debate and math field day competitive teams. The son of John and Mary Ann Capodilupo, he hopes to continue his studies at MIT or Princeton.

Rachel Elizabeth Cawkwell
Byram Hills High School

New York

Rachel Elizabeth Cawkwell, 17, of **Bedford**, entered the Intel Science Talent Search with a **medicine & health** project that examines the communication between malignant tumor cells and macrophages (immune cells) via microvesicles—tiny fragments of cell plasma membranes once thought of as debris, but now believed to be important intercellular communicators. Over the course of three consecutive summers, through methodology including ultracentrifugation, electron microscopy and *in vitro* assays, she demonstrated that macrophages harboring tumor-derived microvesicles have the genetic makeup to support the spread of cancer cells (metastasis). Her work has clinical relevance in predicting the prognosis for cancer patients and in developing potential new treatments in preventing metastasis. At **Byram Hills High School** in Armonk, Rachel captains the cross country team, writes for the yearbook and helps run an annual volleyball tournament for charity. An accomplished pianist, who also enjoys drawing and painting, she is the daughter of Roger and Gail Cawkwell. Rachel hopes to attend Washington University in St. Louis or Emory.

Nicholas Mycroft Christensen
Wetumpka High School

Alabama

Nicholas Mycroft Christensen, 18, of **Wetumpka**, entered a **computer science** project in the Intel Science Talent Search, describing his invention of a device that outperforms traditional hearing aids. Nick's EarMeNow circuit board device and algorithm can shift sounds to lower frequencies in real time. After testing the device on 100 volunteers, he found that those with documented hearing loss, like himself, had 25% or better word recognition. (Two could hear nearly 60% better and some volunteers with normal hearing also benefitted.) His new hearing aid consists of a microphone, circuit board, microprocessor and head-phones, and Nick believes the device could be adapted for use in radios and cell phones. His research, conducted mostly at home over a two-year period, was inspired by his results from an earlier science project, for which he used a pizza pan to make a Wi-Fi antenna that worked as well as a $100 dish antenna. At **Wetumpka High School**, Nick heads the Science Olympiad team and is business captain of the award-winning robotics team. Nick was born in Germany to Robert and Libby Christensen, and he hopes to attend the University of Alabama or MIT.

Michael John Comuniello
Division Avenue High School

New York

Michael John Comuniello, 17, of **Levittown**, examined the inequity of success among high schools in national science fairs for his Intel Science Talent Search **behavioral & social sciences** project. Mike conducted a statistical analysis of all public high schools in New York State, measuring both internal factors (such as teacher qualifications and the percentage of graduates who attend four-year colleges) and external factors (including proximity to a university and the percentage of students eligible for free or reduced lunch). Mike compared these factors to the success of students who competed in national science fairs, including the Intel STS, and found that while internal factors indicated a likelihood of success, external factors had a greater correlation. He hopes his research will lead to equity among schools. First in his class of 299 at **Division Avenue High School**, Mike is a student liaison to the Board of Education, which has altered policy in light of his research. As captain, he led the Science Olympiad team to award-winning status. He plays violin, captains the soccer team and was elected Homecoming King. The son of John and Maureen Comuniello, Mike hopes to attend Stanford or Cornell.

Erika Alden DeBenedictis
Albuquerque Academy

New Mexico

Erika Alden DeBenedictis, 18, of **Albuquerque**, developed a software navigation system that would allow spacecraft to exploit low-energy orbits for the **physics & space sciences** project she submitted to the Intel Science Talent Search. According to the NASA-approved Interplanetary Superhighway concept, the gravity and movement of planets create a network of low-energy opportunities that allow for more efficient transit routes through the solar system. Working at home and building on existing research, Erika developed an original optimizing search algorithm that discovers energy minimizing routes in specified regions of space and would allow a spacecraft to adjust its flight path en route. She believes her novel single-step method of repeated orbit refinement could work with essentially autonomous spacecraft, and may be a practical step forward in space exploration. Erika is an accomplished pianist and vocalist at **Albuquerque Academy** and winner of numerous competitions. In 2009, she was a Davidson Fellow and a first place award winner in the New Mexico Supercomputing Challenge. The daughter of Erik and Beverly DeBenedictis, she hopes to attend Caltech or MIT.

Temple Anne Douglas
Thomas Jefferson High School for Science and Technology

Virginia

Temple Anne Douglas, 18, of **Leesburg**, developed a new urine test for the early detection of Lyme disease for her Intel Science Talent Search **medicine & health** project. Lyme disease is a bacterial infection in which the bacteria *Borrelia burgdorferi (Bb)* is transmitted from ticks to humans. The current method of detecting Lyme disease—to look for antibodies in the blood—is unreliable, giving both false positives and negatives. Temple used hydrogel nanoparticles to trap and concentrate *Bb* proteins in the urine. Her urine test is very sensitive, capable of detecting minute amounts (600 picograms) of Bb proteins. Urine testing for Lyme disease is less invasive than blood tests and can provide reliable results soon after receiving a tick bite. A clinical study is being planned. Temple attends **Thomas Jefferson High School for Science and Technology** in Alexandria, where she is a member of the French Honor Society. For the past six years she has been involved with the Alexandria Youth Relay for Life, a fundraiser for the American Cancer Society. The daughter of Bradford and Patricia Douglas, Temple plans to attend MIT, Princeton or Yale. She hopes to do cancer research because she wants "to make a difference."

Kevin Michael Ellis
The Catlin Gabel School

Oregon

Kevin Michael Ellis, 18, of **Vancouver, Washington,** submitted a **computer science** project to the Intel Science Talent Search about automatic parallelization—the automated conversion of a program designed to run on one processor into a program that can distribute its work among several processors and run many times faster. Working alone in his basement, Kevin created a way to analyze a program as it executes to reveal the pieces of code that can be distributed to multiple processors (also called cores). He also developed a mathematical system to describe his method and verify its properties. He has submitted a paper on a related subject to *Lecture Notes in Computer Science* and presented another paper at an international conference. At **The Catlin Gabel School** in Portland, Oregon, Kevin enjoys lifting weights, studies piano and plays violin in the string ensemble. During lunch breaks, he is an avid player of Go, a game that originated in ancient China. Kevin is captain and software manager of the school robotics team, which is the top FIRST robotics team in Oregon, and attended the world championships the last three years. Kevin's parents are David Ellis and Jennifer Morse, and he hopes to attend MIT or Stanford.

Yale Wang Fan
The Catlin Gabel School

Oregon

Yale Wang Fan, 18, of **Beaverton**, demonstrated the power of quantum computing in solving "NP-complete" (NPC) problems for his Intel Science Talent Search **physics & space sciences** project. NPC problems, such as the fastest way to win battleship, or finding solutions to complicated constraint equations, are among the toughest problems to solve using traditional computing. Yale used quantum computing to identify which algorithms would be best suited to the NPC challenge. His results could give physicists another tool for exploring lattice models of physical theories. Yale is a Davidson Fellow Laureate, won best of fair at the Intel Northwest Science Expo three years in a row, and earned a first place grand award in the physics and astronomy category at the Intel ISEF in 2009. He lectures at quantum computing seminars at Portland State University and is the sole author of a published research paper on quantum logic. A largely self-taught pianist, Yale attends **The Catlin Gabel School** in Portland, where he plays varsity tennis, competes on the robotics team and captains the science bowl team. The son of Jinsheng Fan and Jian Wang, Yale aspires to attend Harvard or MIT and become a physics professor.

Frieda Rose Fein
John Adams High School

Indiana

Frieda Rose Fein, 18, of **South Bend**, submitted a **behavioral & social sciences** project to the Intel Science Talent Search that clarifies the history of the Pokagon Band, one of the few groups of Midwestern Native Americans not forced onto reservations by the U.S. government. Frieda's study measured carbon and nitrogen isotope ratios in collagen from animal bones excavated from a southwest Michigan village site to determine the amount of maize (corn) in the animals' diets. Her results indicate significant levels of maize and suggest that the Pokagon Band adopted a Euro-American lifestyle (farming), which may explain why the government allowed them to remain on their traditional lands. Frieda has started new research using samples that she helped excavate from another site last summer. First in her class of 343 at **John Adams High School**, Frieda is a four-year varsity soccer player and co-founder of the recycling club. The daughter of Jeremy and Antoinette Fein, she enjoys pottery, playing the harp and hiking in Scotland and Yosemite. Frieda, a native of the United Kingdom, is applying to several colleges where she hopes to pursue her love of archaeology and "use science to understand history."

James Evan Fenska
Miami High School

Oklahoma

James Evan Fenska, 17, of **Miami**, submitted a **microbiology project** to the Intel Science Talent Search that evaluated the ability of certain plant extracts to inhibit the growth of *E. coli, Staphylococcus aureus* and methicillin-resistant *S. aureus* (MRSA). Evan tested the efficacy of five natural antioxidants, known as flavonoids, as treatments for antibiotic-resistant infections. Anthocyanins (found mainly in flowers and fruits), green tea extract, propolis (resin used in beehives), red wine bioflavonoids and grape seed extract were all shown to have some inhibitory effects on infection growth. His results indicate that green tea extract, grape seed extract and red wine bioflavonoids inhibit bacteria growth significantly and show considerable promise in reversing resistance to oxacillin in infectious bacteria. Evan attends **Miami High School**, is first in his class of 124, and competes on the varsity soccer and varsity swim teams. He also plays trombone in the school band and is an Eagle Scout, and hopes to attend Washington University in St. Louis or Northwestern. The son of Sally and the late Lyle Fenska, Evan was inspired to become a doctor following a medical mission trip he shared with his father in 2006.

Jason A. Gandelman
Staples High School

Connecticut

Jason A. Gandelman, 17, of **Westport**, entered a **biochemistry project** in the Intel Science Talent Search that investigated toxic compounds called Advanced Glycation End-products (AGEs), which are known to contribute to the long-term health problems associated with diabetes. Jason's study showed that yeast had evolved mechanisms to minimize the formation of toxic AGE compounds. He is now attempting to identify a protein that will block the human body's receptor sites from binding with AGEs. Jason believes his study will lead to new medications to prevent or cure blood vessel and kidney damage associated with diabetes. His research was inspired by his family's long history with the disease. Jason is president of the **Staples High School** engineering team, investment club and debate team, which finished third at the Harvard National Debate Tournament. He counts stock investment as a hobby, and has served on the Westport Youth Commission for four years. A long-time volunteer, he has received recognition for his water quality work with Earthplace. Jason is the son of Mitchell and Kuan Gandelman, is fluent in Mandarin Chinese, and aspires to continue conducting research in biological chemistry in college.

Peter Danming Hu
*Texas Academy of Mathematics and Science*

Texas

Peter Danming Hu, 18, from **Denton**, created a mixture of nanoparticles that turns into a gel at body temperature in his **materials science** project for the Intel Science Talent Search. Therapeutic proteins are critically important in treating diseases (for example, insulin for diabetes and interferons for cancer), but traditional delivery methods result in protein degradation and rapid release. Peter synthesized four series of polymer nanoparticles and combined them in varying ratios to create a mixture that had the best thermogelling properties. This formulation can be mixed with the protein and injected; when it warms to body temperature, the fluid gels, allowing slow, sustained release of the protein. He believes this would allow anticancer drugs injected into a tumor to remain there. Peter is vice president of the engineering society at **Texas Academy of Mathematics and Science**. He was involved in Amnesty International's campaign for human rights, plays piano, was first violin in the Texas All-Region Orchestra, and was an Intel ISEF finalist in 2009. The son of Zhibing Hu and Guonan Wang, Peter hopes to attend MIT or Cornell to study chemical or biological engineering.

Otana Agape Jakpor
Woodcrest Christian High School

California

Otana Agape Jakpor, 16, of **Riverside**, analyzed emission levels of paraffin and soy candles to determine their contribution to indoor air pollution for her Intel Science Talent Search project in **environmental science**. Using a DustTrak—an aerosol monitor that gauges exposure levels of breathable sized particles—Otana measured particle levels produced by paraffin and soy candles in her at-home lab. Her results indicated that a single paraffin wax candle emitted fine particulate matter at levels that exceed outdoor air quality standards, in contrast to soy candles, which produce concentrations 50 times less. Observing how her mother's severe asthma reacted to candles inspired her study, and she hopes to continue researching environmental health in college. Her previous published research on the pulmonary effects of indoor pollution earned a 2008 President's Environmental Youth Award and influenced California ozone regulations. First in her class of 102 at **Woodcrest Christian High School**, she founded two charitable groups: one that benefits orphaned children in Uganda, and another that harvests oranges to be donated to a local food bank. Her parents are Riase and Karen Jakpor.
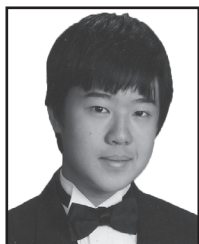

Ruoyi Jiang
Ward Melville High School

New York

Ruoyi Jiang, 17, of **East Setauket**, submitted an Intel Science Talent Search project in **biochemistry** in which he spent two years developing a new computational method for drug design, and then used it to investigate why some cancer cells are resistant to the anticancer drug Taxol. Ruoyi methodically explored how the molecular structure of proteins affected their interaction with the chemical structure of the medication to better understand the function of the drug. Chemists can use this information to design cancer treatments that more effectively bind proteins in cancer resistant cells. Ruoyi is a student at **Ward Melville High School**, where he serves as chief editor of the school newspaper and competes on both the math and science teams. He also enjoys drawing and bicycling in his spare time, and volunteers weekly at a hospital and at a local soup kitchen. The son of Jiansheng Jiang and Junping Xia, Ruoyi has earned perfect SAT scores. He believes that current methods of drug development, which are based on trial-and-error, will be replaced by more rational and efficient computer-based development methods. He plans to attend Harvard or MIT in pursuit of a career in chemistry.
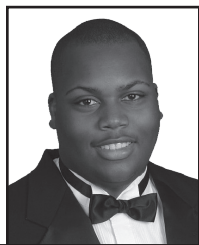
Lanair Amaad Lett
North Carolina School of Science and Mathematics

North Carolina

Lanair Amaad Lett, 18, of **Henderson**, submitted an Intel Science Talent Search project in **medicine & health** that investigated the effects of the HDAC-1 gene on the growth of beta cells, the insulin-producing cells of the pancreas. Because insulin deficiency results in diabetes—a disease that has taken a toll on his own family—Lanair is particularly interested in insulin production. In his experiments with an insulinoma cell line and rat islets (clusters of cells in the pancreas containing many cell types), he successfully demonstrated that over expression of the HDAC-1 gene significantly increased beta cell proliferation. He believes his research could help lead to more efficient treatments for diabetes, and that better understanding of the pathway that drives beta cell proliferation could be a key in finding a cure. At **North Carolina School of Science and Mathematics**, in Durham, Lanair organized and spearheaded a school-wide food and supplies drive for the local food bank. He is lifestyles editor of the school newspaper and competes on the varsity science bowl team. The son of Kim Lett, he plans a career in medicine or research and hopes to study at Stanford or Duke.

Yifan Li
*Montgomery Blair High School*

Maryland

Yifan Li, 18, from **Rockville**, entered the Intel Science Talent Search with a **medicine & health** project on the development of retinal pigment epithelium (RPE) cells from mouse embryonic stem cells. RPE cells are important for visual function and there is currently a lack of RPE cell supply for transplantation—a shortage that stem cells may be able to fill. Working with cells that had differentiated from mouse stem cells, Yifan identified colonies that resembled RPE cells in shape and genetic expression. He hopes his work might someday allow scientists to grow retinal cells to treat diseases that cause blindness, such as age-related macular degeneration. Yifan's success has drawn the attention of several researchers at the National Eye Institute, who are interested in continuing this work. Yifan, the son of Zhuqing Li and Yun Zhou, has played the piano since he was three, and has performed at the Kennedy Center and Lincoln Center. Yifan enjoys fencing, is a four-year member of the math league team, and captains the debate team at **Montgomery Blair High School** in Silver Spring. A native of China, he hopes to attend Stanford or Princeton and study biology or economics.

Elisa Bisi Lin
Plano West Senior High School

Texas

Elisa Bisi Lin, 18, of **Plano**, submitted an **environmental science** project to the Intel Science Talent Search. She spent two years conducting research to improve organic solar cells and organic light emitting diodes (OLEDs) by incorporating multiwalled carbon nanotubes (MWNTs) at the electrodes of both devices. Elisa's hybrid solar cells showed an 80% improvement in the maximum amount of current they could deliver and a 15% increase in efficiency. By introducing transparent MWNT sheets into the architecture, she also created the first inverse OLEDs. These emit stable display-quality lighting and should be able to be produced simply, efficiently and with a three-fold increase in resolution. The recipient of numerous academic awards, Elisa plays in the marching band at **Plano West Senior High School**. She volunteers at Teen Court as an attorney for juveniles with Class C misdemeanors and has worked extensively with autistic children to improve their cognitive and social skills. Elisa is also president of Science Pals, which she created to demonstrate fun and safe science to children with autism. The daughter of Lisan and Amy Lin, she hopes to attend MIT, Rice or University of Texas, Austin and prepare for a career in research.
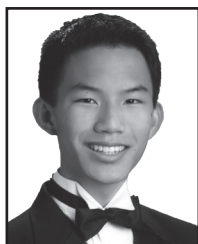
David Chienyun Liu
Lynbrook High School

California

David Chienyun Liu, 18, from **Saratoga**, created a system to search digital images for his Intel Science Talent Search **computer science** project. What began as David's effort to organize the family photo album grew into software that searches images automatically by linking visual cues with concepts (called semantic concept models), such as trees and buildings, to improve retrieval precision by 22%. Then, using a spring graph, he created an interactive exploration system that can effectively group conceptually similar images. Working from home, he tested the system by examining aerial images that he obtained from NASA to identify hazards to buried oil pipelines and achieved a 96% recognition rate. David speculates that this technology can be used in real time by unmanned aerial vehicles to safeguard pipelines and other valuable resources. At **Lynbrook High School** in San Jose, David is co-president of the robotics team and founder of the computer club. A multiple award winner at Intel ISEF competitions, he enjoys piano, tennis and Web development. David hopes to study computer science at Stanford or MIT and is the son of Hui Liu and Kathleen Lin.

Paul Masih Das
*Lawrence High School*

New York

Paul Masih Das, 17, from **Lawrence**, synthesized single-layer graphene (a sheet of carbon that's as thick as a single atom) using a relatively quick, easy and inexpensive method that he developed for his Intel Science Talent Search **chemistry** project. Graphene has higher thermal conductivity, electron mobility and tensile strength than silicon and has the potential to replace silicon in many applications. Using eight different analytical methods, Paul confirmed that his milder graphene-creation method produced sheets greater than one square micron in area with minimal defects; Paul believes these graphene sheets were larger than any previously produced. As a member of Young Ambassadors of America at **Lawrence High School** in Cedarhurst, Paul has represented the United States on cultural tours of Japan, Spain and Italy. He plays on the school's tennis team, is captain of the math team and is a member of the chess club. He is an award-winning musician and manages the chamber orchestra. Paul also enjoys soccer and baseball. The son of Wilfred and Joycelyn Masih Das, Paul hopes to attend MIT or Cambridge to study particle physics or chemical engineering.
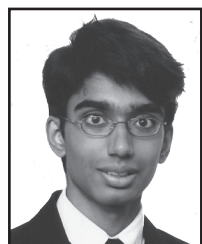
Akhil Mathew
Madison High School

New Jersey

Akhil Mathew, 18, of **Madison**, entered an Intel Science Talent Search project in **mathematics**. Akhil combines algebraic geometry, representation theory, and category theory in his work on Deligne categories of complex rank. Deligne created a large family of categories parametrized by complex numbers which interpolate classical categories, ones in which the complex number in question is a positive integer. Akhil shows, under certain finiteness assumptions, that important properties of these categories are determined by constructible sets. He then shows that these properties hold generically if they hold on a sufficiently large set of parameters. Akhil is a tutor in chemistry, math and French at **Madison High School**, where he is also active in the chess club. Since eighth grade, he has taken courses at Drew University, where he recently assisted in preparing a math textbook for publication. He is moderator of an online math forum run by Johns Hopkins University and was a Davidson Fellow Laureate in 2008. Akhil is the son of Mathew Thomas and Rama Madhavarao and was born in India. He hopes to continue his studies at Harvard or MIT.
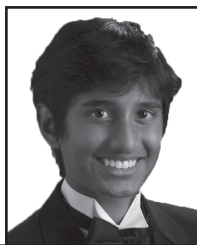
Raman Venkat Nelakanti
Lynbrook High School

California

Raman Venkat Nelakanti, 17, of **Sunnyvale**, investigated the green algae *Chlamydomonas reinhardtii*, a potential source of hydrogen, a renewable biofuel, for his Intel Science Talent Search **plant sciences** project. These algae require an oxygen-free environment to produce hydrogen. Depriving the algae of sulfur prevents oxygen generated by photosynthesis from reaching levels that inhibit hydrogen production, but also inhibits algae growth. Raman tested different sulfur concentrations and found that *C. reinhardtii* consume oxygen, grow, reproduce and generate enough hydrogen to power a fuel cell when grown in media with a 60.7 µM sulfur concentration. He believes his work will help make *C. reinhardtii* hydrogen production more efficient. Raman attends **Lynbrook High School** in San Jose where he is president of a community service club, and co-founder and co-president of the cricket team. An expert in the chemistry and biology of composting, he volunteers at a community garden that serves the needy. The son of Bhava and Tara Nelakanti, Raman performs Indian Carnatic vocal music. He hopes to attend Stanford or MIT, study bioengineering or biochemistry and conduct research.

Joshua William Pfeffer
North Shore Hebrew Academy High School

New York

Joshua William Pfeffer, 17, of **Plainview**, submitted an Intel Science Talent Search project in **mathematics** about super Kähler-Ricci flow. Josh works in differential geometry. The Ricci flow on a manifold is a tool which smooths out irregularities while retaining basic features of the manifold; Perleman used Ricci flows in his solution of a famous open problem in geometry, the Poincare Conjecture. In the context of mathematical physics, especially string theory, notions of supersymmetry and supermanifolds arise, and in analogy with the ordinary manifold case, Josh defines a super Kähler-Ricci flow equation for supermanifolds. He connects the behavior of the super Kähler-Ricci flow with the Ricci flow in interesting cases, and also gives conditions guaranteeing stability of solutions of his new concept. Josh earned perfect SATs and attends **North Shore Hebrew Academy High School** in Great Neck, where he heads both the math and debate teams and is the newspaper editor-in-chief. One of his previous science projects concerned fractal analysis of abnormal structures in the brain. He plans to attend Harvard or MIT. Josh enjoys tennis and classical guitar, and his parents are Daniel and Mindy Pfeffer.

Arjun Ranganath Puranik
William Fremd High School

Illinois

Arjun Ranganath Puranik, 17, of **Palatine**, submitted a **mathematics** project to the Intel Science Talent Search that classifies the representations of rational Cherednik algebras, which have applications in quantum physics. Arjun's research gives a deepened understanding of H_3, the group of symmetries of the regular icosahedron (a polyhedron built of 20 equilateral triangles). He studies an algebraic structure built from H_3, called the rational Cherednik algebra. His classification of finite dimensional representations of this algebra provides useful linear algebra information about this complicated structure. His result contributes to the efforts to classify all rational Cherednik algebras. Arjun, who was born in India, is the son of Ranganath and Parimala Puranik. He is first in his class of 747 at **William Fremd High School** where he is managing editor of the newspaper, lead member of the math team and captain of the scholastic and science bowl teams. He has been recognized for his achievements in varsity tennis and piano and is a weekly volunteer at the Alexian Brothers Medical Center. His college choices include Stanford and MIT and he plans to work as a researcher.

Katherine Rebecca Rudolph
Naperville Central High School

Illinois

Katherine Rebecca Rudolph, 18, of **Naperville**, asks "How closely can we pack identical spheres?" for her Intel Science Talent Search project in **mathematics**. Kate studies packing of spheres of uniform size in n-dimensional space; for n= 2, 3 the most dense packings are orderly lattice packings, but for higher dimensions the situation is more complicated. Assuming a conjecture of Torquato and Stillinger holds, she improves a lower bound on the maximal density of sphere packing in high dimensions. Dense packings are of interest to chemists studying supercooled matter and cryptologists in search of error-correcting computer code. At **Naperville Central High School**, Kate is a captain of the math team, a member of the drama club and has been a member of the JETS science team for the past four years. Winner of numerous awards, Kate has perfect ACT scores and strives to connect her knowledge of network dynamics with various scientific applications. She also says she enjoys waterskiing whenever she can. The daughter of Michael and Rebecca Rudolph, she plans to major in math at MIT or Caltech and one day work as a research mathematician.

Alan Robert Sage
Stuyvesant High School

New York

Alan Robert Sage, 17, from **New York**, entered an Intel Science Talent Search **plant sciences** project concerning chemotropism—the attraction of a plant's roots to chemicals that are potentially beneficial, and their repulsion to chemicals that may be harmful. Alan designed an experimental system where the roots of *Arabidopsis thaliana* grew downward toward a drought-simulating chemical, mannitol, but then turned left or right at an angle in search of water. He created a new procedure for measuring chemotropism and then used it to test glutamate, an amino acid that appeared to cause plant roots to be repulsed. The son of Howard and Lillian Sage, Alan was a finalist in a poetry competition and, as a freshman, he wrote and directed a one-act play about race relations titled, "Far Rockaway." At **Stuyvesant High School**, Alan serves on the newspaper's editorial board and says he can read Latin fluently. He likes to spend his spare time exploring New York City by subway, and is said to be an expert on many of the world's transit systems. He is a student of piano and music theory and aspires to pursue a curriculum that includes math, science and the humanities at Yale or Oxford.

Sarine Gayaneh Shahmirian
Chaminade College Preparatory

California

Sarine Gayaneh Shahmirian, 17, from **Northridge**, entered an Intel Science Talent Search **chemistry** project that may contribute to the development of new cancer treatments. Scientists use transition metal-stabilized organic cations to create enzyme inhibitors that prevent the formation of cancer agents. Reactions involving these substances have used strong acids that are unsuitable for processes involving complex biomolecules. Sarine developed a novel method to react these cations under neutral conditions, allowing their use with acid-sensitive compounds. Sarine's presentation at the regional division meeting of the American Association for the Advancement of Science received the division-wide President's Award for best paper. At **Chaminade College Preparatory** in West Hills, Sarine is founder and head of the Future Doctors of America Club and the school's science magazine. She is an accomplished classical pianist and volunteered in Armenia, rebuilding homes and protecting the environment. The daughter of Varaz and Karina Shahmirian, she hopes to attend Harvard or Princeton and ultimately join Doctors Without Borders.

Sunanda Sharma
Shrewsbury High School

Massachusetts

Sunanda Sharma, 17, of **Shrewsbury**, investigated the effect of an enriched environment on autism-relevant behavior for her Intel Science Talent Search project in **behavioral & social sciences**. Focusing on an autism candidate gene (called PTEN), active in embryo formation and development, she studied both juvenile and adult mice, using those with PTEN irregularities as autism models. After exposing them to significant sensory and social enrichment, she quantified changes in their behavior through a set of tests that measured patterns of social approach and anxiety, both critical in determining potential interventions in any autism model. She believes her findings show that environmental enrichment can be used to influence deficits in brain circuitry caused by genetic abnormality even when the gene is very early-acting, and is a co-author of a paper on the subject being prepared for publication. At **Shrewsbury High School**, Sunanda is active in speech and debate, plays clarinet in the band, works on the newspaper and is a mentor. She has won numerous honors in state and regional science fairs and hopes to attend MIT or Harvard. She is a native of India and the daughter of Jitendra and Usha Sharma.

Katheryn Cheng Shi
Texas Academy of Mathematics and Science

Texas

Katheryn Cheng Shi, 16, from **Sugar Land**, used computational chemistry to predict the existence of rare-gas compounds in her Intel Science Talent Search project in **chemistry**. Rare-gas molecules are used in lasers for eye surgery, semiconductor manufacturing and to create anti-tumor agents. Katheryn analyzed more than 80 hypothetical molecules using several quantum mechanical methods and identified two new stable rare-gas compounds, HArN and HKrN. She hopes to collaborate with synthetic chemists to synthesize these molecules. Katheryn is the first author of a paper submitted to *Chemical Physics Letters*. At **Texas Academy of Mathematics and Science** in Denton, she founded a math tutoring program for middle school students and has been the winner of numerous academic awards. She volunteers at a pet shelter and provides therapeutic horseback riding for persons with disabilities. As a 12-year-old, Katheryn earned a black belt in TaeKwonDo and reads Chinese and Spanish fluently. She enjoys swimming, ice skating and playing clarinet. The daughter of Hongxiao Shi and Han Cheng, Katheryn hopes to attend MIT or Harvard and study computational biology and chemistry.

Jane Yoonhae Suh
Palos Verdes Peninsula High School

California

Jane Yoonhae Suh, 18, of **Rancho Palos Verdes**, developed a microfluidic device that aids the growth and development of human pluripotent stem cells (hPSCs) for her Intel Science Talent Search project in **medicine & health**. One challenge in culturing hPSCs for study is maintaining optimal growth conditions for a variety of cells and media. Jane's device facilitates this by better representing the stem cell's natural environment in its microchambers, which allows scientists to evaluate gene expression at the level of the individual cell. This could lead to a superior method for growing stem cells into transplant organs and has applications in the field of regenerative medicine. Jane has researched microfluidic devices for over two years and is co-author of a paper published in the *American Journal of Pathology*. First in her class of 595 at **Palos Verdes Peninsula High School** in Rolling Hills Estates, Jane hopes to attend Harvard or Yale in pursuit of a career as a research scientist. She also volunteers for Peace4Kids, which encourages creative expression while providing educational programs and services for foster children and at-risk youth. Her parents are Myung In Suh and Sunhee Suh.

Benjamen Chang Sun
Red River High School

North Dakota

Benjamen Chang Sun, 17, from **Grand Forks**, entered the Intel Science Talent Search with an **environmental science** project focused on how dirt and debris in the street interact with rainwater. One of the first to conduct such a study using street particles, Ben found that the dirt's particle size altered how effectively it removed contaminants such as lead, chromium and arsenic from the water, and that most contaminant adsorption occurred within five seconds. He also studied how some of the contaminants could later be leached from the particles by uncontaminated water, and found that the particles had a limited capacity to adsorb metal contaminants. He has been studying water quality on his own for four years and is a state winner of the National Stockholm Junior Water Prize. Ben is the son of Michael and Jenny Sun, has co-authored both a published paper and a book chapter on nanoparticles, and is an accomplished violinist and concertmaster. As a **Red River High School** award winner for his considerable community service, Ben initiated a water quality awareness program for hometown youth. He hopes to attend Harvard or Stanford.

Kevin Young Xu
Roslyn High School

New York

Kevin Young Xu, 18, of **Roslyn Heights**, entered the Intel Science Talent Search with a **behavioral & social sciences** project examining demographic and psychological factors that may contribute to a lack of standard care for breast cancer (radiotherapy or chemotherapy after lumpectomy) among inner city patients. He surveyed 240 patients by mail and analyzed 105 responses, to conclude that patients with a female oncologist were more likely to receive standard care, and that patients who participated in decision-making with their physicians had less anxiety than those who did not. Kevin also found equivalent levels of participatory decision-making and patient anxiety regardless of physician's gender and whether or not standard care had been received. He believes his study highlights the importance of educating the public about follow-up breast cancer treatment. Kevin is president of the model congress club at **Roslyn High School** and principal cellist in the Eclectic Electric String Ensemble. He is a winner of numerous academic and service awards, and a volunteer at the Elmhurst Hospital. The son of Richard Xu and Karen Wang, Kevin hopes to attend Columbia or University of Chicago.

Lynnelle Lin Ye
Palo Alto Senior High School

California

Lynnelle Lin Ye, 18, of **Palo Alto**, entered a **mathematics** project in the Intel Science Talent Search that analyzed the game of Chomp on graphs and sets. Lynnelle seeks a way to find the winner of two person combinatorial games, assuming perfect information. Classical examples of such games are Chess and Go (difficult to analyze) and Nim (well understood). She gives a reduction technique for games on simplicial complexes such as graphs, and produces a general method which allows her to analyze certain "subset-takeaway" games, including ones played on bipartite graphs and complete n-partite graphs. Lynnelle attends **Palo Alto Senior High School**, where she has served as president of the math club for three years. The daughter of Jun Ye and Caren Wang, she earned a perfect 2400 in her SATs and, in the 2008 China Girls Math Olympiad, received a gold medal as the U.S. team's top scorer. Lynnelle volunteers weekly as a math coach and is passionate about combinatorial game theory, which she finds elegant and fascinating. In college, she plans to continue researching game theory, which has applications in economics and artificial intelligence, as she works toward a Ph.D. in mathematics.

Angela Yu-Yun Yeung
Davis Senior High School

California

Angela Yu-Yun Yeung, 17, of **Davis**, entered the Intel Science Talent Search with an **engineering** project focused on cognitive radio, a concept the FCC has recently recognized as part of a "wireless revolution" to meet the challenge of an overcrowded radio frequency spectrum. Over a two-year period, by using mathematical tools for modeling this type of decision-making and by applying spectrum sharing algorithms, she developed high performance networking policies that would enable users in a cognitive radio network structure to efficiently share the radio frequency spectrum while minimizing interference with one another. She compared her approach to existing policy using MATLAB simulations and found that time and energy required to find an open channel was decreased up to 90%. Angela is president of the math honor society at **Davis Senior High School** and director of the Willett Elementary School math club. In 2009, she was a first place winner in the mathematics and software category at the California State Science Fair and a finalist in the Intel ISEF. An accomplished pianist, she is a soloist, accompanist, and assistant teacher. The daughter of King-Wah and Wei-Wei Yeung, Angela hopes to study at Stanford or Harvard.

Lori Ying
South Side High School

New York

Lori Ying, 18, of **South Hempstead**, entered the Intel Science Talent Search with an **animal sciences** project that may play a role in preventing the spread of dengue fever, which affects 50 to 100 million people annually. Dengue is spread by the *Aedes aegypti* mosquito, and scientists are attempting to control the spread by releasing genetically altered mosquitoes that cannot carry the disease. Lori found that the female mosquitoes in her study apparently preferred genetically modified males over regular males, and already-mated males over virgin males. She believes that the willingness of female mosquitoes to mate with mutant mosquitoes is a positive indicator that the transgenic mosquito program may succeed. President of the engineering club and treasurer of the forensic club at **South Side High School** in Rockville Centre, Lori has competed in the CSI Forensics World Challenge. She plays violin, works with a theater group for the developmentally disabled and has served as a leader in the National Art Honor Society. Lori also volunteers at a hospital and in an acupuncturist's office. The daughter of Danny Ying and Dawn Zhu, she plans to attend the University of Pennsylvania or Columbia.

Alice Wei Zhao
Sheboygan North High School

Wisconsin

Alice Wei Zhao, 16, of **Sheboygan**, submitted an **engineering** project to the Intel Science Talent Search describing her invention of a portable device to deliver a continuous supply of heated high-pressure gas that helps form nanoparticle coatings and materials. Alice's challenge was to provide a gas that is both very hot (700°C or 1300°F) and under high pressure (200 psi)—two requirements that are difficult to achieve together. To heat the pressurized gas, she proposed using an induction coil with a heating coil of mild steel. For insulation, Alice used a tube-in-tube design with natural convection air flowing through it to keep the heating coil hot and prevent the induction coil from melting. In lab tests, the device worked successfully. Last year, a Taiwanese aeronautical conference accepted a paper that she co-authored on this subject. Alice's many awards include third place in a national inventors competition, which she earned while in second grade. First in her class of 405 at **Sheboygan North High School**, Alice enjoys piano, vocal music and tennis. The daughter of Yougui Zhao and Chonghua Wang, Alice hopes to attend MIT or Caltech and one day become a biomedical engineer or patent lawyer.

Linda Zhou
Academy for Medical Science Technology

New Jersey

Linda Zhou, 18, of **River Edge**, studied drug resistance in breast cancer for her Intel Science Talent Search **biochemistry** project. She examined the effects of turning off a gene that codes for a protein called hTERT and found that silencing the gene reduced the drug resistance and migration of cancerous cells. The results of her research reveal previously unspecified functions of hTERT involvement in the development of drug resistant tumors and in the metastasis of breast cancer. She believes that the additional findings of her study involving cancer cell growth signaling suggest both a possible treatment for drug resistant tumors and a new explanation for the mechanism of hTERT regulation. A co-author of a published research paper in *Journal of Cancer Molecules*, Linda attends the **Academy for Medical Science Technology** in Hackensack. She fences, plays lacrosse and competes with the Academic Decathlon Team. Linda volunteers weekly with the youth council, is EMT-certified and holds a regular part-time job. The recipient of many academic awards, Linda is the daughter of Dong Huo Zhou and Ying Liu. She hopes to pursue a career as a neurologist or forensic pathologist.

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Finalists Listed by State

Intel Science Talent Search 2010
Finalists Listed by Last Name

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