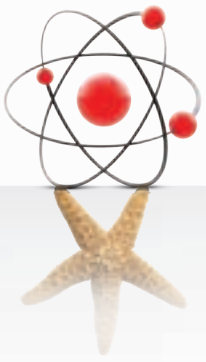
INQUIRE. INNOVATE. INSPIRE.

2011 Finalists

Erika DeBenedictis
First Place Winner
Intel Science Talent Search 2010



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2011 Finalists

The Intel Science Talent Search (Intel STS) 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 seven Nobel Prizes and four National Medals of Science. The Intel STS recognizes 300 students and their schools as Semifinalists each year—from among 1,744 high school senior applicants in 2011—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 2011

Intel Science Talent Institute 2011
March 10–15, 2011

The 40 Finalists of the Intel Science Talent Search 2011, 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 16 young women and 24 young men come from 39 schools in 15 states. Finalists were selected from among 1,744 entries that were received from 42 states, the District of Columbia, and one qualifying U.S. school overseas.

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 acknowledging those mentors to avoid any potential for judging bias. Intel STS 2011 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 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 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 supported this annual program.

Since 1942, the STS has recognized 21,000 Finalists and Semifinalists who have received $14.2 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 seven Nobel Laureates, four National Medal of Science winners, eleven 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 13th year of sponsorship of the Intel Science Talent Search (Intel STS).

The Process

Students submit written reports of their scientific research, an extensive application 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, 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 are planning to enter the Intel Science Talent Search in their senior year of high school.

Awards

The top award for the Intel Science Talent Search 2011 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 each, and Eighth–Tenth places will each receive $20,000. The remaining 30 Finalists will each receive $7,500. Winners will be selected by the judging committee and announced at a black-tie gala on March 15, 2011.

Each of the 300 students named a Semifinalist in the Intel STS 2011 will receive a $1,000 award for their outstanding science research, in addition to any amount that students may win as Finalists. Each of their schools will receive an award of $1,000 for each Semifinalist named in the Intel STS 2011. 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, 2011, the date of the Intel Science Talent Search Awards Gala.*

Amol Aggarwal
Saratoga High School

California

Amol Aggarwal, 17, of **Saratoga**, submitted an Intel Science Talent Search project in **mathematics** investigating the comparison and measurement of distances in a convex polygon. Amol's interest in combinatorial geometry was sparked by a contest problem involving the possible number of isosceles triangles formed by the vertices of a certain polygon. This led him to open the problems of Erdös and others concerning various counts involving vertex distances for the general class of convex polygons with *n* sides. Amol obtained improvements of known upper bounds for several such counts. His work has implications in computer vision and pattern recognition, optimization theory, computational and algebraic geometry, and music theory. Amol is a student at **Saratoga High School**, where he competes as a member of the award-winning chess team. He enjoys sharing his mathematical skills with fellow students as a participant in several local math clubs, and volunteers at a local homeless shelter, where he helps students with their homework and tutors in all academic areas. Amol plans to pursue a career as a professor and researcher, combining his interests in mathematics and economics. He is the son of Alok and Sangeeta Aggarwal.

Shubhangi Arora
Novi High School

Michigan

Shubhangi Arora, 17, of **Novi**, submitted an Intel Science Talent Search **microbiology** project addressing the genetic basis of drug resistance in a common yeast. *Candida albicans* causes an opportunistic infection, candidiasis, which has a mortality rate of 40 percent in patients who are immunocompromised. Results from the latest phase of Shubhangi's three-year study, indicated that the *C. albicans* gene IPT1 is implicated in multidrug resistance and confers resistance without creating additional protein products. Shubhangi believes that once the gene's key regulatory proteins are identified, pharmaceutical companies will be able to design new antifungal drugs that target the proteins and benefit at-risk patients. Her interest in the drug resistance of superbugs, and methods to combat them, began in the ninth grade. Shubhangi is a video producer and anchor for the award-winning newscast *The Cat's Eye News at* **Novi High School**. She heads the math club and varsity cross country team, and she intends to run the Chicago marathon one day. Born in India to Anupam and Shikha Arora, she is fluent in Hindi and is a Dale Carnegie graduate assistant. Shubhangi hopes to study molecular biology in college and earn a combined M.D./Ph.D. to pursue a career in medical research.

Eta Atolia
Rickards High School

Florida

Eta Atolia, 17, of **Tallahassee**, assessed the value of the alga *Nannochloropsis oculata* as a biofuel feedstock and source of the valuable omega-3 fatty acid eicosapentaenoic acid (EPA) for her Intel Science Talent Search project in **biochemistry**. Algae yield significantly more biofuel than traditional plant sources. While *N. oculata* is an abundant source of oleic acid, a fatty acid with optimal fuel properties, current economics do not support industrial scale biofuel production. Eta proposed that this particular alga might also produce other marketable lipids like EPA to offset the cost. EPA, which is sold as a dietary supplement, is important to good health and shows promise in cancer treatment and prevention. Eta believes that the potential of using algae for the production of various biological molecules is tremendous. First in her class of 254 at **Rickards High School**, Eta is president of the National Honor Society and co-founder of a service club that collected 500 pairs of jeans for Haitian quake victims. She has earned awards for piano, tennis, and swimming and she is a member of the math club. The daughter of Manoj and Vineeta Atolia, she was born in India and is fluent in Hindi and French. Eta hopes to do biological research.

Madeleine Amanda Ball
Ursuline Academy of Dallas

Texas

Madeleine Amanda Ball, 18, of **Dallas**, identified a previously unknown means of cholera transmission for her Intel Science Talent Search submission in **animal sciences**. Copepods (tiny crustaceans) found in brackish water were already known to carry the bacteria that causes deadly cholera. However, when Madeleine started her copepod research three years ago, conventional wisdom held that these bacteria were not a problem with copepods living in fresh water, where they are used as a natural means of mosquito control. Madeleine has shown that freshwater copepods actually can harbor the cholera-causing bacteria in a dormant state and that, in this state, the bacteria cannot be detected using conventional testing procedures. Her findings provide a possible explanation for cholera epidemics, such as the recent outbreak in Haiti. At **Ursuline Academy of Dallas**, Madeleine plays the tuba in the concert band, is a leader of the nationally-recognized Color Guard, directs and performs in theater productions, and plays soccer. To interest more girls in science, Madeleine championed efforts to institute an annual science fair at her school. The daughter of Scott and Lisa Ball, Madeleine hopes to study infectious diseases and one day work as an epidemiologist.

Alison Dana Bick
Millburn High School

New Jersey

Alison Dana Bick, 17, of **Short Hills**, sought a low-cost, portable and publicly accessible method for testing water potability for her **engineering** submission to the Intel Science Talent Search. Concerned by the threat of contaminated drinking water in her community, Alison worked for over four years researching and developing several devices to accurately test water for inorganic materials and harmful bacteria. An early version—made from a cell phone, a plastic bag and a mirror—yielded promising results, but was less accurate than current commercial testing devices. While attempting to improve the cell phone device, she designed and optimized a microfluidic apparatus, which allowed her to easily observe the reaction between a small amount of testing fluid and the water sample. This device produces results that rival the accuracy of current water quality tests but does so in seconds and at a fraction of the cost. Meanwhile, her cell phone device (patent pending) is currently being tested by the local chapter of the American Red Cross. Alison attends **Millburn High School**, where she competes on the varsity fencing, track and cross country teams. She is a certified sailing instructor. Alison's parents are Jonathan and Barbara Bick.

Joshua David Bocarsly
The Lawrenceville School

New Jersey

Joshua David Bocarsly, 18, of **Plainsboro**, believes his research for the **materials science** project he submitted to the Intel Science Talent Search will play an important role in the development of artificial polyester ligaments and tendons. Artificial ligaments are engineered to be biodegradable and allow space for cells to integrate into them and regrow damaged ligaments. However, cells do not integrate well with the implants due to the properties of the polyester used. To improve cell ingrowth, Joshua modified the implants with a cell-friendly nanoscale coating. In addition, he found that patterning this surface treatment with stripes induced cell elongation in the direction of the stripes and encouraged growth in an ideal way to regenerate ligaments. While his studies of cell behavior are preliminary, Joshua believes that the research has exciting potential. The son of Andrew and Patricia Bocarsly, Joshua is a founding member and design editor of *The First Amendment*, a student-run political magazine, and a member of the Science Olympiad at **The Lawrenceville School**. He is co-captain of the varsity fencing team and has earned honors for his skill. Joshua is fluent in Spanish, which he has studied in Segovia, Spain.

Scott Paul Boisvert
Basha High School

Arizona

Scott Paul Boisvert, 17, of **Chandler**, investigated aquatic habitats in search of a link between water chemistry and the proliferation of a harmful fungus for his Intel Science Talent Search **environmental science** project. Chytridiomycosis, a lethal disease contributing to the decline of the amphibian population worldwide, is caused by the fungus *Batrachochytrium dendrobatidis*. Scott gathered and tested water samples from several distinct watersheds in his native state for levels of inorganic compounds and compared them to measurements of the fungus' growth and movement. His results suggest that contaminants in the aquatic environments—occurring naturally or through industrial, agricultural or urban run-off—impact the growth of the fungus. Scott hopes the results of this three-year research study will guide habitat conservation programs for amphibian populations around the world. The son of Ronald and Gloria Boisvert, Scott is completing his Eagle Scout project and volunteers at Banner Gateway Medical Center. At **Basha High School** he is first in his class of 553 and plays varsity tennis. Scott is also co-author of a paper that was presented at the 2010 AACR-IASLC Joint Conference on Molecular Origins of Lung Cancer.

Wenyu Cao
Phillips Academy

Massachusetts

Wenyu Cao, 18, of **Belle Mead, New Jersey**, submitted a **mathematics** project to the Intel Science Talent Search in graph theory, which combines his interests in mathematics and computer science. An expander graph is one with the seemingly contradictory features of high connectivity and few edges; such graphs are useful in network design and error-correcting codes. Wenyu studied bipartite graphs, ones with two sets of vertices and edges only allowed between pairs of points in the distinct sets; a bipartite graph is biregular if all points on the same side have the same number of edges. He showed that random biregular graphs are good expanders, and he also gives a method for constructing a class of expansive biregular graphs. Wenyu's work has applications in error correcting codes, used in cryptography and deep space telecommunications. Born in China, Wenyu is the son of Huimin Cao and Xiaomei Chen, and is fluent in Mandarin Chinese. A winner in the 2009 USA Mathematical Olympiad, Wenyu also received a gold medal in the 2010 International Olympiad in Informatics. He attends **Phillips Academy** in Andover, and has volunteered on a sustainable farm and at a meal center as a way to give back to his community.

Xiaoyu Cao
Torrey Pines High School

California

Xiaoyu Cao, 17, of **San Diego**, optimized the synthesis of a polymer scaffold used in biosensors for the **chemistry** project she submitted to the Intel Science Talent Search. Xiaoyu's work could deliver a nanoscale biosensor capable of handling the rigors of everyday use. Traditional biosensors are made from scaffolds of silicon; their chemical properties are well suited for sensing, but they are brittle and prone to unwanted reactions with their environment. Xiaoyu developed and optimized a new method to fabricate silicon-like scaffolds from stronger, more stable polystyrene. Her creation has the same optical properties as silicon but is more rugged and less reactive. The biosensors Xiaoyu works with have a wide range of potential applications, such as rapidly detecting disease antibodies and tracking the process of industrial reactions. At **Torrey Pines High School** Xiaoyu is feature editor of the school paper, a member of the math club and a competitor on the academic team. The winner of numerous academic, music and community awards, Xiaoyu is fluent in Mandarin and French, plays piano, and performs clarinet with the Torrey Pines Wind Ensemble. She is the daughter of Jun Cao and Xinnan Ji, and was born in China.

Emily Li Chen
Brownell-Talbot School

Nebraska

Emily Li Chen, 17, of **Omaha**, investigated a possible target of drug therapy for neurodegenerative conditions like dementia and diseases like Alzheimer's and Parkinson's for the **microbiology** project she submitted to the Intel Science Talent Search. She studied the function of neural progenitor cells (NPC), which continually differentiate into neurons and other cells, helping the body to repair itself. With neurodegenerative disorders, however, the release of small proteins, called cytokines, forces NPC to largely differentiate into astrocytes (multi-functional cells), creating a dearth of essential neurons. Her findings indicate that this can be counteracted by blocking the protein STAT3, and thereby inhibiting astrocyte formation and promoting neurogenesis. She believes drugs that target the STAT3 pathway may help alleviate neurodegenerative damage. Emily is editor-in-chief of the yearbook and a top player on the varsity tennis team at **Brownell-Talbot School**. The recipient of numerous academic and community awards, she has logged more than 900 hours of community service. Fluent in Chinese and an accomplished pianist, she is the daughter of Yizhong Chen and Hong Pan and plans a career in neuroscience.

Sung Won Cho
Groton School

Massachusetts

Sung Won Cho, 18, of **Lexington**, analyzed the effects of habitat structure on ground beetle communities on two types of sites in eastern Massachusetts for his Intel Science Talent Search project in **animal sciences**. He collected his beetles (Coleoptera: Carabidae) in a mainland forest and on four islands in Boston Harbor, and studied five habitat variables —dominant plant, soil and litter types; ground coverage (rocks and logs); and proximity to a body of water—to determine how these factors affected beetle diversity in geographically distinct areas. His analysis suggests that while habitat factors do affect diversity, biotic factors such as competition may also contribute. He also found that although there were habitat differences between the two areas, similar patterns emerged. He believes his research raises questions about the ecology of isolated ecosystems and how different communities within one system affect each other. At **Groton School**, Sung Won plays varsity squash and captains the math team. He has perfect SAT scores and plans a career in entomology or biomechanical engineering. Sung Won was born in the Republic of Korea and speaks fluent Korean. He is the son of YongJun Cho and HyunSook Chang.

Benjamin Mathias Clark
Penn Manor High School

Pennsylvania

Benjamin Mathias Clark, 15, of **Lancaster**, studied aspects of binary star formation for his Intel Science Talent Search project in **physics and space science**. Working primarily from his home, Benjamin conducted a comprehensive study of data from the Sloan Digital Sky Survey to determine how frequently stars form binary systems. In his investigation of more than 50,000 stars, he determined that the fraction of stars existing in closely orbiting binary systems increases with increasing stellar mass. His results have implications for our understanding of how stars form and can be used to validate other scientists' theories of star formation. Benjamin, who taught himself the advanced statistical methods needed to conduct this study, won first place in the Pennsylvania Math League and is a two-time qualifier for the USA Mathematical Olympiad. He is first in his class of 442 at **Penn Manor High School** in Millersville where he is a math tutor and head delegate of the Model UN. Son of James and Jill Clark, Benjamin enjoys hiking, skiing and cross country running. He was a national finals qualifier in the Team America Rocketry Challenge and is close to attaining the rank of Eagle Scout.

Jonathan Aaron Goldman
Plainview-Old Bethpage John F. Kennedy High School

New York

Jonathan Aaron Goldman, 17, of **Plainview**, studied the relationship between native language and perception of visual stimuli for his Intel Science Talent Search project in **behavioral and social sciences**. He hypothesized that native English readers would more readily recall features of an image located on the left side of the visual field and native Hebrew readers would more readily recall features on the right side, but his research showed that English readers recalled features faster when on the right side of an image and Hebrew readers were faster on the left. He also examined the relationship between the position of an image and the time it takes to locate the image in a series. English readers identified the matching image faster when located toward the right and vice versa for Hebrew readers. Jonathan believes his findings could make print ads more successful by strategically locating them on a page. The son of Michael and Andrea Goldman, Jonathan is president of the Science Honor Society and a member of the Science Olympiad team at **Plainview-Old Bethpage John F. Kennedy High School**. He says he loves to farm because he is able to see the fruits (and vegetables) of his labor. Jonathan plans a career in industrial and organizational psychology.

Jan Jiawei Gong
Garden City High School

New York

Jan Jiawei Gong, 18, of **Garden City**, submitted a study of sugar addiction for her Intel Science Talent Search project in **medicine and health**. Using the blue mussel as an animal model, Jan found that high levels of glucose can regulate morphine receptors and cause morphine release, suggesting that sugar can be addictive. She also found that high levels of glucose can greatly increase the release of nitric oxide (NO), whose metabolites can contribute to vascular damage, but that naloxone, which counteracts the effects of morphine, and L-NAME, a NO synthase inhibitor, can block the effect of glucose on NO release. She believes these may someday serve as treatments for obesity and vascular damage in diabetics. Jan has perfect SAT scores and is first in her class of 275 at **Garden City High School** where she is captain of both the math team and the varsity fencing team, president of the Latin Honors Society, and principal cellist in the chamber orchestra. Jan volunteers at a local hospital, arranges concerts at nursing homes and organized fundraisers for UNICEF and Haitian earthquake victims. The daughter of Henry and Liming Gong, Jan is fluent in Mandarin and plans a career in research.

Michelle Abi Hackman

John L. Miller Great Neck North High School

New York

Michelle Abi Hackman, 17, of **Great Neck**, studied the effect of separating teenagers from their cell phones for her Intel Science Talent Search **behavioral and social sciences** project. After noticing that her friends at a group dinner were texting each other instead of speaking, Michelle designed a project to research the anxiety that humans might feel when unable to use their cell phones. Because Michelle is not sighted, she trained ten assistants to administer her tests and record the results. She isolated 150 high school students (some were allowed to keep their cell phones and the rest were not) and compared their levels of anxiety. Michelle found no significant differences between the groups though data trends may suggest that some students isolated with their phones may have remained more alert than their phoneless counterparts. At **John L. Miller Great Neck North High School**, Michelle sings with the jazz choir and started the recycling program. In her spare time, Michelle and a friend lead efforts to fund and promote construction of a rural school in Cambodia for underprivileged girls. The daughter of Daniel and Sarah Hackman, Michelle volunteers with Reporters Without Borders and is considering a career in behavioral science research and science journalism.

Bryan Dawei He

Williamsville East High School

New York

Bryan Dawei He, 16, of **Williamsville**, studied a coding theory problem in **computer science** for his Intel Science Talent Search project, describing a compact binary code for "mosaic floorplans"—the layout designs for very large scale integration (VLSI) circuits. A floorplan describes the placement of components on the computer chip, and an efficient layout requires designers to solve various optimization problems. The best floorplan algorithms use binary codes to systematically generate and evaluate alternative layouts, and compact coding results in more efficient algorithms. Bryan's compact binary code (using at most 3.5n-2 bits) significantly improves the best previously known code (using 8n bits). As a ninth grader at **Williamsville East High School** in East Amherst, Bryan wrote a program that could play "Connect Four" better than most humans, including himself. Over three years, he has won three gold and three silver medals at State Olympiad competitions, currently competes in the USA Computing Olympiad Gold Division, andd is second author of a patient privacy paper submitted to *Proceedings of National Academy of Sciences* for publication. The son of Xin He and Hwa Liu, Bryan is a cellist and black belt martial artist who plans to pursue further study of algorithms and artificial intelligence.

Rounok Joardar
Plano West Senior High School

Texas

Rounok Joardar, 17, of **Plano**, spent three years developing a novel high efficiency hybrid concentrator solar cell for his Intel Science Talent Search project in **engineering**. Convinced that solar power can be an attractive replacement for fossil fuels, Rounok focused on reducing the cost per watt (CPW) of electricity generated by increasing cell efficiency, while also lowering cell cost and peripheral expenses. Through a series of experiments conducted in his own backyard with equipment he had constructed in the family garage, Rounok attempted to build an optimized solar cell by combining a conventional photovoltaic cell with a thermoelectric generator to convert the waste heat into energy. He believes this is the first known practical investigation of this type of hybrid cell, which showed a five percent reduction in CPW and a five percent increase in power output at the same time. A student at **Plano West Senior High School**, Rounok attended the London International Youth Science Forum, having qualified as first place award winner in engineering at the 2010 National Junior Science and Humanities Symposium. Rounok is fluent in Bengali and has studied Spanish extensively. He is the son of Kuntal Joardar and Nivedita Guha.

Matthew Lam
Jericho High School

New York

Matthew Lam, 17, of **Old Westbury**, researched the role of education in overcoming barriers to pain management in Chinese American cancer patients for his Intel Science Talent Search project in **behavioral and social sciences**. Matthew's two-year study was inspired by his experience in an oncology clinic where he noted that Chinese cancer patients complained of pain despite medical treatment. When he found that very few studies had been done on pain in Chinese Americans, he conducted his own. His questionnaires, regarding dose schedule adherence, pain management and beliefs about taking pain medication, were distributed before and after education sessions. He observed a correlation between education and successful pain management; the American Cancer Society has already funded a ten-year continuation study in New York. The son of Lawrence and Lai Lam, Matthew is co-captain of the tennis team at **Jericho High School** and plays piano and alto saxophone. Speaking fluent Cantonese, Matthew went to Hong Kong to further his epidemiology studies in international public health policies for controlling SARS, Avian Flu and AIDS. Matthew also helped HIV-infected children in China through fundraising and a pen-pal program he co-founded.

Si-Yi Ryan Lee
North Carolina School of Science and Mathematics

North Carolina

Si-Yi Ryan Lee, 18, of **Charlotte**, submitted a project to the Intel Science Talent Search in **biochemistry** proposing an answer to a fundamental question of protein evolution. Proteins are chains of molecules that must fold and twist into specific 3D structures to function properly. Si-Yi demonstrated that the shapes proteins assume during the initial stages of folding depend on sequences that are apparently unaffected by natural selection. This implies that only the final shape of a protein, which dictates its actual function, is subject to evolutionary pressure. Si-Yi's work attempts to resolve a paradox that has challenged biochemists and may enable researchers to better understand diseases caused by faulty protein folding, such as Alzheimer's or Mad Cow Disease. Si-Yi attends the **North Carolina School of Science and Mathematics** in Durham, where he founded the Biology Society to prepare students for the USA Biology Olympiad. A winner of two national gold medals in the Science Olympiad, Si-Yi has received multiple awards for community service and leadership. He recently took up rock climbing and is a licensed windsurfer. The son of Alvin Lee, Si-Yi was born in Hong Kong and speaks fluent Cantonese.

Bonnie Rae Lei
Walnut High School

California

Bonnie Rae Lei, 18, of **Walnut**, combined DNA and anatomical analysis of sea slugs for her Intel Science Talent Search **animal sciences** project. Bonnie studied two different tropical sea slug species and found that they were genetically indistinct. She also found that a Bahamas population of these sea slugs was genetically distinct enough to be a separate species, and has proposed a new taxonomic name for it. Her analysis indicated that the populations diverged some five million years ago, when a sea channel closed, partially isolating the Bahamas area from the Atlantic Ocean. Her work may provide crucial insight into the biodiversity of this genus. At **Walnut High School**, Bonnie co-founded the Writers' Guild and literary journal, for which she is editor-in-chief. She also founded a chapter of Namlo, an organization assisting people in developing countries, to sponsor a sister school in rural Nepal. She is also first in her class of 703. She has received a grant to study bats and endangered otters in Brazil and was one of two U.S. representatives at the first World Youth Climate Conference in Mexico. Her research has been published in two paleontology journals and online by the American Museum of Natural History. Bonnie, who has perfect SATs, is the daughter of John and Jenny Lei.

Krystle M. Leung
Naperville Central High School

Illinois

Krystle M. Leung, 17, of **Naperville**, studied the effect of exposure to particulates in Central California and its effect on pulmonary inflammation for her Intel Science Talent Search **environmental science** project. Micro- and nano-sized particulates found in air pollution are more harmful than larger particulates because the microscopic objects more easily infiltrate the delicate structures of lungs causing inflammation. Krystle worked with lung tissue exposed to pollutants in California in summer, winter, and two control groups. She found more inflammatory cells in the winter group, and noticed that the tiny particulates tended to settle in the smaller airways. She hopes her research may help others better understand the consequences of breathing airborne particulates. Krystle is captain of three competitive scholastic clubs at **Naperville Central High School**, and has perfect SATs. Fluent in French and conversant in Chinese, her hobbies include origami, reading French and Russian literature, swimming, and playing piano, and she helped raise $3,000 for visually impaired children worldwide. She is the daughter of Dr. and Mrs. Philip Leung.

Jonathan F. Li
St. Margaret's Episcopal School

California

Jonathan F. Li, 18, of **Laguna Niguel**, conducted research that could affect how cancer treatments are developed and applied for his Intel Science Talent Search project in **bioinformatics and genomics**. Jonathan developed a computer model to study the individual and combined effects of cell compression, motility, and contact inhibition on the growth of tumor cell clusters. He found that increased motility has a direct effect on the growth rate of a tumor—cell lines with greater motility overcome the forces of cell-to-cell adhesion and have more space to proliferate. Jonathan's research questions the value of therapies that kill healthy cells while destroying cancer cells. He delivered a paper on his project at the annual meeting of the Society for Mathematical Biology in Rio de Janeiro. Jonathan was a member of the United States Physics Team and a Davidson Fellow. He is on the varsity golf and soccer teams at **St. Margaret's Episcopal School** in San Juan Capistrano. A cellist in the school orchestra, he has played with All-State and All-Southern California Honor Orchestras. Jonathan is founder and president of the Orange County Math Circle, which encourages math among the under-served. Fluent in Mandarin and classical Latin—he has translated most of Virgil's *Aeneid*—he is the son of Zhongmin Li and Wei-Wei Fang.

Selena Shi-Yao Li
Mira Loma High School

California

Selena Shi-Yao Li, 17, of **Fair Oaks**, developed a new therapeutic strategy for liver cancer for her Intel Science Talent Search project in **biochemistry**. Conventional treatments for this fifth most common cancer have met with limited success, but a new drug in development, arginine deiminase (ADI), is promising. It targets a characteristic enzyme deficiency in the malignant cells, essentially "starving" them to death, while normal liver cells remain unaffected. But the efficiency of ADI is limited because the drug induces autophagy, a process that prolongs cell survival despite a lack of nutrients. To address this, Selena combined ADI with chloroquine, a malaria treatment that affects the machinery of autophagy, and found the combination of reagents to be four times as effective as ADI used alone. Selena is first in her class of 392 at **Mira Loma High School** in Sacramento, a member of the principal's advisory board and captain of the award-winning dance/drill team. She is a program director of the California Association of Student Councils and vice president of the Leukemia and Lymphoma Society Junior Board. Selena is fluent in Chinese and has a black belt in martial arts. She is the daughter of Xin-Nong Li and Jun-Min Wang.

Andrew Bo Liu
Henry M. Gunn Senior High School

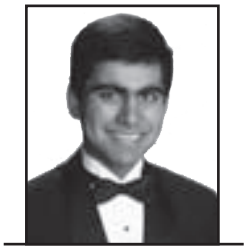
California

Andrew Bo Liu, 17, of **Palo Alto,** studied transplant rejection for his Intel Science Talent Search project in **bioinformatics and genomics**. Current treatments for transplant rejection suppress the entire immune system and can make the recipient susceptible to other diseases. The ideal treatment would be to suppress only rejection-causing immune pathways, but current methods of pathway analysis are inadequate because they fail to identify interactions between separate pathways. Andrew developed an analysis method that accounts for inter-pathway interaction. He used his method to analyze kidney transplant data and found it better identified the pathways involved in rejection. He also discovered the involvement of pathways formerly unknown in rejection, allowing for proposal of a disease model that is currently being validated in mice, and which could lead to better treatment. Andrew is president of the speech and debate club and co-editor-in-chief of *The Chariot* at **Henry M. Gunn Senior High School**. He is also an accomplished pianist. Andrew has perfect SAT scores, and is fluent in Mandarin and Spanish. The son of Yajun Liu and Shirley Hong Zeng, he plans to be an executive at a high-tech company or a professor.

Jenny Jiaqi Liu
Amity Regional High School

Connecticut

Jenny Jiaqi Liu, 18, of **Orange**, studied human-robot interaction for her Intel Science Talent Search **computer science** project. Her project recruited 62 participants, 18 to 40 years of age, to teach (by demonstration) five short predefined dances to a small robot, named Keepon, that could lean, tilt, bounce, and rotate. Participants were randomly assigned to a robot that showed either human-like, neutral, or irrelevant emotions, as expressed by prerecorded vocalizations. In reality, the robot's performance was solely based on the number of times the volunteer had demonstrated each dance. Jenny found that volunteers were more engaged—and repeated each dance more often—when the robot demonstrated a believable emotional response. She expects her findings will help engineers design robots with which people are comfortable interacting. Jenny is active in the National Honor Society at **Amity Regional High School** in Woodbridge. An award-winning violinist, she is concertmaster of the Connecticut Youth Symphony and performed at Carnegie Hall. She is first author of a research paper accepted for publication in the *International Journal of Creativity and Problem Solving*. Born in China and fluent in Mandarin, she is the daughter of Feng Liu and Li Ni.



Rohan Mahajan
The Harker School

California

Rohan Mahajan, 17, of **Cupertino**, submitted a **materials science** project to the Intel Science Talent Search that researched ways to improve the efficiency of photoelectrochemical (PEC) cells, used in sustainable hydrogen production. PEC cells consist of a semiconductor photoanode and a platinum cathode, and use sunlight to generate hydrogen and oxygen from water. Rohan developed a new way to dope the photoanode (titanium dioxide) with sulfur. He synthesized nanowires—enhanced by elemental doping, quantum dot sensitization, or both—and showed that some of these configurations increased the light absorption of the photoelectrodes more than sixfold. This approach could be used to further increase the efficiency of PEC devices and might also be applicable to photovoltaic cells. Rohan attends **The Harker School** in San Jose, where he is president of the chemistry club and captain of the debate team. The son of Umesh and Manjula Mahajan, he serves on the Bay Area Youth Health Advisory Board. Rohan also volunteers with both the Pacific Free Clinic, where he helps diagnose patients and instruct health education classes, and the Lucile Packard Children's Hospital, working in the maternity department.

Matthew Miller
Western Alamance High School

North Carolina

Matthew Miller, 18, of **Elon**, studied how the placement of small bumps on the suction side of the base section of wind turbine blades could dramatically affect their aerodynamics for his Intel Science Talent Search project in **engineering**. The small bumps act as vortex generators (VGs), and Matthew found that when they are properly located, they increase the efficiency of the blade. He first tested the approach with a propeller in a small wind tunnel he constructed in his family's garage and found that VGs could increase propeller rotation by 10 percent. Then in a university wind tunnel, he showed that the VGs could increase power from a wind turbine blade by 23 percent and increase lift of an airfoil by 33 percent. In a test conducted in a farmer's field, he showed that VG-equipped wind turbine blades were no noisier than conventional blades and made a more pleasant sound. Matthew is senior class president, president of the National Honor Society and plays varsity tennis at **Western Alamance High School**. He produces videos for nonprofits and went to El Salvador with Global Health Outreach to help provide medical aid. The son of Mark and Lisa Miller, Matthew was invited by President Obama to be part of the first White House Science Fair in 2010.

Keenan Monks
Hazleton Area High School

Pennsylvania

Keenan Monks, 17, of **Hazleton**, studied elliptic curves over finite fields of prime characteristic *p*, a prime integer, for his **mathematics** project submitted to the Intel Science Talent Search. Such curves are used widely in cryptography, and are given by certain polynomials in two variables. The points on these curves have the algebraic structure of a group. A supersingular curve is one where this group has no points of order *p*; supersingular curves give rise to codes which are easily cracked. Keenan gives a criterion for locating the supersingular members of two infinite families of elliptic curves, hence showing which ones to avoid in encryption work. Keenan attends **Hazleton Area High School**, where he is captain of the cross country and track and field teams. During his last four summers he enjoyed hiking the Colorado Rocky Mountains. Keenan, an avid pianist for 12 years, is the winner of several piano competitions, has performed at Carnegie Hall, and enjoys sequencing music in his spare time. He has also volunteered with the Great Pennsylvania Cleanup for the past seven years, helping remove trash from community roadways. The son of Kenneth and Gina Monks, Keenan coauthored a paper published in *Discrete Mathematics*.

Prithwis Kumar Mukhopadhyay
Woodbury High School

Minnesota

Prithwis Kumar Mukhopadhyay, 18, of **Woodbury** studied the relationship between carrageenan, a common food additive, and cancer for his Intel Science Talent Search submission in **medicine and health**. In the body, cells send and receive chemical signals between each other and their environment. Disruption of these signals can cause cells to transform into malignant cancers. Prithwis determined that reduced intercellular activity of ASB (an enzyme that modifies sulfates) is associated with increased levels of chondroitin sulfate in the cell membrane; this increase impedes cell signaling. By showing that carrageenan, which is used as an emulsifier in processed food, reduces ASB activity, he established a link between this additive and the disruption of cellular signals. His conclusions enhance understanding of the mechanisms responsible for cancer and raise questions about the safety of carrageenan. First in his class of 442 at **Woodbury High School**, he is captain of the Science Quiz Bowl team and is the only student on the school district curriculum advisory committee. He enjoys basketball, cricket, and cycling. The son of Partha and Munmun Mukhopadhyay, Prithwis was born in India and speaks Bengali, Hindi, and Spanish.

Evan Michael O'Dorney
Venture School

California

Evan Michael O'Dorney, 17, of **Danville**, compared continued fraction convergents with iterated linear fraction transformations for his Intel Science Talent Search project in **mathematics**. Evan drew upon his fascination with patterns in studying two methods for approximating the square root of a non-square integer. One method (continued fractions) is more accurate, while the other (iterated linear transformation) is faster. He discovered exact conditions under which the iteration method produces the same values as the continued fraction method infinitely often. A student at **Venture School** in San Ramon, Evan has participated in several math competitions and was a winner in the 2010 USA Mathematical Olympiad. He is also involved in the Berkeley Math Circle, where he instructs his fellow students and serves as a contest coordinator. Additionally, Evan is an accompanist for the children's and teen choirs at his church and sings in the adult choir. He also volunteers regularly with a local homeless outreach program. The son of Michael and Jennifer O'Dorney, Evan enjoys improvising and composing music for the piano and programming games to be played on a calculator. He plans to pursue a Ph.D. in mathematics.

Sunil Kochikar Pai
The Kinkaid School

Texas

Sunil Kochikar Pai, 17, of **Houston**, developed a new approach to measure electron transfer properties of molecules for his Intel Science Talent Search **chemistry** project. Three years ago, Sunil designed and constructed an inexpensive voltammetry system suitable for high school research projects, which could be built for less than 10 percent of the cost of a commercial instrument. He subsequently increased the sensitivity of the instrument by modifying the electrodes with carbon nanotubes, and then used it to measure electron transfer properties of oxygen molecules in solution at temperatures ranging from 77° to 277° F. Historically, such measurements have been done in the gas phase, which is much more expensive and, apparently, less informative. Using this new approach, Sunil was able to identify additional quantum properties of the oxygen anion. Sunil is president of the math club and a member of the varsity cross-country team at **The Kinkaid School**, where he plays in the orchestra and is secretary of the Orchestra Board. In his spare time, Sunil enjoys playing chess, tennis, and golf, and he is youth president of the Houston Konkani Association. His parents are Nagaraja and Sujatha Pai.

Nikhil Parthasarathy
The Harker School

California

Nikhil Parthasarathy, 17, of **Mountain View**, researched irregular structures of distant Lyman break galaxies for his **physics and space science** project submitted to the Intel Science Talent Search. Using various methods to analyze astronomical images, Nikhil explored the morphologies of these very distant galaxies by examining images taken by the Hubble Telescope as well as other published data (which reflect the galaxies when they were 11 billion years younger than they are now). His work confirmed previous research showing that the irregular shapes of distant galaxies cannot be characterized like those of closer ones. Nikhil suggests that the radius of an irregular galaxy is a dominant parameter and that there is a faint, extended structure surrounding all of the galaxies that may give further insight into galaxy evolution and formation. At **The Harker School** in San Jose, Nikhil plays varsity tennis and co-founded the Ultimate Frisbee club. In his spare time, he edits and proofreads online books for under-served readers. The son of Sarangarajan Parthasarathy and Mala Raghavan, Nikhil plays in a rock band, is an officer for an honors society that focuses on community performances, and relaxes by playing classical guitar.

Grace Eleanor Phillips
Mamaroneck High School

New York

Grace Eleanor Phillips, 17, of **Larchmont**, studied the genetics of eggplants for her Intel Science Talent Search project in **plant science**. Grace used a variety of genetic engineering techniques in an attempt to identify the wild ancestor of the modern domesticated eggplant. Although the ancestry question remains a mystery, her research advanced the understanding of the relationship between eggplant species, and indicated that two of the major eggplant species are so genetically similar that they may not even be distinct species. Grace also identified characteristics that could be used to enhance the medicinal benefits of eating the vegetable. She believes her research, which was mostly conducted at the New York Botanical Gardens, will be valuable to genetic engineers seeking to further optimize the use of eggplant and related plant species. Grace attends **Mamaroneck High School**, where she is co-captain of the math team. She is a vocalist, pianist, and violinist and plays in the school's symphony orchestra, chamber orchestra, and string quartet. The daughter of Andrew Phillips and Karen Johnson, she plans to have a career in science research.

Alydaar Rangwala
The Albany Academies

New York

Alydaar Rangwala, 17, of **Loudonville**, investigated ultraviolet (UV) light phototherapy as a treatment for autoimmune diseases like Langerhans cell histiocytosis (LCH) for his Intel Science Talent Search **biochemistry** project. He became interested in LCH after meeting a child who subsequently died from this disease. After searching the literature, he hypothesized that long wave UV light (UVA1) might be a viable treatment, and used special UVA1-generating LEDs to test his hypothesis on mouse tissue. Findings from his 2.5-year study indicate that dendritic cells, critical to forming and modulating immune responses, migrate toward UVA1. He believes this effect might help the body combat several systemic autoimmune diseases, including LCH, lupus and scleroderma. Alydaar is president of the local Ronald McDonald House Teen Board, investment club, and student body and is president/founder of the American Red Cross Club at **The Albany Academies**, where he competes in forensics and track and field. Fluent in Gujarati (an Indian dialect) and accomplished in Latin, he plays guitar and competes in local chess tournaments. The winner of many academic and community service awards, Alydaar looks forward to a career in medicine. He is the son of Mazhar and Sakina Rangwala.

Laurie Ann Rumker
Oregon Episcopal School

Oregon

Laurie Ann Rumker, 18, of **Portland**, conducted a biodegradation experiment for her Intel Science Talent Search project in **environmental science**. Clay infused with a cationic surfactant (which lowers the surface tension of water) has been used to protect groundwater from contaminants at Superfund sites; the surfactant helps the clay repel water. Laurie was concerned that biodegradation of the surfactant could cause pollutants to be released into the environment. However, her laboratory investigation indicated that the compound that she tested was only attacked by a hydrocarbon-degrading species of bacteria in the absence of the clay. This suggests that biodegradation of the infused surfactants is not likely in the short term, although more research is required to assess long-term stability. Laurie received a first place award in environmental management at Intel ISEF 2010 for her research. Laurie attends **Oregon Episcopal School**, where she plays varsity soccer and lacrosse, and sings in a concert choir and an a cappella group. She has also been active in charity fund-raising, especially on behalf of Run for Congo Women. The daughter of David Rumker and Susan Phillips, Laurie plans to pursue a career in scientific research or bioengineering.

Shubhro Saha
Choate Rosemary Hall

Connecticut

Shubhro Saha, 17, of **Avon**, performed computational research on an alternative method of electrolysis for hydrogen production for his Intel Science Talent Search **chemistry** project. Currently, only about four percent of the world's hydrogen energy is made through sustainable water electrolysis, which uses platinum as the catalyst for proton reduction. Shubhro researched the possibility of using a nickel catalyst for electrolysis, which may be more cost-effective and durable than platinum. Using a supercomputer to model the reaction thermodynamics, he identified a possible mechanism for the interaction of the catalyst in hydrogen production. His algorithm's approach may also allow scientists to more efficiently predict reaction pathways in the future. Shubhro is a student at **Choate Rosemary Hall** in Wallingford, where he is captain of the award-winning debate team. He also writes for the school newspaper, enjoys playing piano in the jazz band, runs cross country, and develops web applications in his free time. The son of Samar and Saswati Saha, he is proficient in Bengali and hopes to someday become the CEO of a hydrogen energy company.

David Kenneth Tang-Quan
Palos Verdes Peninsula High School

California

David Kenneth Tang-Quan, 18, of **Rancho Palos Verdes**, took a genomic approach in studying the most common fungal pathogen affecting human beings for the **microbiology** project he submitted to the Intel Science Talent Search. He focused on *Candida albicans*, a fungus that can invade the bloodstream of immunocompromised patients, resulting in a 50 percent mortality rate. But for *C. albicans* to colonize patients and cause disease (candidiasis), it must be able to withstand various stressors and invade host cells. David's research explored two biochemical pathways that play key roles in the pathogen's general stress response. He found that inhibiting either of these pathways at the genetic level can severely limit *C. albicans'* ability to survive. David believes his findings could provide new targets for anti-candidiasis therapies which will spur the development of more effective treatments. First in his class of 552 at **Palos Verdes Peninsula High School** in Rolling Hills Estates, he is editor-in-chief of the school paper, president of the Latin program and math club, and sings with the varsity choir. Besides earning perfect SAT scores, David is a pianist, an Eagle Scout, and a student member of his district's Board of Education. He is the son of Kenneth and Debbie Tang-Quan.

Chelsea Sierra Voss
Cupertino High School

California

Chelsea Sierra Voss, 17, of **Santa Clara**, submitted a **bioinformatics and genomics** project to the Intel Science Talent Search. She created a computer model of the signaling cascade that controls differentiation of cells in the developing nematode—a roundworm frequently studied as a model of animal development. Her computer model is surprisingly simple, yet predicts with high accuracy the actual mutations observed in the nematode. Chelsea believes that simplified yet powerful computer models of complex biological systems, similar to the one she has developed, will ultimately allow entire organisms to be modeled by computer. Chelsea attends **Cupertino High School** where she competes locally and nationally with the math team and is co-president of the Spanish Honor Society. She led a robotics team project and wrote a grant application to help raise funds. Last year she went to Rosarito, Mexico, to work in an orphanage and use her Spanish skills. In her free time, she enjoys playing piano and occasionally inventing melodies and learning songs that interest her. The daughter of Charles and Martha Voss, Chelsea plans a career in biological research or bioengineering.

Yushi Wang
Sunset High School

Oregon

Yushi Wang, 17, of **Portland**, investigated the use of multi-value quantum computing algorithms to increase the speed and efficiency of quantum computing for his Intel Science Talent Search **computer science** project. Quantum computers use *qubits*, which can be in multiple states at the same time (unlike single-state bits that store only two states, 0 and 1). Yushi's invention of a ternary Toffoli gate could greatly improve the efficiency of quantum computing algorithms. His work addressed an obstacle with binary quantum computing algorithms—they often produce garbage bits, and dealing with these bits requires significant computational effort which saps efficiency. Yushi's algorithm design reduced the number of garbage bits, promising faster and more efficient computers. At **Sunset High School**, Yushi heads the science and math clubs and serves as a state board member of the Model United Nations. He includes math, physics and literature among his favorite subjects and in his spare time plays the violin and enjoys Frisbee and card games. The son of Steven and Ying Wang, Yushi speaks the language of his native China, and he hopes one day to become a researcher or engineer and continue his study of quantum computing.

Elaine Zhou
Lake Highland Preparatory School

Florida

Elaine Zhou, 18, of **Winter Park**, studied the catalytic partial oxidation of an industrial solvent (2-propanol) for her **chemistry** submission for the Intel Science Talent Search. Currently, waste propanol is incinerated; Elaine showed that it could be converted into a potential energy source using platinum nanoparticles at a temperature that is significantly less than is required to oxidize it without a catalyst. Furthermore, she found that different methods of synthesizing the nanoparticles produced particles with different shapes. The flatter particles actually have more effective bonding sites, were more efficient, and worked at lower temperatures. This might have broad implications since the reactions that Elaine studied could make fuel cell catalysts more cost effective. Elaine attends **Lake Highland Preparatory School** in Orlando, where she plays varsity tennis, is president of Mu Alpha Theta (a mathematics society), and is active in speech and debate, where she is ranked nationally in original oratory. The daughter of Shuigen Zhou and Xiaowei Sun, Elaine speaks Mandarin, plays the piano, and volunteers at Give Kids the World, which serves children with life-threatening illnesses.

Intel Science Talent Search 2011

Finalists Listed by State

Intel Science Talent Search 2011

Finalists Listed by Last Name

Notes

Notes

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