INQUIRE. INNOVATE. INSPIRE.

Intel Science Talent Search 2012 Finalists

Evan O'Dorney
First Place Winner
Intel Science Talent Search 2011

INQUIRE. INNOVATE. INSPIRE.

2012 Finalists

The Intel Science Talent Search (Intel STS), a program of Society for Science & the Public, is the nation's most prestigious pre-college science competition. Alumni of STS have made extraordinary contributions to science and hold more than 100 of the world's most distinguished science and math honors, including seven Nobel Prizes and four National Medals of Science. The Intel STS recognizes 300 students and their schools as semifinalists each year to compete for $1.25 million in awards. From that select pool, 40 student finalists are invited to Washington, DC in March to participate in final judging, display their work to the public, meet with notable scientists, and compete for the top award of $100,000.

Intel Science Talent Search 2012

Intel Science Talent Institute 2012
March 8–13, 2012

The 40 finalists of the Intel Science Talent Search 2012, a program of Society for Science & the Public, represent 2.2 percent of entrants to this highly-selective and world-renowned scientific competition. These students have been awarded an all-expense paid trip to Washington, DC to attend the Intel Science Talent Institute, where they are competing for $630,000 in awards.

The 16 young women and 24 young men come from 39 schools in 16 states. Finalists were selected from among 1,839 completed entries that were received from 44 states, the District of Columbia, and three qualifying U.S. schools 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 publicly acknowledging those mentors to avoid any potential for judging bias. Intel STS 2012 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 21,300 finalists and semifinalists who have received $15.1 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 14th year of sponsorship of the Intel Science Talent Search (Intel STS).

The Process

Students submit written reports of their scientific research, an extensive application demonstrating creativity and interest in science, and supporting documents from schools, advisors, and mentors.

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

Awards

The top award for the Intel Science Talent Search 2012 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 13, 2012.

Each of the 300 students named a semifinalist in the Intel STS 2012 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 2012. 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 13, 2012, the date of the Intel Science Talent Search Awards Gala.

Marian Joan Bechtel

Hempfield High School

Pennsylvania

Marian Joan Bechtel, 17, of **Lancaster,** developed an inexpensive seismo-acoustic method to detect buried landmines and built a working prototype for her Intel Science Talent Search **engineering** project. Marian, who is a talented musician, hypothesized that a buried landmine would resonate in response to a seismic vibrator and that nearby microphones could detect the acoustic field generated by the vibrating mine. Her prototype successfully located both plastic and metal mines covered by sand, either wet or dry. Her device works by adjusting the input from two hand-held microphones to cancel background noises such that a distinct dip in signal occurs when the microphones are passed over a vibrating buried mine. Her prototype (built on the skeleton of a broken metal detector she rescued from a dumpster) cost less than $500 — compared to $50,000 alternatives. First in her class of 550 at **Hempfield High School** in Landisville, Marian sings and plays trumpet, violin and piano. The daughter of Timothy and Felicia Bechtel, she enjoys hiking and skiing. Marian hopes her project will help reduce the risks faced by her Mozambican cousins who deal with the threat of landmines daily.

Kurtis Mickel Carsch

Texas Academy of Mathematics and Science

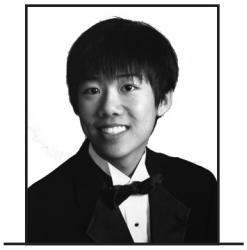
Texas

Kurtis Mickel Carsch, 17, of **Plano,** used computational modeling to identify a novel catalyst that would more efficiently convert methane to methanol for his Intel Science Talent Search **chemistry** project. Current catalytic methods of converting methane gas to liquid methanol consume excessive energy or require extreme temperatures. Kurtis focused on enzyme modeling to establish the optimized geometries of various organometallic (metal-based) catalysts to redesign non-optimal catalytic sets into more effective models that would minimize the energy and temperature needed for the conversion of methane into methanol. He believes his research will result in a cleaner, lower-cost fuel and chemical feedstock, reduce our dependence on petroleum, and promote the creation of methanol-based industries. Kurtis is the primary author of a paper on his research published in *Computational and Theoretical Chemistry*. He is co-founder of a tutoring organization at **Texas Academy of Mathematics and Science** in Denton. The son of Randolph Carsch and Leslie Mickel, he aspires to earn a Ph.D. in chemical engineering and conduct full-time research.

Evan Matthew Chen
Wayzata High School

Minnesota

Evan Matthew Chen, 18, of **Plymouth,** studied the role that the CD24 protein plays in the three different stages of regenerating muscle for his Intel Science Talent Search **bioengineering** project. His research was inspired by his wish to find a cure for muscular dystrophy (MD). To regenerate muscle, quiescent satellite cells found in muscle fibers differentiate into myoblast cells, which fuse into myotubes and form new muscle fibers. Evan found that CD24 appears to be the signal for myoblasts to become myotubes. He also noted that CD24 may increase the rate at which muscles regenerate and thus could possibly be used as a treatment for MD. Evan is captain of the speech team and Public Forum team and a member of the robotics team at **Wayzata High School,** where he is also a varsity tennis player and a tennis mentor. The son of Jason and Amy Chen, Evan can speak, interpret and write — using traditional Chinese characters — Mandarin Chinese. He taught first grade English in Taiwan and is now working to assemble and provide solar-powered headlamps to schools in Somalia so they can do homework after dark. Evan wants to study medicine and trade research for patient care, providing a cure for MD.



Sitan Chen
Northview High School

Georgia

Sitan Chen, 17, of **Suwanee,** obtained results on a problem in graph theory originally motivated by the need to conserve space in circuits for his Intel Science Talent Search **mathematics** project. In this graph theory problem, each vertex is labeled by an integer, with the requirement that any path between two vertices with equal labels must pass through a vertex of higher label. The rank number of a graph is the least number of integers required. Sitan found the (previously unknown) rank for a grid of width four, and improved known bounds for the ranks of other grids. His results and techniques, which can be applied to efficient circuit design, may improve the operation of everyday electronics in the future. The son of Guanghua Chen and Jinghong Ye, Sitan was born in China and is fluent in Mandarin. He attends **Northview High School** in Duluth, where he is first in his class of 492, is president of the math team and competes on the varsity fencing team. In addition to earning perfect SAT scores, Sitan's talent as a pianist and violinist has earned him several top honors including three first place awards for performances at Carnegie Hall. He also founded an organization that raises money for disaster relief through benefit concerts.

Amy Cindy Chyao

Plano East Senior High School

Texas

Amy Cindy Chyao, 17, of **Richardson,** developed a novel photosensitizer that will expand the capability of photodynamic therapy (PDT) to treat cancer for her Intel Science Talent Search **chemistry** project. PDT uses harmless wavelengths of light to activate a photosensitizer — a non-toxic drug — which produces cytoxic oxygen to kill cancer cells. PDT can be site-specific and non-invasive, but is currently limited to treating surface tumors or tumors that can be reached with fiber optic endoscopes. Amy developed her photosensitizer by attaching a nitric oxide donor to titanium dioxide nanotubes treated with lead sulfide. When activated, the nitric oxide efficiently generates the most effective type of cancer-destroying oxygen. Amy believes her development is a step toward the non-invasive treatment of deep tumors and metastases. Amy has perfect ACT scores and is first in her class of 1,473 at **Plano East Senior High School,** where she is president of Learning About Science and Engineering Research. An accomplished cellist, Amy plays with several orchestras, and she created a nonprofit organization that helps immigrant children learn to spell. The daughter of Tim Chyao and Kate Wang, she is a co-author of two articles in peer-reviewed journals.

Juliana Mathea Coraor

Huntington High School

New York

Juliana Mathea Coraor, 17, of **Huntington**, studied whether modifying ferroelectrics — materials with unique electrical properties — could increase their electrical efficiency for her Intel Science Talent Search project in **physics and space science**. Their electrical characteristics are strictly controlled by their crystalline structure, and can be modified by applying strain or by creating structures with alternating layers of two materials (superlattices). Juli investigated methods to adjust the atomic arrangement of superlattices to manipulate their "improper" ferroelectricity, making the material more efficient and resistant to temperature. She found that generating superlattices under compressive strain reduced the effects of improper ferroelectricity. Juli's work may influence future development of capacitors, which are used in most electronic devices ranging from cell phones to particle accelerators. In her spare time, Juli competes in whitewater slalom racing, volunteers as a kayak instructor, and enjoys singing, modern dance and cake decorating. The daughter of John Coraor and Hanna Nekvasil, Juli attends **Huntington High School** and plans to pursue a career in condensed matter physics.

Jordan Saul Cotler

Glenbrook North High School

Illinois

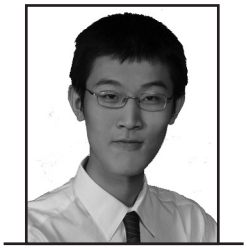
Jordan Saul Cotler, 17, of Northbrook, developed a protocol for distribution of quantum keys that can be used to encrypt both fiber optic and satellite communication for his Intel Science Talent Search **physics and space science** project. He used a fundamental property of quantum mechanics — measuring changes in the states of quantum particles — and added the additional variable of time — relativity. Jordan's protocol securely encodes time and spatial information allowing the detection of any eavesdropper who intercepts the photons used to distribute the key, and theoretically allows for faster transmission of secure information. In addition to his theoretical construct, he also proposed a practical design for its implementation, which he plans to test in a laboratory. Jordan attends **Glenbrook North High School,** plays violin in the Glenbrook Symphony Orchestra, and has played tennis since age 4. A professional magician, he has performed before a wide variety of audiences and published 27 original effects, which he has sold internationally. The son of Scott and Marcia Cotler, he plans to pursue a career in academics as a theoretical physicist, doing research and teaching.

Rachel Michelle Davis

Smithtown High School East

New York

Rachel Michelle Davis, 18, of **Saint James,** engineered a polymer that is both flame retardant and biodegradable for her **materials science** project for the Intel Science Talent Search. After watching her family home burn to the ground at age thirteen, Rachel says she "never felt so helpless" and joined the local volunteer fire department at the earliest possible age three years later. For this project, Rachel studied the best way to add cellulose, a retardant used on textiles, to a mixture of two biodegradable plastics. She found that by soaking the cellulose in a flame retardant additive before blending it with the two plastics, she could make a polymer that was both biodegradable and flame retardant. Her interest in developing flame retardant plastics was sparked when she was taught — during firefighter training — that gas tanks in burning cars might be plastic and flammable. At **Smithtown High School East**, Rachel enjoys Math Fun Night, held to entertain and educate young children. Her hobbies include tennis, video editing and production, and creating new polymer blends. In her spare time, she plays guitar at a nearby nursing home. Rachel is the daughter of Michael and Rosalind Davis and hopes to pursue a career in materials science or chemistry.



Fengning (David) Ding
Phillips Academy

Massachusetts

Fengning (David) Ding, 18, of **Albany, California,** in his Intel Science Talent Search project in **mathematics,** provided an improved understanding of representation theory of infinitesimal Cherednik algebras. David worked in representation theory, a topic in algebra concerning symmetries of vector spaces arising, in this case, from infinitesimal Cherednik algebras. He classified the irreducible finite dimensional representations of this important family of algebras, showing that their structure is richer than that of the related Lie algebras. This work sheds light on deformations of important symmetries, which are related to conservation laws. David attends **Phillips Academy** in Andover, Mass., where he competes on both the math and science teams and volunteers his time as a physics tutor. A gifted violinist in the Academy Orchestra and Chamber Orchestra, he was also the concertmaster of the Amadeus Orchestra and traveled to Ireland last year on an orchestral tour. David is also an outstanding pianist who enjoys reading, photography and chess in his spare time. David was born in Japan to Jian Ding and Jingyu Dai and is fluent in Mandarin. He plans to pursue a career in math or physics as a professor and research scientist.

Ari Misha Dyckovsky
Loudoun County Academy of Science

Virginia

Ari Misha Dyckovsky, 18, of **Leesburg,** worked with quantum entanglement and theoretical quantum information systems for his Intel Science Talent Search project in **physics and space science**. Quantum entanglement involves intimately linking particles so that they maintain precisely correlated characteristics, even when separated. Ari envisioned a new way to entangle quantum objects using the interference characteristics of emitted light photons. He then extended previously derived mathematical formulas to incorporate additional parameters and conducted a detailed computational analysis to define the theoretical quality and efficiency of this new method for transmitting information. Ari believes that his protocol may one day help make a quantum internet and quantum computers possible. Ari is a recreational tennis player and a classical guitarist and attends the **Loudoun County Academy of Science** in Sterling. He was chosen by the school to participate in the International Space Olympics 2010 in Moscow — and placed first in this worldwide competition. Ari is a group leader in Moody's Mega Math M3 Challenge and plans to pursue a career in scientific research. He is the son of Amy Dyckovsky and Jeffrey Trim.

Huihui (Angela) Fan
Stuyvesant High School

New York

Huihui (Angela) Fan, 17, of **Staten Island**, studied the root systems of the flowering plant *Arabidopsis thaliana* to better understand how plants react to changes in environmental nitrogen for her Intel Science Talent Search project in **plant science.** Through a combination of molecular biology/genomics, botany and computer science, Angela compared species ecotypes (geographically separated genetic variants) that have evolved in either nitrogen-rich or nitrogen-poor environments, and was able to determine a role for the previously uncharacterized gene "SUR1-like." She believes that altering the expression of this gene in man-made plant strains would be the first step in modifying crop plants to increase agricultural productivity, while reducing problems resulting from the use of fertilizers. Angela is captain of the policy debate team at **Stuyvesant High School** in New York, and a debate coach with the Urban Debate League in the Bronx, where she teaches debating skills to students dealing with socioeconomic challenges. She also volunteers with the Red Cross and teaches beginning piano in her home. Angela was born in China and is the daughter of Dapeng Fan and Yan Xu. She speaks both Chinese and Spanish.

Clara Louisa Fannjiang
Davis Senior High School

California

Clara Louisa Fannjiang, 17, of **Davis,** submitted a **physics and space science** project to the Intel Science Talent Search that focused on radio interferometry, a method of observing the same object in space through widely separated radio telescopes connected by some type of transmission line. The current technique uses huge amounts of data to image radio sources, a requirement that Clara hoped to eliminate through compressed sensing (CS) — a method used to reconstruct images from highly incomplete data sets. Through simulations, she looked for the best antennae array for CS application. She believes her discoveries, including a way to optimize performance of the Very Large Array, will help astronomers save processing time and generate clearer images. She authored a paper on her results which was published by the Society of Exploration Geophysicists. At **Davis Senior High School,** Clara is co-captain of a Science Bowl team and is also co-editor-in-chief of *Polyphony H.S.*, a national literature journal for high school writers. She is an award-winning pianist and poet, and has perfect SAT scores. Clara is the daughter of Albert and Jean Fannjiang, and her first language is Mandarin.

Eric Edgar Fein

John Adams High School

Indiana

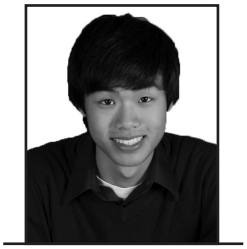
Eric Edgar Fein, 18, of **South Bend**, developed a way to remove nanoparticle contaminants from water for the **earth and planetary science** project he submitted to the Intel Science Talent Search. Engineered nanoparticles, which can be toxic, are entering the environment; for instance, titanium oxide nanoparticles are now a common component of white paint. Eric, concerned about groundwater quality, decided to study the mobility of these contaminants and whether they could be easily removed from water. He found that mica, a soil mineral, removed nanoparticles at low and high pH but not at near-neutral pH. Suspended iron-oxide sand, however, removed 98 percent of the nanoparticles at near-neutral pH. Eric then quantified removal rates for two types of nanoparticles and demonstrated that his approach was practical. Eric is first in his class of 375 at **John Adams High School,** where he was a captain of the school's varsity hockey and cross-country teams and organized a math tutoring program for students for whom English is a second language. Eric, son of Jeremy and Antoinette Fein, has also been part of his school's award-winning Economics Challenge team and has acted in the University of Notre Dame Shakespeare Festival.

Danielle Goldman

Bronx High School of Science

New York

Danielle Goldman, 17, of **Astoria,** submitted a **behavioral and social sciences** project to the Intel Science Talent Search that identified a common neural basis for Major Depressive Disorder (MDD) and Generalized Anxiety Disorder (GAD) in adolescents that could explain why they are often diagnosed together. Prior research suggests that 70 percent of patients with a lifetime history of anxiety disorders also have had at least one episode of MDD, and that half of the patients with a lifetime history of MDD episodes also had a history of at least one anxiety disorder. Danielle's research looked at the role gamma-aminobutyric acid (GABA), a primary neurotransmitter in the brain, might play in these disorders. She analyzed magnetic resonance spectroscopy data from 41 adolescents and found that patients with MDD and GAD exhibited low levels of GABA. She believes this information will help better diagnose these disorders. The daughter of Gary and Ruth Goldman, Danielle attends **The Bronx High School of Science** and hopes to become a pediatric psychiatrist. She is a community volunteer working with homebound senior citizens, conducting book drives for elementary schools and tutoring children for whom English is a second language.



Philip Cody He
Okemos High School

Michigan

Philip Cody He, 17, of **Okemos,** entered a **plant science** project in the Intel Science Talent Search, based on his study of plant immunology. Cody's project focused on two distinct areas in plant biology: the immune response to bacteria and the function of the cytoskeleton, a "scaffolding" within the cell that is regulated by a suite of binding proteins, including *Arabidopsis thaliana* Capping Protein (AtCP). By studying the response of a variety of mutant plant lines to bacterial pathogens, and using a range of analyses, including RNA isolation, Cody was the first to determine that AtCP plays a role in plant immunity, implicating the cytoskeleton component in the expression of an immunity gene. The data he generated will provide the foundation for a grant request being submitted to the National Science Foundation. Cody lettered in football at **Okemos High School,** where he also plays clarinet in the marching and concert bands, is a committee leader of the environmental club and captains the award-winning Quiz Bowl team. He is an elementary school mentor, a Wikipedia contributor and community volunteer for recycling and environmental cleanup projects. He is the son of Sheng Yang He and Ke Dong.

Xiaoyu He
Acton-Boxborough Regional High School

Massachusetts

Xiaoyu He, 18, of **Acton**, contributed to the understanding of rotor-routers as part of his Intel Science Talent Search project in **mathematics.** A rotor-router is a deterministic algorithm for moving particles in a network according to rules assigned to each node. Using computer programming to inform his intuition, Xiaoyu proved that certain types of rules are universal, in the sense that they can model all other rules, and in the process he gained insight into the symmetries and structure of rotor-routers. Xiaoyu has perfect SAT scores and attends **Acton-Boxborough Regional High School,** where he is captain of the math team and volunteers as an assistant coach for the junior high team. Xiaoyu was awarded a gold medal at the International Math Olympiad in both 2010 and 2011 and competes regularly at the local and national level. An accomplished artist, Xiaoyu enjoys painting both portrait and Escher-inspired abstract works and has had his work displayed at local exhibitions. He plans to pursue a career that combines both math and computer science to supplement his interest in artificial intelligence. Born in China, Xiaoyu is the son of Jiafu He and Can Wang and is fluent in Mandarin.

Siddhartha Gautama Jena

International Academy

Michigan

Siddhartha Gautama Jena, 18, of **Bloomfield Hills,** conducted a three-year study of the effect of excess cholesterol on the ability of red blood cells to transport water, oxygen and carbon dioxide for his Intel Science Talent Search **medicine and health** project. By measuring the movement of these life-sustaining molecules into and out of red blood cells in the presence and absence of elevated cholesterol, Siddhartha demonstrated that excess cholesterol impaired their transport. He also found that a common treatment for Type II diabetes, glyburide, and a compound called ONO-RS-082 can offset these detrimental effects of elevated cholesterol. He hopes that this new understanding will result in the early diagnosis, treatment and management of patients with elevated cholesterol. Siddhartha attends **International Academy,** is active on the Science Olympiad team and the student council, and is co-founder of an event to raise funds for educational infrastructure in poor countries. He has earned awards for both solo and ensemble piano performances and as a saxophone soloist. The son of Bhanu and Minakhi Jena, Siddhartha is first author on a paper related to this project published in the *Journal of Biological Physics and Chemistry.*

Adam Orval Kalinich

Illinois Mathematics and Science Academy

Illinois

Adam Orval Kalinich, 17, of **Glen Ellyn,** submitted an Intel Science Talent Search project in **mathematics** which concerned the complexity of determining the winner of poset games. Poset games are two-player combinatorial games such as Nim and Chomp. Adam used insights from Nim to obtain results for general poset games. He described a method for taking a game with a known winner and producing a second game with the other player as winner. From this he concluded that it must be difficult in general to determine the winner of a game, since otherwise one could do certain computations faster than possible. He recently published his findings as sole author in the peer-reviewed journal *Information Processing Letters*. Adam attends the **Illinois Mathematics and Science Academy** in Aurora where he competes on the varsity quiz bowl team. In recent years Adam has backpacked through Europe, Vietnam and Cambodia. His travels inspired him to arrange a week-long workshop in Phnom Penh to educate high school students on combinatorics and game theory in preparation for the International Math Olympiad. The son of Kevin and Gail Kalinich, he enjoys playing board games and bridge as well as reading graphic novels.

EunBe (Grace) Kim

Academy for Medical Science Technology

New Jersey

EunBe (Grace) Kim, 19, of **Cresskill,** submitted a **biochemistry** project to the Intel Science Talent Search that tested whether tamoxifen (TAM) could help treat Burkitt's lymphoma (BL), a cancer of immune system B-cells. Based on recent studies, Grace predicted that TAM would successfully block intracellular signals that promote the growth of BL cells. TAM is commonly used to treat breast cancer because it binds to the estrogen receptors of those cells, but has not been widely studied for use against lymphomas that lack estrogen receptors, such as BL. Her findings indicate that TAM also inhibits growth and survival in BL by binding B-cell protein kinase C. Grace hopes her findings will help reduce treatment costs for patients with BL in Central Africa, where it is responsible for 70 percent of childhood lymphomas. She initiated her three-year research project after her grandmother was prescribed TAM for breast cancer. Born in Korea to Giho Kim and Kyung Ai Kim, Grace is fluent in her native language. She attends the **Academy for Medical Science Technology** in Hackensack, enjoys performing in a junior tap dance ensemble and spends time each week volunteering as an EMT and as a tutor to low income elementary students.

Savina Dine Kim

Commack High School

New York

Savina Dine Kim, 17, of **Dix Hills,** investigated how neurotransmitters are produced and activated at the cellular and molecular level for her Intel Science Talent Search **biochemistry** project. Neurotransmitters are essential to cognition, a complex function which includes learning, memory, attention and problem solving. Studies have reported a significant decrease in these vital receptors in the brains of patients with neuropsychiatric disorders such as schizophrenia. Savina's study of the mechanism of neurotransmitter production and activation may open new doors to understanding the mechanics of how neuropsychiatric disorders arise and could lead to novel strategies to stop and reverse the progression of neuropsychiatric disorders and cognitive deficits. Captain of the fencing team at **Commack High School,** Savina also coaches fencing at a yearly cancer fundraiser, Lunge for Life. She is president of the school's science honor society and managing editor of the school paper. A pianist and cellist — she also teaches cello — Savina is a member of several orchestras and has performed at Lincoln Center. The daughter of Hyojung and Jaeran Kim, Savina was born in Korea. She hopes to become a neurosurgeon.

Frederic Koehler

Montgomery Blair High School

Maryland

Frederic Koehler, 18, of **Silver Spring,** submitted a **computer science** project to the Intel Science Talent Search that described a novel way to schedule batch jobs for processing in a way that saves both energy and time. Batch jobs are tasks which can be completed simultaneously on any sort of machine. Frederic devised a new scheduling algorithm that minimizes the number of batches while reducing total processing time. He also created a very fast algorithm for cases when job arrival times and deadline times are in the same order. He predicts that his work will find many applications including saving time and fuel for the semiconductor industry and for the military when managing supply lines. His algorithm has been submitted to a major computer science conference for publication. At **Montgomery Blair High School,** Frederic is president of the computer club, helps maintain the school's servers and website, and participated in the TeraGrid, USACO and UMD programming contests. In his spare time, Frederic enjoys reading, and playing flute and piano. The son of Robert Koehler and Yuri Nakai, Frederic hopes to pursue his passion: constructing new programming languages.

Meredith Paloma Lehmann

La Jolla High School

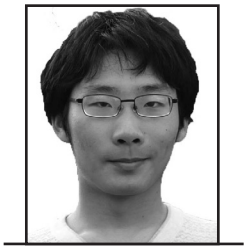
California

Meredith Paloma Lehmann, 16, of **La Jolla**, questioned the prevailing understanding of the spread of epidemics for her Intel Science Talent Search submission in **medicine and health.** Her results challenged the conventional wisdom that says modern epidemics spread most readily through large hub airports near population centers. Meredith created a simulation model that incorporated a second travel mode for infected travelers: long distance auto trips. In the U.S., these car trips are five times more numerous than those by air and, as in the classic "six degrees of separation" social experiment. Meredith concluded that any susceptible individual might be no more than a few long car trips away from an infected person. Her findings imply that auto travel may contribute more to the spread of epidemic disease than air travel in the continental U.S. This is her fourth project modeling epidemics. When not busy with her studies at **La Jolla High School,** she works part time as a math tutor and babysitter. The daughter of Bruce and Irene Lehmann, Meredith earned a perfect score on her SATs and has been a Young Epidemiology Scholar National Delegate. She is a highly skilled cellist who has played in numerous community orchestras.

Jack Zhihao Li
El Segundo High School

California

Jack Zhihao Li, 18, of **El Segundo,** developed a nano-scale capsule that a patient can swallow, which could be used to create new enzyme-based therapies for his Intel Science Talent Search **bioengineering** project. Jack's research focused on devising a treatment for phenylketonuria (PKU), a genetic disease that causes toxic levels of the amino acid phenylalanine to build up in the body causing mental retardation and seizures. The disease could be treated by orally administering the enzyme phenylalanine ammonia lyase (PAL), which processes phenylalanine; however, PAL is quickly digested in the stomach and small intestine. To protect the enzyme, Jack created nano-scale capsules that pass safely through the stomach and small intestine. A pharmaceutical company is now working to further develop this PKU treatment. Editor-in-chief of the **El Segundo High School** newspaper, Jack is also woodwind captain of the high school band and co-founder of the Science Bowl team. Born in China, he is the son of Wen Li and Jiehui Wang. An accomplished saxophonist, Jack owns and manages a musical instrument sales company and uses part of the profits to provide scholarship funds for students in China. He hopes to start a biotech firm to provide low-cost medicines for the poor.



Jiacheng (Ben) Li
Arcadia High School

California

Jiacheng (Ben) Li, 18, of **Arcadia,** proposed a new way to detect and correct data transmission errors for the **computer science** project he submitted to the Intel Science Talent Search. Ben examined a concept called lightweight fault tolerance that seeks to prevent errors during digital signal processing, something that is of critical importance for spacecraft systems, which he studied during a summer NASA internship. Ben believes his solution demonstrates an improved method for handling errors in digital processors, and offers a significant reduction in hardware overhead and power consumption while reducing size requirements. His work may enable robust fault tolerance in spacecraft radar and instrument signal processing, and could have many commercial applications. Ben attends **Arcadia High School** and represented the U.S. at the 2011 International Physics Olympiad in Thailand. The son of Rukun Li and Lu Yang, Ben enjoys hiking, rollerblading, playing piano and composing, and volunteers at a local hospital for several hours each week. A native of China, he speaks Mandarin and is teaching himself Japanese. He filed a patent application last summer and aspires to start his own technology company.

Neil Kamlesh Mehta

Jericho Senior High School

New York

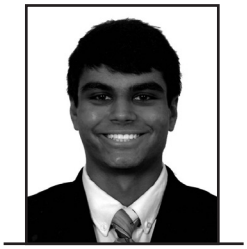
Neil Kamlesh Mehta, 17, of **Jericho,** entered a **biochemistry** project in the Intel Science Talent Search investigating the effects of a gene mutation associated with schizophrenia on a protein of neuregulin-1, which is considered a schizophrenia susceptibility gene. Neil's study identified this mutation as the cause for a significant reduction in intracellular signals resulting in improper neural connections, presenting abnormalities similar to those found in brains of patients with schizophrenia. He believes his research presents an avenue for uncovering the possible causes for subsets of the disease and demonstrates the potential of optogenetics, the use of particular frequencies of light to achieve restoration of protein signaling and, in turn, of receptor and protein expression. He believes this use of light stimulation may point to future treatment for this debilitating mental disorder that afflicts one percent of the U.S. population. The son of Kamlesh and Alpana Mehta, Neil provides extensive math and science tutoring to younger peers before and after school. He is captain of the badminton and bowling teams and a member of the debate club at **Jericho Senior High School,** and he hopes to earn a Ph.D. in neurobiology.

Jin Pan

Henry M. Gunn High School

California

Jin Pan, 17, of **Palo Alto,** submitted to the Intel Science Talent Search a **bioinformatics and genomics** project offering new glimpses into the role of pauses that take place when proteins fold. Proteins are known to fold into very particular shapes but it is still unclear how they manage to do this successfully and efficiently. One theory suggests that this is facilitated by slowing translation. To study this, Jin developed a novel computer model that he believes shows that the pauses in protein formation exist to aid folding. This knowledge may help researchers design superior vaccines, express certain proteins at higher rates to produce new pharmaceuticals, and improve the computational models used to study protein structures. Jin is a varsity sprinter at **Henry M. Gunn High School** and is active in Math Circles, Science Olympiad and the Ultimate Frisbee team. He is a former Northern California Chess Champion and a long time member of the school chess club where he remained undefeated throughout his junior year. Fluent in Mandarin, Jin is the son of Chiling Pan and Runhuai Yang. He developed and teaches his own math course at Egan Junior High School and aims to complete a double major in theoretical math and computer science.



Neel S. Patel

Oviedo High School

Florida

Neel Sanjay Patel, 17, of **Geneva,** studied how non-speech patterns of sounds, called sonifications, can convey information for his **behavioral and social sciences** project submitted to the Intel Science Talent Search. Sonifications can represent information in the same way that a line graph represents a data trend: for example using increasing pitch or loudness to indicate an upwards sloping line. His four-year study focused on how sonifications are perceived, how accurately they are understood and the mental activities required for comprehension. He found that people can interpret and recreate data they can hear with a high degree of accuracy. As part of his research, Neel developed SonicGraph, a user-customizable tool kit that allows users to create sonifications from data sets. He believes that sonification could be as revolutionary as the graphical user interface was 30 years ago. An Eagle Scout, Neel is first in his class of 483 at **Oviedo High School,** and has varsity letters in swimming and water polo. He is the lead author of two papers delivered at professional conferences and a paper accepted for publication in a peer-reviewed journal. The son of Sanjay and Nita Patel, he hopes to change the world through science.

Anirudh Prabhu

West Lafayette Junior-Senior High School

Indiana

Anirudh Prabhu, 17, of **West Lafayette,** investigated perfect numbers, an ancient subject in number theory dating from Euclid's work around 300 B.C., for his Intel Science Talent Search project in **mathematics.** A perfect number is one which equals the sum of all its proper divisors, such as 6 = 1 + 2 + 3. There are 47 known perfect numbers, all even. Anirudh considered the odd case, and gave the first non-trivial analytic lower bound for odd perfect numbers, a bound in terms of the number of distinct prime divisors. By improving his lower bounds and also improving known upper bounds, one could hope to show that no odd perfect numbers exist. Anirudh is sole author of a paper describing his findings, published in the International Journal of Contemporary Mathematics, and was also first author of a publication in the peer-reviewed journal Integral Transforms and Special Functions. Anirudh attends **West Lafayette Junior-Senior High School,** where he is president of the math club and the Red Cross Club, which he co-founded in 2010. He was crowned Homecoming King in the fall of 2011. Anirudh enjoys playing tennis and ping-pong, and is the son of Nagabhushana and Rajini Prabhu.

Oliver Adolfo Quintero
The John Cooper School

Texas

Oliver Adolfo Quintero, 18, of **The Woodlands,** developed a new, "eco-friendly" ionic liquid with superior electrochemical properties for his Intel Science Talent Search **chemistry** project. Room temperature ionic liquids (RTILs) are salts that remain liquid at temperatures below 100 degrees Celsius. Oliver synthesized a new RTIL and successfully demonstrated that it was chemically stable and non-volatile yet highly conductive and effective for electroplating applications. Oliver believes his research could also contribute to the development of environmentally friendly energy sources such as fuel cells and efficient rechargeable batteries. The son of Enrique Quintero and Laura Jimenez-Quintero, Oliver is fluent in Spanish and donates his time at a community medical clinic as a translator. He plays varsity soccer at **The John Cooper School,** where he is also an active member of the literary magazine, *Inkblots.* Oliver volunteers with Habitat for Humanity where he has served on the steering committee for the past four years, and also enjoys cooking family recipes in his spare time. He hopes to pursue a career as a scientific researcher, working to develop sustainable energy sources.

Sayoni Saha
Gretchen Whitney High School

California

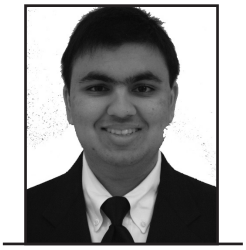
Sayoni Saha, 17, of **Cerritos,** studied the self-concepts of children with Down syndrome (DS) for the behavioral and **social sciences** project she submitted to the Intel Science Talent Search. In her study of 41 children with DS, she analyzed their responses toward two dolls, one with a "typical" appearance and one with features of DS. She found that regardless of age, gender, awareness of their condition and level of functioning, children with DS preferred the typical doll and thought it more closely resembled themselves. Sayoni believes this preference may reflect internalized stereotypes and suggests that the relationship between societal views of DS or developmental disabilities and the self-concept of children with DS should be further explored. At **Gretchen Whitney High School,** Sayoni is president and founder of the Global Concerns Club and principal violist in the school orchestra. She also performs with the Orange County Youth Symphony Orchestra and is the Secretary General of Whitney Model UN. Sayoni has received top honors in oratorical competitions at both state and national levels, and is fluent in Spanish and Bengali. Born in India and raised in Singapore until age 11, she is the daughter of Krishnendu and Sharmila Saha.

Anna Sato

Ward Melville High School

New York

Anna Sato, 17, of **East Setauket,** developed a membrane that can remove iodine and cesium from water for her Intel Science Talent Search project in **materials science**. Anna had previously authored a paper, published in the *Journal of Electron Microscopy*, on her research using filtration to remove bacteria and viruses from water. Motivated by the Fukushima nuclear plant explosion in Japan, which released dangerous radioactive particles, Anna developed a new class of nanofibrous polymeric membranes that combine filtration with adsorption to effectively remove iodine and cesium. Anna believes that such a filter could be used in homes to remove a wide range of contaminants at a cost comparable to disposable coffee filters, thereby providing broad access to safe drinking water to people around the world. Anna has played varsity tennis and is co-president of Tri-M Music Honor Society at **Ward Melville High School,** and is principal violist of Juilliard's Pre-College Orchestra. Anna is also an accomplished artist, and illustrated a published book that she co-authored on Japanese Kanji. The daughter of Yimei Zhu and Eriko Sato, Anna helps out Sundays at a local soup kitchen and raised about $7,000 to help victims of Japan's recent earthquake.



Saurabh Sharan

Bellarmine College Preparatory School

California

Saurabh Sharan, 18, of **Cupertino,** proposed a novel algorithm as his Intel Science Talent Search **computer science** project that may improve image and photo recognition software. Saurabh created an improved automated method to accurately identify the shapes and sizes of cells in digital microscopic images. He tested his new system on a public database of cell images and reported that it outperformed the current state-of-the-art in two different measures of accuracy. Saurabh's design could lead to significant improvements in the automated tools used by clinicians and researchers to examine cells in biologic samples. Saurabh says the idea for his project came from watching characters on a popular TV show try to enhance grainy images from a security camera using photo recognition software. Saurabh attends **Bellarmine College Preparatory School** in San Jose, where he is founder and president of the programming club and vice president of its national champion robotics team. The son of Atul and Preeti Sharan, Saurabh plays jazz trombone and counts golf, swimming, photography and yoga among his hobbies. His ambition is to pursue a long career in computer science and make meaningful contributions to image recognition technology.

Andrey Sushko
Hanford High School

Washington

Andrey Sushko, 17, of **Richland**, entered an **engineering** project in the Intel Science Talent Search in which he used the surface tension of water to turn the shaft of a tiny motor — only 7 mm in diameter. Working in his home, Andrey began by testing various materials to determine which ones best facilitated curvature of the water surface when an electrical current was applied. After choosing the hydrophobic coating that worked the best, he constructed a motor to translate that curvature into shaft rotation. The key feature of his work is that, unlike conventional motors, the efficiency of Andrey's motor should, theoretically, increase with miniaturization. He believes his work may pave the way for micro-robotics and a range of other micro-mechanical devices. Born in Russia to Peter and Maria Sushko and raised in the UK, Andrey moved to the U.S. in 2009 and speaks Russian and Spanish. Andrey is first in his class of 391 at **Hanford High School** and has captained the Science Bowl team, Knowledge Bowl and math team. An avid sailor, Andrey has fabricated model boats of increasing complexity for the past ten years, and recently filed for a Guinness World Record for the smallest radio-controlled sailing yacht.

Nithin Reddy Tumma
Port Huron Northern High School

Michigan

Nithin Reddy Tumma, 17, of **Fort Gratiot,** investigated the signaling pathways involved in cancer progression for the **biochemistry** project he submitted to the Intel Science Talent Search. Using techniques to measure activated protein levels in cultured breast cell lines at varying stages of malignancy, he characterized two biochemical pathways that play a role in cancer pathogenesis, specifically identifying the role of a protein (gC1qR) in the evolution and immune-evasion of cancers. He believes his study clarified some of the mechanisms by which cells become malignant and, by defining the signaling pathways involved in the process, provided new targets for novel cancer treatments. First in his class of 332 at **Port Huron Northern High School,** Nithin is an award-winning varsity tennis player, the leading scorer on the varsity Quiz Bowl team and co-founder and captain of the robotics team. He is also the founder of a district-wide math circle for gifted students and a research club for middle school children. A volunteer for the Port Huron Museum, he created an online database of historical information and initiated a program to restore local landmarks. Fluent in Telugu, a language of India, Nithin is the son of Suresh and Kavita Tumma.

Benjamin Mark Van Doren
White Plains High School

New York

Benjamin Mark Van Doren, 18, of **White Plains,** explored the purpose of morning flight, a poorly understood behavior of nocturnal migratory birds, for his **animal sciences** Intel Science Talent Search submission. Benjamin combined topographical and weather data to determine that autumn morning flight is important for accurately orienting during long migrations and is affected by environmental conditions and manmade structures. He demonstrates that morning flights tend to orient into the wind, with potential implications for the expansion of cityscapes and industrial-scale wind power generation. Benjamin's work garnered interest from other ornithologists, appearing in *North American Birds* and presented at a symposium of the Association of Field Ornithologists. He serves on his city's Sustainability and Environmental Enhancement Committee and facilitated the designation of five new parcels of parkland in White Plains. He also spent three weeks on a remote Maine island studying the behavior of at-risk seabirds. Benjamin is first in his class of 500 at **White Plains High School** where he is captain of the track team and earned perfect SAT scores. His parents are Daniel and Susan Van Doren.

Angela Wang
Shaker High School

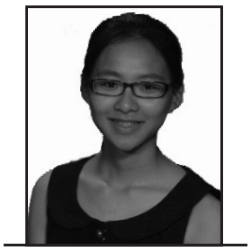
New York

Angela Wang, 17, of **Latham,** analyzed the efficacy of an auditory-based brain-computer interface (BCI) for her **computer science** Intel Science Talent Search project. BCIs are currently used by the disabled to communicate solely through brain signals. In order to establish whether certain areas of the brain were more effective at signaling in response to auditory stimuli, Angela created and tested a novel montage — a specific arrangement of EEG electrodes that register brainwave activity through wearable caps with sensors. This auditory-based montage was processed by the BCI into computer commands and compared with existing montages that respond well to visual stimuli. Although the results did not yield a significant difference between the two, her work provides an example of the successful operation of an auditory BCI. This may benefit patients with no muscular control who lack the ability to track visual stimuli using their eye movements. At **Shaker High School,** Angela is first in her class of 494, competes on the varsity tennis team, and is chief editor of the school newspaper. She has perfect SAT scores, is first violinist in the Empire State Youth Orchestra and has performed at Carnegie Hall. Her parents are Jason Wang and Rong Yao.

Leon Yao
Troy High School

California

Leon Yao, 17, of **Diamond Bar,** studied light waves in fiber optic networks for his **engineering** project for the Intel Science Talent Search and believes his work may help lead to a better and faster Internet. Leon explored how light wave polarization can degrade the quality and limit the speed of data transmission in these networks. He then developed a better way to modulate this polarization to improve performance in fiber optic networks. After modeling his research on a computer, he experimentally demonstrated that his method significantly increased the speed and improved uniformity of polarization scrambling over previous approaches while reducing costs. He is lead author of a paper about his project submitted to *Optics Express.* Leon attends **Troy High School** in Fullerton, frequently participates in math competitions and was co-captain of the national math team at the world championships in Beijing. He is an opera singer and co-founder and president of the seven-member Wind Band that performs at senior centers. The son of Xiaotian Yao and Yuanyuan Fang, Leon has earned a junior black belt and is fluent in Chinese. He hopes to earn a Ph.D. in photonics and eventually lead his own team of lab researchers.



Mimi Yen
Stuyvesant High School

New York

Mimi Yen, 17, of **Brooklyn,** closely mapped the region of the gene that affects mutant behavior called head plugging in a type of worm for her Intel Science Talent Search **animal sciences** project. Hermaphroditic development in this worm species has eliminated the need for males and made it difficult for natural selection to act on male behavior. Reduced selection may have resulted in the tendency of male worms to deposit a mucous plug — normally deposited on the vulva of a hermaphrodite — on the excretory pore of other males when hermaphrodites are not present. In addition to identifying the gene responsible for the behavior, Mimi also found that headplugging is controlled by hermaphroditic chemical secretions and does not affect a male's mating ability. She believes that studying mutant behaviors in simpler organisms will help us better understand the genes that contribute to behavioral variations in humans. Founder of the research club at **Stuyvesant High School** in New York, Mimi plays French horn and is on the school's National Ocean Sciences Bowl team. She has volunteered at a local hospital and prepared food for people too sick to cook. The daughter of Dat Kein Yen and Ai Ming Li, she was born in Honduras and is fluent in Cantonese.

Zizi Yu
Amity Regional High School

Connecticut

Zizi Yu, 17, of **Woodbridge**, investigated whether early exposure to food allergens in the first three years of life help prevent the development of food allergies for her **medicine and health** Intel Science Talent Search project. While existing health guidelines recommend that exposure to food allergens should be avoided in early childhood, Zizi sought to prove the Hygiene Hypothesis, which says exposure is necessary for effective immune systems. She collected data on 258 teenagers to determine whether there was a relationship between food allergies and exposure to those allergens during infancy and early childhood. Her findings suggest that early exposure to food allergens significantly decreased the likelihood of food allergies later in life. She has published her findings in the *Internet Journal of Epidemiology*, and is the paper's first author. At **Amity Regional High School,** Zizi is first in her class of 435, serves as editor-in-chief of the newspaper and is president and founder of the Amity Leo Club, which provides community service to the local VA hospital and area nursing homes. Born in China, Zizi speaks fluent Mandarin, is an award-winning violinist and enjoys figure skating. Her parents are Cheng Fang Yu and Lan Xu.

Alissa Yuan Zhang
Saratoga High School

California

Alissa Yuan Zhang, 17, of **Saratoga,** explored molecule-specific glucose detection for diabetes monitoring in the **chemistry** project she submitted to the Intel Science Talent Search. She focused on the use of Raman spectroscopy and surface-enhanced Raman spectroscopy (SERS) for glucose detection. These are methods that may eventually allow patients with diabetes to monitor their glucose levels noninvasively, once the sensitivity of the technique is improved. Alissa developed three approaches to achieve this. One of these used a photonic crystal fiber to enhance the Raman signal, setting a new lower limit for the detection of glucose. All three of her approaches demonstrated molecule-specific detection of glucose at physiological concentrations. She is first author of a paper on the project, accepted for publication by *Science of Advanced Materials,* and co-author of a paper published in *Analytical and Bioanalytical Chemistry*. Alissa is an officer in the math and science clubs at **Saratoga High School,** and head coach and coordinator for a middle school math club. She has perfect SAT scores and is an accomplished pianist and violinist. She enjoys horseback riding and skiing, and is the daughter of Jin Zhang and Eileen You.

Intel Science Talent Search 2012

Finalists and Research Project Titles

Intel Science Talent Search 2012

Finalists by State

Intel Science Talent Search 2012

Finalists by Last Name

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