Highlights From Intel ISEF 2005

A Week of International Competition

Fair Honors Young Scientists From Around the World

More than 1,400 young scientists from 41 countries came together in Phoenix, Arizona, for Intel ISEF 2005. The world's largest pre-college science competition awards more than US$3 million in scholarships.

Meet the Intel Foundation Young Scientist Winners

Three high school students who earned the Intel Foundation Young Scientist Award at Intel ISEF 2005 share a passion for science. Each received a US$50,000 scholarship. Read more.

Projects Reflect Range of Interests

Student researchers investigate questions about everything from renewable energy to biotechnology to robotics. Take a look at some projects that just may improve the world of tomorrow. Read more.

Excellence in Science

Illustrious scientists, including nine Nobel Laureates, shared insights with finalists during the Excellence in Science and Technology Panel. Read more.

The Week in Pictures

Photo gallery captures memorable moments from Intel ISEF 2005. Read more.

Follow Your Dreams

Astronaut Sally Ride, the first American woman in space, challenged students to "dream big" during opening ceremonies of Intel ISEF 2005. Read more.

Press Information

- Read the press releases.
- Access the Intel ISEF Virtual Press Kit.

Looking Back

- Intel ISEF 2004 (PDF; 23 pages)
- Intel ISEF 2003 (PDF; 7 pages)
- Intel ISEF 2002 (PDF; 3 pages)

Intel ISEF

Astronaut Challenges Students to 'Dream Big'

The 1,400 high school students gathered for Intel ISEF heard a tantalizing prospect about their future when astronaut Sally Ride, the first American woman in space, spoke at opening ceremonies. "There's a good chance that the first person who will go to Mars is in this room tonight," she said.

Astronaut Sally Ride delivered keynote.

Ride, now a physics professor at the University of California, San Diego, told the audience that traveling to space was her childhood dream. "I dreamed of space, and knew that science would get me there," she said.

She credited two teachers with building her confidence early in her education. "They told me, if you're good at math and science in seventh grade, you'll be good at math and science in high school and college and beyond. You don't get dumber. I needed to hear that," she told the finalists. Ride deferred one dream—becoming a world-champion tennis player—to pursue doctoral studies in astrophysics at Stanford University.

Ride had nearly earned her Ph.D. when she opened the college newspaper one morning and saw a small advertisement placed by NASA, recruiting applicants for a new class of astronauts. She applied that day and became one of 35 selected from an applicant pool of 8,000. Her astronaut "class" was the first group trained to fly the space shuttle, and included six women.

During her keynote address, Ride shared photos taken aboard the space shuttle. She pointed out the sights and details that are seared in her memory—the Earth aglow at night with city lights, the thin veil of air that forms our atmosphere, the eye of a hurricane viewed from above.

Ride shared photos from space.

Big Dreams

Theme for the opening ceremony was Dream Big, and speakers reinforced that message throughout the evening. Ride encouraged the students to pursue their own big dreams, but reminded them that dreaming won't be enough to create the future they want. "I was prepared to take advantage of opportunity when it came my way," she said. "You are at the age now to build your foundation for the future."

Intel Chief Executive Officer Craig Barrett reminded students that one person "can have a huge impact in science or technology. One person can create change that affects entire societies and cultures and civilizations."

By pursuing careers in science and technology, Barrett told the student finalists, "You have the opportunity to be that singular person who has a major impact on the world."

<< Return to Highlights From ISEF

Intel ISEF

Meet the Intel Foundation Young Scientist Winners

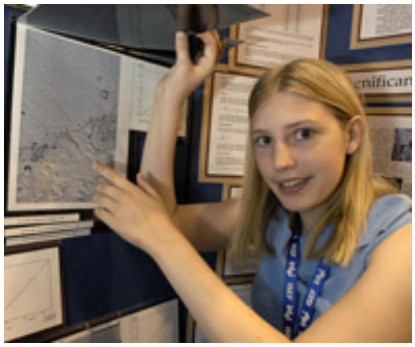
Intel Foundation Young Scientist Award
Three high school students—two from the United States and one from Germany— received the highest award of the Intel International Science and Engineering Fair on Friday, May 13, 2005. Each of the Intel Foundation Young Scientist Award winners received a US$50,000 scholarship.

Ameen Abdulrasool


Ameen Abdulrasool

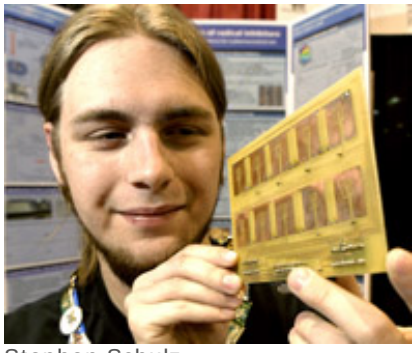
Ameen Abdulrasool, 18, a senior from Lane Technical High School in Chicago, Illinois, developed a small, self-contained, portable navigation system to help the visually impaired travel without the need of a guide. Abdulrasool's Behavioral and Social Sciences project, "Prototype for Autonomy: Pathway for the Blind," combines global positioning satellite (GPS) technology, verbal directional signals heard through a headset, and vibration devices worn as bracelets. "It's like an On-Star* system at the handheld level for the blind," explains Abdulrasool. He was inspired by his father and several other relatives who are blind. Abdulrasool worked at his kitchen table to build his system, designing circuits and reusing components such as small motors from remote-control cars. "Each part of the tool leads to the next step—the GPS receiver leads to verbal commands, then verbal commands lead into the circuit, which leads into the motor to make the bracelets vibrate. It's like a domino effect." Users hear a steady stream of verbal cues, such as, "sharp right turn in one meter," "turn now," "turn completed." Just as the user approaches a right turn, the right bracelet begins to vibrate to reinforce the message. Abdulrasool said the vibration signal was a major enhancement to his project. "Blind people become so used to using their guide cane, their sense of touch becomes a big part of their navigation skills." He is applying for a patent for his invention and plans to attend the University of Illinois in the fall.

Gabrielle Gianelli


Gabrielle Gianelli

Gabrielle Gianelli, 17, a junior from Lake Highland Preparatory School in Orlando, Florida, used mathematics to prove that there were once oceans on Mars. For her Space Science project, "Fractal Dimension Analysis of Putative Martian Coastlines," she used data from a topographic map of Mars and taught herself statistics in order to analyze fractals. "Fractals describe things in the natural world that are chaotic. Geological features have specific fractal dimensions. If you know the fractal dimension of something, you can classify what sort of geological feature it is. And that's exactly what I did," she said. Gianelli believes that understanding the geology of Mars will help us better understand Earth. "Earth and Mars are so similar. Mars has obviously undergone drastic climatic changes. Scientists should want to know what caused Mars to change so radically." In 2007, NASA plans to send an unmanned rover to Mars to explore the same area that Gianelli studied. "They will test for signs of water. If there's water, it's extremely likely there was once life on Mars, which would be a momentous discovery in all fields of science." Growing up near the Kennedy Space Center inspired Gianelli's love of astronomy. "I wanted to be an astronaut until I found out I'm afraid of heights. So I decided to be a scientist." After another year of high school, she plans to study applied math in college.

Stephen Schulz



Stephen Schulz

Stephen Schulz, 19, a senior from Gesamtschule Buer-Mitte in Gelsenkirchen, Nordrhein-Westfalen, Germany, developed new electrochemical methods to analyze compounds called flavonoids that can protect against cancer and other diseases. For his Chemistry project, "From Synthesis to Analysis of Radical Inhibitors," he devised an economical new form of a "lab on a chip" that miniaturizes laboratory procedures to a surface the size of a coin. "A lab on a chip normally costs $5,000. Mine costs just $15 because I do it with standard printed circuit technology," he explained. "I didn't think it would work at first. When it did, it was an amazing feeling." Shulz has been experimenting with chemistry since first grade and has built a small laboratory in his backyard. He also develops electronics, which gave him the idea to try using printed circuits for his lab on a chip. With new methods to synthesize and analyze radical inhibitors like flavonoids, he said, "it's possible to have more flavonoid structures than nature has. This may help us prevent diseases like cancer or cardiovascular disease." He plans to study chemistry at the University of Muenster in Germany.

---

back to top

Intel ISEF

Projects Reflect Range of Interests

Inside the vast exhibit hall of Intel ISEF, banners hang above the rows of student displays, identifying the 14 categories in which more than 1,400 finalists compete. At the 2005 fair, engineering generated the most entries with 213 projects, followed by environmental sciences with 198. More than 19 percent of finalists have applied to patent their projects. Whether they are solving perplexing mathematical problems or investigating potential breakthroughs in medicine and health, student researchers share a passion for research and an insatiable curiosity about the world around them.

Reaching Out

Growing a new generation of scientists takes time and energy. That's why the Intel ISEF Outreach Program starts early, building interest in science fairs among middle school students. Read more.

High school students from more than 40 countries qualify for Intel ISEF by winning at affiliated regional or national fairs. The chance to win a share of US$3 million in prizes adds to the excitement at the event, but many students describe even bigger motivations—developing an alternative energy source, learning about a distant star, improving mobility for the disabled, or contributing new understanding by answering an intriguing question. To read about a sampling of student projects, click on these themes.

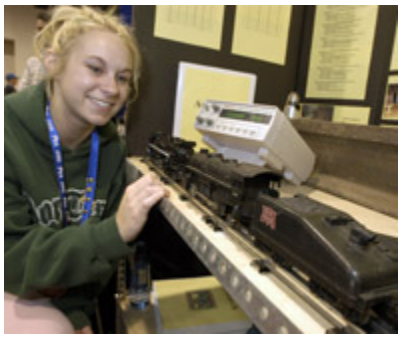
- Inventing the Future: Using technology and engineering to tackle challenging problems, students are developing innovations that may change how we live, work, and travel.
- Improving Life: When students turn their curiosity to health and safety, they generate ideas that may advance medicine, improve mobility, and save lives.
- Answering Good Questions: Inquiry takes students in interesting directions, as they dig for answers to intriguing questions.

Intel ISEF
Inventing the Future

Using technology and engineering to tackle challenging problems, students are developing innovations that may eventually change how we live, work, and travel.

An Ear to the Track

When trains derail or collide, the results can be lost lives, injuries, and millions of dollars in property damage. Courtney Rafes, 17, from Northwest High School in Justin, Texas, devised a railroad warning system for the future that uses ultrasonic sound. "I attached sender transducers and receiver transducers on the tracks. Using ultrasonic sound, the system was able to detect if there is a break in the track or if two trains are approaching a collision," she explained.



Courtney Rafes

Rafes believes her system is the first of its kind. "No one has ever tested sound on a train track before," she said. Dinner conversations with a neighbor sparked her interest in train safety. "He's like a train detective—when there is an accident, he investigates what happened."

Getting her system to work involved weeks of trial and error, including eight experiments and more than 2,000 tests. Rafes worked with model train tracks, clearing out her family's living room to give her room to experiment. Using proportion ratios, she determined that a signal could cover at least a mile and a third of full-scale train track. "So every mile and a third, we could have a sender and a receiver. That way if there was a break in the track, you could narrow your inspection to a short length." Rafes has not yet done a cost-analysis of her system, but soon will get a chance to test it on a full-size train and tracks.

She has been entering science fairs since kindergarten and began focusing on engineering projects in seventh grade. "I want to do something that will help people and save lives."

Humanoid Robot Platform

Like many students of science, Yang Ge, 17, of Beijing Jingshan School in Beijing, China, considers the human robot a fascinating subject. But the complexity of humanoid robots makes them challenging to design and prohibitively expensive—making them inaccessible for most students. Ge has designed a general humanoid robot platform that brings human-shaped robotics within reach of anyone who can follow a blueprint.

Yang Ge

Ge has been studying computers for more than nine years—nearly half his life. Robotics is a keen interest. Previously, he developed an insect-like robot with six legs. That got him thinking about how to build a human-shaped robot that would interact with its environment in the way that people do. Breakthroughs in artificial intelligence, he realized, will require scientists to understand "how the human shape interacts with the environment."

In the first phase of his project, he developed a robot platform with the idea that others could use his model to build their own humanoid robot from sheet metal. "Others who want to join this research can use simple components and follow my instruction to build this."

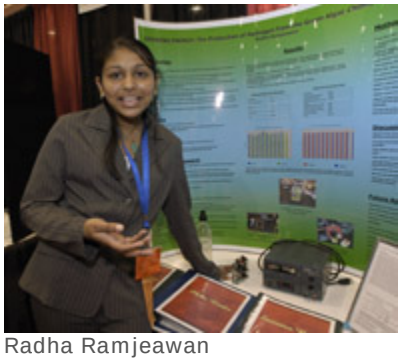
Next, he set out to design a way for his humanoid robot to walk with a natural gait and adapt to uneven surfaces, with a minimum of calculating and energy. "I wanted to have dynamic balance function," he explained.

When humans move, their body and brain functions are coordinated to help keep them upright and mobile, even if they encounter obstacles. Ge developed a gyroscope-like mechanism to provide similar balance for his robot. A two-axis gyro was used to tell the attitude of the body. Two groups of sensors on the feet can capture the state of touching the ground. The signals from these receptors were synthesized, enabling the robot to keep a dynamic balance and adapt to uneven surfaces by itself. The system can realize when it is falling down, and then choose a proper countermeasure to take.

Getting the robot to walk with a "human" gait was a major breakthrough. "My mom always likes this robot, like a baby," he said. "The first time it walked, it was like a baby's first steps. The first step is not perfect, but it's wonderful." Ge plans to continue making modifications, using images and additional computing to enable the robot to sense changes and maneuver on uneven surfaces.

Growing Energy

Radha Ramjeawan, a 15-year-old freshman from Uniondale High School in New York, has developed a system for using hydrogen waste from a form of green algae to run through a fuel cell and generate electricity. If used to power cars of the future, her system could eliminate oil dependency along with the pollution caused by using fossil fuels.


Radha Ramjeawan

Ramjeawan began by researching *Chlamydomonas reinhardti*, commonly occurring, unicellular green algae that are capable of hydrogen production when grown under anaerobic conditions. In the past, most of the research has focused on biological issues. "Research has been done on *Chlamydomonas reinhardti* and the production of hydrogen," she said, "but no one has put that together with a fuel cell. My idea was to combine it, and this had technically never been done before."

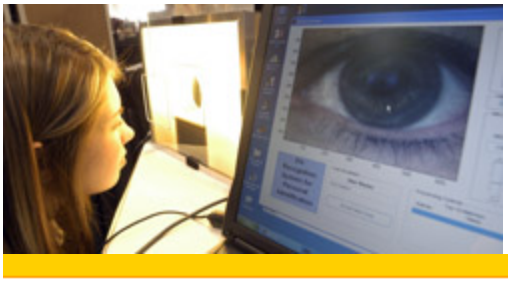
Getting her system to work took some trial and error. Working in her high school lab, she cultured the green algae that naturally secretes hydrogen under certain conditions. She channeled hydrogen yields into an existing fuel cell, "a device that hydrogen runs through, combining with oxygen to generate electricity." She had to experiment to get the various components to work as a system, "but when it finally worked, it felt really great. It felt like you contributed to the scientific community—like a real scientist."

She did extensive testing to ensure that electricity production would be adequate, and was encouraged by the results. "We have two billion people on the planet who currently do not have electricity. This system could be applied on a world basis to bring electricity to them, without causing new environmental problems."

Ramjeawan's sister was an Intel ISEF finalist last year, so getting to the fair was a personal goal. "I wanted to get this far," she said. Her high school encourages science fair participation through a science research club. "Science is the passion for kids in our school," she said.

back to top

<< Return to Student Projects



Intel ISEF

Improving Life

When students turn their curiosity to health and safety issues, they generate ideas that may advance medicine, improve mobility, and save lives.

Innovations in Prosthetics

Designing prosthetic fingers poses a classic design challenge: balancing form and function. Brandon Peart, 17, from Hillcrest High School in Midvale, Utah, has taken a two-part approach to developing prosthetic phalanges that simulate human movement and also look like human fingers.

Brandon Peart

"One of the problems in designing prosthetics is that you can't balance form and function. This is especially true with prosthetics for fingers. Cosmetic prosthetics look like fingers but don't give any functionality. Then you have prosthetics that give some functionality, like hooks or clamps, but they don't have any resemblance to human fingers," Peart explained.

Peart set out to design a joint that can approximate the complex arcs and curves of the human finger. He found inspiration in an unexpected place. "I was painting, and noticed how the bristles of the paintbrush move back and forth to create different angles. I got the idea to control all the bristles individually. So I started with the way the brush works and did a backwards design approach."

His prototype consists of strands of cord running vertically, connected to circular pallets that provide support and precise control. The device is capable of complex movement, which simulates and even surpasses what the human finger joint can do. "It should be able to do a fine approximation of how a finger works. It also resembles the shape of a finger," Peart said. "By applying an artificial epidermis, you would have the aesthetic appeal of cosmetic fingers."

Before he built his first prototype, Peart conducted extensive modeling. "I did mathematical modeling to see if this was even feasible. My actual equation was three pages long. When I finally got it into computer, and it worked—wow!" Once the math was solved, Peart was eager to start building. "The idea has been in your mind for eight months. By the time you get the math done, and it works, you want to go out and build it—you want something tangible, a fruition of your dreams."

Following the design process, Peart went through several prototypes, testing and then making improvements on each successive model. Building comes naturally to him. "I've always like meddling with my hands. It's a family trait. We built our house from the ground up. We have a woodshop at home and a metal shop in the family. It's my dad's hobby to invent—he's always building things."

Peart plans to continue working on his project. "I hope to find funding to miniaturize it and build electrical components. Once that works, I'll hope to move to trials." Peart sees an increasing need for improved prosthetics due to industrial accidents, war injuries, and birth defects.

Pressure Suit for Physiotherapy

Daniel Mazor, 18, and Harel Cohen, 18, both from Maayan-Shahar in Emeq Hafar, Israel, have developed a pressurized suit that they believe will improve physiotherapy treatment for patients experiencing extreme physical disability and paralysis due to brain injury or illness.

Daniel Mazor (Left) and Harel Cohen

Inspired to help handicapped students at a school in Israel, they investigated current treatment protocols. Physical hyper- and hypo-sensitivity is currently treated with touch-care physiotherapy. "We don't know what is it like to be without normal sensitivity," Mazor explained. They learned that physiotherapists simply apply pressure on patients' extremities.

Mazor and Cohen developed a computerized system that will allow for more individualized treatment. Their system combines an inflatable sleeve with a pneumatic device, so that

pressure can be gradually controlled by sensors. "The physiotherapist sits next to computer and can control the pressure for all situations," Cohen explained.

Mazor and Cohen also included animation for the patient to watch during treatment. "This gives the student something to watch, and also information that helps him to know his body boundaries. When the pressure suit squeezes the right arm, the student can see that on the screen. He has a visual sense of what he is feeling," Mazor said.

The students plan to give their pressure suit to the school. "They want it for their students—they are very happy, very eager to have it," Cohen said.

Designing Better Wheelchairs
Devices that improve mobility for the physically challenged drew the attention of several Intel ISEF finalists. Here are two approaches for improving wheelchair design.

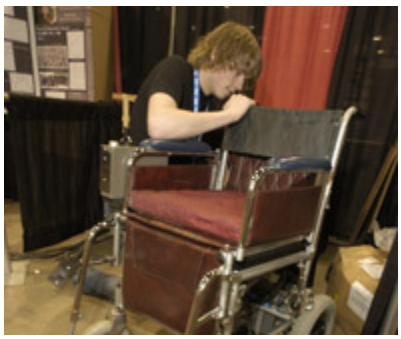
Convertible Wheelchair. Two students from Argentina teamed up to design the Convertible Wheelchair, designed to facilitate transference from wheelchair to bed. Martin Bricchi, 18, and Leandro Martinez, 20, from Technician School No. 9 in Buenos Aires, wanted to improve on currently available devices, such as winches or mobile cranes, used to transfer the physically disabled. They developed a multi-purpose wheelchair controlled by electronics. The chair can flatten out, converting to a bed, or elevate so that it is level with a bed surface for easy transference.


Martin Bricchi (Left) and Leandro Martinez

The students believe their device will increase self-sufficiency by reducing dependence on another person. Their multi-purpose chair also can be used to program movement exercises, helping with physical therapy.

Elevating Wheelchair. Richard Entwisle, 18, of Canford School in Dorset, United Kingdom, set out to design a wheelchair that would eliminate what he sees as a "height disadvantage" for users. "When a wheelchair user comes into a group of people who are standing, they are not at the same eye level—not on an equal basis. Reception desks are often at head height. Even supermarket shelves are often out of reach. Wouldn't it be great if you could have a higher height advantage, without having to have someone lift you up or do something for you? It would higher your self-esteem and let you do more."

Entwisle worked through a series of prototypes, starting with a Lego* model, then a wooden prototype, then a full-sized chair. After trial and error, he decided to use an electro mechanic actuator as a lifting mechanism. Electronics control the grooved mechanism so that the chair remains stable and level at any height. He had to work through a variety of design challenges. "The center of gravity has to be such so that it doesn't tip over. The wheels need more stability. The leg rests and arm rests have to be comfortable and safe."


Richard Entwisle

Although Entwisle was working on the project for a school assignment, he did most of the work in his home workshop. "I've been engineering and making models since I was young. I think I was born like this."

The Bat Hat
Two brothers—Taylor Ducote, 15, and Dylan Ducote, 17—from Catholic High School in New Iberia, Louisiana, collaborated on a project designed to help the visually impaired navigate. "The Bat Hat" uses high-frequency sound waves and sonar sensors to detect objects from two to 10 feet away. The user, wearing a hat equipped with sonar sensors and headphones, hears a variable tone based on the object's distance. As objects get closer, the warning tone gets higher.

The Ducote brothers got the idea for their project when a team of college students from their area entered the DARPA (Defense Advanced Research Projects Agency) Grand Challenge, a contest to design an unmanned vehicle that could maneuver across 150 miles of desert. "We started talking about how could we apply the same navigation ideas to people who can't see," explained Taylor.

They also wanted to design something affordable. Sonar sensors fit the bill for function and economy. "There are other devices available," Dylan added, "but they tend to be very expensive and complicated. You need to take a course to learn to use them. We wanted to design something simpler and cheaper."

Through experimentation, they realized that providing the user with feedback through a continuously varying tone would be an important feature. "As you get closer, the pitch changes. A higher pitch is like an alert to watch out," Taylor said. They added stereo sensors, which enable the user to detect moving or stationary objects at corners, rather than simply straight ahead.

Their father's boss, an electrical engineer, helped them understanding the electronics required to make their project work. "We had to build the circuitry, conduct tests, and switch transistors and capacitors to get the tones we wanted," Dylan explained. Next, they plan to program in voice messages so that the user would receive more specific feedback, rather than simply tones.

Taylor Ducote (Left) and Dylan Ducote

Being brothers sometimes made the collaboration easier, Taylor said. "And sometimes harder," Dylan added.

back to top

<< Return to Student Projects

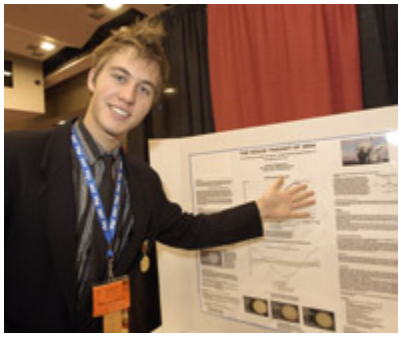
Intel ISEF

Answering Good Questions

Inquiry takes students in interesting directions, as they dig for answers to intriguing questions.

Venus Transit

When Marc Baggenstos, 18, from German International School in Cape Town, South Africa, set out to investigate an astronomical question, he decided to apply historic methods rather than relying on cutting-edge technologies. "I wanted to see where science is coming from," he explained," so that I will have a better understanding of where it is going.


Marc Baggenstos

Specifically, Baggenstos wanted to calculate the astronomical unit—the distance between Earth and sun—by observing the Venus Transit of 2004. "A transit occurs when a planet passes in front of the sun as seen from the Earth," he explained. From reading journals, he knew that the Venus Transit would occur on June 8, 2004.

Baggenstos needed a variety of measurements to make his calculations. He measured the angular distance between Venus and the sun on various occasions between January and May. "Using simple trigonometry, I was able to figure out the relative distance from the sun to Venus, by measuring the angle the sun creates." To measure the angular radius of the sun, he projected its image onto a wall with a pinhole mirror, an historic method he discovered through Internet research.

Baggenstos didn't entirely rule out technology during his project. "During the transit I took numerous photos. Precise timing and positioning was done by GPS. I later scanned the photos, and measured the angular distance on the pictures." Reaching his final calculation involved applying Newton's Laws of motion to the NASA values for the planetary mean orbits for 1.5 January 2000.

The result? "I obtained an average value of 150362547km (only 0.51 percent more than the real value). These results were better than expected." Baggenstos acknowledges that the value "has been calculated far more accurately to date. It's reworking an historic method. It was interesting to use a variation of the same basic method that was used 150 years ago. I have a better understanding of astronomy now."

Search for Tomorrow

Why do Internet search engines produce results that are far from ideal? Jason Rezvanian, 18, and Harish Srivivasan, 17, both from duPont Manual Magnet High School in Louisville, Kentucky, teamed up to improve Internet search engines by adding a layer of linguistic context. Current search engines, including programs that place advertisements on the Web, fail to consider context, Rezvanian explained. "For example, next to a *New York Times* article about a homicide victim who was stuffed inside a suitcase, an ad for luggage ran on the right-hand side of the Web page."

Determined to build a better system, the two long-time classmates developed Project Mingle, which they consider to be a new breed of webcrawler. It uses a refined keyword identification algorithm and associative linguistics to compile a list of logical associations. They compared associations in consideration of frequency, significance, and relevance to each page in the search results subset. Search results were divided into categories defined by their corresponding associations.

"It allows you to refine research to the nth degree and streamline the number of clicks to get to the right hit," Rezvanian explained. At the same time, their program offers back end advantages. "It allows you to track the growth, spread, and decline of ideas across the Internet. If you clock hits to a subset instead of a Web site, you get better understanding of an idea rather than the popularity of one single Web site."

Srinivasan provided the technical input to make the program work. "Jason has been a big idea person. I'm more technical." He had to solve "a big glitch" on the eve of the regional science fair that qualified them for Intel ISEF. "Getting the job done is my primary motivation," Srinivasan says. "I'll stay up all night to solve a problem."

Rezvanian readily admits that his teammate "is the brains of the operation," but added that he learned more about programming and also about hardware through the project. "We learned capabilities of different chipsets. How that influenced our results was exponentially more important than I originally understood."

Both high school seniors, the two will head in different directions next year. Srinivasan plans to study computer science, and Rezvanian is headed for a business major.

Pigeon or Duck?

Macy Allen, 15, a freshman at North Lamar High School in Paris, Texas, is a runner who wanted to improve her time on the track. So she turned her attention to biomechanics, developing a medicine and health project, "Pigeons or Ducks," that investigated how the foot position in females affects their sprinting speed.

Macy Allen

Allen's original motivation was personal. "I wanted to be more competitive, more explosive in my sprinting. I took instruction, and the first thing they talked about was foot position." Allen is naturally duck-footed—favoring an outward turn of the foot—but the coaches changed her to an in-toe, or pigeon toe, position. It took time and practice to make the switch, she said, "but as I got more coordinated and more balanced with it, I started to shave time off my sprints. Then I wondered, is it just me? Or could this apply to others?"

For her research project, Allen tested 23 female athletes. She timed them as they ran three heats in the in-toe and three in the out-toe position. Regardless of each runner's natural foot position, all ran faster as "pigeons"—keeping the foot turned in. Through research, Allen learned that the in-toe position provides more stability, like a lever for the runner to push off from.

Allen plans to continue researching the biomechanics of running. "I'd like to design a shoe or a device that you wear that maintains the proper foot position. That could be a next step," she says. She also sees potential applications of her research in injury prevention. An unexpected benefit of her project, she said, is that she has become a more keen observer of running form, which may help her improve her own performance on the track.

back to top

<< Return to Student Projects

Intel ISEF

Reaching Out to Younger Students

Across Arizona, thousands of middle school students regularly stay after school to explore science the way professional scientists do—by asking questions and pursuing their own investigations. During Intel ISEF, nearly 400 middle school students exhibited their original science projects during a special one-day event in Phoenix, part of the Intel ISEF Outreach Program.

Two students from Sacaton Middle School worked on a project about growing plants in sandy soil. The best part? "Getting results," they agreed. Both girls plan to do another science project next year.

The Intel ISEF Outreach Program is coordinated through Intel Public Affairs and supported by the Intel Foundation. The outreach effort is part of Intel® Innovation in Education, a worldwide initiative that helps today's students prepare for the career demands of tomorrow.

Middle school students and teachers from nine Arizona schools have been preparing for the special event since last fall. Participating students were recruited from Native American Tribal Schools and other schools serving Native students, as well as urban schools in Phoenix serving a predominately Latino population.

Intel also sponsored science teacher workshops and provided an after-school curriculum to help students design and develop science fair projects. Students have learned about research methodology and conducted their own hands-on investigations. They have also had a chance to work with science mentors and gain exposure to science careers.

Eugenia Echols, education manager for Intel in Arizona, has watched both students and teachers grow as a result of the after-school experience. "When we began, well over 90 percent of these students had never been exposed to inquiry-based science. Now, they are clearly seeing themselves as successful. They have taken an idea, and now it has a true form. They realize they can be successful at trying and doing new things."

To help ensure a successful experience, Intel provided teachers with more than 50 hours of training. "Teachers were also assigned science coaches to provide them with ongoing support and ongoing professional development," Echols said. "This was brand- new for many of the teachers. Some were apprehensive at first. Now, they want to continue. They want to know, what's the next step to have my classroom feel like a laboratory all the time?"

Two students from Isaac Middle School built their own model electric train. They had to solve problems involving the power source to keep the train from going too fast and derailing. "It was hard," they said, "but fun."

The student-centered, inquiry-based approach can be adapted to all subject areas, Echols noted. "The art of working on projects seeps into everything teachers are doing." The middle school curriculum has been designed to integrate language arts and social studies along with science. "A lot of students have done socially significant projects. That's intentional," Echols added. "We want to create socially responsible scientists and researchers."

The Intel Outreach Program will continue next year, when Intel ISEF takes place in Indianapolis, Indiana. After-school science programs will also continue next year in Arizona, where 10,000 students already are participating. "The joy is seeing the change in children and teachers," said Echols.

The middle school science fair at Intel ISEF 2005 was affiliated with the Discovery Channel Young Scientist Challenge.

<< Return to Student Projects

Intel ISEF
Excellence in Science

An illustrious international panel of scientists and technologists, including nine Nobel Laureates, shared career highlights and advice with a packed audience of high school finalists during a special event of Intel ISEF 2005.

During a two-hour question-and-answer session, students heard that scientific breakthroughs result from curiosity, persistence bordering on stubbornness, and an unwillingness to give up in the face of failure. Douglas Osheroff, winner of the Nobel Prize in Physics, told the students, "Failure is an invitation by nature to try something new."

Dudley Herschbach, winner of the Nobel Prize in Chemistry, likened the work of a scientist to that of a musician. "You have to love it, master the instrument, understand the culture. You will play some wrong notes, but that's OK. It's part of the joy of the chance to do it."

Where do great ideas come from? Joseph Murray, winner of the Nobel Prize in Physiology or Medicine, explained how his pioneering work in kidney transplantation came about. As a young surgeon during World War II, he saw that skin could be transplanted to save lives. That prompted him to study organ transplantation and eventually to conduct the first successful human kidney transplant. "To see that first transplant patient go from sick to healthy was amazing," he said, encouraging students to "select a problem that inspires you."

Douglas Osheroff (left) and Norman Ramsey, both Nobel Laureates in Physics, shared insights with students.

Technologist Alan Kay, winner of the Charles Stark Draper Prize, urged students not to be dissuaded from what truly interests them, even if their dreams may seem impractical to others. "Stick to the things you love and find people to fund you to do it."

Astronomer Jocelyn Bell Burnell, winner of the Herschel Medal for the discovery of the first pulsars using a radio telescope of her design and construction, drew a burst of applause when she debunked the notion that women are not biologically suited for math and science. "Rubbish!" she said. "And I have the evidence to back it up." Bell Burnell cited several countries—including Malaysia and Singapore—where an increasing percentage of physicists are female. The under-representation of women in mathematics and the sciences, she said, "has to do with culture and gender rather than biology and sex."

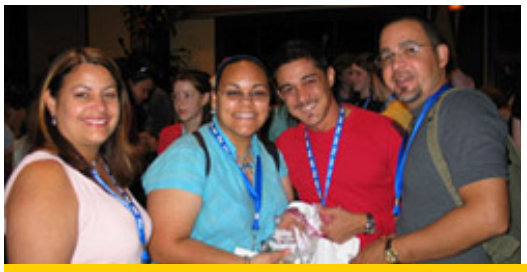
Astronomer Jocelyn Bell Burnell predicted a new wave of research about dark matter.

The panelists predicted no shortage of issues awaiting research by the next generation of scientists. Osheroff cited global warming as the most-pressing problem. "Global warming has the potential to destroy society," he said. Kay cited the need for drinkable water as a critical global issue, and added that the so-called computer revolution "has barely started." Kurt Wüthrich, winner of the Nobel Prize in Chemistry, predicted that our understanding of DNA will open new areas of discovery. "We have not yet started to exploit the potential of this information for research."

Bell Burnell urged students to keep their eyes on space if they want to pursue big new ideas. "Astronomy is about to provoke a revolution in physics," she predicted. Some 95 percent of

space consists of dark matter, "and we have little clue what it is." She told the current crop of Intel ISEF finalists, "You are of the right age to be on the crest of this new wave of research. It's going to be huge fun."

back to top



Intel ISEF

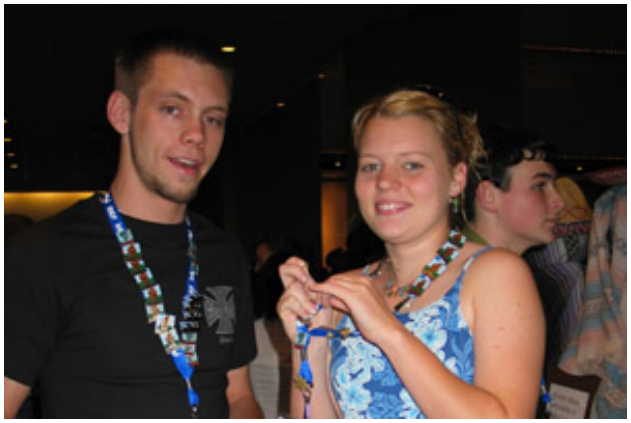
The Week in Pictures

Phoenix Civic Plaza Convention Center in Phoenix, Arizona, was the gathering place for more than 1,400 high school students who assembled for the weeklong celebration of science known as the Intel International Science and Engineering Fair (Intel ISEF). At the 56th annual fair, finalists had a chance to talk with Nobel Laureates, get acquainted with fellow students from around the globe, and experience the sights and culture of the Southwest. Take a look at the week in pictures.

Phoenix, Arizona, provided a sunny setting for Intel ISEF.

The hotel lobby is a sea of people as finalists arrive from around the world.

Like Olympic athletes, student finalists exchange souvenir pins.



Pin-trading gives students a chance to get acquainted.

Finalists are all smiles as the annual event begins."

Opening ceremonies began with Mariachi music, a Southwest tradition."

Sharing Southwest culture, Native Spirit Dancers and Singers performed the traditional Fancy Dance.

The Hoop Dance was performed by Native Spirit Dancers and Singers during opening ceremonies.

Students representing every country gathered on stage for an international shout-out during opening ceremonies.

Intel CEO Craig Barrett, sporting sunglasses, met students and learned about their research.

The Japanese delegation included both student finalists and science teachers.

An illustrious group of 11 award-winning scientists and technologists presented the Excellence in Science and Technology panel.

Students lined up for a chance to ask a question of scientists during the Excellence in Science and Technology presentation."

The Copper Square Celebration gave finalists a chance to celebrate.

Students found plenty to talk about during the week.

Not always serious, finalists let off steam at Cooper Square.

The exhibition floor included individual and team projects in 14 research categories.

A finalist explains his research to two Nobel Laureates, physicists Norman Ramsey (middle) and Herbert Kroemer (right).

Nobel Laureate Robert Curl takes time to answer

During public viewing, finalists explain their

students' questions.

Finalists help spark younger students' interest in science.

projects to visitors.

Intel ISEF finalists uphold the scientific tradition of sharing their research results.

Finalists gather for the awards ceremony, grand finale for Intel ISEF 2005.

The three top-prize winners enjoy their moment in the spotlight.