Highlights From Intel ISEF 2004

A Week of International Competition

Meet the Winners | Student Projects | Teachers of Excellence | 2004 Photos | Intel ISEF Judges

Fair Honors Young Scientists From Around the World

Some 1,300 young scientists from nearly 40 countries came together in Portland, Oregon, for Intel ISEF 2004. The world's largest pre-college science competition awards more than $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 2004 share a passion for science. Each received a US$50,000 scholarship and a high-performance computer. Read more.

Projects Reflect Range of Interests

Student researchers investigate questions about everything from water on Mars to the health of rivers that run through their communities. Take a look at some projects that just may improve the world of tomorrow. Read more.

Honoring Teachers of Excellence From Around the World

Meet the teachers honored for their successful classroom strategies. Read more.

The Week in Pictures

Photo gallery captures memorable moments from Intel ISEF 2004. Read more.

Judging Process Brings Rewards

On judging day, 1,500 experts evaluate student projects, looking for excellence of scientific research, analysis, and presentation. What do judges have to say about the experience? Read more.

The Next Wave

In a special presentation, Intel Chief Technology Officer Pat Gelsinger offers Intel ISEF finalists a glimpse into the future of innovation.
Learn more.

Return to Highlights From ISEF

Intel ISEF

Creating the Next Wave

Intel's Chief Technology Officer Offers an Innovation Forecast

An inquisitive mind. Perseverance. A lot of hard work. A little luck.


Pat Gelsinger

Those ingredients are the building blocks of innovation, according to Pat Gelsinger, chief technology officer (CTO) for Intel.

During a special presentation at Intel ISEF, Gelsinger first traced his own "Cinderella" story—from Pennsylvania farm boy raised by parents educated in a one-room school to CTO of a Fortune 500 company. Planting the idea that anything's possible for today's young innovators, he went on to offer a glimpse of where technological innovation may be heading in the near future.

With chips becoming smaller, faster, and less expensive to produce, Gelsinger said we may soon see cell phones small enough to wear as an earring. A new generation of data-gathering devices means baby blankets could have built-in temperature sensors, and smart bandages could be programmed to detect infections. Advances in nano-scale technology will lead to chip-based medicines, with medical research taking place at the DNA level.

The next big wave of innovation will come from what Gelsinger calls "convergence." This means bringing together computers and communications devices in new and more powerful ways. The computing devices that students will soon want for their college dorms, for example, might combine the personal computer with consumer electronics features. One machine could include video camera, cell phone, instant messaging, television, digital music library, plus more traditional computing features.

Along with this new wave of interconnected products will come new usage models that "could transform business and society," Gelsinger said. The societal changes that lie ahead may be as profound as those that came when the automobile replaced the horse and buggy, he said. "Communications will be ubiquitous, always connected, across multiple networks."

To give students a glimpse of what's ahead, Gelsinger offered a narrated tour of his future home—the one he might inhabit as a 70-year-old retiree. Sensors would track his daily activities, including exercise, social interactions, meals, and medications. If he happened to fall, sensors would detect that and a communications network would generate a call for help. For older people and others facing health concerns, products currently in development "may be the tools that will allow them to stay home longer, living independently."

Outside the home, sensor networks will soon be used for gathering massive amounts of data, he predicted. In agriculture, for example, small sensors can measure humidity, temperature, and other factors. Environmental applications allow for monitoring wildlife behavior unobtrusively. Similarly, sensors may lead to breakthroughs in search and rescue, firefighting, earthquake monitoring, and dozens of other critical tasks. "We will be collecting information never possible to accumulate before," Gelsinger said.

Who's going to develop all these products and ideas of the future? Turning to the audience of young scientists, Gelsinger asked, "Who out there is the Edison or Wright brother of tomorrow?"

Return to Highlights From ISEF

intel innovation in education

Intel ISEF

Meet the Intel Foundation Young Scientist Winners

Intel Foundation Young Scientist Award

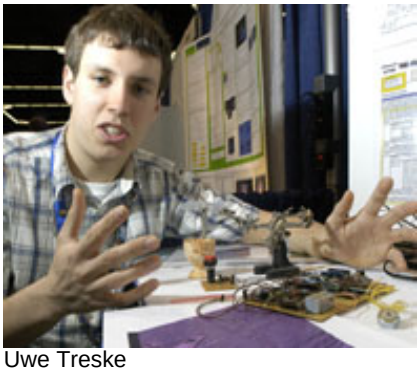
Students from three continents received the highest award of the Intel International Science and Engineering Fair on Friday, May 14, 2004. Each of the grand-prize winners received a US$50,000 scholarship and a high-performance computer.

Sarah Rose Langberg

Sarah Rose Langberg

Sarah Rose Langberg, 17, a junior from Canterbury School in Fort Myers, Florida, spent a year analyzing volcanic rock samples from the deep ocean floor for her earth and space sciences project. Langberg's project is titled "Petrology, Morphology, and Geochemistry of the Southern Juan de Fuca Ridge: Evidence for Off-Axis Volcanism." Langberg conducted chemical investigations, ran a mathematical simulation, and also studied video footage from the ocean floor in her effort to explain the distinct features that characterize one of the most active volcanic regions on Earth. "I studied the shiny glass surface of rock samples. This is where magma instantly freezes when it hits ice-cold ocean water." Langberg's interest in geology took off when she visited a lab at the University of Florida. Dr. Michael Perfit agreed to be her mentor for a summer internship. During the following school year, she continued making regular three-hour trips to the lab. She credits her high school research adviser, Dr. Betsy Glass, for convincing her to "take that first step and ask to do an internship. That was the springboard." Langberg's current dream is landing a spot aboard a research expedition at sea to continue her studies into "the frontiers of science."

Uwe Treske



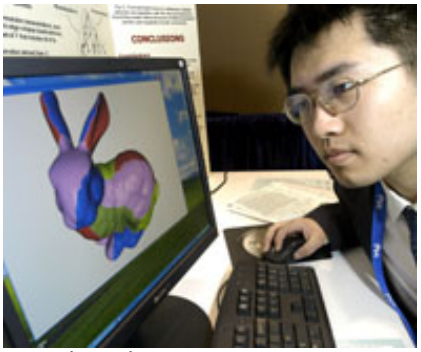
Uwe Treske

Uwe Treske, 18, a senior from Paul Gerhardt Gymnasium in Grafenhainichen, Sachsen Anhalt, Germany, developed an inexpensive but powerful microscope that delivers a 1,000-fold improvement in resolution over normal light microscopes. His physics project is titled "Low-Cost Scanning Tunneling Microscope." Treske was inspired when he saw a German television show about the Scanning Tunneling Microscope (STM), an important tool in nanotechnology. "It fascinated me-the idea that you could achieve atomic resolution. I wanted to see an atom for myself. Of course, STM are very expensive. I decided to try to make a cheaper version so that any student could work with this tool." Treske based his invention on the principles of the STM, but used inexpensive materials that he acquired in his community of 8,000. For example, he used tungsten filament from ordinary light bulbs to make the fine spike tip for his microscope, recycled styrofoam blocks for building materials, and the standard sound card from a personal computer for digitizing the measuring signal. Where did his inventiveness come from? "My science career began with my grandfather. He repaired television sets, and I helped him. That taught me about chips and circuit boards," Treske said. "I've learned that you can do scientific research anywhere, with whatever resources are available to you."

Yuanchen Zhu

Yuanchen Zhu, 19, a senior at Shanghai Foreign Language School in Shanghai, China, developed an improved method for generating high-quality, three-dimensional computer graphics for his computer science project. His project is titled "Real-Time Remeshing With Optimally Adapting Domain: A New Scheme for View-Dependent Continuous Levels-of-Detail Mesh Rendering." Zhu's goals were to improve the level of

detail while speeding up the time required for rendering precise images. "With computer graphics, you are trying to simulate the whole world and represent that accurately on the screen. There's a lot of mathematics involved," he said, "as well as programming." Zhu said he considers math a tool to help him reach desired goals. "If a graphics problem requires math, I will learn what I need to know." Zhu became interested in computer programming in sixth grade. "This is an especially exciting time to be involved in computer graphics," he said. "The processing speed is progressing at a rapid rate. Five years from now, we may be producing photo-realistic, interactive movies." His project has possible applications in 3-D games, virtual reality, medical visualization systems, flight simulators, and other fields.



Yuanchen Zhu

back to top

Intel ISEF
Projects Reflect Range of Interests

Inside the vast exhibit hall of Intel ISEF, wide banners hang above the rows of student displays, identifying the 14 categories in which finalists compete. At the 2004 fair, engineering generated the most entries with 192 projects. On the other extreme was gerontology, with 29. But no matter what the topic, student researchers share a passion for research and an insatiable curiosity about the world around them. Earth and space sciences finalists go even farther, investigating questions about other planets and distant stars.

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-curing cancer, designing fuel-efficient vehicles, being the first to solve a mathematical problem, or helping the blind have greater access to information. To read about a sampling of student projects, click on these themes.

- Searching for Cures: Medical researchers investigate everything from common health concerns to possible cures for rare diseases.
- Improving Quality of Life: Projects that focus on adaptive technologies offer new ideas for people facing physical challenges.
- Creating a Cleaner Planet: Environmental projects search for solutions for problems affecting the natural world.

Return to the Student Projects

Intel ISEF

Reaching Out to Younger Students

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. Outreach efforts in Oregon for 2004 were a collaboration of Intel Public Affairs in Oregon and Arizona, the Intel Foundation, and a nonprofit organization in Oregon called Saturday Academy.

The Intel pilot project for 2004 recruited middle school students from four Oregon school districts to participate after-school science clubs. Students developed their own research projects, then presented them to judges during an event that took place during Intel ISEF. The middle school event was affiliated with the Discovery Channel Young Scientist Challenge.

Participating schools enroll a high percentage of students who are traditionally under-represented in science competitions. "This is a way to build interest," explains Morgan Anderson with Intel Public Affairs in Oregon, "and get more students thinking about science fairs by the time they reach high school."

Middle school students presented their research projects.

"Without this experience, my students would not think they could ever compete in an event like Intel ISEF," said Rebecca Hall, a science teacher and after-school science club coordinator at Five Oaks Middle School in Beaverton, Oregon. Part of the pilot program this year, Hall said her students "have gained so much confidence. They're motivated. This experience has opened up the whole world of science fairs to them."

Using an after-school curriculum developed for the pilot project, Hall introduced her students to inquiry-based activities, then helped them develop their own project ideas. The informal after-school club gave teacher and students time to develop "a personal connection," Hall added. "In a school of 1,100, these students now have a teacher they know well."

Students' confidence soared as a result of the experience.

For middle school teachers thinking about starting an after-school science club, Hall offers some advice: "Start small. Expect it to be a learning experience the first year and build from there. And recruit students who love science. This will open so many new opportunities for them."

Return to the Student Projects

intel innovation in education

Return to the Student Projects

Intel ISEF

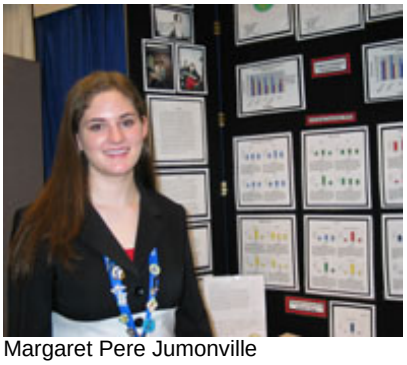
Searching For Cures

Student scientists who investigate issues in health and medicine are motivated by the chance to offer new solutions to health problems. Their research could improve and possibly even save lives. Some students tackle everyday concerns—the contamination of drinking water stored in reused plastic bottles or the effects of chlorine on the lung function of swimmers. Others search for cures for cancer or Alzheimer's disease, or explore treatments for arthritis or diabetes. Here's a look at projects that may someday improve public health.

Soothing Strained Voices

Margaret Pere Jumonville, 15, a freshman at Saint Joseph's Academy in Baton Rouge, Louisiana, focused her research on something that affects her own life. "I'm a singer, so I've always been concerned about abusing your voice. Singers make a habit of drinking water, but I wanted to find out if hydration really makes a difference." Her medicine and health project, "Got Abuse? Get Water! Vocal Abuses and Effects on Fundamental Frequency and Vocal Quality," included research in a computerized speech laboratory at Louisiana State University.

Jumonville studied vocal abuse among three test populations: singers, teachers, and children. "Vocal abuse is any action that's harmful to the vocal folds. Most singers are aware of this. Teachers suffer a lot of vocal abuse from talking all day long, and often in a loud voice. Children can abuse their voices by yelling on the playground." Once she learned how to use the specific computer programs that suited her research needs, Jumonville proceeded to measure and analyze five parameters related to frequency and amplitude. The findings surprised her. "I had a lot of problems with my singers. They didn't follow the patterns. Because I'm a singer, I know that they can control their voice, especially when it's under stress. It turns out that singers were not experiencing as much vocal abuse as a teacher would from talking in a loud voice throughout the day." Child subjects showed a measurable increase in vocal abuse by the end of the school week. Her conclusion? "Vocal abuse does harm vocal folds, and hydration is proven to help restore the folds to relatively normal function. So getting in the habit of drinking water every day would help to ward off vocal abuse."



Margaret Pere Jumonville

Tackling a Rare Disease

Sam Howell, 17, a senior at Saginaw Arts and Sciences Academy in Saginaw, Michigan, became interested in a rare and potentially fatal form of cancer when his older sister, Heather Boyes, was diagnosed with Lymphomatoid Papulosis (LyP). Because LyP affects such a small population, the disease receives little attention from researchers. There is no known cause or cure. Howell's research led him to hypothesize that the T-lymphocytes involved in the disease do not originate in the subject's body, but instead are of extraneous origin. His theory: fetal stem cells are transferred from fetus to mother during birth as a model of microchimerism.

Howell spent hundreds of hours doing laboratory work, both at his high school and at a university research lab where he analyzed DNA samples using polymerase chain reaction and electrophoresis. He faced challenges along the way as he pushed deeper into an area that few researchers have studied. But step by step, he obtained results that supported his hypothesis. When he reached a particular breakthrough that showed a DNA match, "I was ecstatic," he says. He was also surprised. He had expected to find a match between his sister and her third child. Instead, the evidence showed a match with her first child, a son. Through additional research, he found the presence of male cells in the female subject "which more definitively supports my hypothesis," he said.

Sam Howell

Since he began his project, Howell has found that researchers have good reason to focus on LyP. "This has wide applications. My research applies to other auto-immune diseases," he said, such as lupus and rheumatoid arthritis. In the course of the disease, papules on the surface of the skin wax and wane. "Specialists want to know how the body 'cures' these cancerous tumors," he said. Howell's long-term goal? "Developing targeted cell therapy" that will offer a cure.

Reducing Travel Risk

Marcus Cannon, 16, and Simeon Cannon, 16, cousins from Redeemer Baptist School in New South Wales, Australia, teamed up to research a potential health risk for air travelers. Their medicine and health project is called "Using Duplex Doppler Ultrasound Technique to Reduce the Risk of Deep-Vein Thrombosis Formation During Periods of Prolonged Sitting."

The students became interested in deep-vein thrombosis when they read about the incidence of pulmonary embolism, or blood clots, associated with air travel. “We read about a healthy 28-year-old woman who took a long flight from Sydney to London, then died from a blood clot. That’s what got us interested in this research,” said Simeon.

Simeon Cannon (Left) and Marcus Cannon

They started by developing a hydraulic foot pump to reduce the risk of deep-vein thrombosis last year, winning the Intel Young Scientists 2003 award for Australia. This year’s project extends their research, using ultrasound to measure blood flow velocity and graphic analysis to further understand their data. They have also refined their foot pump prototype, which uses bungee cords for resistance. Their goal is to make a product small enough to tuck into a purse or backpack and use for leg exercises during air travel, while seated at a computer, or during any period of prolonged sitting.

A key discovery in their research is that sleep appears to further increase the chances of blood clots. “That’s something that’s never been identified before,” Simeon said. Their quantitative analysis showed that sitting still for an hour leads to a 30 percent drop in blood velocity, and falling asleep leads to a further drop of 20 percent. Medical researchers have taken an interest in their project. That means the students will be able to continue their studies in a hospital setting, analysing whether oxygen levels also affect blood flow.

Return to the Student Projects

Return to the Student Projects

Intel ISEF
Improving Quality of Life

Improving the quality of life for people living with physical challenges is the goal that motivates many young scientists, engineers, and inventors. Here's a look at projects that focus on the development of adaptive technologies.

Technologies for the Visually Impaired


Ahmad Shakir Manshad

Ahmad Shakir Manshad, 14, a sophomore from Las Cruces High School in Las Cruces, New Mexico, says the inspiration for his project came from a startling statistic. "I read that every single minute, someone in the United States would become blind or visually impaired. There are already 10 million blind or visually impaired people in this country. I also learned that millions of the visually impaired report they use the Internet." Manshad's computer science project, "T-Web: The Talking Web Browser for the Blind and Visually Impaired," offers users an interactive, easy-to-navigate experience of surfing the Web. To make his project work, he had to develop a new Web browser and program it to interact with a text-to-speech component. That enables the computer to read aloud whatever information the user selects from the screen. "I wanted it to be very interactive for the user. I wanted to make sure it was comfortable to use, so the user would never get lost. Ease of use was way up there," he says.

Manshad's research included analyzing existing Web browsers for the visually impaired, then making his own, improved browser. Although he had taken some computer programming classes at his high school, he had to teach himself a powerful programming language to achieve the results he wanted. "When I got the browser to work the first time, I was so happy. Then all I had to do was make it talk." Manshad plans to continue working on his project, making further refinements. "I would like to have more users test it so I can get more feedback and identify and solve any problems." Initial feedback lets him know he's on the right track. "One user, who is blind, told me he enjoyed using the T-Web because it's more interactive than other browsers."

Another student took a different problem-solving approach to assisting the visually impaired. Felipe Fischborn Pohren, 20, is a junior at Escola Tecnica Estadual Monteiro Lobato in Taquara, Rio Grande do Sul, Brazil. His project is called "Computers Applied to the Social Inclusion of Visually Handicapped People." Pohren's engineering project transmits information from a computer to a Braille converter. By converting what's on the computer screen to Braille, he says, the user gains access to the wider world of information now available online. "The user gains a greater opportunity to learn and can overcome social isolation," he says. He anticipates that his project could have applications for creating new learning opportunities. "The blind or visually impaired can use this to write, take tests, read the Web," he says.

Designing a Robotic Bed


Daniel Rubino(Left) and Jose Alejandro Riedel

Ideas for interesting projects can come from unexpected sources. For Jose Alejandro Riedel, 19, and Daniel Martin Rubino, 18, both seniors at Technician School No. 9 in Buenos Aires, Argentina, the inspiration for their "Orthopedic Robotics Bed" came during a hospital visit to see an ailing grandparent. "We saw people restricted to hospital beds who are quadriplegic. We thought we could use electronics in some way to make their life a little better," explains Riedel.

Their engineering project combines microcontrollers, sensors, and electronics to turn an ordinary bed into a user-controlled environment. Depending on his or her physical abilities, the user can activate signals using voice commands, tapping on a controller, or blowing into a microphone. "This will allow them to control things like the lights in the room," Riedel explains. Users could select music or other electronic entertainment, or change the volume or channel. "To those without disabilities, these may seem like easy things. But to a person who spends all day, every day, in a hospital bed, this makes him a little more independent. This might be a great thing," Riedel adds.

The students developed a prototype that is designed to turn any bed into a robotic bed. "You don't have to buy a special bed. We also made it low voltage, so that our system could work off a car battery," Riedel says. The teammates had to overcome a number of technical challenges to make their prototype work. But the efforts were worthwhile when they asked a user to test their communications device. "He was very excited

about the possibilities for this," Riedel says.

Getting a Lift


Blake Price

Blake Price, 17, a junior at Happy High School in Happy, Texas, became interested in the health risks that falling poses to older people after his science teacher's grandparent suffered a broken hip as a result of a fall. His engineering project, "The Lift Assist: Second Edition," uses mechanical engineering and electronics to provide a solution.

Using Price's prototype, a person grabs onto two levers, pushes a button to start the battery-powered motor, and is slowly pulled to an upright position. The device can be used with any type of seat, including a soft couch. Unlike existing lift-chair devices, which propel users out of their seats, Blake's product continues to offer support once the user is standing. "If an older person is medicated, he or she might have trouble with balance. This gives them time to get steady." The motorized levers also offer assistance to users who lack upper-body strength.

Price did user testing with his target audience and continued modifying his design to make improvements. "I was concerned about ergonomics and wanted to be sure my product would be safe." The best part of the process, he said, "is the chance to make something new that solves real problems."

Return to the Student Projects

Return to the Student Projects

Intel ISEF

Creating a Cleaner Planet

Students from diverse communities turned their attention to a wide range of environmental topics—from the reforestation of a landfill to alternative energy sources to the dangers posed by road salt.

Recycling Plastic Waste

Students on opposite sides of the globe came up with different strategies to solve the same issue: recycling styrofoam waste products safely.

Mariela Campos (Left to Right), Giannina Tedesco, and Maria del Rocio Romero

In Costa Rica, three students from Academia Teocali in Liberia, Guanacaste, decided to tackle a problem they see with their own eyes. “We live in a coastal area where tourism is important, and we see styrofoam containers left along the streets,” explained Giannina Tedesco, 16. Through research, she and fellow team members Maria del Rocio Romero, 15, and Mariela Campos, 15, learned that burning styrofoam releases a gas that contributes to global warming.

Romero noticed that a container made of styrofoam started to break down when it was filled with orange juice. That led to the hypothesis that essential oil extract, D-limoneneit, could be used as a non-toxic organic solvent to break down solid polystyrene waste through distillation. Extracted styrene could then be used to produce polystryrene or expanded polystyrene. This could have economic benefits for developing countries, where styrene often has to be imported. Essential orange oil is a product of Costa Rica. Using the product for a new purpose “could be a local solution to a problem of global importance,” said Romero.

In Taiwan, Chinese Taipei, Yu-Chen Cheng, 17, was similarly motivated to find an environmentally sound method for dealing with polystyrene waste. She developed a method for converting expandable polystyrene (EPS) wastes into EPSR (EPS rubber). Her treatment model resembles a miniaturized water treatment plant. The economical processing method recovers copper, which can be used in industry. She also found that EPSR wastes could be mixed with calcium carbonate to produce a solid decorative material, similar to modeling clay, yielding new and creative uses for material that typically winds up in landfills.

Alternative Energy Ideas

For Arthur J. Petron, 18, a senior at Dallastown Area High School in York, Pennsylvania, risk-taking is part of the process of invention. “If you’re not taking a risk, you’re not going anywhere,” he said. For his engineering project, “Hydrocarbon Production Through Electrical Ionization,” he designed a chamber filled with hydrogen gas to produce synthetic hydrocarbons—an idea that could generate an alternative energy source.

Arthur J. Petron

Petron initially considered working on the design of hydrogen fuel cells, “but then I decided to approach the problem more directly. Creating an alternative source like this would decrease our dependency on other countries for petroleum-based fuels, and could have environmental and economic benefits.”

One of his biggest challenges was finding a lab willing to let him run tests. “My experiment is kind of volatile,” he admits, given that it involves hydrogen gas and electric sparks. A researcher at York College finally agreed to give him lab time. “His only condition was that whenever I did a combustion trial, I had to tell him in advance.” Petron’s most satisfying research moment? “Putting the chamber in the hood, turning it on, and not having it blow up.”

His dream career, Petron says, is becoming a researcher with his own lab. “I could spend as much time as I want there and come up with new things.”

Water Quality

Water quality is a topic that engages the interest of many students, leading to a wide variety of projects. Quintisha Marie Walker, 16, a sophomore at Saginaw Arts and Sciences Academy in Saginaw, Michigan, focused her attention on the effects of dioxin contamination in the Tittabawassee River. She took water samples upstream and downstream from a chemical plant site, and also compared toxicity of water samples taken at different times of the year.

Walker next used sea urchin embryos to study the developmental effects of exposure to contaminants. “Sea urchin embryos are useful for developmental studies because they are transparent,” she explains. Using a digital microscope, she photographed the developing embryos and analyzed the slides visually. Walker says some people jump to the conclusion that their health problems are the result of water contamination. She prefers to use scientific methods “to break down the claims and get more specific information.” Her long-term goal, she says, “is to use science to help the world. I want to make a contribution.”


Quintisha Marie Walker

Three students from Wusong High School in Shanghai, China, started their environmental science research by seeking to restore a creek on the school grounds. Yajia Lu, 19, Yi Zhang, 18, and Chen Lin, 18, went on to conduct a scientific study of the ecological treatment of small, shallow eutrophic waters. Their resulting strategies involve physical, ecological, and environmental engineering. The young scientists say they are attracted by “the precision of science and the art of innovation.”

Return to the Student Projects

Intel ISEF

Meet the Educators of Excellence 2004

Exchanging Ideas a Goal of Intel ISEF Excellence in Teaching Awards

Five exceptional high school science teachers from four continents shared classroom strategies and effective ideas for project-based learning during the Intel International Science and Engineering Fair. Winners of the 2004 Intel ISEF Excellence in Teaching Award are from Argentina, Japan, and Ukraine, along with Colorado and Florida in the United States.

Each teacher received an all-expense-paid trip to Intel ISEF in Portland, Oregon, along with a US$3,500 prize. In addition, each winner is invited to request up to US$10,000 in funding from the Intel Foundation for a proposal to replicate program ideas in additional schools. Intel has sponsored the Intel ISEF Excellence in Teaching Award since 1997.

Fostering an exchange of ideas is a primary goal of the award, which recognizes outstanding teachers who use project-based learning to engage students in the study of science and mathematics. Winners presented workshops about their effective methods and programs during the Intel ISEF Educator Academy. The academy brings together select educators and government participants to observe how young people from all over the world explore science and math. Academy participants use demonstrated methods to increase the effectiveness of science fair competitions and promote the inclusion of authentic research projects in the mathematics and science curriculum.

Read more about the winners of the 2004 Intel ISEF Excellence in Teaching Award:

- Maria Adela Moyano de Burt, Escuela de Comercio Republica de Panama, Concepcion City, Tucuman Province, Argentina
- Akihiko Shindo, Okayama Ichinomiya Senior High School, Okayama, Japan
- Paul Pshenichka, Chernivtsi City Lyceum #1, Chernivtsi, Ukraine
- Roberta Tanner, Loveland High School in Loveland, Colorado
- Wafa Khalil, MAST Academy High School in Miami, Florida

Return to the 2004 Educators

Intel ISEF

Argentine Students Improve Quality of Life


Maria Adela Moyano de Burt

Maria Adela Moyano de Burt teaches biological sciences at Escuela de Comercio Republica de Panama, a high school in Concepcion City, Tucuman Province, Argentina.

Now in her 33rd year of teaching, she launched the Technological-Scientific Thought Challenge 12 years ago. The program takes a multidisciplinary approach to problem solving, involving a wide section of the diverse community in improving the quality of life in rural Argentina. Students of a wide range of ages work with teachers, community members, and volunteers from universities and industry on research projects in the environmental, health, and behavioral sciences.

Recent projects have focused on creating specialized health care centers, establishing a drinkable water distribution system, creating an archaeological museum, designing a greenhouse from plastic water bottles, and using indigenous plants to develop ecological dyes for fibers. Focusing on issues of local importance is critical, she says. “Comprehension starts with our situation. From the local problems, we can go out to look at global issues. Then we can compare our situation with problems happening around the world.”

When students use their research skills and creativity to tackle local issues and help overcome community challenges, she adds, “they develop their own competence and their own identities.”

Moyano de Burt also directs a regional science fair that celebrates student successes and showcases community solutions. She has had many students participate in Intel ISEF and other international events. Such experiences offer students more opportunities for sharing ideas and collaborating.

Moyano de Burt has replicated the program in other communities in Argentina and continues expansion efforts.

Return to the 2004 Educators

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Return to the 2004 Educators

Intel ISEF

Integrating Math and Science in Japan


Akihiko Shindo

Akihiko Shindo teaches biology at Okayama Ichinomiya Senior High School in Okayama, Japan. In 2002, the school was named a Super Science High School by the Japan Ministry of Education for its development of integrated science and mathematics education.

Shindo introduces tenth-graders to the fundamentals of scientific research during a four-day science camp with the theme of "harmony between scientific technology and nature." The science camp experience offers students a chance to “learn things that cannot be learned in the classroom,” Shindo explains, “by engaging in field research.”

Traditional teaching methods are knowledge-based, with the teacher’s role to cover content. Doing field research, in contrast, means that students must initiate, plan, experiment, observe, and report on what they have learned. Assessments of student knowledge before and after the camp show clear growth in learning.

In eleventh grade, student teams build on their earlier field experience to design their own in-depth research projects. Finally, students present their research achievements at science contests and to academic societies. The effect, Shindo says, is an “overall improved motivation for learning,” along with the fostering of creativity and originality.

Seeing evidence of student growth is satisfying to Shindo, who hopes the program will help to develop a new generation of scientists. He is encouraged to see that interest in after-school science clubs is already on the increase. When he was in high school, he had a teacher who inspired him to pursue college studies in biology. A teacher’s influence can be long-lasting, Shindo says. “I felt it firsthand.”

Return to the 2004 Educators

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Return to the 2004 Educators

Intel ISEF

In Ukraine, Quasar Unites Students and Scientists


Paul Pshenichka

A teacher of physics since 1969, Paul Pshenichka of Chernivtsi City Lyceum #1 in Chernivtsi, Ukraine, says “the opportunity to interact with creative thinkers” is what continues to motivate him as a teacher.

More than a decade ago, he established a Youth Scientific Society called Quasar to give students opportunities to extend their research beyond the classroom. The learning environment is like “a small academy,” Pshenichka says, with students pursuing research projects in physics, mathematics, computer science, astrophysics, ecology, economics, and other fields. Students from the program participate in Ukrainian national and international scientific conferences and competitions.

Seeing how students interact in Quasar, where they investigate problems in depth and often work with university mentors, has convinced Pshenichka to take a more project-based approach to teaching in the traditional classroom. “Physics as a subject is divided into experiments and theory. It is mostly taught theoretically. That is boring for the students,” he says, “but a project starts with an experiment. That is initially very exciting. In the best experiments, the outcome is unknown. It’s an adventure.”

He has developed many experiments to introduce students to the principles of physics. Some are simple enough so that students can do them at home, with no sophisticated equipment. The experiments “generate the mind of the students,” he explains. “Every student generates his own solution. Some take a different approach, using new ideas to solve problems.” As student thinking becomes more sophisticated, students’ projects “develop into high scientific projects.”

Pshenichka is co-author of the physics textbook *Physics: A Step in the Next Century,* which includes many examples of his classroom experiments.

Many of his former students have gone on to launch careers in science, including researchers at Princeton University, University of Wisconsin, and in industry. Now, these alumni are mentoring Pshenichka’s current crop of students, helping to create the next generation of young scientists.

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Diverse Students Develop Microcomputer Projects


Roberta Tanner

In an innovative high school course about electronics, Colorado science teacher Roberta Tanner takes her students into brand-new territory. Students enrolled in Microcomputer Projects at Loveland High School design, build, program, and troubleshoot their own electronic projects. In the process, says Tanner, an Intel ISEF Excellence in Teaching Award winner for 2004, “students get to learn something they’ve never studied in school at all. It’s fun to see them excited about learning.”

An engineer at IBM before she shifted to teaching high school physics 13 years ago, Tanner says the Microcomputer Projects elective was an outgrowth of her physics classes, where she often matches students with local engineers. “An engineer from Hewlett Packard asked me why the high school wasn’t offering any electronics or engineering classes. With help and inspiration from local engineers, I put together the course proposal,” she explains.

Developing the elective has meant plenty of learning for the teacher, whose background is in mechanical engineering. She asked questions, dug into technical documents, and found experts willing to help. “If I don’t know an answer, I tell my students we’ll figure it out together.” She has written a textbook that covers everything needed to launch a similar course, including resources for teachers and a text for students.

The only prerequisite for Microcomputer Projects: students have to have completed first-year algebra and geometry, and be enrolled in at least second-year algebra. “I want students who are interested in math,” she explains, “and at a level where they can think logically.” With no minimum grade-point average for admission, the course attracts a wide range of learners. Tanner’s strategy for teaching such a diverse group? “I start with the idea that no question is a stupid question. Students come in with no academic background in this subject. It’s my job to help them understand.”

She begins by introducing the whole class to the basics of electronics through hands-on learning. Next, students begin to work independently. They write specifications for the project they want to design, then proceed with building, testing, and improving their prototype.

Tanner encourages students to develop projects that come from their own interests. One student spent hours programming an elaborate multifunction timer, with at least nine different alarms and LED displays. Another was happy to build a simple but functional clock. At both ends of the complexity scale, Tanner says, developing a successful project “gives students a real sense of accomplishment. They learn problem solving, perseverance, and the importance of keeping documentation.” Students also learn from local engineers who volunteer as mentors.

One of Tanner’s favorite success stories involves a struggling student who returned for a fifth year of high school planning to pick up only enough credits to graduate. “He took Microcomputer Projects and did quite well in it. He decided to finish up the year, and he’s taking physics now. It’s so exciting to see a student who was doing very poorly become so motivated.”

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Florida Course Promotes High-Energy Learning


Dr. Wafa Khalil

In the Sunshine State of Florida, a former medical researcher has turned her interest in sustainable energy into a rigorous high school program focusing on solar power. Dr. Wafa Khalil, an Intel ISEF Excellence in Teaching Award winner for 2004, incorporates scientific thinking, mathematics, independent research, and creative problem solving in her solar energy classes at MAST Academy, a public magnet high school in Miami.

Developing her solar energy program, including state-approved curricula for two yearlong courses, has taken time and plenty of her own energy, she admits. “What makes it worthwhile is seeing the response of the students—their genuine interest, and how they want to take ideas in more depth. There should be no boundary for learning.”

Khalil proposed the solar energy elective eight years ago when she joined MAST Academy. The magnet school, with an enrollment of 550 students in grades 9-12, takes advantage of its waterfront location and technology infrastructure to focus on maritime and science technology. It’s also a place where new ideas are welcome, says Khalil, who credits a supportive administration for helping get her solar energy class launched. The first year, she had 35 students. The next, more than 100. Eventually, she developed a second-year program, Solar II, for students eager to continue with independent research projects and development of working prototypes for solar-powered products.

What strategies help make the program a success? “It’s hands-on learning, but I always put the minds on, as well,” Khalil says. “I don’t dilute the science because it’s project-based.”

The course integrates mathematics and science, and brings in “economics, politics, and effects of energy use on society. It’s a holistic approach,” Khalil explains, where students learn through “exploration and application.” Students begin with an analysis of long-term energy consumption patterns in their own homes and eventually go on to build solar collectors and design solar-powered products. They showcase their products in an annual event, Solar Celebration: The Sky is the Limit. Advanced students share their research and original thinking in a scientific symposium that attracts university researchers, energy company representatives, and interested community leaders.

Many of Khalil’s students enter their research and design projects in competitions such as Intel ISEF and the Intel Science Talent Search. “I don’t have to push my students to do their research. They want to be competent, to be knowledgeable. They love it,” she says.

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The Week in Pictures

The Oregon Convention Center in Portland, Oregon, was the gathering place for more than 1,300 high school students who assembled for the weeklong celebration of science known as Intel ISEF. At the 55th annual fair, finalists had the chance to talk with Nobel laureates, get acquainted with fellow students from around the globe, and explore the City of Roses. Take a look at the week in pictures.

The world's largest high school science fair filled the exhibition halls of the Oregon Convention Center.

Opening ceremonies included a multicultural, multimedia welcome.

Finalists from Peru were all smiles after their long flight.

Getting acquainted is all part of the experience.

Pin-trading tradition gives students a chance to mingle.

Like Olympic athletes, science fair finalists trade souvenir pins from around the world.


Intel CEO Craig Barrett welcomes finalists to Portland.


Intel CEO Craig Barrett gets acquainted with finalists.


Mason Hedberg (right) and Intel CEO Craig Barrett exchange greetings. In addition to being an Intel ISEF finalist, Hedberg is winner of the 2004 Intel Science Talent Search.


Students, teachers, and CEO-all share a passion for science.


Archaeologist Anna Roosevelt of the University of Illinois Chicago spoke with students after a panel presentation on Excellence in Science and Technology.


Students were eager to talk with Nobel Laureate Dudley Herschbach.


Nobel Laureate Richard Roberts spoke with students about his research in medicine.


The Jefferson Dancers from Portland entertained finalists.

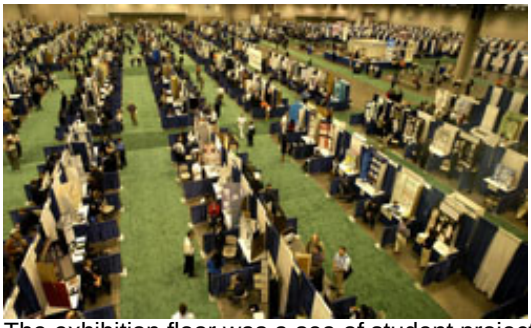

The Jefferson Dancers changed costumes for their second number.


Obo Addy & Okropong, a National Touring Company of Traditional Music and Dance of Ghana based in Portland, performed traditional Ghanaian dance and music.

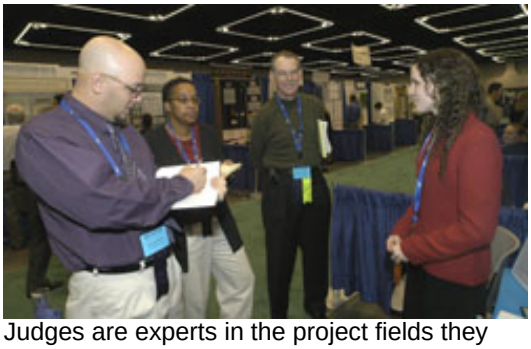

High-engergy dancing was a crowd pleaser.


Intel ISEF finalists joined the festivities on stage.


Dancers created a larger circle to include Intel ISEF students.

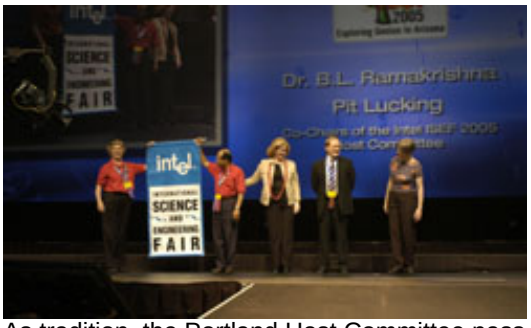

The exhibition floor was a sea of student projects, organized by categories.


Judges discussed the task of evaluating students' research.


Judges are experts in the project fields they evaluate.

Judges look for quality of presentation along with excellence of research.

To cap off an exciting week—the Grand Awards Ceremony.



As tradition, the Portland Host Committee pass the Intel ISEF Banner to the Phoenix Host Committee for Intel ISEF 2005.

Intel ISEF finalists erupt in cheers as confetti rains down on the top three winners at the conclusion of the Grand Awards Ceremony.

Intel ISEF Judging Process Brings Rewards

Meet the Winners | Student Projects | Teachers of Excellence | 2004 Photos | Intel ISEF Judges

Tense but eager young faces fill the exhibit hall at Intel ISEF when the day for project judging finally arrives. After months of research and weeks of preparation, it's showtime.

Each finalist answers challenging questions posed by 10 or more judges during individual interviews. In their search for excellence, judges evaluate such factors as quality of research, creativity, thoroughness, data analysis, and presentation quality. The 1,500 judges who roam the exhibit hall, electronic scan pads in hand, are all experts in their fields. Each holds a Ph.D. or has spent at least six years working in a specialty field.


Judging day bring finalists and judges face to face.

What's the experience like from the judges' point of view? Steve Pawlowski, an Intel Fellow and veteran Intel ISEF judge, describes the process: "You walk up to a project that a student has been working on for a year. In 10-15 minute time frame, you try to get as smart as you possibly can about what the student did in order to make a rational assessment of how good this is."

Being a judge brings its own rewards. "I always come away smarter, more knowledgeable, with new ideas in terms of how to do things in a completely different way," says Pawlowski. "I learn a lot. I get exposure to some pretty interesting and fascinating projects. I'm sure I get more out of it than I give," Pawlowski says.

John Birchak, a manager in the Knowledge Solutions Group of Intel and also a long-time judge, says he is amazed each year to see "so many wonderful, gifted, bright-eyed, inquisitive, self-motivated students, and so many great and interesting projects." His biggest challenge? "So little time." He makes a point to tour the project displays again during the public exhibition so that he can ask students more questions in an unofficial capacity. "My son and I spend the entire public day talking with students. I love learning about and sharing in the excitement, interest, explorations, discoveries, hard work, and dreams of every student I talk with."

Judges come away from the event "feeling good about the next generation of scientists," says Birchak. "The level of accomplishment by the best and brightest continues to amaze me."


John Birchak

At the same time, Birchak adds, "I worry that too many kids are being left behind. There are too few opportunities for talented kids who lack access to resources and encouragement from parents, teachers, and mentors." Pawlowski acknowledges that his own children's school district is not yet involved in promoting science fair activities. "This is a fantastic program," he adds, "but kids who don't know about the opportunity will never be able to take advantage of it."

It's only natural that many judges wind up sounding like ambassadors for Intel ISEF. They get to hear for themselves the excitement and enthusiasm that students share about their research experiences. And although not every finalist comes away with an award, all students have the opportunity to discuss their work with knowledgeable experts. Often, judges ask questions that help students consider different directions for their future research. The unofficial slogan among judges? "Select the best and encourage the rest."

back to top