Intel International Science and Engineering Fair

A program of Society for Science & the Public

From the Search for Alternative Energy Sources to Cancer-fighting Compounds...

The future is in good hands.

No place is this more evident than at the Intel International Science and Engineering Fair where more than 1,500 budding scientists gather each May to present cutting-edge research to esteemed judges and vie for nearly $4 million in scholarships to continue their studies.

These young innovators – winners of local and regional competitions around the globe – have not taken the easy road. Instead, they have tackled the tough issues of the day: the quest for alternative energy sources and strategies to reduce environmental impact; studies on medical conditions and ways to eradicate disease and suffering; the development of technology that sheds light on the mechanics of the universe or simply improves day-to-day life for us all.

Meet some of the innovators at Intel ISEF 2009:

Bruno Oliveira Buzo, Brazil
To reduce the incidence of skin cancer among low-income populations, Oliveira Buzo developed an inexpensive sunscreen using a South American plant extract.

Anna Simpson, USA
Simpson built a robot capable of autonomously navigating dangerous sites and detecting hazardous chemicals.

Francesco Marcuzzi, Massimiliano Andreetta and Sabrina Grassi, Italy
This team developed a safe, affordable way to reclaim soil contaminated by heavy metals: introduce toxin-absorbing plants.

Kin Israel Notarte, Karina Louise de la Cruz & Jamie Mananquil, Philippines
In their search for potential anti-cancer compounds, this team studied the effect of marine algae on sea urchin embryos.

Nathan Monroe, USA
To reduce reliance on fossil fuels, Monroe developed a polymer solar panel that can be sprayed onto virtually any surface to generate energy.

Bruno Oliveira Buzo, Rio Claro, Brazil

In Brazil, the incidence of skin cancer has risen dramatically in recent years. Additionally, studies have shown that low-income populations are disproportionately affected by the disease, partially due to the high cost of sunscreens.

To address this problem, Bruno Oliveira Buzo set out to develop an inexpensive sunscreen using an extract of a plant believed to hold promise as a potential sun filter: Bixa orellana, also known as the aciote, urucu or “lipstick” tree. This tree, native to tropical regions of the Americas, has long been valued for its production of annatto, a substance used historically for everything from body paint and lipstick to spicing up dishes and treating ailments.

In his research, Oliveira Buzo experimented with a variety of methods to isolate Bixin, the active substance from the plant, and determine its grade of purity. Through another series of laboratory tests, the young

scientist was able to demonstrate that Bixin can be as effective as existing chemical and physical sun filters, making it a viable, low-cost alternative to existing options.

back to top^

Anna Simpson, San Diego, California, USA

Anna Simpson has been “hooked on robotics” since her involvement in a FIRST LEGO* League Challenge – focused on the Mars rovers Spirit and Opportunity – way back in fifth-grade. Perhaps it should come as no surprise then that Simpson chose robotics for her research.

Specifically, Simpson designed and built an autonomous robot capable of navigating dangerous sites and detecting hazardous chemicals. When the robot is deployed, it moves into risk zones where it locates a spill, sucks in vapor, detects any harmful agents present and communicates an alert. Simpson, who spent two years working on the design and self-taught herself the intricacies of circuitry, says the robot’s program can be adapted to implement a variety of algorithms for search and response. The result: a variety of life-saving applications in industry, security and counterterrorism.

And, yes, Simpson’s design does incorporate LEGO* bricks.

back to top^

Francesco Marcuzzi, Massimiliano Andreetta and Sabrina Grassi, Udine, Italy

To reclaim soil contaminated by heavy metals, Francesco Marcuzzi, Massimiliano Andreetta and Sabrina Grassi developed a safe and inexpensive approach to removing toxins: introducing vegetation.

Specifically, Marcuzzi, Andreetta and Grassi examined the toxin-absorption abilities of two plants, *Thlaspi caerulescens* and *Nicotiana tabacum*, when exposed to the contaminated soils of Torviscosa, Italy, an area known for polluted soils and a high incidence of cancer after years of abuse by the chemical industry. They studied the growth of these plants in varying samples of polluted soil and then analyzed plant materials at the end of each plant’s life cycle. Lab results showed that *Thlaspi caerulescens* was particularly effective in absorbing toxins from the soil, resulting in its classification as a “hyperaccumulator.” *Nicotiana tabacum* also absorbed toxins from the soil, but produced more biomass.

Marcuzzi, Andreetta and Grassi believes that genetic alteration of these plants could further enhance their ability to absorb toxins from polluted soils and provide a safe, affordable method of land reclamation.

back to top^

Kin Israel Notarte, Karina Louise de la Cruz & Jamie Mananquil, Dumaguete, Philippines

In an effort to identify potential anti-cancer compounds, Kin Israel Notarte, Karina Louise de la Cruz and Jamie Mananquil examined the effect of marine algae on the mitotic inhibition of sea urchin embryos.

Crude extracts of algae were applied to *Tripneustes gratilla* sea urchin embryos, and the mitotic inhibitory effect was examined through cell stage. Statistically significant results were obtained within hours. *Portieria hornemannii*, red algae previously reported to have anti-cancer properties, caused nearly complete mitotic inhibition compared to the control. *Laurencia papillosa*, *Caulerpa racemosa* and *Gracilaria arcuata* showed strong inhibition. *Sargassum cristaefolium*, *Halimeda discoidea*, *Codium geppiorum* and *Laurencia thuyoides* showed slight or no inhibition.

Because sea urchins are related to humans, sharing more than 7,000 genes of the human DNA sequence, this research may help to identify new treatments for cancer.

back to top^

Nathan Monroe, Ponte Vedra Beach, Florida, USA

Motivated to reduce reliance on fossil fuels, Nathan Monroe investigated the viability of inexpensive, lightweight, “plastic” solar cells that can be used virtually anywhere to create solar energy.

Monroe’s research involved developing a liquid polymer that can be sprayed or painted onto any surface to create a photovoltaic cell. This process is cheaper, but also less efficient than the existing silicon standard.

As a result, Monroe experimented with various production techniques, adjusting variables such as polymer thickness and nanofiber length. He found that increases in nanofiber length resulted in statistically significant increases in efficiency.

So far, Monroe has successfully employed his solar technology on the bill of a baseball cap, now capable of recharging an iPod or cell phone. But one day, he envisions his solar cell paint being used to power cars, buildings and maybe even the International Space Station. After all, transporting a can of liquid polymer into space is infinitely less complicated and expensive than the current method of transporting a payload of large, fragile silicon panels into orbit.

back to top ^

Intel ISEF in "The Biggest Little City in the World"

More than 1,500 young innovators gathered in Reno, Nevada, in May, 2009, to compete in the world's largest pre-collegiate science fair, the Intel International Science and Engineering Fair, a program of Society for Science & the Public. Representing 51 countries, regions and territories, these young scientists and mathematicians earned top honors at local and regional competitions in order to qualify for the 2009 Intel ISEF competition.

During their week in Reno, students presented original research projects to panels of esteemed judges and competed for nearly $4 million in scholarships and awards. They also shared their work with the media and the public, and participated in event activities, including the annual ISEF pin exchange and a student social.

Throughout the event, students had the opportunity to befriend other participants from around the world and interact with distinguished professionals in their fields of study. The latter included rubbing elbows with Intel Chairman of the Board Craig Barrett, who visited with young scientists on the convention center floor to learn more about their projects and the inspiration behind them. Watch video ›

Take a look at their week in pictures:

Students from Cuba getting ready for Intel ISEF 2009.
Number of Pictures: 1 of 17

Intel ISEF participants from Jordan set up their science projects.
Number of Pictures: 2 of 17

Intel ISEF participant from China sets up his science project.
Number of Pictures: 3 of 17

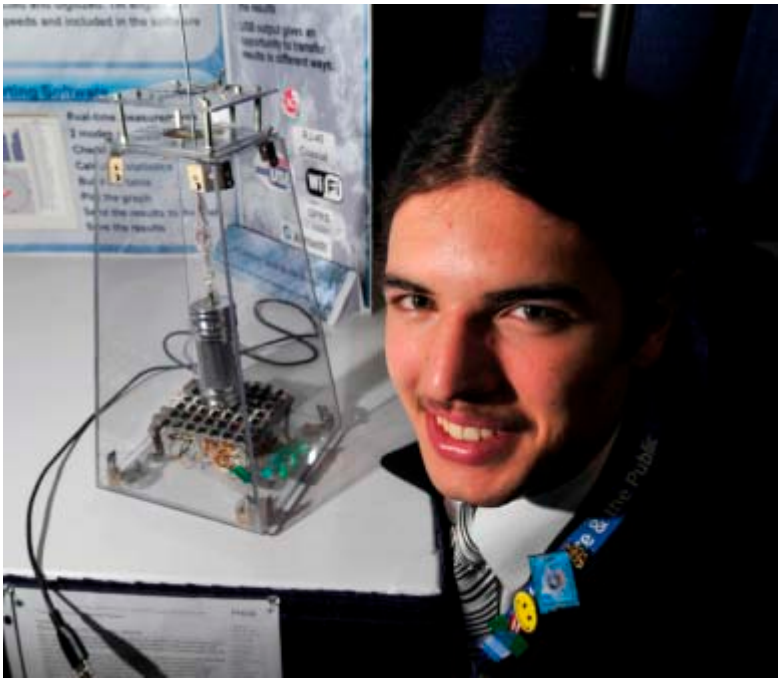
Intel ISEF Students teaming up for science!
Number of Pictures: 4 of 17

Students from the Philippines proudly display their country flag.
Number of Pictures: 5 of 17

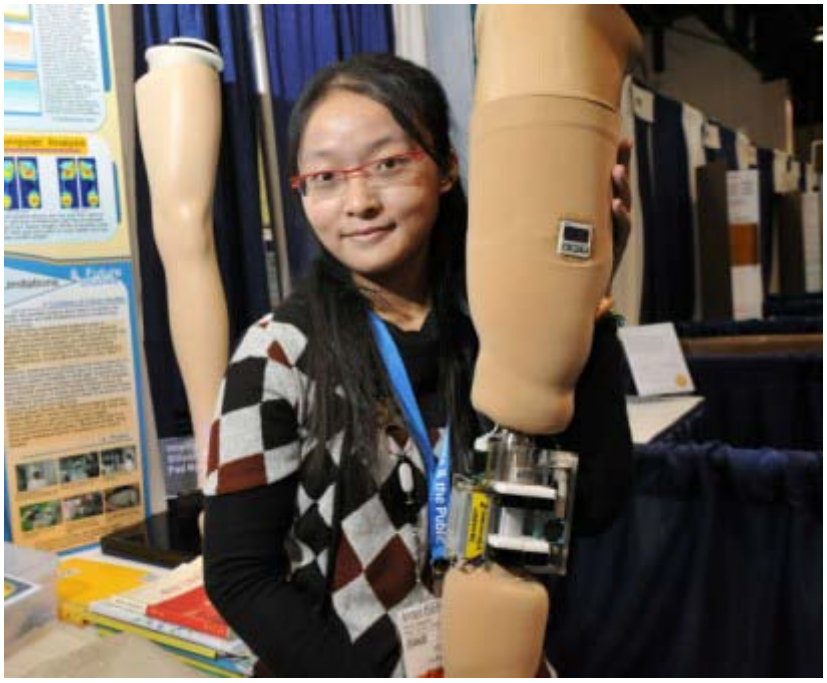
Intel ISEF Students mingling and getting to know each other before the event opens.
Number of Pictures: 6 of 17

Bird's eye view of the Intel ISEF exhibit floor in Reno, NV.
Number of Pictures: 7 of 17

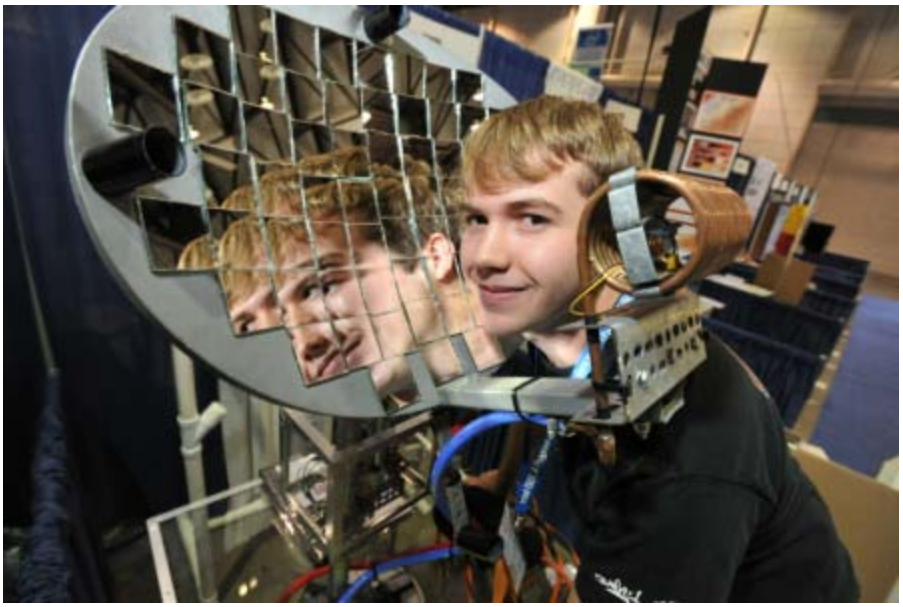
Intel ISEF participant interviewed by the media.
Number of Pictures: 8 of 17



Olexandr Olenyev from Ukraine with his “Versatile Wind Velocity and Direction Transducer.”
Number of Pictures: 9 of 17

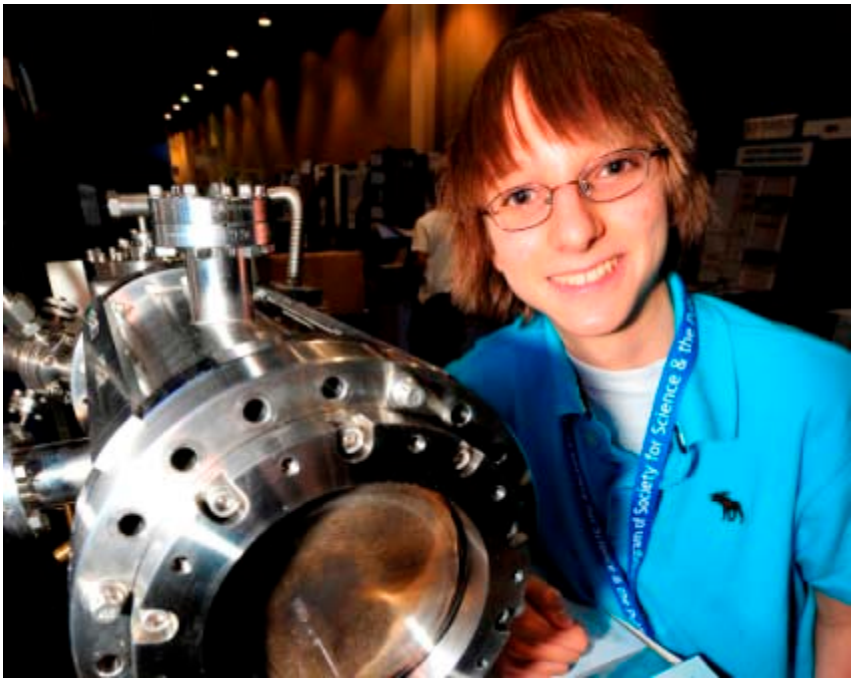


Ying Pan from China with her project - "Suction Socket Fit Improver: Intelligent Variable Silicone Rubber Pad Technology for Above-Knee Prostheses.".
Number of Pictures: 10 of 17



Seth Fisher from Bernville, PA, with his Solar Heat Concentrator.
Number of Pictures: 11 of 17

Joshua Uhuotu Toluwani Ojapa and Funmilola Olanrewaju Lawal of Lagos Lagos Nigeria with their project – "The Design and Construction of a Fuelless Power Generator"
Number of Pictures: 12 of 17



Taylor Wilson from Reno, NV, with his Farnsworth Fusor: a machine that generates neutrons and demonstrates nuclear fusion reactions at a very low level.
Number of Pictures: 13 of 17

Intel's Chairman, Craig Barrett, learns about Brazil's project.
Number of Pictures: 14 of 17

Amy David from Pineville, WY, explains to Craig Barrett her research project – a study of how the brain is hit when a snow skier lands a jump. Amy is a competitive ski jumper and hopes to go to the Olympics one day.
Number of Pictures: 15 of 17

Student addressing Nobel Laureate panel.
Number of Pictures: 16 of 17

The 2009 Intel ISEF Top Three Winners. L-R: Li Boynton, 17, of Houston , TX; Tara Adiseshan, 14, of Charlottesville, Va.; and Olivia Schwob, 16, of Boston, MA
Number of Pictures: 17 of 17

The Intel Foundation Young Scientist Award Winners

On May 15, 2009, Tara Anjali Adiseshan, Li Sallou Boyntin and Olivia Catherine Schwob earned top honors at the Intel International Science and Engineering Fair when they received Intel Foundation Young Scientist Awards and $50,000 college scholarships.

In addition to these Intel Foundation Young Scientist Award winners, more than 500 Intel ISEF competitors received scholarships and prizes for their innovative research. This included 19 “Best of Category” winners who received $5,000 Intel scholarships and a new laptop powered by the Intel® Core™2 Duo processor. Intel also awarded $1,000 grants to the winners’ schools and the Intel ISEF-affiliated fairs they represent.

Tara Adiseshan, Charlottesville, VA, USA
Tara Adiseshan demonstrated that sweat bees and the parasitic nematodes that live inside them have been evolving in response to and in concert with each other since ancient times.

Li Boynton, Houston, TX, USA
Resolved to improve the quality of drinking water around the world, Li Boynton discovered that a bioluminescent bacterium may offer a safe and inexpensive way to test for a broad range of common water contaminants.

Olivia Schwob, Boston, MA, USA
In an effort to better understand how humans learn, Olivia Schwob examined the effect of mammalian gene expression on associative conditioning, a type of learning, in roundworms.

Tara Adiseshan, Charlottesville, VA, USA
Tara Adiseshan set out to solve an evolutionary puzzle when she conducted her research on the long-term relationship between sweat bees and nematodes (microscopic worms) that live inside them. Specifically, the 14-year-old junior at Ramana Academy, Charlottesville, VA, hypothesized that sweat bees and nemotodes, which demonstrate a symbiotic relationship, had been undergoing cospeciation, the process of evolving in response to and in concert with each other, since ancient times.

By examining genetic material from multiple species of sweat bees that host nematodes, Adiseshan was able to construct a phylogenetic tree for the bees and then compare the data with an existing phylogenetic tree for nematodes. The comparison of the congruent phylogenies showed clear evidence of co-cladogenesis, supporting the theory that the relationship between sweat bees and nematodes is ancient, with speciation events in the hosts resulting in speciation events in the symbiotes.

Adiseshan’s work provides a greater understanding of these organisms, as well as additional insight into evolutionary history.

back to top^

Li Boynton, Houston, TX, USA
Interests in environmental science and public health led Li Boynton to consider new methods for testing the quality of drinking water. Observing the limitations and significant expense of conventional chemical-specific tests, Boynton saw a need for a broader, more efficient assay for testing. This led the 17-year-old junior from Bellaire High School, Bellaire, Texas, to consider the non-pathogenic, bioluminescent bacterium *Vibrio fischeri* as a possible biosensor for contaminants.

Specifically, Boynton examined the effect of six common water contaminants – mercury, sodium nitrate, zinc sulfate, copper sulfate, the herbicide Atrazine and the pesticide Permetherin – on the bioluminescence of *V. fischeri*.

Results showed a clear correlation between the light intensity of the bacteria cultures and the presence and toxicity of contaminants, indicating that the bacterium may be viable as a fast, economical method of detecting a broad range of toxins often found in drinking water supplies.

Boynton's research could be significant in improving public health, worldwide.

back to top ^

Olivia Schwob, Boston, MA USA

Olivia Catherine Schwob has always been interested in cognitive science. As a result, her project, *How Worms Learn*, examines the effect of Mammalian gene expression on associative conditioning, a type of learning, in *Caenorhabditis elegans*, a small roundworm commonly used as a model organism in laboratory research related to humans.

Specifically, Schwob hypothesized that GAP-43, a mammalian gene proven to be associated with learning in humans, would improve learning in C. *elegans*. To test her theory, the 16-year-old junior at Boston Latin School, Boston, MA, extracted the gene from a mouse and used it to create a fusion protein construct which she then injected the gonads of *C-elegans* to create progeny expressing GAP-43. The results? GAP-43 significantly stimulated learning in the organism.

Schwob's research will help scientists better understand how humans learn and, one day, may even be useful in treating or preventing mental disabilities.

back to top ^