Neutrinos to buckyballs: 10 talents tower

America's oldest precollege science-scholarship contest has chosen the youngest first-place winner in its 58-year history.

Natalia Toro, 14, of Boulder, Colo., took top honors in the Intel Science Talent Search with a theoretical study of subatomic particles called neutrinos. Her project taps into one of the hottest topics in physics (SN: 1/30/99, p. 76). Toro is the first young woman since 1995 to win the premier award, this year a $50,000 scholarship.

Beaming and gripping the prize plaque, Toro seemed stunned by her selection at a March 8 ceremony. It came after a round of speeches and naming of runners-up, during which her hopes had flagged. "I was standing, thinking, 'It doesn't really matter,'" she recalls. "I just can't really believe it."

Toro used equations from quantum mechanics to derive results indicating that neutrinos swap identities. Her predictions agree with data obtained by physicists using a sophisticated detector.

The strong showing of quantum mechanics research carried into second place. David C. Moore of Potomac, Md., invoked quantum mechanics to model ultrasmall electronic switches made from molecules and determine their most effective structure. Moore is an Eagle Scout and competitive runner who also manages his school's computer network. He received a $40,000 scholarship.

Keith J. Winstein of Oak Park, Ill., placed third for some masterful digital sleight-of-hand. He researched ways to embed information imperceptibly into a stream of computer data, winning a $30,000 scholarship. A lover of music as well as computer science, Winstein co-founded a computing association and a jazz choir.

Carol A. Fassbinder of Elgin, Iowa, the fourth-place winner, investigated a potential new chemical control for a mite that threatens her family's honeybees and those of beekeepers across the nation. A patent on the compound is in the works.

Mathematics projects secured fifth and sixth places for Rio G. Bennin of Berkeley, Calif., and Lisa B. Schwartz of Roslyn, N.Y., respectively. Bennin developed a method of dividing a geometric figure such as a triangle into two equal parts. He has also twice won a national math competition. Schwartz explored patterns in two-way sequences of positive integers. She also edits two school publications.


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Natalia Toro describes her winning research.

The fourth- through sixth-place winners each received a $20,000 scholarship.

Capturing seventh place, Scott A. Fruhan of West Newton, Mass., found evidence that immune cells in multiple sclerosis patients attack a person's body with inflammatory hormones. Looking skyward, Kurt E. Mitman of McLean, Va., studied mysterious, fleeting blasts of energy from space known as gamma ray bursts. The eighth-place winner has submitted for publication a scientific paper he coauthored on the same topic.

Saddened that her ailing grandmother forgot her granddaughter's name, Diana Townsend-Butterworth of New York City sought a link between Alzheimer's disease and the heavy metal cadmium, work recognized by the ninth-place award. In 10th place, Alexander Wissner-Gross of New Hyde Park, N.Y., simulated the use of soccer-ball-shaped molecules, called buckyballs, for making minuscule electronic circuits.

Scholarships worth $15,000 went to the seventh- through 10th-place winners. Each of the remaining 30 finalists of the 1,470 entrants (SN: 1/30/99, p. 71) received a $3,000 scholarship.

All 40 finalists have bright prospects, says J. Richard Gott, a Princeton University astrophysicist who chairs the judges panel. Past finalists have won five Nobel prizes and a slew of other scientific honors. "If you are a baseball scout, you go out and watch people play baseball. We're testing what [students] actually do as scientists," he says.

The ceremony culminated 6 days full of judging and science activities. "This past week could be described as nothing short of amazing," said Cullen Blake, a student from Glenmont, N.Y., who was selected by his peers for an award in tribute to the recently deceased Glenn T. Seaborg (SN: 3/6/99, p. 147). The Nobel-laureate chemist judged and promoted the contest for 40 years. —*P. Weiss*

Motor cortex helps drive serial memory

In the brain, storing knowledge about the order of previously viewed information may make for a moving experience. A part of the brain's outer layer thought by many researchers only to control muscle movements also helps to discern sequence information in the absence of any bodily activity, a new study finds.

Memory of serial order facilitates many tasks, from dialing telephone numbers to inferring the meaning of what someone says in a conversation.

Thought and action mingle intimately in a network of brain areas that collectively store and remember sequential information, proposes a team of neuroscientists. In the March 12 SCIENCE, they report that the motor cortex plays an influential role in that network.

"The motor cortex is potentially involved in a number of different functions, each subserved by a different brain circuit," contends Apostolos P. Georgopoulos of the University of Minnesota in Minneapolis. He conducted the study with Minnesota coworkers Adam F. Carpenter and Giuseppe Pellizzer.

The researchers implanted microscopic electrodes in the brains of two monkeys. These devices recorded the electrical activity of 925 neurons in each animal's motor cortex.

While using a joystick to hold a cursor in the center of a computer screen, the monkeys saw from three to five yellow shapes presented one after the other until all the shapes were visible. One shape then changed its color to blue. To get a reward, the animals then had to move the cursor to the shape that in the initial sequence had immediately followed the blue one.

A majority of the 925 motor neurons changed their patterns of activity as each succeeding yellow shape appeared. The cells were just as active when the monkeys simply watched the shapes appear as when the animals moved the cursor with the joystick, the researchers say.

Moreover, groups of from 2 to 16 motor neurons often generated signature activity patterns as successive shapes were presented in a trial.

The abrupt shift of electrical activity in small populations of motor neurons as an animal goes from one item to the next in a list may assist in the process of forming a memory of serial order, Georgopoulos theorizes.

"These are exciting new findings," remarks neuroscientist James C. Houk of Northwestern University Medical School in Chicago. "I think of the motor cortex as involved in task execution, but it may well participate in memory for serial order."

Houk has helped to develop a model of the brain network that regulates memories for the order of sequenced information. That model features a part of the brain, the prefrontal cortex, that influences the ability to act on the basis of serial recall.

Although its precise functions remain unknown, the motor cortex may work with the prefrontal cortex to help forge serial-order memories, Houk suggests. —*B. Bower*