Student researchers win top STS awards

Inspired by a high school course on fractal geometry, Ashley Melia Reiter, 17, captured first place this week in the 50th annual Westinghouse Science Talent Search. A senior at the North Carolina School of Science and Mathematics in Durham, Reiter won a $40,000 scholarship for finding the dimensions of fractals generated by Pascal's triangle and its higher analogs.

Denis Alexandrovich Lazarev, 17, overcame a special obstacle to win second place in the competition, which is sponsored by Westinghouse Electric Corp. and administered by Science Service, Inc. When the Soviet-born teenager and his family emigrated to the United States two years ago, he knew fewer than 300 words in English. But a strong interest in biology prompted the youth to visit Columbia University, where a genetics researcher agreed to work with him after school. Lazarev, who attends Elmwood Park (N.J.) Memorial Junior-Senior H.S., won a $30,000 scholarship for investigating mechanisms by which ASF, a regulatory protein, helps control gene expression. He says his work may eventually lead to a method for preventing or treating certain genetic diseases.

Third-place winner William Ching, 17, from Riverdale Country School in New York City, landed a $20,000 scholarship. A talented computer programmer, Ching got his first taste of basic research while writing software for a university biomedical laboratory. Ching stayed on in the lab to learn neurobiology – an experience that led to his discovery that optic nerves contain a chemical receptor known as GABA-B. He also found that a related chemical boosts nerve conduction *in vitro* and shows potential for treating spinal injury and multiple sclerosis.

The winners were among 40 finalists who visited Washington, D.C., for the last stage of the competition, which initially drew 1,573 entries. A panel of researchers judged the students on their creativity and scientific potential. During their five-day stay, the finalists exhibited their work to the public.

Scholarships of $15,000 went to fourth-place winner Dean Ramsey Chung of Mountain Lakes (N.J.) H.S., who studied combinatorial geometry; fifth-place winner Ciamac Moallemi of Benjamin Cardozo H.S. in New York City, who developed a neural-network-based computer system to aid in diagnosing bladder cancer; and sixth-place winner Tessa Lorrell Walters of San Gabriel H.S. in San Dimas, Calif., who not only synthesized certain enzyme inhibitors found in snake venom and designed a more potent class of these inhibitors, but also verified that they lower blood pressure in animals.

Reiter

Lazarev

Ching

Westinghouse Electric Corp.

The judges awarded four scholarships of $10,000. Seventh-place winner Debby Ann Lin of Stuyvesant H.S. in New York City won hers for discovering an evolutionary link between a tick virus and certain strains of influenza virus. Eighth-place winner Yves Jude Jeanty of Stuyvesant identified telltale changes in cytoskeletal proteins that may indicate the ability of cells to move away after one collides with another. Ninth-place winner Jim Way Cheung of the Bronx H.S. of Science in New York City designed a computer program to test a new hypothesis in classical number theory. Determining how accurately a particular numerical model could simulate a climate phenomenon called the El Niño-Southern Oscillation earned a tenth-place win for Rageshree Ramachandran of Rio Americano H.S. in Sacramento, Calif. The remaining 30 finalists each won a $1,000 scholarship.

At Monday's awards dinner, President Bush said of the finalists: "All have created research projects which show how the trailblazers of today can be the heroes of tomorrow." – *R. Cowen*

Got no rhythm: Stalling biological clocks

Critically timed exposures to bright light can virtually shut off the human "biological clock" temporarily, according to a study reported this week. The finding, which confirms previous investigations with plants and insects, aids the development of mathematical models of the complex circadian rhythm that governs sleepiness, hormone levels, body temperature and other daily biological cycles, says Charles A. Czeisler of Brigham and Women's Hospital in Boston.

Mathematical models of circadian peaks and valleys in biological functions may also increase the precision of timed-light treatments for jet-lagged travelers and weary shift workers, Czeisler adds.

In 1989, his team found that five-hour-long exposures to bright light equivalent to sunlight, administered on three consecutive days when body temperature reached its nadir (around two to three hours before waking), shifted volunteers' biological clocks by up to 12 hours, inverting the daily cycle (SN: 6/17/89, p.374).

But more moderate light exposures equivalent to sunrise, administered for about 10 hours and centered around the body's temperature trough, nearly stop circadian-rhythm fluctuations in their tracks, Czeisler and his co-workers report in the March 7 NATURE.

The scientists studied 14 men, aged 18 to 29, in a sleep lab. They charted the men's resting biological cycles for about 40 hours, using body temperature and blood levels of the hormone cortisol. In 18 trials, volunteers went through either one 24-hour cycle with eight hours of darkness, seven of indoor-room light and nine of "sunrise" light, or two 24-hour cycles that each included eight hours of darkness, 11 of indoor light and five of sunrise light. Timing of sunrise exposures centered around each man's body temperature minimum – roughly 5 a.m.

On three trials, regular up-and-down shifts in body temperature and blood cortisol levels nearly stopped. On seven trials, temperature and cortisol cycles shifted unpredictably, with the rhythmic oscillations of one or both partially reduced. And on five trials, only one of the measures displayed a near suppression of oscillations, while the other showed a partial reduction. In three final trials, two men had nearly complete loss of temperature fluctuation and one had partial loss.

Much of the variability in response stems from a difficulty in pinning down the exact point at which light exposure turns off an individual's biological pacemaker, Czeisler says. For instance, one trial shifted a participant's circadian cycle by seven hours, with little effect on rhythmic oscillations. However, just an 18-minute shift in the timing of bright-light exposures during a second trial nearly erased oscillations in that man's body temperature and cortisol.

Biological clocks automatically reset as soon as volunteers left the lab and entered direct sunlight, Czeisler adds. Further work must establish whether behavioral changes accompany a near shutdown of circadian rhythms. Two men who experienced circadian suppression seemed to operate "on a more even keel, without any highs or lows" in mood, he remarks. – *B. Bower*