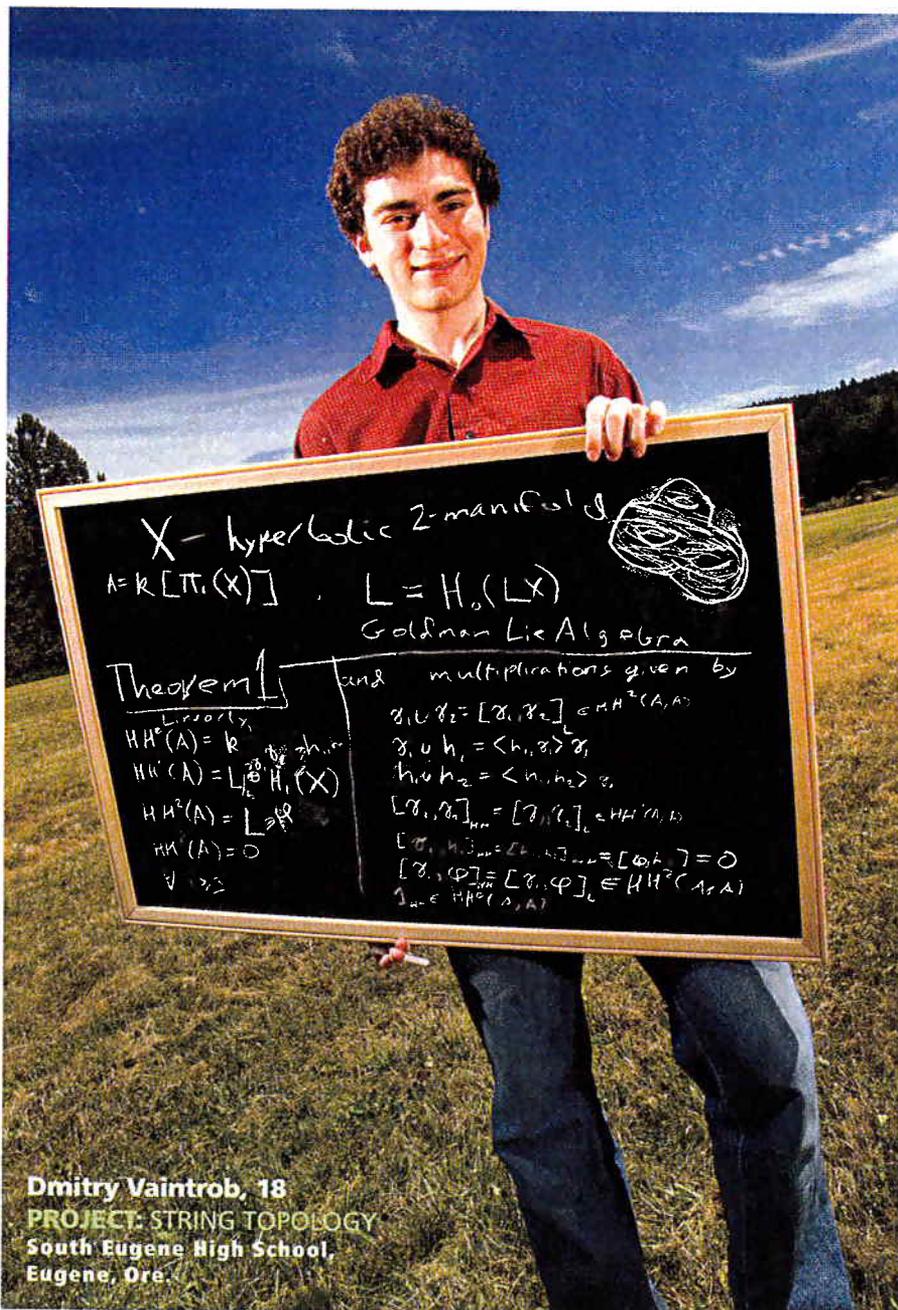




## Junior R&D

Winners at the Intel International Science & Engineering Fair are too young to drink, but they're making discoveries that could reshape scientific knowledge | By Chana R. Schoenberger

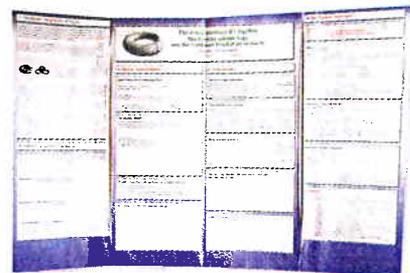


**Dmitry Vaintrob, 18**  
**PROJECT: STRING TOPOLOGY**  
 South Eugene High School,  
 Eugene, Ore.

### Dmitry Vaintrob

remembers producing his first proof, that there are an infinite number of primitive Pythagorean triples (numbers like 5, 12, 13 that make the sides of a right triangle and have no common factor), at age 8. He was reinventing a wheel known to Euclid. Dmitry decided at 12 he wanted to become a mathematician like his father.

Lately Dmitry has been working on a groundbreaking proof detailing how two separate theories, the Hochschild cohomology and the Goldman bracket, can validate the idea of string topology, which uses strings, not



Dmitry's winning science fair exhibit.

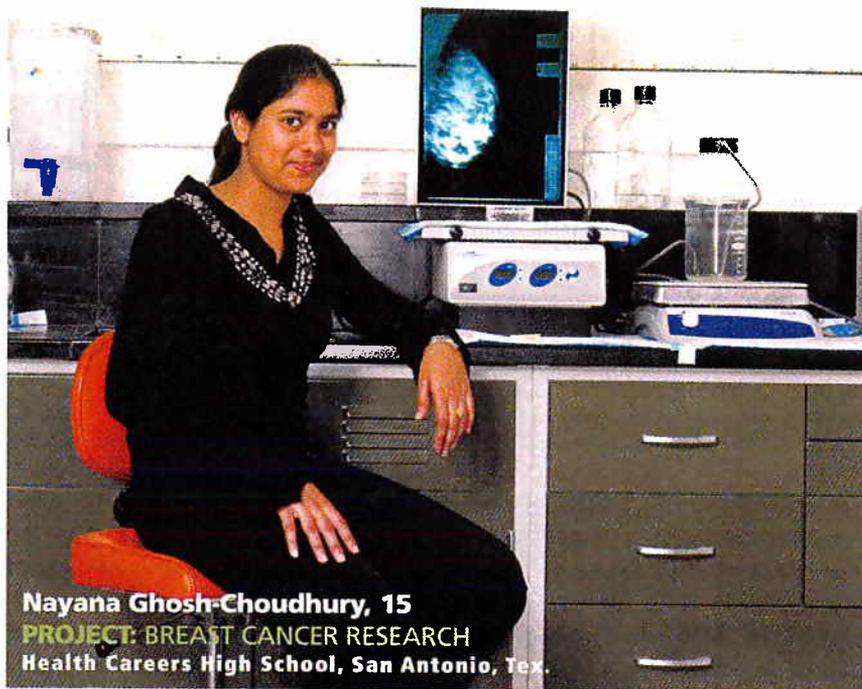
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## Innovation

levels of statin, then documented the death of cells exposed to the drug. She also injected breast cancer cells into rats, measuring their tumors to prove that statin use resulted in smaller tumors. Wondering how the drug prevented cancer cells from growing, she then looked at a protein known to help the cells thrive. Exposure to statins dramatically reduces the activity of the protein in cancer cells. The project won \$1,500 at the international fair for the magnet-school junior, who plans to become a doctor.

### Philip Streich

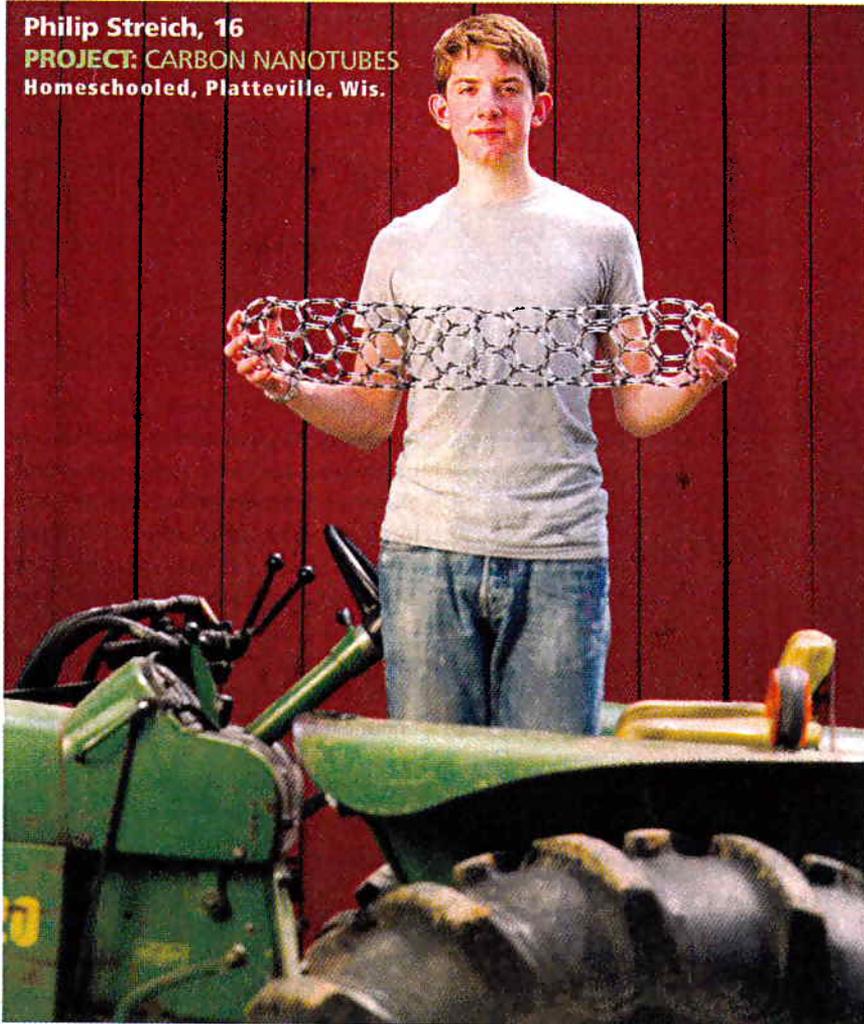
stared at the data for three weeks, but nothing made sense. Last summer he and his mentor, James Hamilton, a chemistry professor at the University of Wisconsin, Platteville, were trying to figure out how to dissolve carbon nanotubes, the tiny, superstrong supermaterial of the future.



**Nayana Ghosh-Choudhury, 15**  
**PROJECT: BREAST CANCER RESEARCH**  
Health Careers High School, San Antonio, Tex.

### Philip Streich, 16

**PROJECT: CARBON NANOTUBES**  
Homeschooled, Platteville, Wis.



Then a lightbulb—no, a laser—came on.

Scientists have assumed for years that nanotubes were insoluble. If they were soluble, it would be easy to arrange them without clumping and losing their ultrastrong properties. Boeing, for one, would love to pour nanotubes into a mold to make an ultralight spaceship, or a bridge to the moon. Streich saw how. He read about a phenomenon called Debye light scattering, which permits the measuring of solubility from the intensity of light scattered by the solution.

Pouring nanotubes into a solution of N-methyl-2-pyrrolidone-, he shot the container with a laser beam, then counted the photons bouncing out with a spectrometer. No commercial instruments were sensitive enough for the task, so he built his own, using spare parts from the lab's reserves. The tests revealed the level at which nanotubes can be dissolved in liquid.

Philip's parents moved the family from Princeton, N.J. to a 400-acre Wisconsin farm after the Sept. 11 attacks. They homeschool their three children, who all help out with livestock chores. Philip, the eldest, has taken 15 college courses at the university. His latest project is searching for dark matter. Philip came away with \$76,650 in prize money from the international science fair. **F**

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