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ON EDUCATION

## **Want to Be an Intel Finalist? You Need the Right Mentor**

By **MICHAEL WINERIP**

**E**AST SETAUKET, N.Y.

EVERYONE asks, how do they do it? Year after year, Ward Melville is one of the leading high schools in the nation for producing top science research projects in the prestigious Intel Science Talent Search competition.

This year Ward Melville, a suburban Long Island public school, had 12 semifinalist winners out of 300 nationally, second only to Montgomery Blair High in Silver Springs, Md., which had 13. In the seven years since Intel took over sponsorship from Westinghouse, Ward Melville ranks third nationally, with 68 semifinalists. The only two ahead are Stuyvesant in New York City (94) which requires an exam for admissions; and Montgomery Blair (89) which has a selective-admissions science program.

How does Ward Melville, a regular public school, do it? Partly, it's a well-to-do district with lots of parents who are doctors and other scientists. They've made research a top priority, naming a former university professor, Dr. George Baldo, to run the program. In 1999, the school doubled the program's size to 130 students and budgeted for a second full-time teaching slot.

The school subscribes to an online service giving students unlimited access to the latest research papers. Dr. Baldo's program has its own \$4,000 printer that can produce an entire science fair poster board in a single 42-inch-wide sheet, and a \$30,000 budget to pay travel expenses to nine science fairs a year. "We don't worry about raffling off a case of soda to buy materials," says Dr. Baldo.

He has a large enough staff to make sure all 38 pages of the Intel international science and engineering fair application get filled out correctly by the 25 students going. "I finally found the two forms you kept asking me for," Tony Li, a student, told Dr. Baldo the other day. "They were under a couch."

But none of these are the main reason Ward Melville excels. High school students cannot do research at this level without adult mentors - often a university professor plus a team of grad students - to pick a

topic that will break new ground, yet be manageable, and to supervise them at every step.

The biggest advantage Lauren Miller, a Ward Melville Intel semifinalist, had during her research on feeding worms? Ward Melville is so close to the State University at Stony Brook, Lauren could bike to the lab daily to work with Prof. Bruce Brownawell and his doctoral students.

Aditi Ramakrishnan, a semifinalist who researched toxicity of nanoparticles in cosmetics, says she would have no project if it were not for the daily help she received from a team of nearby Stony Brook professors. "I'm only 17," she said. "I didn't have the background to create the experiment. I didn't know how to use the equipment. I couldn't create the hypothesis."

Martin Rocek, a Stony Brook physics professor, picked a math project for Neal Wadhwa of Ward Melville. "It happened there was a new development in the field that was not exceedingly technical," says Professor Rocek, who gave Neal private geometry tutorials and suggested several calculations to work out. Those calculations broke new ground in the supermanifold field, but Neal says that at first, he didn't grasp what his answers meant. "Professor Rocek told me the significance of what I'd found," he said. "I didn't know."

"Why is Ward Melville so dominant?" said Miriam Rafailovich, a Stony Brook professor who supervised six Ward Melville students this year. "Proximity with a capital P. Getting kids to a lab is the big issue."

For big-time science fairs, the single most important research students do is finding a willing mentor. The "October Sky" projects - four boys standing in a field shooting off rockets - are all but gone. Even classroom science teachers - racing to finish prepackaged state and advanced placement curriculums - rarely can oversee serious research.

Dr. Baldo agrees that Ward Melville would not be so dominant if it were an hour drive from the university instead of five minutes.

Until 1998, Melanie Krieger ran the Ward Melville program, then left to start a similar program at Kennedy High in Plainview, another upscale Long Island suburb.

IN 12 years at Ward Melville she averaged 7 semifinalists a year; the last seven years at Plainview, she has averaged 2. "She's every bit as good as she was at Ward Melville," said Professor Rafailovich. "But her Plainview kids have trouble getting to a lab for help. It's over an hour drive to Stony Brook. That's a big problem. This isn't the kind of research kids do in their garage."

Aditi spent last summer at a Stony Brook lab, sometimes pulling all-nighters. Professor Rafailovich gave her the topic - to examine whether tiny particles in cosmetics, nanoparticles, could damage skin cells. "Aditi walked into a project where a million dollars had been spent to get to that point," said Professor Rafailovich.

Yuan Sun, a doctoral candidate, made the nanoparticles that Aditi studied. Dr. Nadine Pernodet was in charge of cell cultures and the state-of-the-art sanitizing air hood that grew skin cells for Aditi. "I saw Nadine every single day for many hours," said Aditi. "I could not have done it without Nadine." For Aditi to see the damage the nanoparticles did in a cell she had to be trained on a half-million-dollar confocal microscope that sees three dimensions.

To determine whether nanoparticles did similar damage in human fagocyte cells required Aditi to work with bacteria, something she could not legally do because of her age. So Dr. Celine Pujol did it. "Aditi decided how many nanoparticles to add, what concentrations and the protocol," said Dr. Rafailovich. "But Dr. Pujol did the hands-on work."

The nice thing about working with high school students, says Dr. Rafailovich, is they're so anxious to find a project, they're willing to try out theories that are "a little crazy" but need to be tested. Grad students are often too worried about getting a degree and making a living to take that chance.

Neal Wadhwa was researching his project at Stony Brook while his mentor, Professor Rocek, was serving as host to a national math conference. Neal's research involved Yau's Theorem and he actually got to meet S. T. Yau of Harvard. At the conference, Professor Rocek circulated Neal's findings, and those world-class mathematicians made suggestions to improve his project.

Thursday, Neal is to be in Washington, one of 40 Intel finalists competing for a grand prize scholarship of \$100,000. He's going by plane, but it took lots of very smart adults to get him there.

*E-mail: [edmike@nytimes.com](mailto:edmike@nytimes.com)*