Thanks to his work, now computers can model how a protein responds to pH levels, information that someday could help physicians tailor drugs to individual patients.

For this work, Harrison took fifth place in the 2005 Intel Science Talent Search, received a new laptop, and was awarded $25,000 in prize money. Harrison turned 18 in late August.

Harrison is a high school graduate of Baltimore Polytechnic Institute (http://www.bpi.edu/) (BPI) and was accepted to every college he applied to: Johns Hopkins University, MIT, the University of Maryland at Baltimore County, and Northeastern University. He chose Johns Hopkins because that's where he did his Rosetta work, but thanks to the Baltimore Scholars Program--started by Hopkins in 2004 to help the city's best stay at home--Harrison and 21 other Baltimore public high school students will receive full scholarships to begin classes at Johns Hopkins in September.

Despite his success and the bright future ahead of him, Harrison's feelings are mixed. "My Intel experience brought up a lot of tough, yet unanswered questions," he says. The questions he is referring to are not scientific. "Why am I the first Baltimore City Public High School Student in nearly fifty years to be a finalist? Why am I the first Poly [BPI] student? And probably the biggest question, why am I the only African American this year?" Still, he doesn't dismiss his achievement. "It was a great honor to become an Intel finalist."

Emphasis on Education

Harrison grew up in the middle class Baltimore neighborhood of Hamilton. The only child of a former corrections officer and an elementary schoolteacher who works with deaf and hard-of-hearing students, his parents emphasized education, attending every program he participated in with a video camera in hand. They were selective about the public schools they sent him to, aiming for challenging academic environments, "their belief being that there's nothing more important to your future success than your beginning experiences."
Harrison recalls being fascinated by dinosaurs and spaceships in elementary school, talking about them for hours at a time. The challenges science posed for Harrison, then and now, keep him engrossed. "If it [wasn't] fun, engaging, and impossible to master, I probably wouldn't have given it a fourth look," he explained.

In the sixth grade, on the recommendations of his parents and teachers, Harrison applied to and was accepted by the Ingenuity Project, based at BPI, which prepares Baltimore students to reach nationally competitive levels in math and science. "I was admitted to the program so I decided to give it a shot, nothing to lose," he notes. "If I liked it, great; if I didn't like it, I could get out at any time. I didn't quite understand why I should volunteer to do more work at the time, but I appreciate their foresight now."

In the summer of 2003, Ingenuity Project research coordinator Charlotte Saylor introduced Harrison to Jeffrey Gray, head of a protein structure prediction lab at Johns Hopkins. "We hit it off great," Harrison recalls. Gray told Harrison to play around with computers in the lab. Play around, he did.

**Improving Rosetta**

After reading college organic chemistry textbooks Gray lent him, Harrison started tinkering with Rosetta, which is used in Gray's lab as well as many others. He noticed that it could not simulate how pH affected protein structure, which prompted his odyssey. "Scientists require an accurate map of how and why human proteins interact in the body," he explains. "Proteins are drastically impacted by the acidity of their environment. Therefore, for Rosetta to more accurately model proteins and protein interactions, it is imperative to model the affects of pH on protein structure. Rosetta is amazingly complex, so I had a mammoth task ahead of me, but that just motivated me to give it a try."

Harrison spent thousands of hours on the project, but the way he remembers it, he enjoyed nearly every minute. "Whenever I wondered why [I was doing this], I was immediately drawn back to the challenge and fun of solving such a complicated problem," he says. "As I learned more, I longed for more and more. I was doing something I enjoyed -- not working. Most days I wished I could go to my lab instead of school." Harrison's 3000 lines of code--he wrote much more than that, then pared it down--modify the very guts of Rosetta, allowing scientists to specify pH and calculate the effect of pH on the energies that underlie protein behavior.

And he accomplished all this before he even got his driver's license. "I just never found the time," he said. Yet he does do other things besides science. He enjoys hiking, tackling national parks in Maryland and Virginia, the Cascade Mountains in Washington, and the Appalachian Trail in Pennsylvania. He founded a high school philosophy club and enjoys Sartre and existentialism. He "attempts" to play the trumpet. He signed onto the Johns Hopkins Barnstormers theatre group this summer as a sound designer and technician. "No particular reason for getting involved with amateur theatre," he says. "I have absolutely no related experience. But it's fun and interesting, so who cares."

Harrison acknowledges that good luck and accidents of birth have played important parts in his success. "I realize that I was fortunate to be born into a two parent, supportive middle-class home in a working class neighborhood. I also realize that hundreds of thousands, if not millions, of students around the country haven't been so fortunate."
Ryan Harrison on a hike, one of his several outside interests.

Influencing the Next Generation

He was not, however, the first Baltimore graduate to be raised under such conditions. So why was he the first to achieve this level of success in a national competition? "Maybe I'm the first Baltimore student in nearly fifty years because science was not a traditionally high priority of public education," Harrison remarks. "Very few Baltimore City high school students have had the opportunities Poly or other magnet schools--and Ingenuity--provide. Even fewer have had the opportunity to do research, let alone enter the Intel Science Talent Search. Maybe I'm the first Poly student because while science and math were heavily emphasized over Poly's extraordinary one hundred twenty-two-year history, an organized support system for independent research is relatively new."

"Maybe I was the only African American this year because poor and lower-middle class Americans tend to underperform and shy away from math and science," he continues. "Unfortunately, a disproportionate number of minorities fall into these categories. For a multitude of reasons, some beyond their control, African-American students in particular fall behind. Once behind in education, it is exceedingly difficult to catch up, especially without parent and teacher support."

Harrison would like school systems to constantly expose children to science, math, history, and art as he was exposed to it. "Let them blow the top off a Coke bottle with dry ice," he says. "Let a mathematician tell them what he really does. Tour a battlefield, relive history. Take them to the Meyerhoff, the Baltimore Museum of Art. Give students the skills they need to succeed. Most importantly, teach them how to teach themselves. All of these things are readily accessible, and largely free."

"Education is complex. The problems plaguing education are equally complex," Harrison says. "I don't claim to understand them. I will help where I can." Just being a trailblazer for students of color is a big step in the right direction.

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