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Not Feeling the Fields

Grisha Perelman becomes the first person ever to turn down math's top prize.

by **JOSHUA ROEBKE** • Posted August 25, 2006 12:41 AM

Grisha Perelman *Courtesy International Congress of Mathematicians Press Office*

Grigory Perelman lives with his mother in an undistinguished apartment in St. Petersburg, Russia. On Tuesday, August 22, rather than being honored at a palace in Madrid, where he would receive a gold medallion from King Juan Carlos of Spain, he was probably in his flat, enjoying a late lunch of borscht or writing equations in solitude.

Perelman is the first person in history to turn down the Fields Medal, mathematics' biggest prize. It's an honor he won the right to refuse by audaciously solving the hundred-year-old Poincaré conjecture.

The week-long International Congress of Mathematicians has attracted nearly 5,000 mathematicians from 100 countries to the Spanish capital. Like the Olympics, the very best travel to the host city from all corners of the globe every four years, where they put their hard work and talents on display and see who takes home the gold medals.

"There are always lots of rumors swirling around before the Congress," said Columbia University mathematician John Morgan. "And basically everybody is there to see the Fields."

This year's Congress is not unlike a major sporting event--there's the pre-event buzz, not to mention the tender age of most of the competitors.

Like athletics, math is a game for the young. According to an unwritten, but strictly enforced rule, the Fields Medal is awarded to up to four mathematicians 40 years of age or younger. While the Fields is often referred to as the "Nobel Prize of mathematics," at just around $13,500, it's not quite the windfall that a million dollar-plus Nobel would be. (Alfred Nobel actually scrapped the idea of a math prize because of an adversarial relationship with a certain mathematician.)

What is the Poincaré conjecture?

In a 1904 paper, the French mathematician Jules Henri Poincaré stated that a sphere is a sphere is a sphere. You can punch, kick and throw it; you can inflate or deflate it; you can mold the sphere into another shape. But in the world of topology, no matter what you do to it, the resulting deformed, twisted and complicated form is still a sphere...

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Around 1994, after having some initial success working on the Soul conjecture, a classical problem in differential geometry, Grisha (as Grigory is called in the Russian tradition of diminutive nicknames) quietly dropped off the mathematics community's radar.

In November of 2002, he emerged from his seclusion, publishing a 39-page missive on the site arXiv.org—a repository for math and physics papers yet to be published in peer-reviewed journals—and alerting a few of his fellow mathematicians to its presence. In March of 2003, another 22 cryptic pages appeared. Four months later, seven more followed. Though he never mentioned it by name, in a mere 68 pages Perelman had apparently solved the Poincaré conjecture, a problem so difficult it had stymied mathematicians for 100 years. (In addition, Perelman had also ostensibly resolved the much bigger Thurston Geometrization Conjecture, of which, Poincaré is just a small piece.)

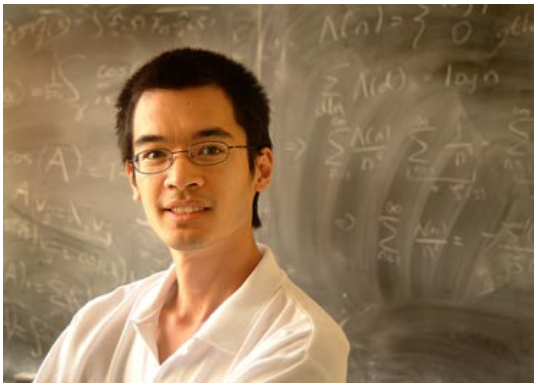
In 2000, the Clay Mathematics Institute deemed it one of the seven most important unsolved problems in math, placing a $1 million bounty on its head. Bruce Kleiner of the University of Michigan told *Nature* that Perelman's effect on the landscape of mathematics was similar to "waking up one morning after an earthquake."

Brevity is hardly the soul of wit in mathematics, and the monkish Perelman proved almost too concise.

"In some sense, Perelman did enough, but just barely enough so that any expert in the field could figure it out," said Columbia's Morgan, who, with Gang Tian of MIT, published a 473-page, expanded demonstration of Perelman's proof of the Poincaré conjecture.

Perelman traveled to the US in 2003 on a sort of valedictory lecture tour of the East Coast, speaking to packed houses. It's the last that most people saw of him.

"He looked like Rasputin, with long hair and fingernails," Robert Greene of UCLA told *The New York Times*. When he spoke at Harvard, Perelman declared he would sacrifice some clarity and linearity for "liveliness," which apparently meant hardly writing down a thing during the entire lecture. (After, one mathematician thanked him for wasting so little chalk.) When the press began showing up at his appearances, Perelman packed it in and went home, though for the next year or two he maintained a correspondence with his peers, answering every question fired at him.



2006 Fields Medal winner Terence Tao. *Courtesy International Congress of Mathematicians Press Office*

"As I was trying to work through his papers, for about a year afterward, I would occasionally e-mail him mathematical questions," said Morgan. "He always seemed to understand what my confusion was and he was always able to pinpoint where I was confused."

Perelman's colleagues eventually ballooned his elegant short story into something more like *War and Peace*—all told about 1,000 pages have been published thus far to explain Perelman's work on Poincaré, and the ultimate conclusion is that Perelman was right. (The verdict is still out on the geometrization conjecture.)

"[Perelman] is very focused on mathematics," Morgan said. "When the conversation is mathematical, he is quite open and approachable." But when the conversation about math turned to million-dollar prizes and Fields medals, Perelman went AWOL.

Beginning last October, Fields Medal gossip began, and rumor had it that UCLA's Terence Tao would win along with Perelman. When the mathematical community discovered that the Congress had invited Perelman to speak (he declined), many of his colleagues were confident he would win. Even a personal visit from the Fields Medal committee chair could not convince Perelman to claim his prize.

Many now believe that when he becomes eligible for the million-dollar Clay Millennium Prize, he will turn it down, as well.

Among mathematicians, Perelman is a singular character—both in his working style and his shrinking from the spotlight.

"There are some mathematicians who work on one problem consistently for years and years, like Andrew Wiles," said newly-minted medalist Tao, referring to the British-American mathematician who, in 1995, published a solution to Fermat's Last Theorem after eight years of solitude. "I don't think I could do that. I don't have the focus, and it would be too frustrating for me. I like to see results a little quicker than that. I also very much enjoy collaborating."

Along with Perelman and Tao, Berkeley mathematician Andrei Okounkov and University of South Paris professor Wendelin Werner were recognized for their work in bridging the gap between math and physics.

Like Nobel laureates, Fields Medalists often find that life is slightly different once they've been honored. As Werner wrote in an e-mail while driving to the conference, "I wonder if it will change the way students will listen in my lectures."

"All the names of the past Fields medalist are famous, and ones that all mathematicians know, so it feels strange to be counted among them," said Tao, the youngest honoree, who at 31, won for work that cuts across many mathematical disciplines. "These are my heroes."

Whether or not he'd like to admit it, Grisha Perelman deserves to be counted among them.

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