



SCIENCE

# Seeker, Doer, Giver, Ponderer

A Billionaire Mathematician's Life of Ferocious Curiosity

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Profiles in Science

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James H. Simons likes to play against type. He is a billionaire star of mathematics and private investment who often wins praise for his financial gifts to scientific research and programs to get children hooked on math.

But in his Manhattan office, high atop a Fifth Avenue building in the Flatiron district, he's quick to tell of his career failings.

He was forgetful. He was demoted. He found out the hard way that he was terrible at programming computers. "I'd keep forgetting the notation," Dr. Simons said. "I couldn't write programs to save my life."

After that, he was fired.

His message is clearly aimed at young people: If I can do it, so can you.

Down one floor from his office complex is Math for America, a foundation he set up to promote math

teaching in public schools. Nearby, on Madison Square Park, is the National Museum of Mathematics, or MoMath, an educational center he helped finance. It opened in 2012 and has had a quarter million visitors.

Dr. Simons, 76, laughs a lot. He talks of “the fun” of his many careers, as well as his failings and setbacks. In a recent interview, he recounted a life full of remarkable twists, including the deaths of two adult children, all of which seem to have left him eager to explore what he calls the mysteries of the universe.

“I can’t help it,” he said of the science he finances. “It’s very exciting.”

Jeff Cheeger, a mathematician at New York University who studied with him a half century ago at Princeton, described Dr. Simons’s career as “mind-boggling.”

Dr. Simons received his doctorate at 23; advanced code breaking for the National Security Agency at 26; led a university math department at 30; won geometry’s top prize at 37; founded Renaissance Technologies, one of the world’s most successful hedge funds, at 44; and began setting up charitable foundations at 56.

This year, he was elected to the National Academy of Sciences, an elite body that Congress founded during Lincoln’s presidency to advise the federal government.

With a fortune estimated at \$12.5 billion, Dr. Simons now runs a tidy universe of science endeavors, financing not only math teachers but hundreds of the world’s best investigators, even as Washington has reduced its support for scientific research. His favorite topics include gene puzzles, the origins of life, the roots of autism, math and computer frontiers, basic physics and the structure of the early cosmos.

“He’s very ambitious,” said Edward Witten, a physicist at the Institute for Advanced Study in Princeton. “He can have a big impact.”

Working closely with his wife, Marilyn, the president of the Simons Foundation and an economist credited with philanthropic savvy, Dr. Simons has pumped more than \$1 billion into esoteric projects as well as retail offerings like the World Science Festival and a scientific lecture series at his Fifth Avenue building. Characteristically, it is open to the public.

His casual manner — he’s known as Jim — belies a wide-ranging intellect that seems to resonate with top scientists.

“He’s an individual of enormous talent and accomplishment, yet he’s completely unpretentious,” said Marc Tessier-Lavigne, a neuroscientist who is the president of Rockefeller University. “He manages to blend all these admirable qualities.”

On a wall in Dr. Simons’s office is one of his prides: a framed picture of equations known as Chern-Simons, after a paper he wrote with Shiing-Shen Chern, a prominent geometer. Four decades later, the equations define many esoteric aspects of modern physics, including advanced theories of how invisible fields like those of gravity interact with matter to produce everything from superstrings to black holes.

Math is considered a young person’s game. But Dr. Simons continues to map its frontiers.

Bruce W. Stillman, director of the Cold Spring Harbor Laboratory on Long Island, recalled seeing a math journal on Dr. Simons’s desk and complimenting him on keeping up with his professional reading.

“He said, ‘What do you mean, reading?’ ” Dr. Stillman recalled. The journal held one of Dr. Simons’s papers. Given that Dr. Simons still works in business as well as philanthropy, Dr. Stillman added, “that’s pretty impressive.”

### **A Boyhood Love of Math and Logic**

During the interview, Dr. Simons reached into the pocket of his blue shirt and pulled out a pack of cigarettes, at times letting one dangle from his mouth unlit. He was relaxed and chatty, wearing tan pants and loafers, his accent betraying his Boston birth and upbringing.

Dr. Simons said he knew as a boy that he loved math and logic. He would lie in bed thinking about how to give the instruction “pass it on” in a clearly defined way.

“One night, I figured it out,” he recalled. By morning, he added, he could no longer remember the insight.

At 14, during a Christmas break, he was hired by a garden supply store for a stockroom job. But he was quickly demoted to floor sweeper after repeatedly forgetting where things went. His bosses were incredulous when, at vacation's end, he told them he wanted to study mathematics at the nearby Massachusetts Institute of Technology.

Excellent test scores and the recommendation of a high school adviser got him into the prestigious school. He graduated in three years, and received his doctorate from the University of California, Berkeley, in three more. It was at Berkeley that he met Dr. Chern, a math prodigy from China.

In his doctoral thesis, Dr. Simons advanced the mathematical understanding of curved spaces, a topic Einstein exploited in his general theory of relativity to show how gravity deforms space and time.

Returning east, he taught math at M.I.T., then Harvard. In 1964, he was recruited into the shadowy world of government spying. At Princeton, while ostensibly part of the academic elite, he worked for the Institute for Defense Analyses, its Princeton arm a furtive contractor for the N.S.A.

On his own time, once a week, he tutored Dr. Cheeger, then a graduate student. "He became my teacher, unofficially," the N.Y.U. professor recalled.

At Princeton, Dr. Simons's cryptography strides helped the N.S.A. break codes and track potential military threats. But he failed as a programmer.

He also managed to fall into political conflict with his boss, Maxwell D. Taylor, a retired four-star Army general. In 1967, General Taylor defended the Vietnam War in a *New York Times Magazine* article. Dr. Simons objected. His reply, also published in *The Times*, said the conflict would "diminish our security" and urged a pullout "with the greatest possible dispatch."

Soon after, he was dismissed, and Stony Brook University on Long Island courted him to become its math chairman.

"It was a lousy department," he recalled. "When I was interviewed by the provost, he said, 'Well, Dr.

Simons, I have to say you're the first person we've interviewed for this job who actually wants it.'

"I said: 'I want it. I want it. It sounds like fun.' And it was fun. And I went there, and we built up a very good department."

In 1976, Dr. Simons won the Oswald Veblen Prize of the American Mathematical Society — geometry's highest honor — raising the department's stature. The award was for recasting the higher math of area-minimizing surfaces, a simple example being a soap film that forms across a wire frame.

But he became restless, and the business world beckoned. In Boston, his family had run a shoe factory. At Berkeley, he had traded stocks. Once, after driving to Bogotá, Colombia, on a motor scooter with a college friend, he persuaded his father to join him in an investment there.

In 1978, he founded a predecessor to Renaissance Technologies in a strip mall close to the Stony Brook campus. In 1982, he set up Renaissance, which grew to occupy a 50-acre campus, complete with tennis courts.

In time, his novel approach helped change how the investment world looks at financial markets. The man who "couldn't write programs" hired a lot of programmers, as well as physicists, cryptographers, computational linguists, and, oh yes, mathematicians. Wall Street experience was frowned on. A flair for science was prized. The techies gathered financial data and used complex formulas to make predictions and trade in global markets.

The company thrived, rewarding investors with double-digit annual returns. It marked an early triumph of the "quants" — quantitative analysts who use advanced math to guide investments — and foreshadowed the ascendancy of **Big Data**.

The secret? "He's a very good people manager," said Nick Patterson, a former Renaissance partner. "That's not," he added, "the stereotype of a mathematician."

Dr. Simons credits his employees. "A good atmosphere and smart people can accomplish a lot," he said.

But he also conceded that his curiosity drove him to examine all kinds of unusual possibilities, such as whether sunspots and lunar phases influenced the financial markets. During the birth of one of his five children, a nurse told Dr. Simons that the obstetrics ward was always crowded during a full moon.

“I tested that one, too,” he said. “Not true.”

### **Success and Tragedy Were Companions**

His philanthropic work began in 1994 when he and his wife founded the Simons Foundation, followed by other charities.

Tragedy hit as his successes grew. On Long Island in 1996, his son Paul, 34, was killed by a car while riding a bicycle.

In 2003, a younger son, Nicholas, 24, drowned while globetrotting. He had worked in Katmandu, and Dr. Simons and his wife went to Nepal repeatedly to set up a memorial institute.

Dr. Simons said he began thinking a lot about old math riddles. “It was a refuge,” he said, “a quiet place in my head.”

One morning in Katmandu, as he relaxed on a hotel porch, the structure of a proof suddenly came to him. It was a solid advance — one he didn’t forget. He discussed it with Dennis P. Sullivan, a mathematician at Stony Brook who had recently won the National Medal of Science, and the two collaborated.

In 2007, the resulting paper ran under the title “Axiomatic Characterization of Ordinary Differential Cohomology.”

What?

“It’s very hard to explain,” Dr. Simons said after a few tries. “But we solved it.”

Dr. Sullivan said that Dr. Simons, in his career, had made a series of seminal contributions and that an early one “revolutionized the consciousness of later generations.” He added that in May 2013, to celebrate Dr. Simons’s 75th birthday, four American math and science luminaries gave lectures about fields he had

advanced.

Forbes magazine ranks him as the world's 93rd richest person — ahead of Eric Schmidt of Google and Elon Musk of Tesla Motors, among others — and in 2010, he and his wife were among the first billionaires to sign the Giving Pledge, promising to devote “the great majority” of their wealth to philanthropy.

Of late, Dr. Simons said, his giving had accelerated, adding that he was particularly proud of Math for America. It awards stipends and scholarships of up to \$100,000 to train high school math and science teachers and to supplement their regular salaries. The corps is expanding to 1,100 teachers, mainly in New York City, but also in Boston, Los Angeles and elsewhere.

His passion, however, is basic research — the risky, freewheeling type. He recently financed new telescopes in the Chilean Andes that will look for faint ripples of light from the Big Bang, the theorized birth of the universe.

The afternoon of the interview, he planned to speak to Stanford physicists eager to detect the axion, a ghostly particle thought to permeate the cosmos but long stuck in theoretical limbo. Their endeavor “could be very exciting,” he said, his mood palpable, like that of a kid in a candy store.

For all his self-deprecations, Dr. Simons does credit himself with a contemplative quality that seems to lie behind many of his accomplishments.

“I wasn't the fastest guy in the world,” Dr. Simons said of his youthful math enthusiasms. “I wouldn't have done well in an Olympiad or a math contest. But I like to ponder. And pondering things, just sort of thinking about it and thinking about it, turns out to be a pretty good approach.”

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