

The Secret World of Jim Simons by Hal Lux

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How does this prize-winning mathematician and former code breaker rack up his astonishing returns? Try a little luck— and a firm full of Ph.D.s.

Last April the State University of New York at Stony Brook held a gala reception at the Waldorf-Astoria Hotel in midtown Manhattan to celebrate raising a record \$1 million — a tidy sum for a state school. After cocktails a balding, white-haired man rose from his seat on the dais to thank the sellout crowd, which included such celebrities as Oscar-winning movie director Martin Scorsese, for its generosity.

"I told my wife, 'We raised \$1 million for Stony Brook,'" said the speaker, hedge fund manager James Simons. "She said, 'Gross or net?'"

Chances are you haven't heard of Jim Simons, which is just fine by him. Nor are you alone. Many on Wall Street, including competitors in his specialty, quantitative trading, haven't heard of Simons or of his operation, Renaissance Technologies Corp., either. And that's simply extraordinary — because, gross or net, Simons may very well be the best money manager on earth.

An extreme judgment? Perhaps. Certainly, there has been no end of claimants to the title. And one after another, over the past few years, these celebrated managers have either blown up or folded their tents. After big reverses, Julian Robertson closed down Tiger Management, and George Soros scaled back the activities of his Quantum Fund this year. John Meriwether's Long-Term Capital Management nearly took down the financial world in 1998.

Simons, by contrast, just keeps getting better. Consider his performance over the past decade. Since its inception in March 1988, Simons' flagship \$3.3 billion Medallion fund, has amassed annual returns of 35.6 percent, compared with 17.9 percent for the Standard & Poor's 500 index. For the 11 full years ended December 1999, Medallion's cumulative returns are an eye-popping 2,478.6 percent (see graph, page 47). Among all offshore funds over that same period, according to the database run by veteran hedge fund observer Antoine Bernheim, the next-best performer was Soros' Quantum Fund, with a 1,710.1 percent return (see table, page 44).

"Simons is No. 1," says Bernheim. "Ahead of George Soros. Ahead of Mark Kingdon. Ahead of Bruce Kovner. Ahead of Monroe Trout."

And Bernheim's numbers don't include Medallion's 2000 performance. In a year of exceptional volatility and market dislocations, the fund is up 64 percent through September. Over the years, Simons' consistency has been exceptional. Apart from his second year, 1989, his fund has not had a losing year (it was down 4.1 percent that year). In fact, in the past decade, it's never returned less than 21 percent.

"Ten years ago I put a small amount of money into Medallion," says one pleased investor, Richard Gelfond, the co-CEO of Imax Corp., the Canadian giant-screen film company. "Today it's a big amount of money."

Medallion, which closed to new investors in 1993, is focused chiefly on commodities and futures trading. Recently, Simons has expanded his equity business. Last year he launched Equimetrix, a \$500 million U.S. fund with a market-neutral trading strategy for institutional investors. Despite market ructions, and the first declining U.S. stock prices in years, Equimetrix this year has returned 24.1 percent through September, compared with -2.23 for the S&P 500 with two thirds the volatility.

And these are all, it should be noted, net numbers. The price of Simons' success is high for investors. He charges a management fee of a stunning 5 percent of assets, in addition to the normal hedge fund rake-in of 20 percent of profits.

To be sure, some investors have had even higher returns in recent years. Hedge fund manager Jeffrey Vinik closed his fund last month after compiling average annual returns of 53 percent since November 1996. And Steven Cohen of SAC Capital Management, reportedly posted returns of 70 percent last year and 49 percent the previous year. Simons, however, has made steady profits over 11 years, compared with just seven for Cohen and four for Vinik.

Simons' risk-adjusted returns are even more impressive. Paul Wick, manager of Seligman Communications and Information Fund, leads all U.S. mutual fund managers, according to Morningstar, with annual returns of 31 percent since 1990. But his Sharpe ratio over the past three years is 0.42; for the same period, Legg Mason's celebrated William Miller III boasts average annual returns of 24 percent — and a Sharpe ratio of 0.64. Simons wracked up a ten-year Sharpe ratio of 1.89 throughout the 1990s, with a 2.52 ratio for the last five years of the decade. Sharpe ratios are a measure of risk-adjusted returns. The higher the number, the better.

How does Simons do it? Start with a world-class mathematical mind. In 1976, at 38, Simons won the American Mathematics Society's Veblen Prize — awarded every five years, it is the geometry world's highest honor — for his work in the excruciatingly esoteric field of differential geometry. His signature work — a 26-year-old theorem crafted with renowned geometrician Shiing-Shen Chern that is known as the Chern-Simons theory — has recently emerged as a critical tool for theoretical physicists searching for fundamental laws of the universe. "Chern-Simons pervades a whole class of theories that underlie our fundamental view of the observable world," says Brandeis University physicist Stanley Deser, an expert on supergravity, a discipline of quantum theory that studies elementary particles and their interaction.

"Jim Simons is without question one of the really brilliant people working in this business," says quantitative trading star David Shaw, chairman of D.E. Shaw, which boasts returns above 50 percent this year. "He is a first-rate scholar, with a genuinely scientific approach to trading. There are very few people like him."

Simons surrounds himself with like minds. The headquarters of Renaissance, in the quaint town of East Setauket on New York's Long Island, resembles nothing so much as a high-powered think tank or graduate school in math and science. Operating out of a one-story wood-and-glass compound near SUNY Stony Brook, Renaissance, founded in 1982, has 140 employees, one third of whom hold Ph.D.s in hard sciences. Many have studied or taught in Stony Brook's math department, which Simons chaired from 1968 to 1976. Among their ranks: practitioners in the fields of astrophysics, number theory, computer science and computational linguistics. In notably short supply are finance types. Just two employees, including the head of trading, are Wall Street veterans.

"I have one guy who has a Ph.D. in finance. We don't hire people from business schools. We don't hire people from Wall Street," says Simons. "We hire people who have done good science."

Confident and witty but intensely secretive about his business's inner workings, Simons shuns publicity. He agreed to talk with Institutional Investor only after much pestering (see box, page 42). And some of what he said was, frankly, unintelligible. We made the mistake of asking him to explain Chern-Simons. After half an hour he allowed, "I can't." He meant, of course, to us.

Simons rarely speaks at financial forums, preferring math conferences. He celebrated his 60th birthday with a geometry symposium at Stony Brook that included such lectures as "Generalized Chern-Simons Invariants as a Generalized Lagrangian Field Theory." That's one reason he is little known on Wall Street. Two years ago Renaissance invited Andrew Lo, whose financial engineering program at the Massachusetts Institute of Technology is the prime recruiting ground for quantitative traders, to speak at its headquarters on options replication. "I had heard of Jim

Simons the mathematician, but I had never heard of Renaissance until they called me up," says Lo. "I said, 'Jim Simons runs a hedge fund?'"

When he does open up, Simons can seem exasperatingly coy in describing his success. "Luck," he told a gathering of potential investors last spring in Greenwich, Connecticut, "is largely responsible for my reputation for genius. I don't walk into the office in the morning and say, 'Am I smart today?' I walk in and wonder, 'Am I lucky today?'"

In fact, Simons is being straightforward. Luck may be the residue of design to baseball minds, but to a mathematician it's the twin of probability, which can be approached through statistical studies. Renaissance's researchers construct statistical models and proprietary algorithms from exhaustive scrutiny of market data.

Like all quantitative money managers, Renaissance aims to find small market anomalies and inefficiencies that can support profitable trading on billions of dollars of capital. Though all quant shops are alike in their dedication to models — Let the best algorithm win! — Renaissance's approach differs from the "convergence trading" popularized by John Meriwether's Long-Term Capital Management and similar arbitrage shops. Convergence traders price financial instruments based on complex mathematical models, find two different instruments that are cheap and expensive on a relative basis and then buy one and sell the other, betting that the prices will, at some point, have to return to their proper level. The Renaissance approach requires that trades pay off in a limited, specified time frame. And Renaissance traders never override the models.

Guided by these models, Medallion's 20 traders conduct rapid-fire buying and selling of a multitude of U.S. and overseas futures contracts, including all major physical commodities, financial instruments and important currencies, in addition to trading equities and mortgage derivatives. This year Medallion made a killing in the volatile oil futures market.

To be sure, Simons' track record is not unblemished. In 1997 he folded a middling market-neutral fund into Medallion after just three years. And a mortgage-backed-derivatives fund he backed in 1995 swooned after enjoying two fine years.

An active venture capitalist and private equity investor in the U.S. and Latin America, Simons sits on the boards of four companies, including Franklin Electronic Publishers, the pioneering electronic spell-checker and book company, of which he owns 22 percent and is chairman (see box, page 41). Simons has recently raised a \$200 million fund to extend Renaissance's reach into technology venture capital investments.

Simons' trading record over the past decade is more than luck. The bigger question is whether he can keep it up. A chain-smoker in defiance of statistical possibilities, Simons is 62 and has no designated successor, and the firm is starting to expand into new areas.

Such a situation can be a recipe for disaster for trading firms. But Simons says with scientific certainty: "The things we are doing will not go away. We may have bad years, we may have a terrible year sometimes. But the principles we've discovered are valid."

The son of a shoe factory owner, Jim Simons grew up daydreaming about numbers. "I wanted to do mathematics from the time I was 3," says Simons, who was raised in the Boston suburb of Newton. "Literally. I would think about numbers and shapes."

After graduating from Newton High School, he entered MIT, studying under renowned mathematicians Warren Ambrose and I.M. Singer. (Says Singer: "He's very intuitive. He has a sense of taste for the right principles in mathematics, and that is very rare, let me tell you.") He received his BS in math in 1958 at 20 and a mere three years later, a Ph.D. in math from the University of California at Berkeley. By 23 he was back at MIT — on the faculty. After one year, he strolled up Massachusetts Avenue and spent two more years as a math professor at Harvard

University. There he worked on solutions to such conundrums as the plateau problem and the Bernstein conjecture, which grapple with the properties of multidimensional surfaces.

Though a rising star in his field, Simons quickly tired of academic life. Seeking adventure, he signed on in 1964 as a code breaker with the Institute for Defense Analyses, a nonprofit research organization that performed work for the U.S. Department of Defense. Angered by a New York Times Magazine story that he thought overly optimistic about the military effort in Vietnam, Simons made comments to Newsweek that were critical of the war. After telling his boss about the interview, he says he was fired from IDA.

Shaken, Simons quickly found a home back in academia. He took the post of chairman of the Stony Brook math department, where he would spend the next eight years doing pure research. "I felt so powerless about being fired," he says. "I thought, 'They can't fire you if you're chairman.'"

Simons' most famous work is his 1974 paper "Characteristic Forms and Geometric Invariants," which he coauthored with the renowned Berkeley geometer Chern. It represented an important breakthrough in geometry that would become known as the Chern-Simons theory.

Differential geometry, Simons' specialty, is the study of curved surfaces and spaces. We are all familiar with spheres; we live on a very big one, after all. But it turns out that, for mathematicians, they are fiendishly complicated. Geometers establish the properties that separate one type of object from another. Although they have been able to determine the properties of what to laymen are such incomprehensible objects as spheres with ten dimensions, they have not been able to do this with spheres in the third dimension. French mathematician Henri Poincaré postulated at the beginning of this century that they ought to be able to do so using simple means. Like Fermat's last theorem, which was finally proved in 1993 after centuries of fruitless efforts, Poincaré's conjecture is one of the mathematical world's great remaining mysteries. (The Clay Mathematics Institute has offered a \$1 million prize to anyone who can find the solution.)

Chern-Simons was not meant to solve Poincaré's conjecture, but it does offer calculations that are useful for distinguishing among shapes in three dimensions. "Chern-Simons offers a route to solve Poincaré's conjecture," says Simons, "but it's a difficult route, and there are other difficult routes."

Difficult, yes, but, say mathematicians, an elegant piece of abstract reasoning. "Chern-Simons, that's a beautiful thing," says George Zettler, a former Columbia University math professor, who now trades swaps and options for the mortgage-backed-securities hedge fund Ellington Management Group. But the paper's language defies translation into plain English. A random sample: "The Weil homomorphism is a mapping from the ring of invariant polynomials of the Lie algebra of a Lie group, G , into the real characteristic cohomology ring of the base space of a principal G -bundle." Difficult, indeed.

Chern-Simons has taken on a second intellectual life, because the theory has come to have a major influence in a completely different scientific discipline. In the mid-1980s Princeton University professor Edward Witten, now one of the world's leading theoretical physicists, noticed the applicability of Chern-Simons to physics and popularized an area that is loosely called Chern-Simons quantum field theory. These days Chern-Simons is used as a tool in many areas of physics research, from string theory to supergravity to black holes. "Every day a physicist is working on a new theory with Chern-Simons," notes Dennis McLaughlin, a Princeton-mathematician-turned-McKinsey-&-Co.-consultant.

Not one to remain lost in abstractions, Simons has long had an affinity for business. In 1961, he and a few MIT classmates invested in a Colombian floor tile and pipe company. At Berkeley he tried his hand at trading, looking to invest about \$5,000 in wedding gifts from his first marriage. He found that stocks bored him. "I went to a Merrill Lynch broker," recalls Simons. "He said, 'Try soybeans.'"

Simons didn't get really hooked on trading until the early 1970s, when he was at Stony Brook. In 1973 the tile company got sold, and he turned the proceeds over to a mathematician he knew who was trading commodities. "In eight months he had multiplied my money by ten times," says Simons.

Even as he was being hailed for his theoretical work, Simons began to make the transition out of academics, working half time at Stony Brook and trading currencies with his own money between 1976 and 1978. In 1978 he left Stony Brook completely, to form a private investment fund called Limroy. Initially, he took a fundamental approach, trying to predict factors like Federal Reserve Board policy and interest rate movements. Over the next ten years, Limroy grew initial capital 25 times by investing in everything from venture capital to technical currency trading.

In 1988 Simons decided to launch a fund that concentrated on pure trading. He shut Limroy and launched Medallion in March 1988. Concentrating on futures trading, the fund earned 8.8 percent in 1988 but lost money steadily in 1989 until Simons halted trading in June.

For six months Simons and former Princeton mathematician Henry Laufer, who is still Renaissance's research chief, rebuilt Medallion's trading strategy, shifting from fundamental analysis to the quantitative approach that powers the firm today. "We started to think about a whole new way to look at futures," says Simons.

Back in action, Medallion made its mark through rapid, short-term trading across futures markets. In the early years the types of inefficiencies that could be exploited by quantitative trading abounded. The firm made money by simply arbitraging Treasury bills against Treasury futures contracts. Luck helped too. In 1990, for example, the fund was long oil when Iraq invaded Kuwait.

Simons steadily recruited top-tier scientists. They focused on speeding up systems, studying how to optimize risk allocation and determining trading strategies. By 1993, after three dazzling years, Medallion had reached \$270 million in assets and stopped taking new money. And Simons began extending his reach. By 1994 Renaissance, which had started with 12 employees, had 36 on staff, and Medallion was trading 40 types of securities, up from 12. Renaissance had always done all of its trading through outside brokers; the following year it opened its first in-house trading operation. Today Renaissance has 140 staffers — it plans to be up to 150 by year-end — and trades 60 different financial instruments around the clock.

"We have three criteria," says Simons. "If it's publicly traded, liquid and amenable to modeling, we trade it."

Three years ago Medallion formed an internal fund-of-funds to invest in outside managers. In part, the fund was looking for new ways to invest excess capital that investors didn't want back. Simons also believed the approach would increase Renaissance's market intelligence and occasionally present opportunities for Renaissance to acquire another fund. Medallion now has \$500 million invested in 40 outside funds, including macro manager Louis Bacon's Moore Capital Management.

Expansion doesn't always work, however. Medallion began trading mortgage derivatives in its fixed-income portfolio in 1992. Though not a Renaissance employee, ex-Lehman Brothers mortgage trader Judah Frankel managed the portfolio for Medallion. In 1995, following the 1994 bond market rout, Renaissance decided to make a larger commitment to the mortgage market and became a co-general partner in a new hedge fund called Matrix, run by Frankel. After gaining 27.4 percent in 1995, the fund racked up a stellar 101.3 percent return in 1996, according to hedgefundnews.com. Then interest rates moved out of the range projected for many of Matrix's trades, and the yield curve inverted. In 1997 the fund gained just 3.3 percent; then in 1998 it lost 20.6 percent of assets. Though several Renaissance executives still have money in Matrix, the company withdrew as a general partner last year. "Inversion was the kiss of death," says Simons. "The fund was unhedged with respect to the yield curve."

Renaissance, he says, would not play such a prominent role in someone else's fund again.

Since the advent of the options and derivatives industry in the early 1980s, Wall Street's banking houses have fallen over themselves to recruit high-powered intellectuals from academia. By contrast, Simons has taken his scientists away from Wall Street, to lavish surroundings in Long Island, not far from the Stony Brook campus where Renaissance began life in office space designed to serve as a business incubator.

Renaissance moved into its East Setauket headquarters three years ago, but Simons and the firm retain close ties to the university. Thanks to Simons' generosity, Stony Brook is considered one of the top ten math departments in the country; several math professors hold the title of James Simons Instructor. In addition to having led for more than a decade the Stony Brook Foundation, which raises and invests a private endowment for the school, Simons has helped the school take a lead role in assuming the management of Brookhaven National Laboratory for the Department of Energy.

Renaissance headquarters feature a gym, lighted tennis courts, a library with a fireplace and large private offices for every employee. All back-office and administrative functions are handled out of the firm's New York offices.

Unusual for a hedge fund, the heart of Renaissance is not its trading room — an uncluttered room where a score of traders buy and sell around the clock — but rather an auditorium with exposed beams that seats 100 and features biweekly science lectures. Last month a molecular biologist presented research on colon cancer. "When you hear someone talk about an interesting use of statistics it helps trigger your thinking," says one Renaissance employee.

The atmosphere is college casual, if intense — think of a perpetual exam week. Though a natty dresser, Simons sets a properly idiosyncratic tone. "He has been known to show up at formal business meetings without socks," says Jerome Swartz, Simons' next-door neighbor on Long Island and an Equimetrix investor.

Married to his second wife, Marilyn, for about 25 years, Simons has four children, two of whom are still school age. At Renaissance he works out of a tidy office with fashionable leather furniture and a large, somewhat gruesome painting of a lynx killing a rabbit. "I used to have it in my house," says Simons. "My wife didn't particularly like it."

Staff turnover is nearly nonexistent. Every six months all employees receive cash bonuses based on fund performance. The six-month benchmark is said to be 12 percent — and it's almost always easily surpassed. Most employees also hold equity in the firm. Simons frequently takes the entire staff and their families — more than 300 people — on lavish weekend vacations. Earlier this year he flew everyone to Bermuda.

Renaissance is divided into three basic groups: computer and systems specialists, researchers and traders. Once a week Simons meets with the research group, discussing in detail the progress of trading strategies under development.

Job candidates don't have to know any finance — in fact, Wall Street experience is a black mark — but they must present a talk on their scientific research to the entire firm before being offered a job. Most staffers seem to know little about the rest of the financial services industry, or even the hedge fund business. Asked about the performance of legendary futures trader and Renaissance rival Paul Tudor Jones, one researcher says, "Who's Tudor Jones?"

For a man who believes in luck, Simons doesn't leave a lot to chance when it comes to recruiting the staff that builds his trading models. As the firm's assets grew, Simons recruited top-flight mathematicians and scientists, including University of Virginia physics professor Robert Lourie and Bell Labs numbers theorist Peter Weinberger, to research new trading strategies. In recent years Simons seems to be especially keen on stockpiling computational linguists who have

worked on building computers that can recognize speech. He has hired away a good part of the speech recognition group from IBM Corp.

Why computational linguists? "Investing and speech recognition are very similar," says one Renaissance researcher. "In both, you're trying to guess the next thing that happens."

As a trader, Simons tries to overcome fundamental laws, not discover them. In the case of quantitative finance, the law is the efficient-markets hypothesis and the belief that markets should be difficult, but not impossible, to beat.

In his rare discussions of trading, the Renaissance president emphasizes that trading opportunities are by their nature small and fleeting. "Efficient market theory is correct in that there are no gross inefficiencies," Simons told the Greenwich Roundtable last year. "But we look at anomalies that may be small in size and brief in time. We make our forecast. Then, shortly thereafter, we reevaluate the situation and revise our forecast and our portfolio. We do this all day long. We're always in and out and out and in. So we're dependent on activity to make money."

Renaissance essentially attempts to predict the future movement of financial instruments, within a specific time frame, using statistical models. The firm searches for something that might be producing anomalies in price movements that can be exploited. At Renaissance they're called "signals." The firm builds trading models that fit the data.

When the trading starts, the models run the show. Renaissance has 20 traders who execute at the lowest cost and without moving markets, crucial requirements for quant investors trading on narrow margins. But the models decide what to buy and sell. Only in cases of extreme volatility, or if the signals appear to be weakening, does the firm sometimes manually cut back. Says Simons, "We don't override the models."

Even in structuring its hedge fund-of-funds portfolio, Medallion takes a quantitative approach. The fund balances the positions of its outside portfolio to ensure that, overall, the fund has no stock market exposure; it is, in other words, a "beta zero" portfolio. Last year the fund-of-funds, on a risk-adjusted basis, even beat trading returns, posting a higher Sharpe ratio than the 2.31 recorded for the overall fund and accounting for about 7 percent of the Medallion's revenues. Nevertheless, investing with outside managers poses certain challenges. "We treat these funds as instruments," says Simons. "But unlike the deutsche mark, managers change their character over time. It's messier to model those time series, but it's not impossible. We do our best."

Renaissance has also pioneered advanced trading technologies that make it possible to earn money on small margins. When few firms were thinking about electronic trading, a Renaissance subsidiary quietly installed a direct trading link to the German futures exchange. "The world is moving in our direction," says one Renaissance executive. "If the NYSE went all electronic it would be great for us."

Though Simons won't reveal the specifics of his trading, it's possible to get a glimpse of Renaissance's style by looking at Equimetrics, the U.S. market-neutral, long-short portfolio, started in April 1999 partly to expand Renaissance's base of institutional investors. Where Renaissance's traditional strength is rapid trading, Equimetrics hopes to apply the same principles to low-turnover trading.

Equimetrics was developed by Robert Frey, its CEO, an eight-year Renaissance veteran who previously worked in the secretive Morgan Stanley & Co. analytical proprietary trading group. All trades in the Equimetrics portfolio are made strictly from proprietary, computer-model-driven strategies, which pick from a universe of about 1,500 highly liquid common and preferred stocks. Typically, the portfolio holds about 1,000 positions, with stock index futures used to adjust the overall risk. No stock is expected to account for more than 5 percent of the portfolio, which will turn over only one to three times per year. The portfolio's leverage is a modest 2- or 3-to-1. (At

the end of the second quarter, Renaissance held stock positions of about \$2 billion in all its funds, according to Securities and Exchange Commission filings.)

So far the strategy is working. Last year, in nine months of trading after the fund's April 1999 launch, Equimetrics gained 12.1 percent, compared with 14.2 percent for the S&P 500. But this year, with the index down 2.23 percent through September, the fund was up 24.1 percent; the volatility of the fund has been just two thirds that of the index.

An Equimetrics report issued to investors in August, shows the nature of some holdings. As the S&P 500 climbed 6.2 percent and Nasdaq rose 11.7 percent for the month, Equimetrics was up 4.4 percent, holding a portfolio with its highest sector weightings in technology (17 percent long, 14 percent short); industrials (5 percent long, 3 percent short); and energy (9 percent long, 7 percent short). The portfolio's short positions had a high price-earnings ratio, 26.7, compared with 18.6 on the long side, and long positions were focused on companies with much higher average market capitalizations — \$35.8 billion — compared with an average \$19.6 billion for the shorts.

All sectors had a net exposure of 2 percent or less, except consumer noncyclicals, which had a — 6 percent exposure. "As market indices soared this month, the short positions took losses, but Equimetrics' long portfolio generated strong returns particularly in technology, financial and energy stocks," notes the Equimetrics report to investors.

What is not known are the secrets of the algorithms that can pick stocks smartly enough to beat the market with a portfolio that's short and long and trade efficiently enough to hold down costs to a bare minimum. Simons explains his firm's approach as the financial econometrics equivalent of blocking and tackling. "We search through historical data looking for anomalous patterns that we would not expect to occur at random. Our scheme is to analyze data and markets to test for statistical significance and consistency over time," says Simons. "Once we find one, we test it for statistical significance and consistency over time. After we determine its validity, we ask, 'Does this correspond to some aspect of behavior that seems reasonable?'"

Renaissance's rapid growth, and its continued diversification into new markets, creates enormous risks for the firm. Even as it grows its core Medallion business, Renaissance is trying to master new, difficult areas, from venture capital to low-turnover trading to investing in outside managers. All have produced blowups at other successful investment firms; some rely on talents far afield from Renaissance's scientific focus.

His firm, insists Simons, remains squarely focused on scientific finance. "I don't think we would do well getting off of that stuff," he says.

Simons, however, will no longer be chief scientist. He's contemplating retirement in three to four years. Going emeritus, so to speak. He plans to indulge in some "old guy" stuff like traveling.

And then there's math. Last year Simons and his old college professor I.M. Singer started fooling around with a fiendishly involved problem. Both are too busy to plug away consistently, but when they get together, says Singer, the ideas start flying.

"It's a fundamental problem concerning the interaction between math and physics," says Singer. "He could possibly make a very serious contribution. I have been urging him to come back."

It's doubtful his investors will be so eager to lose him to the world of theory.

THE PLANE TRUTH ABOUT TRADING FROM SIMONS

A theoretical-mathematician-turned-hedge-fund-manager-and-venture-capitalist, Renaissance Technologies founder and president James Simons has left his mark on fields ranging from futures trading to electronic books to theoretical physics. Publicity shy, Simons won't reveal any of the specific trading strategies that have allowed him to post one of the great long-term

investing records of all times. But in a recent day of interviews with Senior Editor Hal Lux, Simons talked about his various academic and professional lives, what they have in common and what they don't.

Institutional Investor: Do you still do any math research?

Simons: I think about math, but not with any particular success. When I left academia, there were still a couple of problems I was interested in that I'd like to work on when I retire. About a year ago I started doing some work with a professor at MIT. I don't know that I have the brains for it anymore. This work is really different from the deep thinking you do in math.

Is there a connection between the math you did and your trading?

None. Absolutely none.

Yet you hire mathematicians and scientists to do much of your work. Why is that?

Mathematics and science are two different notions, two different disciplines. By its nature, good mathematics is quite intuitive. Experimental science doesn't really work that way. Intuition is important. Making guesses is important. Thinking about the right experiments is important. But it's a little more broad and a little less deep. So the mathematics we use here can be sophisticated. But that's not really the point. We don't use very, very deep stuff. Certain of our statistical approaches can be very sophisticated. I'm not suggesting it's simple. I want a guy who knows enough math so that he can use those tools effectively but has a curiosity about how things work and enough imagination and tenacity to dope it out.

Why are the numbers so good this year for your hedge fund, Medallion?

Once in a while the phenomena we exploit are particularly present. We like a reasonable amount of volatility. In our business we want some action.

Yet for many firms the market has proved increasingly difficult.

Many of the anomalies we initially exploited are intact, though they have weakened some. What you need to do is pile them up. You need to build a system that is layered and layered. And with each new idea, you have to determine, Is this really new, or is this somehow embedded in what we've done already? So you use statistical tests to determine that, yes, a new discovery is really a new discovery. Okay, now how does it fit in? What's the right weighting to put in? And finally you make an improvement. Then you layer in another one. And another one.

Are markets more efficient than when you started?

Considerably more efficient. There was a time when we were trading Treasury bills and we were looking at the discount structure of the bills. We said, Something is crazy here. Far-out bills were trading at some huge discount, but the 12-month physical bill was not exhibiting any such discount. Something was wrong. This was certainly something that a Long-Term Capital Management would have eliminated in a microsecond. So we just kept looking at it and saying, Why is this? The answer was that no one was picking up that inefficiency. So we bought up a whole bunch of Treasury bill futures, hedged the position in various ways, kept our fingers crossed, and sure enough, it came in. It could have gone the other way, I suppose, but not for very long, because the chickens had to come home to roost. But those kinds of opportunities don't exist now. The commodities markets used to trend pretty heavily — long-term trends — but those don't really exist anymore.

Long-Term Capital Management was, like Renaissance, a quantitative trading firm. Did you learn any lessons from its collapse?

Everyone in the company read the book about LTCM. It makes you wary in a general sense. Our approach is very different. We don't start with models. We start with data. We don't have any preconceived notions. We look for things that can be replicated thousands of times. A trouble with convergence trading is that you don't have a time scale. You say that eventually things will come together. Well, when is eventually?

How did LTCM's collapse affect you?

If anything, it was positive. We did very well during that period. Tumult is usually good for us. We don't have credit lines of any significance. We don't do a lot of leveraged-type financing. People were calling us from various banks asking us about our balance sheets. I had our guys calling our counterparties: "Tell me about your problems." Generally, those kinds of times — and also in '94 — when everyone is running around like a chicken with its head cut off, that's pretty good for us because they seem to evidence the patterns that we know how to take advantage of.

Is there a size limit for a firm like Renaissance?

There undoubtedly is, but frequently one does not discover that number until after you're past it. The budget this year is to end with 150 people. If you were to have asked me five years ago, "Could you run Renaissance with 150 people efficiently?" I would have said, "What the hell would they be doing?" That's why we're on the third expansion of this building. For years people have asked me, "How much money can you manage?" And my honest answer has been, "About twice as much as we now manage." And that's still my answer. We now manage a little less than \$4 billion. Can we manage \$7 billion or \$8 billion? Yes. Could we manage \$70 billion? Of course not. I wouldn't have a clue as to how to manage that. It's inconceivable to me to manage that much doing what we do now, but maybe new things would come along. They always have.

Are you prouder of your mathematical legacy, or of this firm?

I would say about equal. The math stuff I did, the outsize reputation that some of it received, came well after I stopped doing it. I wouldn't say that either one is a source of more satisfaction.

Did you always want to be more than an academic?

In college, while I was busy learning mathematics, it occurred to me to start a movie theater. There was only the Brattle Theater in Cambridge. And I thought maybe there's room for another one. Fortunately, I did not start a movie theater. There were periods when I would only think about mathematics, but then I would think, "Gee, maybe there's something else." Through high school, anything related to business seemed absurd to me.

Will you retire anytime soon?

To myself, I have said, "I'm 62; by the time I'm 65, I'd like to pass the baton."

When you retire, will you go back to math?

There are other things I would like to do. I have a charitable foundation. I'd like to travel. But I expect I would try anyway and go back and do some mathematics until the point it occurred to me that this was a waste of my time. I don't know how quickly that would be. But I'd try, yeah.

THE FURTHER VENTURES OF JIM SIMONS

Renaissance Technologies fund whiz James Simons first traded stocks in the early 1960s, while in graduate school at the University of California at Berkeley. Soon after, he had tried his hand at venture capital, when, with some college buddies from the Massachusetts Institute of Technology, he invested in a Colombian floor tile and pipe company. That lucrative deal eventually gave him the capital he used to go into trading full time in the late 1970s.

Otherwise, though Simons remains an active venture capitalist, his track record is decidedly more mixed than his stellar trading history. Still active in Latin America as an investor in the Sanford Group, the industrial holding company that grew out of the investments he and his MIT classmates made, Simons visits the region twice a year.

But technology nowadays plays a prominent part in his U.S. portfolio. Simons got involved in the early personal computer, technology-gadgets and electronic-book markets through a 1981 investment in Franklin Computer Corp., which was founded that year as one of the original general purpose personal computer companies. But in 1984 the company filed for bankruptcy after being forced to settle a copyright infringement lawsuit brought by Apple Computer. It emerged from bankruptcy the following year under new management.

Through another company, Simons had helped to develop new technology that would give Franklin a second life. In 1979 Simons and scientist Peter Yianilos, an expert in artificial intelligence and speech recognition, had founded Proximity Technology, a pioneer in hand-held electronic book technology and spell-check software. The technology was futuristic. "The first book cost \$800 to produce," recalls Yianilos.

Franklin bought Proximity in 1988, a year after Proximity had helped it develop the first blockbuster hand-held computer, a \$69.95 spell-checker called Spelling Ace. Franklin's shares jumped from from 21/8 to more than 10. In 1990 the company was renamed Franklin Electronic Publishers. But despite such product innovations as electronic bibles and wine guides in the 1990s, the company's shares languished, with the exception of a brief run-up to 44 in 1995 when the company came out with one of the first electronic books. In October the stock was trading at 101/4, up from a 52-week low of 33/4.

Through an offshore trust, Simons, now chairman of New York Stock Exchange-listed Franklin, owns 22 percent of the company, a stake worth about \$16 million. This fall the company is releasing a new multimedia device called eBookman, which will allow users to read and listen to books downloaded from the Internet. "Whether Franklin will someday be a huge success, I don't know," shrugs Simons.

A bigger score came in the late 1980s, when Simons invested in Numar Corp., a traditional oil services company, which had become a leader in applying magnetic resonance imaging technology to oil and gas exploration. Numar went public at 121/2 per share in April 1994 and was sold in 1997 to energy services and construction company Halliburton Co. Halliburton bought Numar for \$430 million, making Simons' 900,000 shares of stock worth about \$45 million, four times what they were worth at the time of the IPO.

Through his partnership in an investment firm called Long Island Venture Fund, Simons is a major shareholder in a dot-com direct marketing operation called MyPoints.com, which was taken public in August 1999 by Robertson Stephens. Simons now has a chance to feel dot-com pain, with the stock trading at 21/2, down 97.5 percent from its 52-week high of 9711/16.