# Scientists: This man has your number

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Pierre Azoulay, an associate professor at the MIT Sloan School of Management. Photo: Allegra Boverman

Attention, star scientists: Pierre Azoulay is watching you. Not literally, of course: Azoulay, an economist, inhabits an office tucked away in the MIT Sloan School of Management, far from any lab. But his forte is original research about how life scientists work — or, more precisely, what makes them work well. Which kinds of grants lead to the most creative scientific research? When elite scientists die or switch jobs, what happens to the output of their former colleagues and co-authors?

Information about those questions is just not readily available. Except to Azoulay: The hard numbers supporting his findings come from a unique database charting the careers of 12,000 scientific stars, which he has painstakingly built up over nearly a decade in collaboration with Joshua Graff Zivin, an economist at the University of California at San Diego.

The database paints a kind of pointillist picture, with statistical dots representing those star scientists: It's a complete record of their jobs, awards, patents, papers, their papers' citations and more. If a life scientist has achieved almost any measure of acclaim in the United States during the last half-century, Azoulay knows about it.

"In some sense I have a dossier on each of them and have become intimately familiar with all of them," says Azoulay, a voluble Frenchman who talks about his own work with good-humored detachment. "I am a glutton for punishment in terms of data. I have never done a project that uses readily available data."

The payoff has been considerable: Last year Azoulay received tenure at MIT, where he is the Sloan Distinguished Associate Professor of Technological Innovation, Entrepreneurship, and Distinguished Management. And in recent years, buttressed by the kind of work Azoulay does, the statistical study of scientists themselves has gained a following within government agencies such as the National Science Foundation and the National Institutes of Health.

**Math tango in Paris**

Azoulay, 41, grew up in Paris, in a family with roots in Algeria (where his father was born) and Alsace (where his mother was born). He credits his academic development in secondary school to one Madame Barrière, his math teacher for four years: "I liked math, but I was never good at it. She had such high expectations, and I disappointed her in the beginning. But she stayed on my case, and I can truly say, but for her, I wouldn't be here."

Azoulay received his undergraduate degree from France's Institut National des Télécommunications. While completing his degree, he discovered a study-abroad program, enrolled, and earned a master's

degree at Michigan State University. Azoulay then applied to PhD programs in the United States and entered Sloan — “MIT took a chance on me,” he says — expecting to study telecommunications policy.

Instead, Azoulay fell in with a group of MIT professors, including Rebecca Henderson and Scott Stern, who were studying the production of knowledge in the life sciences, and the commercialization of those findings by pharmaceutical firms. “Within about three months it was clear I wasn’t going to study telecommunications regulation,” Azoulay says.

Azoulay’s doctoral thesis examined the outsourcing of clinical trials by pharmaceutical and biotechnology companies; thanks to unique data he had wrangled from a consulting firm with wide industry ties, he found that firms often hired contract research companies to conduct ”data-intensive” projects but allocated more complex “knowledge-intensive” trials to their own employees. He now says his conclusions at the time were “confused, and confusing,” but the thesis was good enough to get Azoulay a job at Columbia University, where he taught for five years. While there, two events shaped Azoulay’s career as a keeper of scientific statistics.

First, at a conference in 2002, economist Luis Garicano, now of the London School of Economics, took an interest in Azoulay’s thesis research. “Luis basically explained to me what my paper was about,” Azoulay says. “I’ll only give myself credit for one thing, which is that I listened.” Ultimately, Azoulay’s findings shed light on modern economic theories of the firm: Because knowledge-intensive research is harder to measure, firms keep it in-house, while outsourcing assignments that are easier to measure, and hence monitor. By 2004, Azoulay had published a cleaned-up version of the paper in the American Economic Review (AER), an unusually prestigious venue for a young professor.

Soon thereafter, Azoulay gave a talk at Columbia and was peppered with questions by an audience member who knew a lot about drug trials. It turned out to be Graff Zivin. “We talked afterward and said, ‘Let’s get coffee,’” Azoulay says. Before long, they decided to collaborate on studying the effects superstar scientists have on their disciplines; Azoulay now calls Graff Zivin his “partner in crime.”

The duo spent five years compiling the data without publishing any papers based on it — a risky move in a field where tenure-seeking scholars are expected to publish early and often. “The only reason I could do that, and it wasn’t career suicide, was that I had published my thesis well,” Azoulay says, referring to his AER paper. Also, in 2006, Azoulay accepted a job back at MIT, where studying scientists’ careers in granular detail has more cachet than it would at most other institutions.

## The perils of ‘superstar extinction’

Eventually, Azoulay and Graff Zivin started churning out papers based on their still-growing database. In one paper called “Superstar Extinction,” they looked at more than 8,000 scientists who co-authored papers with a star scientist who then died prematurely, and found that the productivity of these collaborators subsequently permanently decreased. They also found that freedom helps scientific creativity flourish: More bioscience breakthroughs come from long-term grants with little oversight, rather than shorter, more directed grants.

More results in this vein are coming soon: Azoulay and Graff Zivin are currently examining what happens to the productivity of scientists when their star colleagues merely switch jobs, rather than die. Azoulay is also working on a paper about how the initial career choice of young life scientists — whether in academia or industry — affects their long-term trajectories.

Still, none of these findings are easy to derive. Azoulay compares the effort it has taken to build and maintain his database to the toil of famed microbiologist Sydney Brenner, who spent 12 hours a day for several years studying how cells divide in the C. elegans worm, before the research paid off. “My appetite for nitty-gritty data collection is somewhat idiosyncratic,” Azoulay admits. “It’s a means, not an end, but if you don’t enjoy the means, you’ll never get to understand how progress takes place in science, and what can be done to speed up this progress.”

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