

A Sharp Rise in Retractions Prompts Calls for Reform



Matthew Ryan Williams for The New York Times

PLEA Dr. Ferric Fang argues that science has changed in worrying ways.

By CARL ZIMMER
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In the fall of 2010, Dr. Ferric C. Fang made an unsettling discovery. Dr. Fang, who is editor in chief of the journal *Infection and Immunity*, found that one of his authors had doctored several papers.

It was a new experience for him. "Prior to that time," he said in an interview, "Infection and Immunity had only retracted nine articles over a 40-year period."

[ting](#) six of the papers from the author,

Naoki Mori of the University of the Ryukyus in Japan. And it soon became clear that *Infection and Immunity* was hardly the only victim of Dr. Mori's misconduct. Since then, other scientific journals have retracted two dozen of his papers, [according to the watchdog blog Retraction Watch](#).

"Nobody had noticed the whole thing was rotten," said Dr. Fang, who is a professor at the University of Washington School of Medicine.

Dr. Fang became curious how far the rot extended. To find out, he teamed up with a fellow editor at the journal, Dr.

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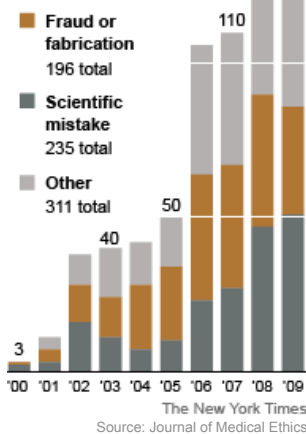
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Retractions On the Rise

A study of the PubMed database found that the number of articles retracted from scientific journals increased substantially between 2000 and 2009.



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Angel Franco/The New York Times

WATCHDOG Dr. Arturo Casadevall of the Albert Einstein College of Medicine in New York teamed up with Dr. Ferric C. Fang to study a raft of retractions.

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scientific mistakes.

Several factors are at play here, scientists say. One may be that because journals are now online, bad papers are simply reaching a wider audience, making it more likely that errors will be spotted. "You can sit at your laptop and pull a lot of different papers together," Dr. Fang said.

But other forces are more pernicious. To survive professionally, scientists feel the need to publish as many papers as possible, and to get them into high-profile journals. And

Arturo Casadevall of the Albert Einstein College of Medicine in New York. And before long they reached a troubling conclusion: not only that retractions were rising at an alarming rate, but that retractions were just a manifestation of a much more profound problem — "a symptom of a dysfunctional scientific climate," as Dr. Fang put it.

Dr. Casadevall, now editor in chief of the journal mBio, said he feared that science had turned into a winner-take-all game with perverse incentives that lead scientists to cut corners and, in some cases, commit acts of misconduct.

"This is a tremendous threat," he said.

Last month, in a pair of [editorials](#) in Infection and Immunity, the two editors issued a [plea](#) for fundamental reforms. They also presented their concerns at the March 27 meeting of the National Academies of Sciences committee on science, technology and the law.

Members of the committee agreed with their assessment. "I think this is really coming to a head," said Dr. Roberta B. Ness, dean of the University of Texas School of Public Health. And Dr. David Korn of Harvard Medical School agreed that "there are problems all through the system."

No one claims that science was ever free of misconduct or bad research. Indeed, the scientific method itself is intended to overcome mistakes and misdeeds. When scientists make a new discovery, others review the research skeptically before it is published. And once it is, the scientific community can try to replicate the results to see if they hold up.

But critics like Dr. Fang and Dr. Casadevall argue that science has changed in some worrying ways in recent decades — especially biomedical research, which consumes a larger and larger share of government science spending.

In October 2011, for example, [the journal Nature reported](#) that published retractions had increased tenfold over the past decade, while the number of published papers had increased by just 44 percent. In 2010 The Journal of Medical Ethics [published a study](#) finding the new raft of recent retractions was a mix of misconduct and honest

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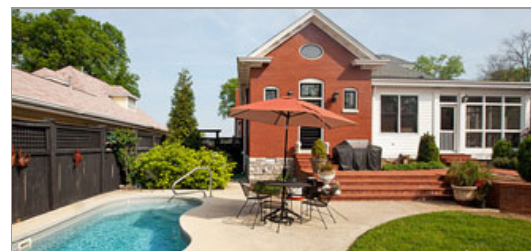
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sometimes they cut corners or even commit misconduct to get there.

To measure this claim, Dr. Fang and Dr. Casadevall looked at the rate of retractions in 17 journals from 2001 to 2010 and compared it with the journals' "impact factor," a score based on how often their papers are cited by scientists. The higher a journal's impact factor, [the two editors found](#), the higher its retraction rate.

The highest "retraction index" in the study went to one of the world's leading medical journals, The New England Journal of Medicine. In a statement for this article, it questioned the study's methodology, noting that it considered only papers with abstracts, which are included in a small fraction of studies published in each issue. "Because our denominator was low, the index was high," the statement said.

Monica M. Bradford, executive editor of the journal Science, suggested that the extra attention high-impact journals get might be part of the reason for their higher rate of retraction. "Papers making the most dramatic advances will be subject to the most scrutiny," she said.

Dr. Fang says that may well be true, but adds that it cuts both ways — that the scramble to publish in high-impact journals may be leading to more and more errors. Each year, every laboratory produces a new crop of Ph.D.'s, who must compete for a small number of jobs, and the competition is getting fiercer. In 1973, more than half of biologists had a tenure-track job within six years of getting a Ph.D. By 2006 the figure was down to 15 percent.

Yet labs continue to have an incentive to take on lots of graduate students to produce more research. "I refer to it as a pyramid scheme," said Paula Stephan, a Georgia State University economist and author of "How Economics Shapes Science," published in January by Harvard University Press.

In such an environment, a high-profile paper can mean the difference between a career in science or leaving the field. "It's becoming the price of admission," Dr. Fang said.

The scramble isn't over once young scientists get a job. "Everyone feels nervous even when they're successful," he continued. "They ask, 'Will this be the beginning of the decline?'"

University laboratories count on a steady stream of grants from the government and other sources. The National Institutes of Health accepts a much lower percentage of grant applications today than in earlier decades. At the same time, many universities expect scientists to draw an increasing part of their salaries from grants, and these pressures have influenced how scientists are promoted.

"What people do is they count papers, and they look at the prestige of the journal in which the research is published, and they see how many grant dollars scientists have, and if they don't have funding, they don't get promoted," Dr. Fang said. "It's not about the quality of the research."

Dr. Ness likens scientists today to small-business owners, rather than people trying to satisfy their curiosity about how the world works. "You're marketing and selling to other scientists," she said. "To the degree you can market and sell your products better, you're creating the revenue stream to fund your enterprise."

Universities want to attract successful scientists, and so they have erected a glut of science buildings, Dr. Stephan said. Some universities have gone into debt, betting that the flow of grant money will eventually pay off the loans. "It's really going to bite them," she said.

With all this pressure on scientists, they may lack the extra time to check their own

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research — to figure out why some of their data doesn't fit their hypothesis, for example. Instead, they have to be concerned about publishing papers before someone else publishes the same results.

“You can't afford to fail, to have your hypothesis disproven,” Dr. Fang said. “It's a small minority of scientists who engage in frank misconduct. It's a much more insidious thing that you feel compelled to put the best face on everything.”

Adding to the pressure, thousands of new Ph.D. scientists are coming out of countries like China and India. Writing in the April 5 issue of *Nature*, [Dr. Stephan points out](#) that a number of countries — including China, South Korea and Turkey — now offer cash rewards to scientists who get papers into high-profile journals. She has found these incentives set off a flood of extra papers submitted to those journals, with few actually being published in them. “It clearly burdens the system,” she said.

To change the system, Dr. Fang and Dr. Casadevall say, start by giving graduate students a better understanding of science's ground rules — what Dr. Casadevall calls “the science of how you know what you know.”

They would also move away from the winner-take-all system, in which grants are concentrated among a small fraction of scientists. One way to do that may be to put a cap on the grants any one lab can receive.

Such a shift would require scientists to surrender some of their most cherished practices — the priority rule, for example, which gives all the credit for a scientific discovery to whoever publishes results first. (Three centuries ago, Isaac Newton and Gottfried Leibniz were bickering about who invented calculus.) Dr. Casadevall thinks it leads to rival research teams' obsessing over secrecy, and rushing out their papers to beat their competitors. “And that can't be good,” he said.

To ease such cutthroat competition, the two editors would also change the rules for scientific prizes and would have universities take collaboration into account when they decide on promotions.

Ms. Bradford, of *Science* magazine, agreed. “I would agree that a scientist's career advancement should not depend solely on the publications listed on his or her C.V.,” she said, “and that there is much room for improvement in how scientific talent in all its diversity can be nurtured.”

Even scientists who are sympathetic to the idea of fundamental change are skeptical that it will happen any time soon. “I don't think they have much chance of changing what they're talking about,” said Dr. Korn, of Harvard.

But Dr. Fang worries that the situation could become much more dire if nothing happens soon. “When our generation goes away, where is the new generation going to be?” he asked. “All the scientists I know are so anxious about their funding that they don't make inspiring role models. I heard it from my own kids, who went into art and music respectively. They said, ‘You know, we see you, and you don't look very happy.’”

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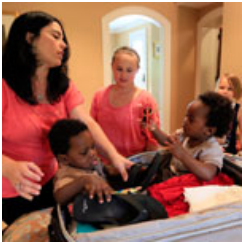
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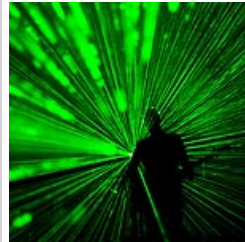
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