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# The Number That's Devouring Science

**The impact factor, once a simple way to rank scientific journals, has become an unyielding yardstick for hiring, tenure, and grants**

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By RICHARD MONASTERSKY

In the beginning, during the late 1950s, it was just an innocent idea in Eugene Garfield's head. A Philadelphia researcher who described himself as a "documentation consultant," Mr. Garfield spent his free time thinking about scientific literature and how to mine information from it.

He eventually dreamed up something he called an "impact factor," essentially a grading system for journals, that could help him pick out the most important publications from the ranks of lesser titles. To identify which journals mattered most to scientists, he proposed tallying up the number of citations an average

article in each journal received.

This accounting method sounds harmless enough. Outside academe, few people have even heard of it. Mr. Garfield, though, now compares his brainchild to nuclear energy: a force that can help society but can unleash mayhem when it is misused.

Indeed, impact factors have assumed so much power, especially in the past five years, that they are starting to control the scientific enterprise. In Europe, Asia, and, increasingly, the United States, Mr. Garfield's tool can play a crucial role in hiring, tenure decisions, and the awarding of grants.

"The impact factor may be a pox upon the land because of the abuse of that number," says Robert H. Austin, a professor of physics at Princeton University.

Impact-factor fever is spreading, threatening to skew the course of scientific research, say critics. Investigators are now more likely to chase after fashionable topics — the kind that get into high-impact journals — than to follow important avenues that may not be the flavor of the year, says Yu-Li Wang, a professor of physiology at the University of Massachusetts Medical School. "It influences a lot of people's research direction."

That influence has also led to a creeping sense of cynicism about the business of science publications. Journal editors have learned how to manipulate the system, sometimes through legitimate editorial choices and other times through deceptive practices that artificially inflate their own rankings. Several ecology journals, for example, routinely ask authors to add citations to previous articles from that same journal, a policy that pushes up its impact factor. Authors who have received such requests say that the practice veers toward extortion and represents a violation of scientific ethics.

What's more, investigations into impact factors have revealed problems with the basic data used by ISI, the company that tabulates citation statistics and journals'

impact factors. Started by Mr. Garfield in Philadelphia, ISI was bought in 1992 by the Thomson Corporation, which has tried to transform the citation enterprise into a more profitable operation by buying up databases and promoting its products. With alarming frequency, editors are finding fault with the impact factors that Thomson has issued.

"This was a serious concern," says Alan Nevill, a professor of biostatistics at the University of Wolverhampton, in England, who took issue with the calculations that ISI made regarding the *Journal of Sports Science*, which he edits. "Academia is being held ransom by these citations."

**Far From Its Roots**

It wasn't supposed to be this way. "We never predicted that people would turn this into an evaluation tool for giving out grants and funding," says Mr. Garfield.

Although he first mentioned the term "impact factor" in a publication in 1955, it wasn't until the 1960s that Mr. Garfield and a colleague fully developed the concept to help them select the most important journals for a new citation index, which has grown into one of the most widely used citation tools in science and the social sciences. It didn't make sense, they reasoned, to include only the journals that get the most citations, because that would eliminate smaller publications. So they invented a type of measurement that reflects the average number of citations per article for each journal.

The basic definition has changed little since then, although the process of calculating impact factors has become highly automated through the use of computer algorithms, which trolled through 27 million citations last year. In June, ISI issued its latest set of impact factors, for 5,968 science journals and 1,712 social-science journals.

To calculate the most recent factor for the journal *Nature*, for example, the company tallied the number of citations in 2004 to all of the articles that *Nature*

published in 2002 and 2003. Those citations were divided by the number of articles the journal published in those two years, yielding an impact factor of 32.182 — the ninth-highest of all journals. It is a number that editors and publishers across the world lust after; more than half of all science journals listed by ISI score below 1.

Impact factors caught on because they are an objective measure that serves many purposes. Librarians can use them to decide which journals to purchase and which to cancel. Editors and publishers can chart their journals' impact factors to gauge their progress relative to competitors. And scientists can examine the numbers to see where their research papers are likely to get the most attention.

Higher-ranking journals, it turns out, do get a message out better. Matthew B. Stanbrook, an assistant professor of medicine at the University of Toronto, tracked what happened after 12 medical journals published a joint statement on research authorship and sponsorship in 2001 — an unusual situation that provided direct comparisons. Over the following 26 months, the highest-impact journal received 100 times as many citations to the article as the lowest one of the 12, Dr. Stanbrook reported at a conference on peer review and publishing last month in Chicago. "There's a measurable value associated with a high-impact journal, which indicates why those journals are important," he says.

Over the years, impact factors have proved so attractive to scientists that they started applying them not only to journals but also to researchers. Ideally, evaluators would look at the number of citations an individual paper receives or a scientist accumulates over his or her career — but that process takes time and money. Impact factors provide a shortcut.

They also help in the modern world of ultraspecialized science. Members of a tenure committee or a hiring panel find it increasingly difficult to assess the papers of a candidate working outside their own subdiscipline, so they use the impact factor of the journal in which the paper appeared as a measure of the paper's quality. By

that logic, evaluators rate a paper more highly if it appears in a high-impact journal, regardless of what the paper actually says.

Europeans cite another reason that impact factors are popular there. In some countries, the community of researchers in a particular field is so small that they all know each other and either collaborate or compete. Using impact factors to assess individual scientists is seen as an improvement over tapping into an old-boy network to make hiring and grant decisions.

**Fuzzy Math**

But relying on impact factors to evaluate a person is statistically dimwitted, say critics of its spreading influence. The measurement is just an average of all the papers in a journal over a year; it doesn't apply to any single paper, let alone to any author. For example, a quarter of the articles in *Nature* last year drew 89 percent of the citations to that journal, so a vast majority of the articles received far fewer than the average of 32 citations reflected in the most recent impact factor.

Mr. Garfield and ISI routinely point out the problems of using impact factors for individual papers or people. "That is something we have wrestled with quite a bit here," says Jim Pringle, vice president for development at Thomson Scientific, the division that oversees ISI. "It is a fallacy to think you can say anything about the citation pattern of an article from the citation pattern of a journal."

Such warnings have not helped. In several countries in Europe and Asia, administrators openly use impact factors to evaluate researchers or allocate money:

- In England, hiring panels routinely consider impact factors, says Mr. Nevill.
- According to Spanish law, researchers are rewarded for publishing in journals defined by ISI as prestigious, which in practice has meant in the upper third of the impact-factor listings.
- In China, scientists get cash bonuses for

> publishing in high-impact journals, and graduate students in physics at some universities must place at least two articles in journals with a combined impact factor of 4 to get their Ph.D.'s, says Martin Blume, editor in chief of the American Physical Society, who recently met with scientists in China.

The obsession with impact factors has also seeped into the United States, although less openly. Martin Frank, executive director of the American Physiological Society, says a young faculty member once told him about a policy articulated by her department chair. She was informed that in order to get tenure, scientists should publish in journals with an impact factor above 5.

"We are slaves to the impact factor," says Mr. Frank, whose organization publishes 14 science journals.

Impact ranking may now be a tool that controls scientists, rather than the other way around. Pressure to publish in the highest-impact science journals — *Nature*, *Science*, and *Cell* — has led researchers to compete more and more for the limited number of slots in those broader journals, thus diminishing the specialty titles that have traditionally served as the main publications of each discipline. Academe used to be a "publish or perish" world, but now the halls of science have turned into a "publish in a high-impact journal or perish" environment, says Massachusetts' Mr. Wang.

He observes that impact factors may even be affecting what kind of research is conducted. Top journals require that papers be topical, in addition to presenting important science, so researchers are shifting the kinds of questions they investigate to accommodate those high-impact journals. "The system is going after the short term," says Mr. Wang.

"For example, it is easy to catch attention when one describes a previously unknown gene or protein related to a disease, even if the analysis is done only superficially," he says. "Follow-up studies, to uncover the true functions of the molecules or sometimes to

challenge the initial analysis, are typically more difficult to publish in journals of top 'impact.'"

Catherine D. DeAngelis, editor of the high-impact *Journal of the American Medical Association*, also criticizes the current culture. The impact factor "has taken on a life of its own," she says, lamenting that many scientists view their work as a failure if they can't get into a top journal. "There are wonderful journals that have impact factors lower than some of the higher-citation journals, and they're perfectly appropriate for good scientists to publish in."

The whole system has led to increasing discontent among researchers, says Dr. DeAngelis. "It's bad for science in that you don't make researchers feel good about what they're doing and the fact that their work gets published in a good journal," she says. "That's bad. You're a better scientist if you're a happy scientist."

Researchers go to great lengths to place their papers in high-impact journals. They will often flip a manuscript from one publication to the next, dropping reluctantly down the impact ladder until they find one that will accept their work. The system slows the pace of science, say critics, because researchers spend their time trying to publish their work rather than moving on to the next set of experiments.

Sometimes authors will put considerable extra work into a paper — at the request of reviewers at top journals — only to find it eventually rejected. "I'll get so exhausted by the whole thing that I won't even publish it or will delay it for a year," says Princeton's Mr. Austin.

**Think Quick**

Deluged by so many manuscripts, high-impact journals can send only a fraction out to experts for review. *Nature,* for example, rejects half of the submissions it gets without forwarding them to referees, says its editor in chief, Philip Campbell.

Mr. Austin worries about that process, saying that

journal editors are summarily rejecting unfashionable papers. "That can really limit creativity, and really pioneering papers will not necessarily be judged as such by these editors," he says, adding that the editors at top journals are not active researchers.

Mr. Campbell responds that editors at *Nature* all have research experience at good labs and keep on top of their fields by attending conferences and reviewing the literature. "They are better than most academics in keeping track of what's going on," he says. "I would put them up against any academic any day in terms of knowing what's going on."

He also rejects a belief widely held among scientists that *Nature* rejects manuscripts if editors suspect that they won't attract citations and therefore will depress the journal's impact factor. If that were true, he says, the journal would stop publishing papers in geology or paleontology, which rarely receive as many citations as ones in molecular biology.

"We're perfectly happy with the fact that we publish papers that are much less cited than others," says Mr. Campbell, who also notes that *Nature* has regularly voiced skepticism about impact factors in editorials, letters, and news articles.

Many other editors contacted by *The Chronicle* also deny making judgments on the basis of whether a paper will attract citations. But Dr. DeAngelis, of *JAMA*, says editors at some top journals have told her that they do consider citations when judging some papers. "There are people who won't publish articles," she says, "because it won't help their impact factor."

She acknowledges that citations sometimes play a role in her own decisions about a paper. "If I'm on the edge and we're going back and forth," she says, "I might make the decision saying, Will people use this? In that case, one of the criteria is: Will they cite it?"

Yet she also publishes papers that she knows will hurt *JAMA*'s impact factor. "We have a special theme issue

on medical education, and we continue to do it," she says, even though articles in it are cited relatively infrequently.

Fiona Godlee, editor of *BMJ* (formerly known as the *British Medical Journal*), agrees that editors take impact factors into account when deciding on manuscripts, whether they realize it or not. "It would be hard to imagine that editors don't do that," she says. "That's part of the way that impact factors are subverting the scientific process."

She says editors may be rejecting not only studies in smaller or less-fashionable fields, but also important papers from certain regions of the world, out of fear that such reports won't attract sufficient citation attention. "It's distorting people's priorities," she says, "and we have to constantly fight against that."

**Cult of the Factor**

Although impact factors have been around for decades, it is only within the past 10 years that they have taken on cult status, as the growing use of the Internet has given researchers easy access to ISI data. The company says the ranking is here to stay.

"One thing we won't do is change the impact factor as it stands now, just because it's become such a key indicator over time," says Mr. Pringle, the vice president for development. Rather than alter the original, ISI has added additional information and measurement tools to complement the impact factor, he says.

But the number continues to be so influential that some who run journals try to manipulate the system. "Publishers have become quite expert in skewing it to their own benefit," says Vitek Tracz, chairman of Current Science Group, which publishes more than 100 open-access journals.

One well-known method is to publish more review articles — those that give overviews of a topic but don't usually present new data. They generally attract more

citations than do original research articles. So when the editorial board of the *Journal of Environmental Quality* met in 2003, it resolved to emphasize review articles in order to shore up the journal's slipping impact factor.

Other tactics exploit gaps in the way ISI calculates the impact factor. When journals publish news articles, editorials, book reviews, and abstracts of meetings, ISI does not count those items as "citable articles"; hence they do not go into the denominator of the impact-factor calculation. But if those uncounted items get cited in the literature, ISI still puts those citations into the numerator, thereby increasing the journal's impact factor.

Managers at ISI and several journal editors contacted by *The Chronicle* dismissed the issue, arguing that news articles and editorials do not get cited often. On average that may be true. But some of them gain enough citations to significantly boost the impact factors of certain journals, says Henk F. Moed, a bibliometrician at the Center for Science and Technology Studies at Leiden University, in the Netherlands, who wrote about the issue in his new book, *Citation Analysis in Research Evaluation* (Springer, 2005). His analysis of the high-impact journal *The Lancet,* for example, showed that free citations from news articles and similar material buoyed the British medical journal's impact factor by 16 percent in 2002.

Many journals have added a considerable number of uncountable items to their mix in recent years, even as they have decreased the number of original research articles. In fact, *Cell, JAMA, The Lancet, Nature, The New England Journal of Medicine,* and *Science* are all now publishing fewer countable research items than they were in 1998, according to ISI data.

At the same time, those top journals and others have made a science out of getting publicity for their products. Big journals with well-funded public-relations offices send alerts to hundreds of reporters each week about the articles slated for their next issues. The system generates news items, which have been shown to increase citations to the original scientific articles, thus raising impact factors. Smaller, less-visible journals

don't benefit from the same media connection.

**Crooked Citations**

Editors defend the changes they have made in their journals, arguing that editorials, book reviews, news sections, and similar features are important and popular with readers. But journal watchers point to other, less scrupulous, ways to raise the citation numbers.

Sometimes journals will run editorials that cite numerous articles from previous issues. In a new study, Jan Reedijk, of Leiden University, and Mr. Moed found that a significant number of journals get a noticeable jump in their impact factors from such self-citations in editorials.

In other cases, research articles in a journal preferentially cite that very journal, with the effect of raising its impact factor. ISI detected a clear example of that practice at the *World Journal of Gastroenterology*. The company stopped listing that journal this year because 85 percent of the citations to the publication were coming from its own pages. (Despite that censure, the journal's Web site has a moving banner that still trumpets its 2003 impact factor.)

The gaming has grown so intense that some journal editors are violating ethical standards to draw more citations to their publications, say scientists. John M. Drake, a postdoctoral researcher at the National Center for Ecological Analysis and Synthesis, at the University of California at Santa Barbara, sent a manuscript to the *Journal of Applied Ecology* and received this e-mail response from an editor: "I should like you to look at some recent issues of the *Journal of Applied Ecology* and add citations to any relevant papers you might find. This helps our authors by drawing attention to their work, and also adds internal integrity to the *Journal*'s themes."

Because the manuscript had not yet been accepted, the request borders on extortion, Mr. Drake says, even if it weren't meant that way. Authors may feel that they have

to comply in order to get their papers published. "That's an abuse of editorial power," he says, "because of the apparent potential for extortion."

Robert P. Freckleton, a research fellow at the University of Oxford who is the journal editor who sent the message to Mr. Drake, says he never intended the request to be read as a requirement. "I'd be upset if people read it that way," he says. "That's kind of a generic line we use. We understand most authors don't actually do that." He changed the wording in the form letter last week to clear up misunderstandings, he said.

Whatever the intention behind such requests, they are becoming more common. Anurag A. Agrawal, an assistant professor of ecology and evolutionary biology at Cornell University, has documented similar practices at five other ecology journals. "It's embarrassing, and it's a scar on our discipline," he says. "Authors are being asked to compromise their principles. That chips away at the fabric of the scientific enterprise."

Mr. Freckleton defends the practice: "Part of our job as editors is making sure that our work is getting cited and read appropriately." The policy, he says, is not an explicit attempt to raise the journal's impact factor.

But the policy has done just that, and quite successfully, according to the *The Chronicle*'s analysis of self-citations to one-year-old articles — which are important in the impact calculation. In 1997 the *Journal of Applied Ecology* cited its own one-year-old articles 30 times. By 2004 that number had grown to 91 citations, a 200-percent increase. Similar types of citations of the journal in other publications had increased by only 41 percent.

The journal was engaged in other questionable activities at the time. Steve Ormerod, executive editor from 2000 through 2004, wrote several editorials during his tenure that cited his own journal dozens of times. In 2002, for example, two of his commentaries cited 103 papers published in the journal during 2000 and 2001. Those two editorials alone raised his journal's 2002 impact factor by 20 percent.

Mr. Ormerod, a professor of ecology at Cardiff University, in Wales, acknowledges that his actions look suspicious, but says "there is a less-sinister explanation." He was attempting, he says, to make the journal more relevant by examining whether past articles on environmental issues had led to policy actions. "As an accident, the impact factor went up at the same time as self-citations went up," he says. He advocates removing self-citations from the impact calculations completely, to avoid any semblance of impropriety.

Nonetheless, the self-citations at his publication had a measurable effect. The ecology journal's impact factor jumped from 1.3 in 1997 to 3.3 in 2004, and its ranking within the discipline rose from 29th out of 86 journals to 16th out of 107.

Following inquiries by *The Chronicle*, Mr. Freckleton said last week he was developing a plan to alter the journal's editorials so that self-citations will not raise its impact factor.

**Complaints From Researchers**

ISI says it is taking steps to stay ahead of the schemers. "It's not easy, but as we become aware of possible abuse, we try to expose that," says Marie E. McVeigh, product-development manager. For example, citation reports now indicate what percentage of citations to a journal come from that same publication.

While it is trying to track abuse from editors, however, ISI may not be doing enough to police itself. Several editors contacted by *The Chronicle* have raised complaints about errors in the company's data and analyses. The problems appear to be growing worse.

Mr. Blume, of the American Physical Society, says researchers have contacted him recently to complain that the ISI database is missing citations to their articles. "Complaints are on the rise," says Mr. Blume, whose organization is looking into the concerns.

Mr. Nevill, editor in chief of the *Journal of Sports*

*Science,* says his journal suffered when ISI incorrectly counted short meeting abstracts as if they were full-fledged original research articles or reviews. That miscoding doubled the number of articles credited to the journal each year, halving its impact factor, he says.

Dr. Godlee, of *BMJ,* says ISI incorrectly counted some items in her journal, such as commentaries, with the effect of depressing its impact factor.

James Testa, director of editorial development at Thomson Scientific, takes issue with calling those cases "errors." Questions often arise about how to define certain types of articles, and ISI works closely with publishers to establish a correct coding system for each journal, he says. The company has decided to rerun its impact-factor calculations this year to correct problems with 10 to 15 journals, says Mr. Pringle, of Thomson Scientific. He says the rising importance of impact factors in science has caused editors to pay closer attention to the calculations, which results in them raising more complaints than in the past.

Like many other editors and researchers, Dr. Godlee sees an easy solution to the types of problems that have been plaguing the calculations, as well as to deliberate deceptions. She suggests that ISI count citations only to original research articles, eliminating the problem of news stories, editorials, reviews, and other kinds of materials. But ISI has steadfastly resisted altering its original formula.

Given the power of ISI and its impact factors, scientists have little choice but to accept the system — although competitors are emerging that could alter the situation. And the growing use of online journals and open-access journals could eventually topple the traditional system of packaging articles into issues of a journal.

Like music lovers who download single songs instead of buying complete albums, some researchers are starting to download only the articles they want, regardless of where they originally appeared. "In terms of where it gets published, it's becoming less and less an issue,"

says Harold P. Erickson, a professor of cell biology at Duke University.

But most scientists still see value in differentiating between the quality of articles in, say, *Science* and *Science of the Total Environment.* Even Mr. Erickson has to face a dean who expects his professors to demonstrate their excellence by occasionally publishing in *Cell*, *Nature*, *Science*, and other journals with soaring impact factors.

**INSIDE THE IMPACT FACTOR**

Each year, the number by which science journals live and die is computed from a simple formula. To calculate the impact factor for journal *X*, Thomson ISI examines the 7,500 journals in its index to find the number of citations to *X* in the previous two years. That number becomes the numerator. The denominator is the number of original research articles and reviews published by *X* in the previous two years.

The impact factor was designed so that smaller journals could compete with larger ones. But the measurement is biased against slower moving fields, like mathematics, in which papers often cite literature that is many years old. Any citation beyond two years old does not enter into the impact-factor calculation. Journals sometimes exploit a loophole in the formula by adding news articles and editorials to their pages. While those don't get counted in the denominator, any citations to them go into the numerator, thus raising a journal's impact score.

$$\text{Impact Factor for Journal } X = \frac{\text{Citations in 2004 to articles published in } X \text{ in 2002 and 2003}}{\text{Articles published in } X \text{ in 2002 and 2003}}$$

**TOP MARKS**

This list of the journals with the highest impact factors reveals one of the measurement's quirks: Because review articles tend to get cited more than original research articles do, 7 of the top 15 journals are review publications. That has led some editors of research journals to add review articles in hopes of raising their impact factors. The list also shows that most of the top journals cover biology or medicine, which have far more active researchers than the physical sciences, and hence draw more citations. For that reason, Thomson ISI, the company that issues impact factors, recommends that journals be compared with others in the same category.

| Journal | Citations in 2004 to articles from 2002 and 2003 | Articles published in 2002 and 2003 | Impact factor |
|---|---|---|---|
| Annual Review of Immunology | 2,674 | 51 | 52.431 |
| Cancer Journal for Clinicians | 1,469 | 33 | 44.515 |
| The New England Journal of Medicine | 28,696 | 744 | 38.570 |
| Nature Reviews Cancer | 5,447 | 149 | 36.557 |
| Physiological Reviews | 2,069 | 61 | 33.918 |
| Nature Reviews Molecular Cell Biology | 4,876 | 147 | 33.170 |
| Reviews of Modern Physics | 2,294 | 70 | 32.771 |
| Nature Reviews Immunology | 4,937 | 151 | 32.695 |
| Nature | 56,255 | 1,748 | 32.182 |
| Science | 55,297 | 1,736 | 31.853 |
| Annual Review of Biochemistry | 1,640 | 52 | 31.538 |
| Nature Medicine | 9,929 | 318 | 31.223 |
| Cell | 17,800 | 627 | 28.389 |
| Nature Immunology | 7,531 | 273 | 27.586 |

| | | | |
|---|---|---|---|
| The Journal of the American Medical Association | 18,648 | 751 | 24.831 |

**SOURCE:** Thomson ISI

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That influence has also led to a creeping sense of cynicism about the business of science publications. Journal editors have learned how to manipulate the system, sometimes through legitimate editorial choices and other times through deceptive practices that artificially inflate their own rankings. Several ecology journals, for example, routinely ask authors to add citations to previous articles from that same journal, a policy that pushes up its impact factor.Â  It is a number that editors and publishers across the world lust after; more than half of all science journals listed by ISI score below 1. ADVERTISEMENT. Impact factors caught on because they are an objective measure that serves many purposes. The number that's devouring science Science since Babylon Little science, big science Panel criteria and working methods. Jan 1961. R Monastersky. Monastersky R. 2005. The number that's devouring science. The Chronicle of Higher Education 52:A12. Price D De Solla. 1961. Science since Babylon. New Haven, CT: Yale University Press. Price D De Solla. 1963. Little science, big science. Those who failed to do so were "devoured" and abandoned socially, becoming shamed ones, the unclean, who could not defend the motherland. But the devouring or hateful mother archetype manifests in a seemingly infinite number of ways. To be sure this topic is far too vast to completely address briefly here, but for now, take the time to begin to consider this dynamic of consciousness. An archetype is a feature of consciousness that all people make contact with but few fully recognize as such.Â  As an introduction to that work, contemplate the ideas presented below and ask yourself, where is the devouring mother archetype in my life and society? Can you see her? The talk begins at approximately the 16 minute mark.

The Number That's Devouring Science. Go. More options | Back issues Home News Today's news Current issue.Â  That influence has also led to a creeping sense of cynicism about the business of science publications. Journal editors have learned how to manipulate the system, sometimes through legitimate editorial choices and other times through deceptive practices that artificially inflate their own rankings. Several ecology journals, for example, routinely ask authors to add citations to previous articles from that same journal, a policy that pushes up its impact factor. The number that's devouring science Science since Babylon Little science, big science Panel criteria and working methods. Jan 1961. R Monastersky. Monastersky R. 2005. The number that's devouring science. The Chronicle of Higher Education 52:A12. Price D De Solla. 1961. Science since Babylon. New Haven, CT: Yale University Press. Price D De Solla. 1963. Little science, big science. To identify which journals mattered most to scientists, he proposed tallying up the number of citations an average article in each journal received. This accounting method sounds harmless enough. Outside academe, few people have even heard of it. Mr. Garfield, though, now compares his brainchild to nuclear energy: a force that can help society but can unleash mayhem when it is misused. Indeed, impact factors have assumed so much power, especially in the past five years, that they are starting to control the scientific enterprise. In Europe, Asia, and, increasingly, the United States, Mr. Garfieldâ€™s tool can play a crucial role in hiring, tenure decisions, and the awarding of grantsâ€¦â€™ Read this article in the Chronicle for Higher Education.