

What's Your h-Index?



Peter J. Heaney

It is the beginning of June, and baseball is ambling into the turn from spring to summer. The Yankees stand in second place in the American League East, 10 games behind the Red Sox. Devoted fans of New York know better than to panic. The season is young, and the state of affairs is familiar. The Red Sox always start hot, but just when it seems that *this* year, Boston really might make it to the post-season, the

team trips, wavers, and then ineluctably tumbles head-over-heels down down in the rankings until it no longer can contend even for a wildcard berth. Supporters of the Red Sox are the True Believers, and they point to their World Series title of 2004 as proof that even the most stubborn of sports curses can be dispelled.

To validate their most fervent hopes, fans of both teams turn to the tea leaves to predict the season's outcome, and in baseball those tea leaves are statistics—reams and reams of statistics that have been collected since Henry Chadwick introduced the concepts of the box score, the batting average, and the earned run average in the mid-19th century. Baseball maintains statistics for every conceivable combination of defensive and offensive parameters, and aficionados pore over these numbers with the concentration of Talmudic scholars to understand why their teams are where they are and how they will do tomorrow. The Yanks have won their last 6 in a row and 8 of their last 10. Could this portend the turnaround that every Yankee fan demands? But Boston's relief pitching seems unbeatable. Hideki Okajima boasts a 1.14 ERA, 0.79 WHIP, 1.55 BAA... The statistical panoply is boundless, and the idioms are a foreign language to the uninitiated.

Despite the many comparisons that can be made between baseball and academia—free agency, team rankings, and hierarchical salary structures come to mind—universities have been comparatively immune to the numerological analyses that baseball players have had to endure. After all, how does one measure the impact of a theater professor who stages a production of *Waiting for Godot*? By the number of seats filled? The amount of support raised by external grants? All parties involved in hiring and promotion decisions in the liberal arts recognize that personnel evaluations, though informed by statistics, ultimately are qualitative, for better and for worse.

Scientists, on the other hand, are people who measure things for a living, and as our careers progress, we are asked to appraise our colleagues with increasing frequency—to assess funding requests, tenure issues, and nominations for prestigious awards. Our zeal for quantification drives the search for hard numbers to support our gut instincts, and the absence of suitable metrics for benchmarking one geochemist's performance against another's is an unacceptable frustration.

Boldly stepping into this breach between reality and expectation is the ISI Web of Science (WoS), which allows the precise calculation of a scientist's influence with a single mouse click. It began modestly in 1955 as the Science Citation Index, which was intended to facilitate searches of the scientific literature. Many of us are old enough to remember long hours spent searching through the heavy tomes of the SCI, which filled bookshelf after bookshelf in library reference sections, squinting our

eyes to read the fine print and puzzling out the often mysterious abbreviations used for journal titles. The World Wide Web literally was created to complete what the SCI started, and now the blazingly fast search engines of the WoS have streamlined beyond our first imagining the pursuit of papers that cite an article of particular interest.

Thomson Scientific soon realized that scientists were accessing the WoS not merely to survey the literature but to count the number of citations for individual articles. In 2006, the company introduced a new capability called Citation Report along with a suite of author identification tools. Together, these features allow a user to pinpoint any scientist and to produce a dataset related to that scientist's productivity: graphs of published articles and citations by year, average number of citations per paper, and an itemization of all papers in any order specified by the user. In this way, the Citation Report transforms the purpose of the WoS from a simple bibliographic resource to a normative vehicle that has standardized the reckoning of scientific achievement.

The metric in the Citation Report that has generated the most buzz is the so-called "h-index," a parameter best explained by example: an author with an h-index of 20 has written 20 articles that have been cited 20 or more times. The advantages of this index are explained in a paper written in 2005 by the parameter's originator, J.E. Hirsch, and published in the *Proceedings of the National Academy of Sciences* (102: 16569-16572). As summarized by ISI, the h-index "is useful because it discounts the disproportionate weight of highly cited papers or papers that have not yet been cited." Indeed, my completely non-random and non-rigorous explorations with Citation Reports confirm a strong correlation between the h-index and geological superstardom. Without naming names, it is interesting to note how many of the most prominent members of our community can boast h-indices in the vicinity of 40 or higher.

The caveats associated with citation statistics are well known. Many subdisciplines within the geosciences still value comprehensive monographs over Ipu's (least publishable units), and the slow rates of production that characterize these kinds of articles yield commensurately small citation values. Moreover, citation statistics inherently represent a popularity contest. Certain topics excite attention that is intense but ultimately of slight import. Conversely, some of the most creative and revolutionary papers are recognized only after decades have passed precisely because of their farsighted nature.

Nevertheless, my guess is that the h-index is here to stay, if only because of its appealing simplicity. The problem with this parameter is that it better captures the character of baseball than of science. Baseball statistics are constructed to showcase consistency. Fans study batting and pitching *averages* and *totals* over many seasons to discriminate between the good and the great. If single moments were of the highest significance, then Bill Mazeroski and Joe Carter would be considered the most impressive batters of all time. They are the only players with walk-off home runs hit in the bottom of the ninth inning in the final game of a World Series. As estimable as these athletes are, no one would rate them with the very best in baseball history; the lifetime batting average for each is close to .260, far below the numbers for Ty Cobb (.366) or Ted Williams (.344).

"No one puts a "K" next to Wayne Gretzky's name in the scoring summary when he pops the puck over an open net, or an "E" when his pass goes wide of a winger on the right side; no one writes "L" after Warren Moon's name when the Oilers lose to the Lions. Baseball, by contrast, looks for blame and then elucidates it, writing down the whiff or the miscue in the scorecard and filing it away in the record books forever."

— Roger Angell, "Hard Lines" in *Baseball*
by Ward and Burns

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2007 AGU VGP FELLOWS

Congratulations to the 2007 Fellows of the American Geophysical Union (Volcanology, Geochemistry, and Petrology Section)!

**SUSAN BRANTLEY**

For her profound contributions to environmental geochemistry, her innovation and leadership in developing new initiatives, and her major impact on national geoscience education.

**RODNEY C. EWING**

For his many extraordinary and fundamental contributions to materials science and mineralogy that have innovative applications to nuclear waste management.

**THOMAS H. HEATON**

For contributions to seismology, especially in the areas of wave propagation, and earthquake source physics, and to a better understanding of earthquake hazards.

**BERNARD MARTY**

For outstanding contributions to the understanding of the origins of both terrestrial and extraterrestrial volatiles and their use in the interpretation of planetary-scale processes.

**THOMAS F. PEDERSEN**

For his insightful studies of marine sediments to understand how oceanographic conditions affect, and are affected by, changes in Earth's climate.

**DAVID POLLARD**

For his unsurpassed blending of field observations and mechanical modeling.

**GEORGES POUPINET**

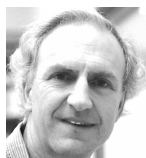
For pioneering the use of earthquake doublets and for elevating the level of solid-Earth geophysics in France.

**JOSEPH R. SMYTH**

For his outstanding contributions to the mineral physics of the Earth and for fundamentally changing our perception of the role of water in the Earth's deep interior.

**FRANK SPEAR**

For his contributions to understanding the dynamic character of metamorphism and orogeny through unified field, analytical, and numerical studies.

**JOHN W. VALLEY**

For contributions to petrology and geochemistry, for discoveries regarding the geologic evolution of the early Earth, and for the development of analytical methods on which those discoveries are based.

HELMHOLTZ-HUMBOLDT RESEARCH AWARD TO HOLLY STEIN

Holly Stein near the village of Os in Norway

Colorado State University Senior Research Scientist Holly Stein will receive the prestigious Helmholtz-Humboldt Research Award for her groundbreaking research in ore deposit geology and geochemistry. Stein is founder and director of the AIRIE Program (Applied Isotope Research for Industry and the Environment), Department of Geosciences, a leading research group in Re-Os geochronology and tracer studies. Re-Os dating contributes critical information for understanding metallogenesis and the temporal relationship of ore deposits to geologic, metamorphic, and tectonic processes. In particular, AIRIE developed the technology to

date molybdenite. Stein draws on her experience in economic geology to contribute new insights and solve problems in other geoscience disciplines.

Recently, the AIRIE Program has turned to Re-Os dating of syn-sedimentary sulfides and organic material in black shales and migrated hydrocarbons, with applications to petroleum exploration. The work is backed by \$2.3 million from the Norwegian Research Council and petroleum industry (Eni Norge, Statoil). The project will be carried out under the auspices of the Norwegian Geological Survey, where Stein has a 50% position, Bernard Bingen and Judith Hannah are co-investigators.

The Helmholtz Association and Alexander von Humboldt Foundation grant up to six research awards annually to internationally recognized scientists. The award categories cover all disciplines of science, including energy, Earth and environment, health, technology, structure of matter, transport, and space. Nominations for the awards are made by members of the Helmholtz Association National Research Center in Germany. Awardees are scientists whose discoveries, theories, and findings have a strong influence on the immediate and broader disciplines beyond their specific research area.

Stein will receive 50,000 euros and attend a reception in Berlin hosted by the president of Germany. She will have a formal affiliation with the GeoForschungsZentrum in Potsdam, where she will work primarily with Rolf Romer on Sn-W-Mo-U metallogenesis in the renowned Erzgebirge. Stein will deliver lectures at several universities in Germany.

Stein received her BS from Western Illinois University and later received that institution Outstanding Woman Alumna Award. She received her MS and PhD from the University of North Carolina at Chapel Hill. She has been active in geologic societies and on editorial boards. Stein received the 2005 Silver Medal from the Society of Economic Geologists for excellence and original work in the geology of mineral deposits. In 2000, she received a Fulbright Research Fellowship, and in 1992 she received a Gilbert Fellowship from the USGS to work with Re-Os chemist John W. Morgan. At that time, she envisioned the broader application of Re-Os geochemistry to the understanding of metallogenesis and continental crustal processes.

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In science, by contrast, the dramatic home run changes the world. Wilhelm von Röntgen discovered X-rays in 1895 and thereby opened the atomic universe to human inspection. James Watson and Francis Crick published the structure of DNA in 1953, and that one paper has fueled a revolution in molecular biology that continues to this day. The stature of these researchers in the scientific pantheon is assured by these single acts of creation because the machinery that drives a field of science can be wholly re-invented when an individual insight upends our primary assumptions.

None of which is meant to denigrate those with lofty h-indices. A value of 40 implies a remarkable production of more than one high-impact paper per year over many decades. But if your papers are struggling to find an appreciative audience, keep aiming for the far wall. You just might snag an idea hanging on the outside corner and knock our current reality out of the ballpark.

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