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Feldman replies: In response to Fred McGalliard, it is instructive to compare the American Physical Society meeting right after the first reports of high-temperature superconductivity with the one right after reports of cold fusion. From what I remember, more than 100 physicists reported the observation of high-temperature superconductivity; in the meeting following cold fusion, the majority of the talks were sharply critical of the initial claim. That is an excellent example of the essential role of reproducibility in a well-functioning physics enterprise. I must also comment on a statement McGalliard made about physicists having fun with cold fusion. I wonder if he investigated whether graduate students who did their theses on cold fusion had fun finding their next position or having a productive scientific career.

My response to Scott Chubb is simple: I'm from the show-me state. If cold fusion is to be accepted as valid by physicists like me, it must demonstrate the same level of reproducibility that high-temperature superconductivity has. So far, it has not come remotely close.

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A new index for measuring scientists' output

The online SAO/NASA Astrophysics Data System (ADS) has a search mechanism that makes it easy to look up citation statistics for astronomy and physics. The h-index has been proposed for rating individuals' output.[1] As examples, Edward Witten currently has an h-index of 125 because he has 125 papers receiving 125 or more citations each, and Albert Einstein has an h-index of only 27. I, by comparison, have an h-index of 46. Any index on which I score higher than Einstein is not optimal!

The h-index is nonlinear and doesn't proportionately reward individuals for their most important paper, however influential it may be. Furthermore, by using total citations, the h-index unfairly favors people in large collaborations, because it effectively treats all authors in a multiauthor paper as if each had written the entire paper alone. Total citations are fine for ranking papers, but for ranking individuals, citations for a paper must be allocated among its authors. There are two easy ways to do that: Either use citations that acknowledge first-author status (for example, ^Einstein, A.) and thus recognize leadership, or use fractions and split the citations equally among authors (normalized citations).

What if we include both measures and take their average? Still, Einstein does not do that well. It's not that people are no longer using his papers; rather, he has become so famous that people no longer bother to cite the original references. Can we find those hidden citations? Yes. Einstein's name is often mentioned in the abstracts and titles of papers. Those name citations, which can also be found on the ADS, are just as important as direct citations to his papers and are arguably even harder to get. Eponymous citations count: If you do something important, people will name things after you—the Einstein ring, the Hubble constant, Feynman diagrams, and the like.

I propose an E-index citation count, proportional to total output. In the E-index, the total count C would equal ½ first-author citations + ½ normalized citations + last-name citations in abstracts + last-name citations in titles. Using ADS as of 1 January 2010, Einstein has C = 71 444 citations. (If you suspect your candidate shares a last name and is not responsible for all the abstract or title citations, then rank the most recent 3000 of them by citation count to get the most important ones, and look at the top 10. If 8 of the top 10 refer to your candidate, give your candidate 80% of those abstract or title citations.)

A convenient citation unit is the milli-Einstein (mE) = 71.4 citations. Some who did well include Fermi (1277 mE), Einstein (1000), Hubble (815), Landau (657), Witten (641), Anderson (561), Schrödinger (502), Weinberg (457), Heisenberg (417), Planck (374), Hawking (323), and Feynman (313).

Every automatic method of ranking will have a few outliers who do either much better or much worse than expected, but the E-index should be an improvement over the h-index for evaluating 20th- and 21st-century astronomers and physicists.

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Remembering Howard Voss

I was saddened to learn of the death of my teaching mentor, Howard Voss (PHYSICS TODAY, July 2010, page 61). I was a graduate teaching assistant at Arizona State University from 1969 through 1972, and although I later earned a teaching certificate in Pennsylvania, most of what I know about teaching I learned as a teaching assistant.

Howard Voss had more confidence in me than I did in myself when I started handling recitation classes, and his trust and confidence slowly paid off. Later on he trusted me and another teaching assistant with a significant revision of the introductory physics lab program. As part of that task we made some bold steps to help students be more creative in learning physics. That was my first experience in seeing my ideas create positive impacts for students.

Possibly the most important thing I learned from that project was the value of trusting people who want to do well. Trust, for me, worked in two directions. I found students and professors trusting me, while I learned about the advantages of trusting my students.

I have known few people who work as well with others as did Howard. In three years the only time I recall seeing him angry was when a fellow grad student of mine somehow dislodged the plutonium–beryllium source from its seat in a neutron howitzer. Even then, with a mirror on a stick in one hand and a contrived tool for picking up the radioactive source in the other, the professor was equal to the task.

I take some comfort from having seen Howard at several American Association of Physics Teachers events in recent years and having taken the time to talk with him about the old days.

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