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Short communication

Does the h -index for ranking of scientists really work?

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HIRSCH (2005) has proposed the h -index as a single-number criterion to evaluate the scientific output of a researcher (BALL, 2005): A scientist has index h if h of his/her N_p papers have at least h citations each, and the other $(N_p - h)$ papers have fewer than h citations each. In a study on committee peer review (BORNMANN & DANIEL, 2005) we found that on average the h -index for successful applicants for post-doctoral research fellowships was consistently higher than for non-successful applicants.

HIRSCH (2005) has proposed the h -index as a single-number criterion to evaluate the scientific output of a researcher (BALL, 2005). The h -index depends on both the number of a scientist's publications, and their impact on his or her peers: A scientist has index h if h of his/her N_p papers have at least h citations each, and the other $(N_p - h)$ papers have fewer than h citations each.

To demonstrate that the h -index is a useful yardstick to compare different scientists competing for research fellowships the index should be strongly related to the assessment by peers (COLE, 1989). We investigated committee peer review for awarding long-term fellowships to post-doctoral researchers as practiced by the Boehringer Ingelheim Fonds (B.I.F.; www.bifonds.de) – an international foundation for the promotion of basic research in biomedicine (BORNMANN & DANIEL, 2005). According to FRÖHLICH (2001) – managing director of the B.I.F. – applicants that demonstrate excellence in scientific work are selected for the fellowships by the B.I.F. Board of Trustees (seven internationally renowned scientists); otherwise the applicants are rejected. Our study involved 414 applicants from the years 1990 to 1995

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(64 approved and 350 rejected) with a total of 1,586 papers published *previous* to application. The papers received a total of 60,882 citations (according to the Science Citation Index provided by Thomson Scientific, Philadelphia).

The *h*-index for a B.I.F. applicant is the highest number of papers the applicant has that have each received at least that number of citations (citation window: from year of publication to the end of 2001). The applicant's *h*-indices range from 0 to 13. Table 1 shows the relation between the applicants' averaged *h*-indices (h_m) and the decisions (approval or rejection) of the Board of Trustees for the years 1990 to 1995. For every year, the *h*-indices of approved applicants are on average higher than those of rejected applicants. The results for the criterion 'citations per paper' are very similar: papers that had been published by approved applicants can be expected to have 49% more citations than papers that had been published by rejected applicants (BORNMAN & DANIEL, 2005).

All in all, the results suggest that the *h*-index is a promising rough measurement of the quality of a young scientist's work as it is judged by internationally renowned scientists in the field of biomedical sciences.

Table 1. Averaged *h*-indices for approved and rejected B.I.F. applicants by year of Board of Trustees' meeting

Board of Trustees' decision	Year of Board of Trustees' meeting						Total
	1990	1991	1992	1993	1994	1995	
Approved							
h_m	5.15	3.90	2.92	4.14	2.83	4.33	3.84
h_{sd}	3.13	3.35	2.29	2.85	1.27	2.06	2.61
n	13	10	13	7	12	9	64
Rejected							
h_m	2.71	2.94	2.70	2.40	2.46	2.99	2.72
h_{sd}	2.58	2.12	2.17	1.69	2.11	2.05	2.11
n	52	36	57	60	52	93	350

Note: h_m is the arithmetic mean of h ; h_{sd} is the standard deviation of h ; n is the number of applicants. Example for reading: Applicants that were approved for a B.I.F. fellowship in 1990 have on average an *h*-index of 5.15; i.e., they have written approximately 5 papers that have each had at least 5 citations from year of publication to the end of 2001.

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