*This essay was originally published in the Current Contents print editions June 20, 1994, when Thomson Reuters was known as The Institute for Scientific Information® (ISI®).*

See also: ["The agony and the ecstasy: the history and meaning of the Journal Impact Factor"](http://thomsonreuters.com/products_services/science/free/essays/history_of_journal_impact_factor/)

Librarians and information scientists have been evaluating journals for at least 75 years. Gross and Gross conducted a classic study of citation patterns in the '20s.[1](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.1) Others, including Estelle Brodman with her studies in the '40s of physiology journals and subsequent reviews of the process, followed this lead.[2](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.2) However, the advent of the Thomson Reuters citation indexes made it possible to do computer-compiled statistical reports not only on the output of journals but also in terms of citation frequency. And in the '60s we invented the journal "impact factor." After using journal statistical data in-house to compile the [*Science Citation Index*](http://thomsonreuters.com/products_services/science/science_products/a-z/science_citation_index/)*® (SCI®)* for many years, Thomson Reuters began to publish [*Journal Citation Reports*](http://thomsonreuters.com/products_services/science/science_products/a-z/journal_citation_reports/)*® (JCR®)*[*3*](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.3) in 1975 as part of the *SCI* and the [*Social Sciences Citation Index*](http://thomsonreuters.com/products_services/science/science_products/a-z/social_sciences_citation_index/)*® (SSCI®)*.

Informed and careful use of these impact data is essential. Users may be tempted to jump to ill-formed conclusions based on impact factor statistics unless several caveats are considered.

Definition

The *JCR* provides quantitative tools for ranking, evaluating, categorizing, and comparing journals. The impact factor is one of these; it is a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period. The annual *JCR* impact factor is a ratio between citations and recent citable items published. Thus, the impact factor of a journal is calculated by dividing the number of current year citations to the source items published in that journal during the previous two years (see Figure 1).

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| **Figure 1: Calculation for journal impact factor.** |
| **A**= total cites in 1992 |
| **B**= 1992 cites to articles published in 1990-91 (this is a subset of A) |
| **C**= number of articles published in 1990-91 |
| **D**= B/C = 1992 impact factor |

The impact factor is useful in clarifying the significance of absolute (or total) citation frequencies. It eliminates some of the bias of such counts which favor large journals over small ones, or frequently issued journals over less frequently issued ones, and of older journals over newer ones. Particularly in the latter case such journals have a larger citable body of literature than smaller or younger journals. All things being equal, the larger the number of previously published articles, the more often a journal will be cited.[4](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.4), [5](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.5)

Applications

There have been many innovative applications of journal impact factors. The most common involve market research for publishers and others. But, primarily, *JCR* provides librarians and researchers with a tool for the management of library journal collections. In market research, the impact factor provides quantitative evidence for editors and publishers for positioning their journals in relation to the competition—especially others in the same subject category, in a vertical rather than a horizontal or intradisciplinary comparison. *JCR®* data may also serve advertisers interested in evaluating the potential of a specific journal.

Perhaps the most important and recent use of impact is in the process of academic evaluation. The impact factor can be used to provide a gross approximation of the prestige of journals in which individuals have been published. This is best done in conjunction with other considerations such as peer review, productivity, and subject specialty citation rates. As a tool for management of library journal collections, the impact factor supplies the library administrator with information about journals already in the collection and journals under consideration for acquisition. These data must also be combined with cost and circulation data to make rational decisions about purchases of journals.

The impact factor can be useful in all of these applications, provided the data are used sensibly. It is important to note that subjective methods can be used in evaluating journals as, for example, by interviews or questionnaires. In general, there is good agreement on the relative value of journals in the appropriate categories. However, the *JCR* makes possible the realization that many journals do not fit easily into established categories. Often, the only differentiation possible between two or three small journals of average impact is price or subjective judgments such as peer review.

Using the Impact Factor Wisely

Thomson Reuters does not depend on the impact factor alone in assessing the usefulness of a journal, and neither should anyone else. The impact factor should not be used without careful attention to the many phenomena that influence citation rates, as for example the average number of references cited in the average article. The impact factor should be used with informed peer review. In the case of academic evaluation for tenure it is sometimes inappropriate to use the impact of the source journal to estimate the expected frequency of a recently published article. Again, the impact factor should be used with informed peer review. Citation frequencies for individual articles are quite varied.

There are many artifacts that can influence a journal's impact and its ranking in journal lists, not the least of which is the inclusion of review articles or letters. This is illustrated in a study of the leading medical journals published in the *Annals of Internal Medicine*. [6](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#ref.6)

Review Articles

Review articles generally are cited more frequently than typical research articles because they often serve as surrogates for earlier literature, especially in journals that discourage extensive bibliographies. In the *JCR* system any article containing more than 100 references is coded as a review. Articles in "review" sections of research or clinical journals are also coded as reviews, as are articles whose titles contain the word "review" or "overview."

The Source Data Listing in the *JCR* not only provides data on the number of reviews in each journal but also provides the average number of references cited in that journal's articles. Naturally, review journals have some of the highest impact factors. Often, the first-ranked journal in the subject category listings will be a review journal. For example, under Biochemistry, the journal topping the list is *Annual Review of Biochemistry* with an impact factor of 35.5 in 1992.

Methods Articles

It is widely believed that methods articles attract more citations than other types of articles. However, this is not in fact true. Many journals devoted entirely to methods do not achieve unusual impact. But it is true that among the most cited articles in the literature there are some super classics that give this overall impression. It should be noted that the chronological limitation on the impact calculation eliminates the bias super classics might introduce. Absolute citation frequencies are biased in this way, but, on occasion, a hot paper might affect the current impact of a journal.

Variation Between Disciplines

Different specialties exhibit different ranges of peak impact. That is why the *JCR®* provides subject category listings. In this way, journals may be viewed in the context of their specific field. Still, a five-year impact may be more useful to some users and can be calculated by combining the statistical data available from consecutive years of the *JCR* (see Figure 2). It is rare to find that the *ranking* of a journal will change significantly within its designated category unless the journal's influence has indeed changed.

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| **Figure 2: Calculation for five-year impact factor: One year of citations to five years of articles.** |
| **A**= citations in 1992 to articles published in 1987-91 |
| **B**= articles published in 1987-91 |
| **C**= A/B = five-year impact factor |

An alternative five-year impact can be calculated based on adding citations in 1988-92 articles published in the same five-year period. And yet another is possible by selecting one or two earlier years as factor "B" above.

Item-by-Item Impact

While Thomson Reuters does manually code each published source item, it is not feasible to code individually the 12 million references we process each year. Therefore, journal citation counts in *JCR* do not distinguish between letters, reviews, or original research. So, if a journal publishes a large number of letters, there will usually be a temporary increase in references to those letters. Letters to the *Lancet* may indeed be cited more often that letters to *JAMA* or vice versa, but the overall citation count recorded would not take this artifact into account. Detailed computerized article-by-article analyses or audits can be conducted to identify such artifacts.

Cited-Only Journals in the JCR

Some of the journals listed in the *JCR* are not citing journals, but are cited-only journals. This is significant when comparing journals by impact factor because the self-citations from a cited-only journal are not included in its impact factor calculation. Self-citations often represent about 13% of the citations that a journal receives. The cited-only journals with impact factors in the *JCR* Journal Rankings and Subject Category Listing may be ceased or suspended journals, superseded titles, or journals that are covered in the science editions of *Current Contents®*, but not a citation index.

Users can identify cited-only journals by checking the *JCR* Citing Journal Listing. Furthermore, users can establish analogous impact factors, (excluding self-citations), for the journals they are evaluating using the data given in the Citing Journal Listing (see Figure 3).

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| **Figure 3: Calculation for impact factor revised to exclude self-citations.** |
| **A**= citations in 1992 to articles published in 1990-91 |
| **B**= 1992 self-citations to articles published in 1990-91 |
| **C**= A - B = total citations minus self-citations to recent articles |
| **D**= number of articles published 1990-91 |
| **E**= revised impact factor (C/D) |
| (see [**Table 1**](http://thomsonreuters.com/products_services/science/free/essays/impact_factor/#table 1) for numerical example) |

Title Change

A user's knowledge of the content and history of the journal studied is very important for appropriate interpretation of impact factors. Situations such as those mentioned above and others such as title change are very important, and often misunderstood, considerations.

A title change affects the impact factor for two years after the change is made. The old and new titles are not unified unless the titles are in the same position alphabetically. In the first year after the title change, the impact is not available for the new title unless the data for old and new can be unified. In the second year, the impact factor is split. The new title may rank lower than expected and the old title may rank higher than expected because only one year of source data is included in its calculation (see Figure 4). Title changes for the current year and the previous year are listed in the *JCR®* guide.

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| **Figure 4: Unified 1992 impact factor calculation for title change.** |
| **A**=1992 citations to articles published in 1990-91 (a1 + a2)  **A1**=those for new title **A2**=those for superseded title |
| **B**=number of articles published in 1990-91 (B1 + B2)  **B1**=those for new title  **B2**=those for superseded title |
| **C**=unified impact factor (A/B)  **C1**=A1/B1 = *JCR®* factor for the new title  **C2**=A2/B2 = *JCR* factor for the superseded title |

Conclusions

The impact factor is a very useful tool for evaluation of journals, but it must be used discreetly. Considerations include the amount of review or other types of material published in a journal, variations between disciplines, and item-by-item impact. The journal's status in regard to coverage in the Thomson Reuters databases as well as the occurrence of a title change are also very important. In the next essay we will look at some examples of how to put tools for journal evaluation into use.

***Dr. Eugene Garfield***  *Founder and Chairman Emeritus, ISI*

**Self-Citation study of journals in the Reproductive Systems category of the   
1992 *SCI® Journal Citation Reports®* (*JCR®*).**

**Table 1:** Calculation of impact factors without self-citations.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Reproductive Systems Journals** | **(A/D) JCR Impact Factor** | **A Cites in 1992 to 1990-91 Articles** | **B Self-cites in 1992 to 1990-91 Articles** | **C (A-B) Minus Self- Cites** | **D**  **Articles Published 1990-91** | **E (C/D) Revised Impact Factor** |
| AM J REPROD IMMUNOL | 1.931 | 224 | 54 | 170 | 116 | 1.466 |
| ANIM REPROD SCI | 0.701 | 110 | 23 | 87 | 157 | 0.554 |
| BIOL REPROD | 3.257 | 726 | 265 | 461 | 530 | 2.757 |
| EUR J OBSTET GYN R B | 0.449 | 169 | 19 | 150 | 376 | 0.399 |
| HUM REPROD | 1.328 | 627 | \* | 627 | 472 | 1.328 |
| INVERTEBR REPROD DEV | 0.899 | 98 | 8 | 90 | 109 | 0.826 |
| J REPROD FERTIL | 2.211 | 1287 | 209 | 1078 | 582 | 1.852 |
| J REPROD IMMUNOL | 1.442 | 137 | 20 | 117 | 95 | 1.232 |
| MOL REPROD DEV | 2.003 | 597 | 107 | 490 | 298 | 1.644 |
| OXFORD REV REPROD B | 1.765 | 30 | \* | 30 | 17 | 1.765 |
| REPROD DOMEST ANIM | 0.565 | 39 | 2 | 37 | 69 | 0.536 |
| REPROD FERT DEVELOP | 1.493 | 221 | 40 | 181 | 148 | 1.223 |
| REPROD NUTR DEV | 0.579 | 84 | 10 | 74 | 145 | 0.510 |
| REPROD TOXICOL | 0.859 | 79 | 26 | 53 | 92 | 0.576 |
| SEMIN REPROD ENDOCR | 0.347 | 25 | \* | 25 | 72 | 0.347 |
| SEX PLANT REPROD | 1.659 | 136 | 38 | 98 | 82 | 1.195 |

\* In 1992, *Human Reproduction* was not covered in a citation index, but has been added to the *Science Citation Index* (*SCI*) for 1993. The 1992 issue of *Oxford Reviews of Reproductive Biology* was not received in time to process its citations for Thomson Reuters 1992 database. *Seminars in Reproductive Endocrinology* is not covered in a citation index.

**Table 2:** Comparison of *JCR* impact factors to revised impact factors.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Journals ranked by an impact factor** | | | **Journals ranked by *JCR* impact factor: calculated without self-citations:** | | |
| 1 | BIOL REPROD | 3.257 | BIOL REPROD | 2.757 |  |
| 2 | J REPROD FERTIL | 2.211 | J REPROD FERTIL | 1.852 |  |
| 3 | MOL REPROD DEV | 2.003 | OXFORD REV REPROD B | 1.765 |  |
| 4 | AM J REPROD IMMUNOL | 1.931 | MOL REPROD DEV | 1.644 |  |
| 5 | OXFORD REV REPROD B | 1.765 | AM J REPROD IMMUNOL | 1.466 |  |
| 6 | SEX PLANT REPROD | 1.659 | HUM REPROD | 1.328 |  |
| 7 | REPROD FERT DEVELOP | 1.493 | J REPROD IMMUNOL | 1.232 |  |
| 8 | J REPROD IMMUNOL | 1.442 | REPROD FERT DEVELOP | 1.223 |  |
| 9 | HUM REPROD | 1.328 | SEX PLANT REPROD | 1.195 |  |
| 10 | INVERTEBR REPROD DEV | 0.899 | INVERTEBR REPROD DEV | 0.826 |  |
| 11 | REPROD TOXICOL | 0.859 | REPROD TOXICOL | 0.576 |  |
| 12 | ANIM REPROD SCI | 0.701 | ANIM REPROD SCI | 0.554 |  |
| 13 | REPROD NUTR DEV | 0.579 | REPROD DOMEST ANIM | 0.536 |  |
| 14 | REPROD DOMEST ANIM | 0.565 | REPROD NUTR DEV | 0.510 |  |
| 15 | EUR J OBSTET GYN R B | 0.449 | EUR J OBSTET GYN R B | 0.399 |  |
| 16 | SEMIN REPROD ENDOCR | 0.347 | SEMIN REPROD ENDOCR | 0.347 |  |

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3*. SCI® Journal Citation Reports®: a bibliometric analysis of science journals in the ISI® database*. Philadelphia: Institute for Scientific Information, Inc.®, 1993.

4.**Garfield E.** Citation analysis as a tool in journal evaluation. *Science* 178:471-9, 1972.

5.**------------------.** Citation indexing for studying science. *Nature* 227:669-71, 1970.

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# Impact factor

From Wikipedia, the free encyclopedia

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The **impact factor**, often abbreviated **IF**, is a measure reflecting the average number of [citations](http://en.wikipedia.org/wiki/Citation) to articles published in [science and social science journals](http://en.wikipedia.org/wiki/Scientific_journal). It is frequently used as a [proxy](http://en.wikipedia.org/wiki/Proxy_(statistics)) for the relative importance of a journal within its field, with journals with higher impact factors deemed to be more important than those with lower ones. The impact factor was devised by [Eugene Garfield](http://en.wikipedia.org/wiki/Eugene_Garfield), the founder of the [Institute for Scientific Information](http://en.wikipedia.org/wiki/Institute_for_Scientific_Information) (ISI), now part of [Thomson Reuters](http://en.wikipedia.org/wiki/Thomson_Reuters). Impact factors are calculated yearly for those journals that are indexed in [Thomson Reuters](http://en.wikipedia.org/wiki/Thomson_Reuters) [*Journal Citation Reports*](http://en.wikipedia.org/wiki/Journal_Citation_Reports).

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## [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=1)] Calculation

In a given year, the impact factor of a journal is the average number of citations received per paper published in that journal during the two preceding years.[[1]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-IFintro-0) For example, if a journal has an impact factor of 3 in 2008, then its papers published in 2006 and 2007 received 3 citations each on average in 2008. The 2008 impact factor of a journal would be calculated as follows:

*A* = the number of times articles published in 2006 and 2007 were cited by indexed journals during 2008.

*B* = the total number of "citable items" published by that journal in 2006 and 2007. ("Citable items" are usually articles, reviews, proceedings, or notes; not editorials or Letters-to-the-Editor.)

2008 impact factor = *A*/*B*.

(Note that 2008 impact factors are actually published in 2009; they cannot be calculated until all of the 2008 publications have been processed by the indexing agency.)

New journals, which are indexed from their first published issue, will receive an impact factor after two years of indexing; in this case, the citations to the year prior to Volume 1, and the number of articles published in the year prior to Volume 1 are known zero values. Journals that are indexed starting with a volume other than the first volume will not get an impact factor until they have been indexed for three years. Annuals and other irregular publications sometimes publish no items in a particular year, affecting the count. The impact factor relates to a specific time period; it is possible to calculate it for any desired period, and the *Journal Citation Reports* (JCR) also includes a 5-year impact factor.[[2]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-newJCR-1) The JCR shows rankings of journals by impact factor, if desired by discipline, such as [organic chemistry](http://en.wikipedia.org/wiki/Organic_chemistry) or [psychiatry](http://en.wikipedia.org/wiki/Psychiatry).

## [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=2)] Use

The IF is used to compare different journals within a certain field. The [ISI Web of Knowledge](http://en.wikipedia.org/wiki/ISI_Web_of_Knowledge) indexes more than 11,000 science and social science journals.[[3]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-2)

## [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=3)] Criticisms

Numerous criticisms have been made of the use of an impact factor, including the more general debate on the usefulness of citation metrics. Criticisms mainly concern the validity of the impact factor, policies that alter it, and its incorrect application.[[4]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-EASE-3)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=4)] Validity

* The impact factor is highly discipline-dependent. The percentage of total citations occurring in the first two years after publication varies highly among disciplines from 1-3 percent in the mathematical and physical sciences to 5-8 percent in the biological sciences.[[5]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-4)
* The impact factor could not be reproduced in an independent audit.[[6]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-5)
* The impact factor refers to the average number of citations per paper, but this is not a [normal distribution](http://en.wikipedia.org/wiki/Normal_distribution). It is rather a [Bradford distribution](http://en.wikipedia.org/wiki/Bradford%27s_law), as predicted by theory. Being an [arithmetic mean](http://en.wikipedia.org/wiki/Arithmetic_mean), the impact factor therefore is not a valid representation of this distribution and unfit for citation evaluation.[[7]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-6)
* In the short term — especially in the case of low-impact-factor journals — many of the citations to a certain article are made in papers written by the author(s) of the original article.[[8]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-marashi-7) This means that counting citations may be independent of the real "impact" of the work among investigators. Garfield, however, maintains that this phenomenon hardly influences a journal's impact factor.[[9]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-garfield98-8) Moreover, a study of author self-citations in diabetes literature found that the frequency of author self-citation was not associated with the quality of publications.[[10]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-9) Similarly, journal self-citation is common in journals dealing in specialized topics having high overlap in readership and authors, and is not necessarily a sign of low quality or manipulation.[[11]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-10)
* Journal ranking lists constructed based on the impact factor only moderately correlate with journal ranking lists based on the results of an expert [survey](http://en.wikipedia.org/wiki/Statistical_survey).[[12]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-serenko-11)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=5)] Editorial policies which affect the impact factor

A journal can adopt editorial policies that increase its impact factor.[[13]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-12)[[14]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-13)

* Journals may publish a larger percentage of review articles which generally are cited more than research reports.[[15]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-14) Therefore review articles can raise the impact factor of the journal and review journals will therefore often have the highest impact factors in their respective fields. Conversely, journals may choose not to publish minor articles, such as case reports in medical journals, which are unlikely to be cited and would reduce the average citation per article.
* Journals may change the fraction of "citable items" compared to front-matter in the denominator of the IF equation. Which types of articles are considered "citable" is largely a matter of negotiation between journals and Thomson Scientific. As a result of such negotiations, impact factor variations of more than 300% have been observed.[[16]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-PLoS-editorial-15) For instance, editorials in a journal are not considered to be citable items and therefore do not enter into the denominator of the impact factor. However, citations to such items will still enter into the numerator, thereby inflating the impact factor. In addition, if such items cite other articles (often even from the same journal), those citations *will* be counted and will increase the citation count for the cited journal. This effect is hard to evaluate, for the distinction between editorial comment and short original articles is not always obvious. "Letters to the editor" might refer to either class.
* Several methods, not necessarily with nefarious intent, exist for a journal to cite articles in the same journal which will increase the journal's impact factor.[[17]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-16)[[18]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-pmid12139549-17)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=6)] Manipulations of the impact factor

* In 2007, the specialist journal [*Folia Phoniatrica et Logopaedica*](http://en.wikipedia.org/w/index.php?title=Folia_Phoniatrica_et_Logopaedica&action=edit&redlink=1), with an impact factor of 0.66, published an editorial that cited all its articles from 2005 to 2006 in a protest against the absurd use of the impact factor.[[19]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-18) The large number of citations meant that the impact factor for that journal increased to 1.44. As a result of the increase, the journal was not included in the 2008 and 2009 *Journal Citation Reports*.[[20]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-19)
* In 2008, a single article "A short history of SHELX" included a sentence that essentially instructs readers to cite the paper: "This paper could serve as a general literature citation when one or more of the open-source SHELX programs (and the Bruker AXS version SHELXTL) are employed in the course of a crystal-structure determination". This article received more than 6,600 citations. As a consequence, the impact factor of the journal *Acta Crystallographica Section A* rose from 2.051 in 2008 to 49.926 in 2009, more than *Nature* (31.434) and *Science* (28.103).[[21]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-20) The second most cited article in *Acta Crystallographica Section A* in 2008 had only 28 citations.[[22]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-21)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=7)] Incorrect application of impact factor

* The IF may be incorrectly applied to evaluate the significance of an individual publication or to evaluate an individual researcher.[[23]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-Seglen-BMJ-22)

This does not work well since a small number of publications are cited much more than the majority — for example, about 90% of Nature's 2004 impact factor was based on only a quarter of its publications, and thus the importance of any one publication will be different from, and in most cases less than, the overall number.[[24]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-23) The impact factor, however, averages over all articles and thus underestimates the citations of the most cited articles while exaggerating the number of citations of the majority of articles. Consequently, the [Higher Education Funding Council for England](http://en.wikipedia.org/wiki/Higher_Education_Funding_Council_for_England) was urged by the [House of Commons](http://en.wikipedia.org/wiki/House_of_Commons_of_the_United_Kingdom) [Science and Technology Select Committee](http://en.wikipedia.org/wiki/Science_and_Technology_Select_Committee) to remind [Research Assessment Exercise](http://en.wikipedia.org/wiki/Research_Assessment_Exercise) panels that they are obliged to assess the quality of the content of individual articles, not the reputation of the journal in which they are published.[[25]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-24)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=8)] Responses

* Because "the impact factor is not always a reliable instrument" in November 2007 the [European Association of Science Editors (EASE)](http://en.wikipedia.org/wiki/European_Association_of_Science_Editors) issued an official statement recommending "that journal impact factors are used only - and cautiously - for measuring and comparing the influence of entire journals, but not for the assessment of single papers, and certainly not for the assessment of researchers or research programmes".[[4]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-EASE-3)
* In July 2008, the [International Council for Science](http://en.wikipedia.org/wiki/International_Council_for_Science) (ICSU) Committee on Freedom and Responsibility in the conduct of Science (CFRS) issued a "Statement on publication practices and indices and the role of peer review in research assessment", suggesting some possible solutions, e.g. considering penalising scientists for an excessive number of publications per year.[[26]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-test-25)
* In February 2010, the [Deutsche Forschungsgemeinschaft](http://en.wikipedia.org/wiki/Deutsche_Forschungsgemeinschaft) (German Foundation for Science) published new guidelines to evaluate only articles and no bibliometric information on candidates to be evaluated in all decisions concerning "...performance-based funding allocations, postdoctoral qualifications, appointments, or reviewing funding proposals, [where] increasing importance has been given to numerical indicators such as the [h-index](http://en.wikipedia.org/wiki/H-index) and the impact factor".[[27]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-26) This decision follows similar ones of the [National Science Foundation](http://en.wikipedia.org/wiki/National_Science_Foundation) (US) or the [Research Assessment Exercise](http://en.wikipedia.org/wiki/Research_Assessment_Exercise) (UK).[[*citation needed*](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed)]

## [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=9)] Other measures of impact

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=10)] Related indices

Some related values, also calculated and published by the same organization, are:

* the [immediacy index](http://en.wikipedia.org/wiki/Immediacy_index): the number of citations the articles in a journal receive in a given year divided by the number of articles published.
* the **cited half-life**: the median age of the articles that were cited in *Journal Citation Reports* each year. For example, if a journal's half-life in 2005 is 5, that means the citations from 2001-2005 are half of all the citations from that journal in 2005, and the other half of the citations precede 2001.[[28]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-27)
* the **aggregate impact factor** for a subject category: it is calculated taking into account the number of citations to all journals in the subject category and the number of articles from all the journals in the subject category.

These measures apply only to journals, not individual articles or individual scientists (unlike the [H-index](http://en.wikipedia.org/wiki/H-index)). The relative number of citations an individual article receives is better viewed as [citation impact](http://en.wikipedia.org/wiki/Citation_impact).

It is, however, possible to measure the Impact factor of the journals in which a particular person has published articles. This use is widespread, but controversial. Garfield warns about the "misuse in evaluating individuals" because there is "a wide variation from article to article within a single journal".[[9]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-garfield98-8) Impact factors have a large, but controversial, influence on the way published scientific research is perceived and evaluated.

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=11)] PageRank algorithm

In 1976 a recursive impact factor that gives citations from journals with high impact greater weight than citations from low-impact journals was proposed.[[29]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-28) Such a recursive impact factor resembles the [PageRank](http://en.wikipedia.org/wiki/PageRank) algorithm of the [Google](http://en.wikipedia.org/wiki/Google) search engine, though the original Pinski and Narin paper uses a "trade balance" approach in which journals score highest when they are often cited but rarely cite other journals. A number of subsequent authors have proposed related approaches to ranking scholarly journals.[[30]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-29)[[31]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-30)[[32]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-31) In 2006, Johan Bollen, Marko A. Rodriguez, and [Herbert Van de Sompel](http://en.wikipedia.org/wiki/Herbert_Van_de_Sompel) also proposed using the [PageRank](http://en.wikipedia.org/wiki/PageRank) algorithm.[[33]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-32) From their paper:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **ISI Impact Factor** | | **PageRank** | | **Combined** | |
| 1 | 52.28 | [ANNU REV IMMUNOL](http://en.wikipedia.org/wiki/Annual_Reviews_(publisher)) | 16.78 | [Nature](http://en.wikipedia.org/wiki/Nature_(journal)) | 51.97 | [Nature](http://en.wikipedia.org/wiki/Nature_(journal)) |
| 2 | 37.65 | [ANNU REV BIOCHEM](http://en.wikipedia.org/wiki/Annual_Reviews_(publisher)) | 16.39 | [Journal of Biological Chemistry](http://en.wikipedia.org/wiki/Journal_of_Biological_Chemistry) | 48.78 | [Science](http://en.wikipedia.org/wiki/Science_(journal)) |
| 3 | 36.83 | [PHYSIOL REV](http://en.wikipedia.org/wiki/Physiological_Reviews) | 16.38 | [Science](http://en.wikipedia.org/wiki/Science_(journal)) | 19.84 | [New England Journal of Medicine](http://en.wikipedia.org/wiki/The_New_England_Journal_of_Medicine) |
| 4 | 35.04 | [NAT REV MOL CELL BIO](http://en.wikipedia.org/wiki/Nature_Reviews_Molecular_Cell_Biology) | 14.49 | [PNAS](http://en.wikipedia.org/wiki/Proceedings_of_the_National_Academy_of_Sciences) | 15.34 | [Cell](http://en.wikipedia.org/wiki/Cell_(journal)) |
| 5 | 34.83 | [New England Journal of Medicine](http://en.wikipedia.org/wiki/The_New_England_Journal_of_Medicine) | 8.41 | [PHYS REV LETT](http://en.wikipedia.org/wiki/Physical_Review_Letters) | 14.88 | [PNAS](http://en.wikipedia.org/wiki/Proceedings_of_the_National_Academy_of_Sciences) |
| 6 | 30.98 | [Nature](http://en.wikipedia.org/wiki/Nature_(journal)) | 5.76 | [Cell](http://en.wikipedia.org/wiki/Cell_(journal)) | 10.62 | [Journal of Biological Chemistry](http://en.wikipedia.org/wiki/Journal_of_Biological_Chemistry) |
| 7 | 30.55 | [Nature Medicine](http://en.wikipedia.org/wiki/Nature_Medicine) | 5.70 | [New England Journal of Medicine](http://en.wikipedia.org/wiki/The_New_England_Journal_of_Medicine) | 8.49 | [JAMA](http://en.wikipedia.org/wiki/Journal_of_the_American_Medical_Association) |
| 8 | 29.78 | [Science](http://en.wikipedia.org/wiki/Science_(journal)) | 4.67 | [Journal of the American Chemical Society](http://en.wikipedia.org/wiki/Journal_of_the_American_Chemical_Society) | 7.78 | [The Lancet](http://en.wikipedia.org/wiki/The_Lancet) |
| 9 | 28.18 | [NAT IMMUNOL](http://en.wikipedia.org/wiki/Nature_(journal)) | 4.46 | [J IMMUNOL](http://en.wikipedia.org/wiki/Journal_of_Immunology) | 7.56 | [NAT GENET](http://en.wikipedia.org/wiki/Nature_Genetics) |
| 10 | 28.17 | [REV MOD PHYS](http://en.wikipedia.org/wiki/Reviews_of_Modern_Physics) | 4.28 | [APPL PHYS LETT](http://en.wikipedia.org/wiki/Applied_Physics_Letters) | 6.53 | [Nature Medicine](http://en.wikipedia.org/wiki/Nature_Medicine) |

The table shows the top 10 journals by [ISI](http://en.wikipedia.org/wiki/Institute_for_Scientific_Information) Impact Factor, PageRank, and a modified system that combines the two (based on 2003 data). [*Nature*](http://en.wikipedia.org/wiki/Nature_(journal)) and [*Science*](http://en.wikipedia.org/wiki/Science_(journal)) are generally regarded as the most prestigious journals, and in the combined system they come out on top[*[citation needed](http://en.wikipedia.org/wiki/Wikipedia:Citation_needed" \o "Wikipedia:Citation needed)*].

The [Eigenfactor](http://en.wikipedia.org/wiki/Eigenfactor) is another [PageRank](http://en.wikipedia.org/wiki/PageRank)-type measure of journal influence,[[34]](http://en.wikipedia.org/wiki/Impact_factor" \l "cite_note-33) with rankings freely available online.[[35]](http://en.wikipedia.org/wiki/Impact_factor#cite_note-34)

### [[edit](http://en.wikipedia.org/w/index.php?title=Impact_factor&action=edit&section=12)] Article level metrics and altmetrics

Alternative metrics (often on a article-level) are sometimes called altmetrics. Altmetrics include metrics of use such as views or mentionings in social media. For example, the [BMJ](http://en.wikipedia.org/wiki/BMJ) published as early as in 2004 the number of views for the articles it published - a metric that is somewhat correlated to subsequent citations ([Perneger, 2004](http://www.bmj.com/content/329/7465/546)). In 2008, the [Journal of Medical Internet Research](http://en.wikipedia.org/wiki/Journal_of_Medical_Internet_Research) (JMIR) started publishing article-level metrics such as views and tweets ("tweetations") - the latter were found to be predictive for highly cited articles, leading the author to propose the "twimpact factor", which is defined as the number of tweets within the first 7 days of publication, as well as the twindex, which is the rank percentile of the twimpact factor of an article compared to similar articles within the same journal ([Eysenbach, 2011](http://www.jmir.org/2011/4/e123/)). JMIR publishes its article-level metrics (including the twimpact factor) on its [Top Articles](http://www.jmir.org/stats/mostTweeted) page. Starting in March 2009, the [Public Library of Science](http://en.wikipedia.org/wiki/Public_Library_of_Science) also introduced article level metrics[[36]](http://en.wikipedia.org/wiki/Impact_factor" \l "cite_note-35) on every article in all of their titles

**Journal Impact Factors**  
  
Journal Impact Factor is from Journal Citation Report (JCR), a product of Thomson ISI (Institute for Scientific Information). JCR provides quantitative tools for evaluating journals. The impact factor is one of these; it is a measure of the frequency with which the "average article" in a journal has been cited in a given period of time.   
  
The impact factor for a journal is calculated based on a three-year period, and can be considered to be the average number of times published papers are cited up to two years after publication. For example, the impact factor 2012 for a journal would be calculated as follows:   
  
A = the number of times articles published in 2010-2011 were cited in indexed journals during 2012  
  
B = the number of articles, reviews, proceedings or notes published in 2010-2011  
  
impact factor 2012 = A/B  
  
(note that the impact factor 2011 will be actually published in 2012, because it could not be calculated until all of the 2011 publications had been received. Impact factor 2012 will be published in 2013)  
  
Impact factor of Nature, Science and Cell journals can be found on their journal websites.

I Editor in-chief, getting lot of mails from the many Authors regarding **“what is the Impact factor for my Journal**”. But most of the people don’t what is the impact factor, what is the way for calculating the journal impact factor and how we can use the impact factor. Most of the individuals treating the Impact factor as a main quality parameter for ranking the journals. But we should be noted that the Impact factor of a journal is no way related to the main quality parameters like quality of peer review and quality of content of the journal. To educate each individual regarding the Impact factor, I have summarized the main points here below. **Please note:** Impact factor can be calculated after completing the minimum of 3 years of publication; hence Journal Impact Factor cannot be calculated for new journals. Journal Impact Factors\* (\*Source: Thomson Reuters, Science gateway) Journal Impact Factor is from Journal Citation Report (JCR), a product of Thomson ISI (Institute for Scientific Information). JCR provides quantitative tools for evaluating journals. The impact factor is one of these; it is a measure of the frequency with which the "average article" in a journal has been cited in a given period of time. The impact factor for a journal is calculated based on a three-year period, and can be considered to be the average number of times published papers are cited up to two years after publication. For example, the impact factor 2010 for a journal would be calculated as follows: A = the number of times articles published in 2008-9 were cited in indexed journals during 2010

B = the number of articles, reviews, proceedings or notes published in 2008-2009

**Impact factor 2010 = A/B** (Note that the impact factor 2009 will be actually published in 2010, because it could not be calculated until all of the 2009 publications had been received. Impact factor 2010 will be published in 2011) **\*\*\*Please note the following key points related to Journal Impact factor:**

Journal Impact Factor cannot be calculated for new journals. I mean “the impact factor of a journal is calculated by dividing the number of current year citations to the source items published in that journal during the previous two years, hence impact factor can be calculated after completing the minimum of 3 years of publication.

Journal Impact Factor will be a quotient factor only and will not be a quality factor.

Journal Impact Factor will not be related to quality of content and quality of peer review, it is only a measure of the frequency with which the "average article" in a journal has been cited in a particular year or period.

Journal which publishes more review articles will get highest impact factors