



ELSEVIER

**Focus on bibliometrics and altmetrics**



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# Background to bibliometrics

# Background to bibliometrics



## Citation Indexes for Science

A New Dimension in Documentation  
through Association of Ideas

Eugene Garfield

"The uncritical citation of disputed data by a writer, whether it be deliberate or not, is a serious matter. Of course, knowingly propagandizing unsubstantiated claims is particularly abhorrent, but just as many naive students may be swayed by unfounded assertions presented by a writer who is unaware of the criticisms. Buried in scholarly journals, critical notes are increasingly likely to be overlooked with the passage of time, while the studies to which they pertain, having been reported more widely, are

approach to subject control of the literature of science. By virtue of its different construction, it tends to bring together material that would never be collated by the usual subject indexing. It is best described as an association-of-ideas index, and it gives the reader as much leeway as he requires. Suggestiveness through association-of-ideas is offered by conventional subject indexes but only within the limits of a particular subject heading.

If one considers the book as the macro unit of thought and the periodical article

case. Classified indexes are also dependent upon a subject analysis of individual articles and, at best, offer us better consistency of indexing rather than greater specificity or multiplicity in the subject approach. Similarly, terminology is important, but even an ideal standardization of terminology and nomenclature will not solve the problem of subject analysis.

What seems to be needed, then, in addition to better and more comprehensive indexes, alphabetical and classified, are new types of bibliographic tools that can help to span the gap between the subject approach of those who create documents—that is, authors—and the subject approach of the scientist who seeks information.

Since 1873 the legal profession has been provided with an invaluable research tool known as *Shepard's Citations*, published by Shepard's Citations, Inc., Colorado Springs, Colo. (2). A citation index is published for court cases in the 48 states as well as for cases in Federal courts. Briefly, the Shepard citation system is a listing of individual American court cases, each case being followed by

1955

## Citation Analysis as a Tool in Journal Evaluation

Journals can be ranked by frequency and  
impact of citations for science policy studies.

Eugene Garfield

1972



ISI JOURNAL  
CITATION  
reports.

1975

A ratio between citations and recent citable items published in a journal;  
the average number of citations received per published article.

Year -2

Year -1

Citing year

ISI Web of Knowledge<sup>SM</sup>

Journal Citation Reports<sup>®</sup>

2012 JCR Science Edition



Journal Impact Factor ⓘ

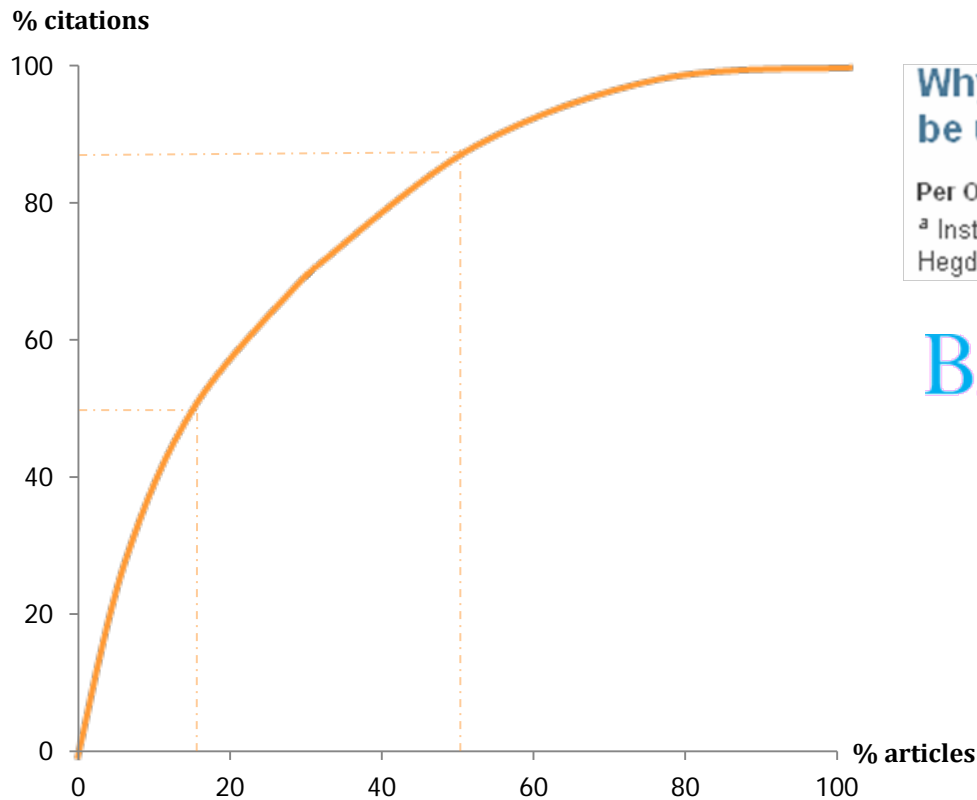
Cites in 2012 to items published in:	2011 = 221	Number of items published in:	2011 = 156
	2010 = 416		2010 = 151
	Sum: 637		Sum: 307
Calculation: $\frac{\text{Cites to recent items}}{\text{Number of recent items}}$	$\frac{637}{307}$		= 2.075

To **all** items  
(regardless of type)

Only **source** items  
(‘articles’ and ‘reviews’)

Citations to non-source items (editorials, letters, news items, book reviews, abstracts, etc) may **inflate** the IF

IF



## Why the impact factor of journals should not be used for evaluating research

Per O Seglen, professor<sup>a</sup>

<sup>a</sup> Institute for Studies in Research and Higher Education (NIFU)  
Hegdehaugsveien 31 N-0352 Oslo Norway

BMJ

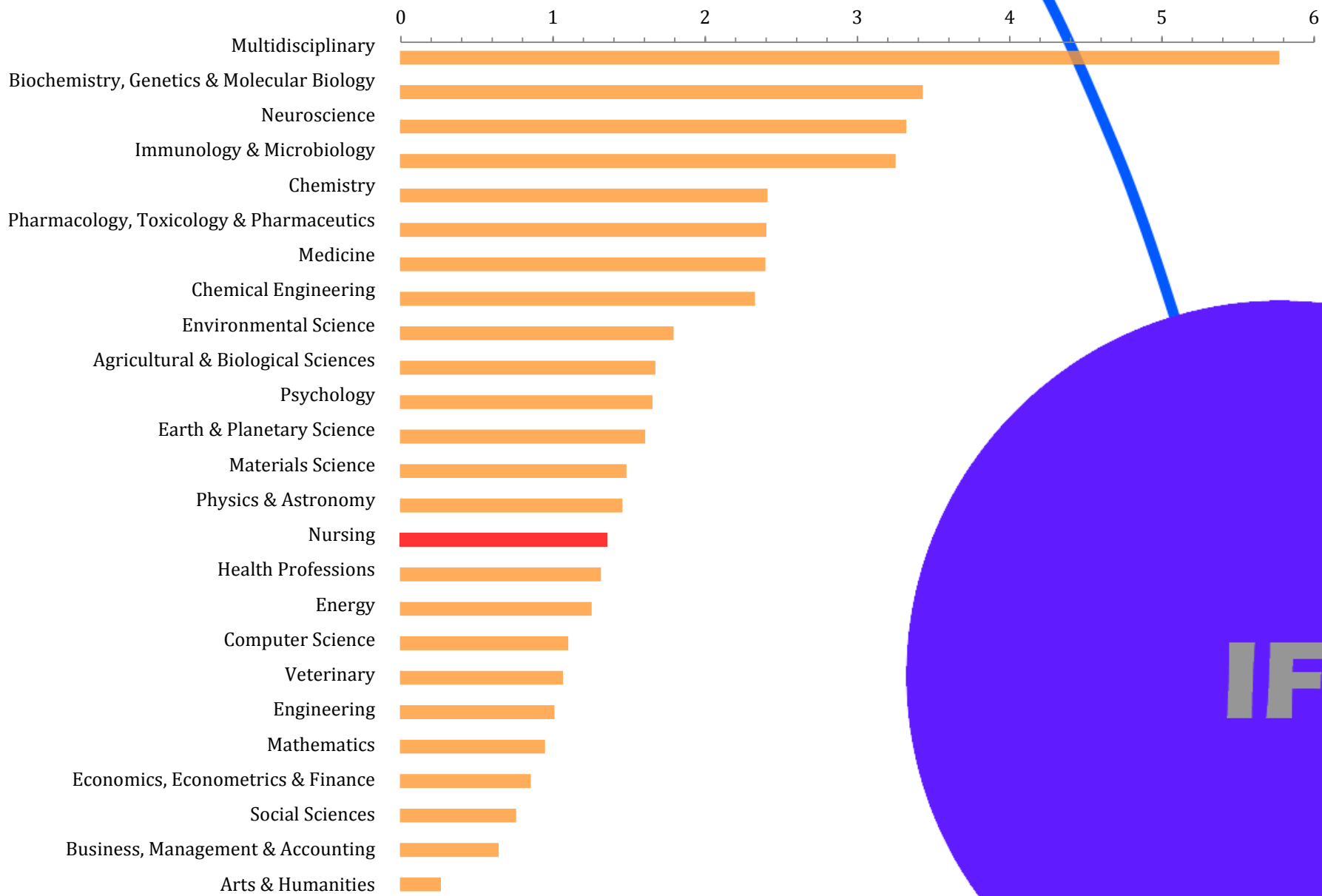
Cumulative contribution of articles (with different citation rates) to total journal impact.

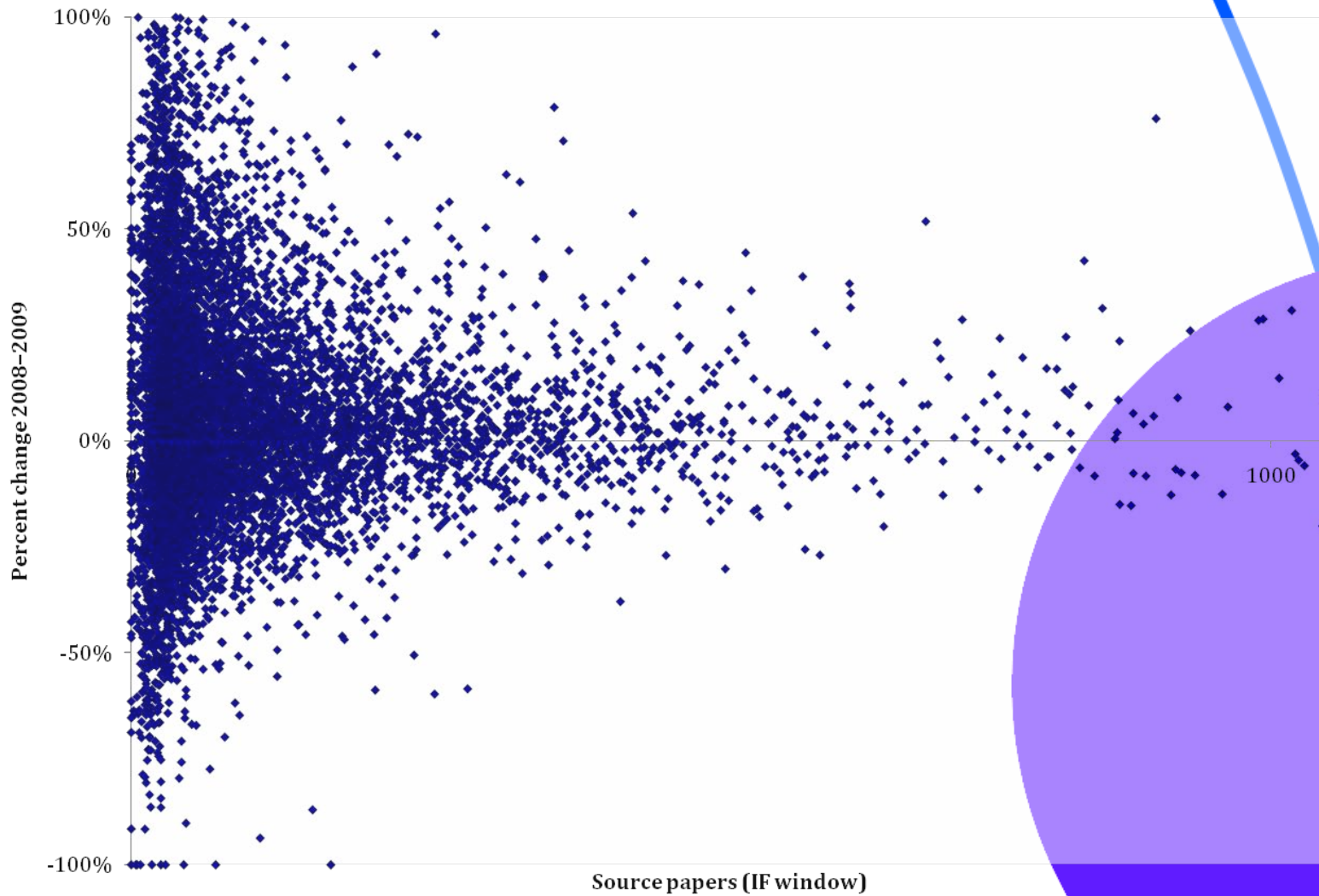
IF

Rank	Abbreviated Journal Title <i>(linked to journal information)</i>	ISSN	Total Cites	Impact Factor
1	<a href="#">NEW ENGL J MED</a>	0028-4793	232068	53.298
2	<a href="#">LANCET</a>	0140-6736	158906	38.278
3	<a href="#">JAMA-J AM MED ASSOC</a>	0098-7484	117668	30.026
4	<a href="#">ANN INTERN MED</a>	0003-4819	45683	16.733
5	<a href="#">PLOS MED</a>	1549-1277	12574	16.269
6	<a href="#">BRIT MED J</a>	0959-535X	74759	14.093
7	<a href="#">ARCH INTERN MED</a>	0003-9926	37598	11.462
8	<a href="#">CAN MED ASSOC J</a>	0820-3946	11413	8.217
9	<a href="#">BMC MED</a>	1741-7015	1835	6.035
10	<a href="#">COCHRANE DB SYST REV</a>	1469-493X	29593	5.715
11	<a href="#">MAYO CLIN PROC</a>	0025-6196	9150	5.698
12	<a href="#">J INTERN MED</a>	0954-6820	7706	5.483
13	<a href="#">AM J MED</a>	0002-9343	22346	5.430
14	<a href="#">ANN FAM MED</a>	1544-1709	2351	5.355
15	<a href="#">BRIT MED BULL</a>	0007-1420	3064	4.543
16	<a href="#">MEDICINE</a>	0025-7974	4821	4.350
17	<a href="#">AM J PREV MED</a>	0749-3797	11729	4.044
18	<a href="#">CLEV CLIN J MED</a>	0891-1150	1513	3.773
19	<a href="#">ANN MED</a>	0785-3890	3306	3.516
20	<a href="#">PREV MED</a>	0091-7435	9643	3.216

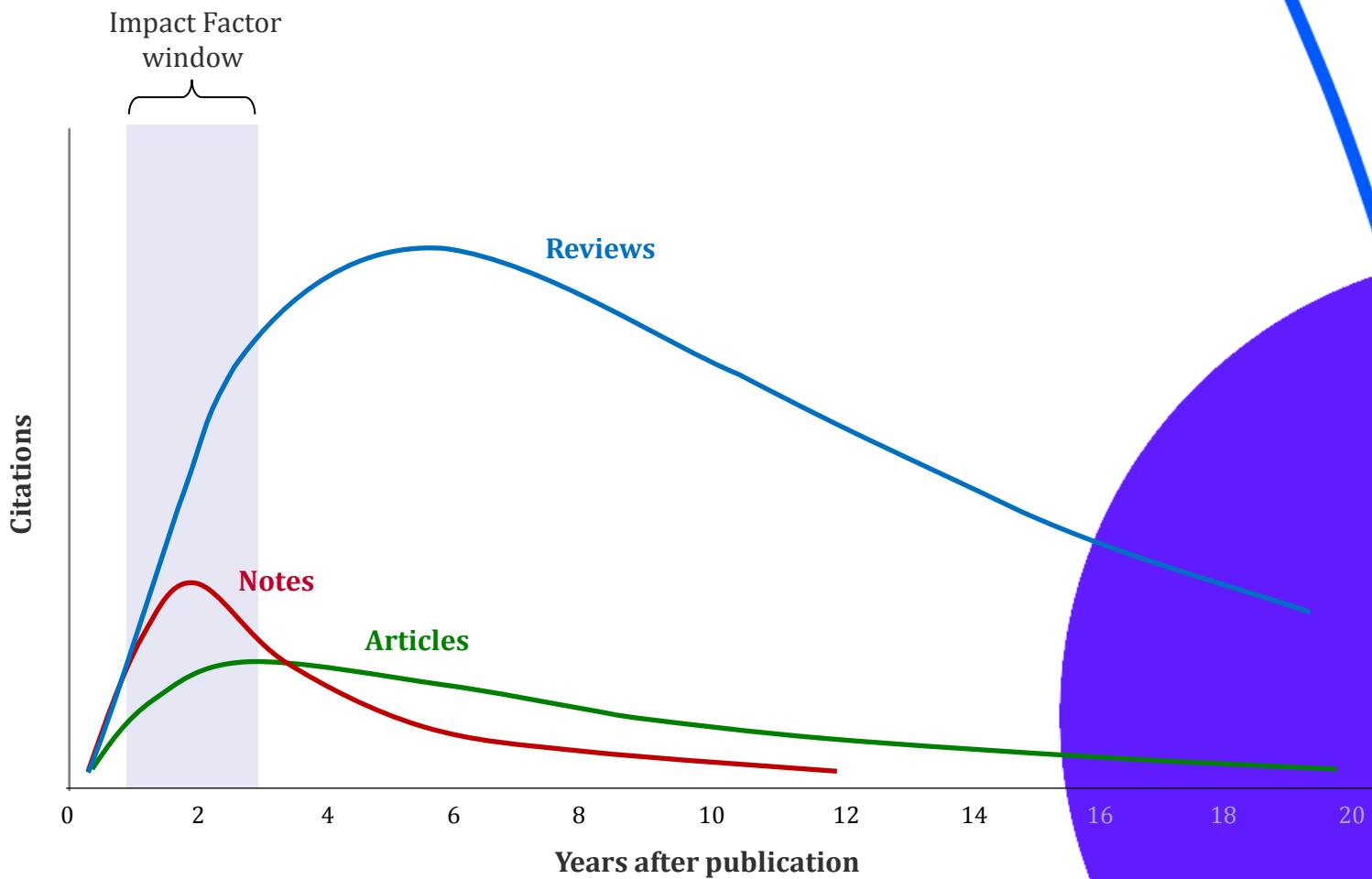


IF









**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

By RICHARD MONASTERSKY

**THE WALL STREET JOURNAL.**

June 5, 2006

**Science Journals Artfully Try  
To Boost Their Rankings**

By SHARON BEGLEY

*Journal of*  
**Documentation**

Vol. 64, Iss. 2 (2008)

**Is the impact of journal impact  
factors decreasing?**

Jan Reedijk

*Leiden Institute of Chemistry, Leiden University, Leiden, The Netherlands, and*

Henk F. Moed

*Centre for Science and Technology Studies (CWTS), Leiden University,  
Leiden, The Netherlands*

**IF**

# Elsevier's philosophy on the Impact Factor

“Elsevier uses the Impact Factor as one of a number of **performance indicators** for journals. It acknowledges the many **caveats** associated with its use and strives to share **best practice** with its authors, editors, readers and other stakeholders in scholarly communication. Elsevier seeks **clarity** and **openness** in all communications relating to the IF and does not condone the practice of **manipulation** of the IF for its own sake.”



IF

# Elsevier's policy on journal self-citations

“An editor should **never** conduct any practice that obliges authors to cite his or her journal either as an implied or explicit **condition of acceptance** for publication. Any recommendation regarding articles to be cited in a paper should be made on the basis of direct **relevance** to the author's article, with the objective of **improving** the final published research. Editors should direct authors to relevant literature as part of the peer review process, however this should **never** extend to **blanket instructions** to cite individual journals.”

“Part of your role as Editor is to try to increase the **quality** and **usefulness** of the journal. Attracting high quality articles from areas that are **topical** is likely the best approach. **Review** articles tend to be more highly cited than original research, and **letters** to the Editor and **editorials** can be beneficial. However, practices that ‘engineer’ citation performance for its own sake, such as **forced self-citation** are **neither acceptable nor supported by Elsevier.**”



IF

# Immediacy Index

Looks at citations to papers published in the same year.

$$\text{Publication year} = \text{Citing year}$$

ISI Web of Knowledge<sup>SM</sup>

Journal Citation Reports<sup>®</sup>

2012 JCR Science Edition

## Journal Immediacy Index ⓘ

Cites in 2012 to items published in 2012 = 55

Number of items published in 2012 = 154

Calculation:  $\frac{\text{Cites to current items}}{\text{Number of current items}} = \frac{55}{154} = 0.357$

- Topicality
- Publication frequency/schedule has greater effect

IF



# 5-year Impact Factor (IF5)

Considers articles published in the five previous years.



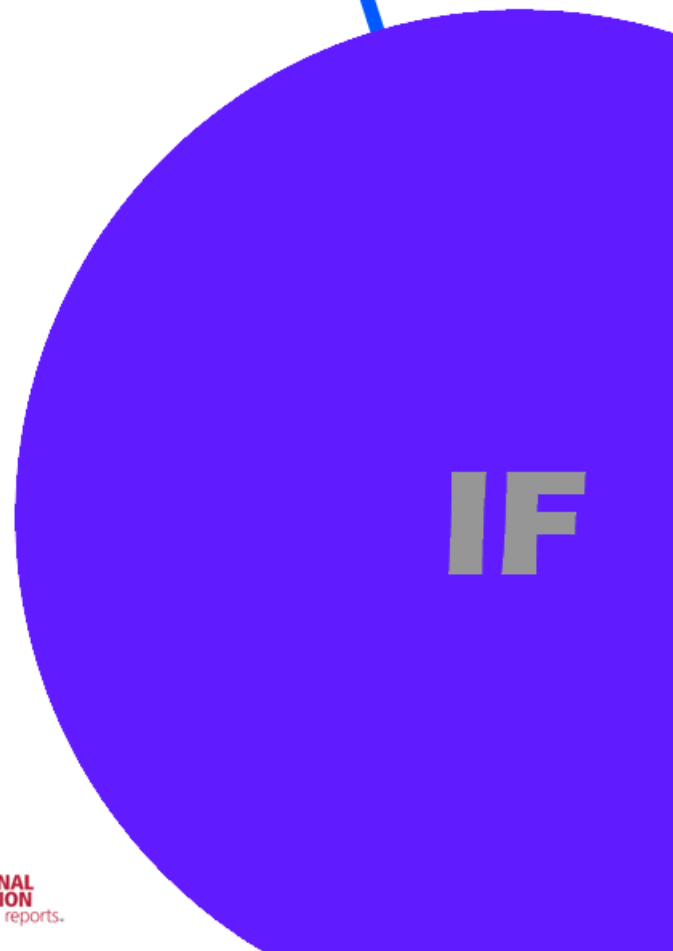
ISI Web of Knowledge<sup>SM</sup>

Journal Citation Reports<sup>®</sup> 2012 JCR Science Edition

5-Year Journal Impact Factor ⓘ

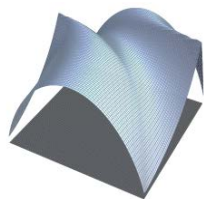
Cites in {2012} to items published in:	2011 = 221	Number of items published in:	2011 = 156
	2010 = 416		2010 = 151
	2009 = 537		2009 = 158
	2008 = 432		2008 = 163
	2007 = 386		2007 = 127
	Sum: 1992		Sum: 755

Calculation:  $\frac{\text{Cites to recent items}}{\text{Number of recent items}} = \frac{1992}{755} = 2.638$



- Longer-term impact
- Still unable to compare across subject fields





# Eigenfactor

Citations *weighted* by the EF of the citing journal

Same time window as the IF5

Self-citations excluded

Freely available at [eigenfactor.org](http://eigenfactor.org); on the JCR

**Eigenfactor:** size dependent

**Article Influence:** size independent

Google

PageRank Update In Progress



Year -5

Year -4

Year -3

Year -2

Year -1

Citing year

Citations *weighted* by the SJR of the citing journal

Considers 3 years of publications

Self-citations limited (33%)

Uses Scopus data



**Scopus**



**SJR**

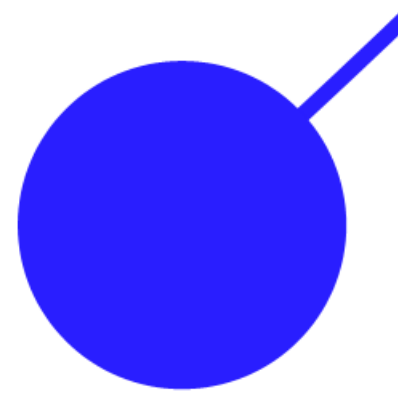






Universiteit Leiden

# Source Normalized Impact per Paper



# SNIP

Citations *weighted* by the likelihood of citation  
in the subject field of source

Raw Impact per Paper  $\div$  Relative Database Citation Potential

Allows for comparison between subject fields

Also considers 3 years of publications

Uses Scopus data

# Scopus

Year -3

Year -2

Year -1

Citing year

# h-index



Applicability

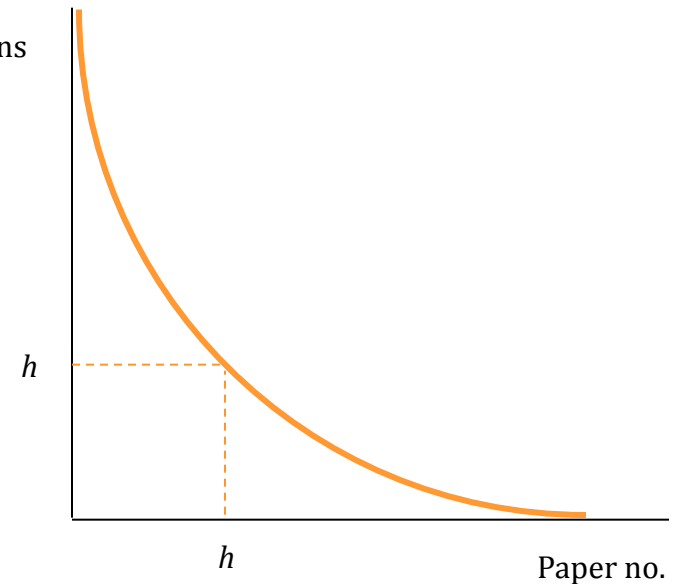


Key trends

# Scopus

- Rates individuals based on career publications
- Incorporates both quantity and quality
- Productivity and age constraints
- Available on Scopus, also calculated from many sources

Citations



**Hirsch, J. (August 2005)**

“An index to quantify an individual’s scientific research output.”

# Common properties of bibliometric indicators

- Journal-level analysis
- Citation-based
- Medium/short-term
  - Citation window (1 year)
  - Publication window (1 to 5 years)
- Ratio of citations  $\div$  papers
  - Size independence
- Advantage to highly-cited fields, article types, etc.

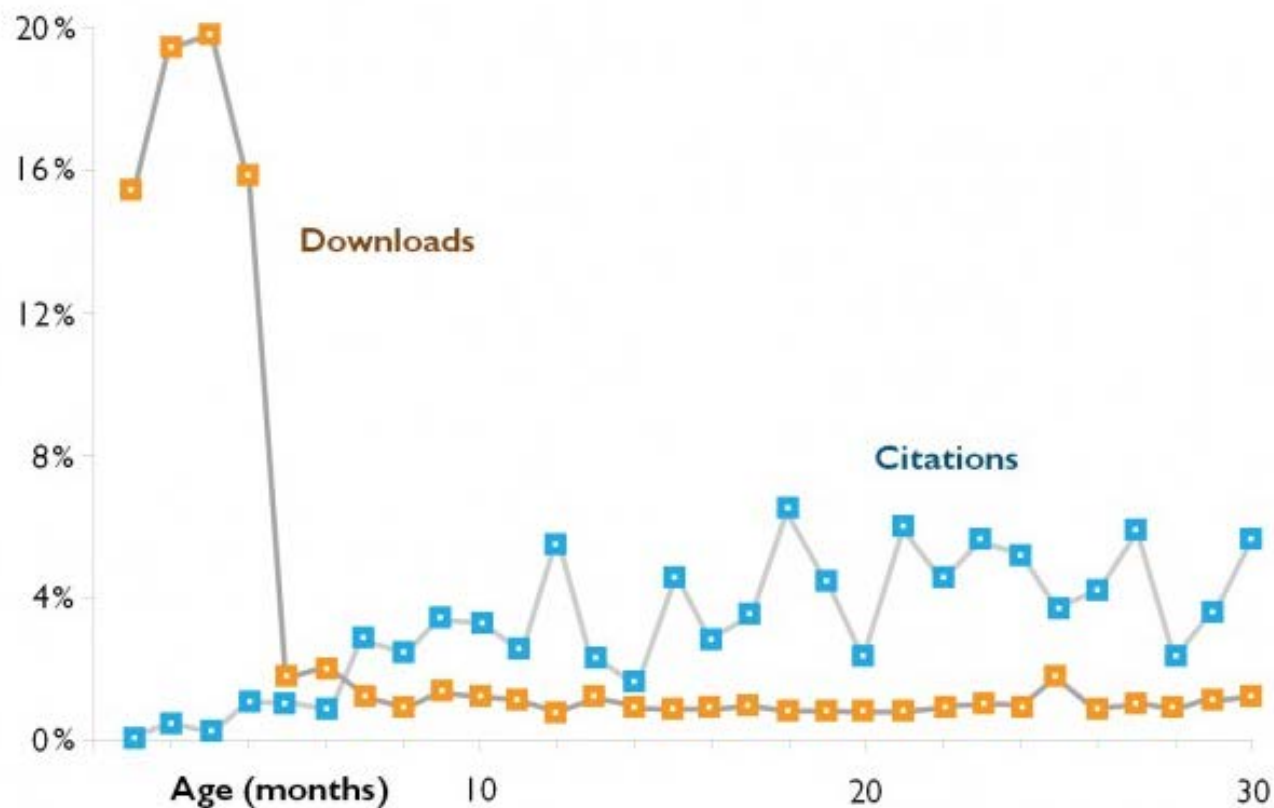


IF

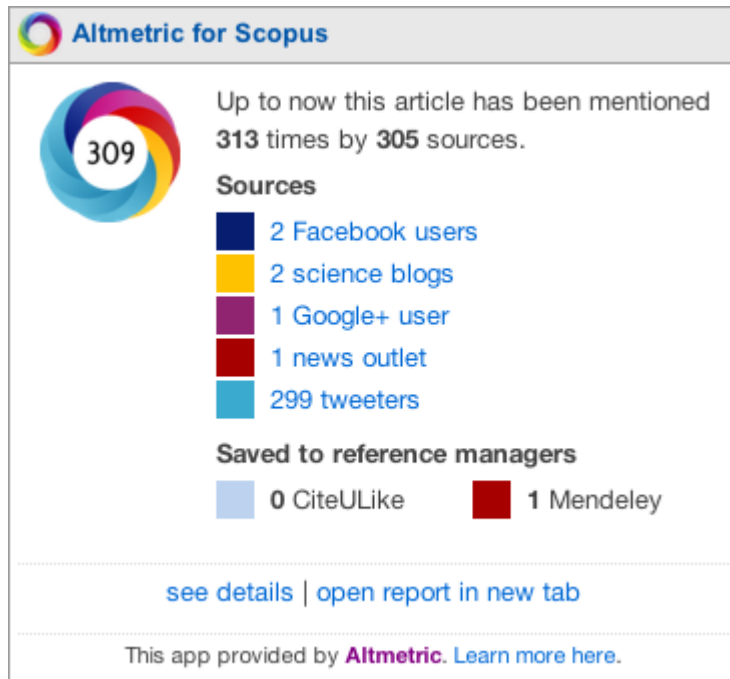


# Alternatives to citation metrics

# Usage



# Altmetrics



# Scopus

## ImpactStory.

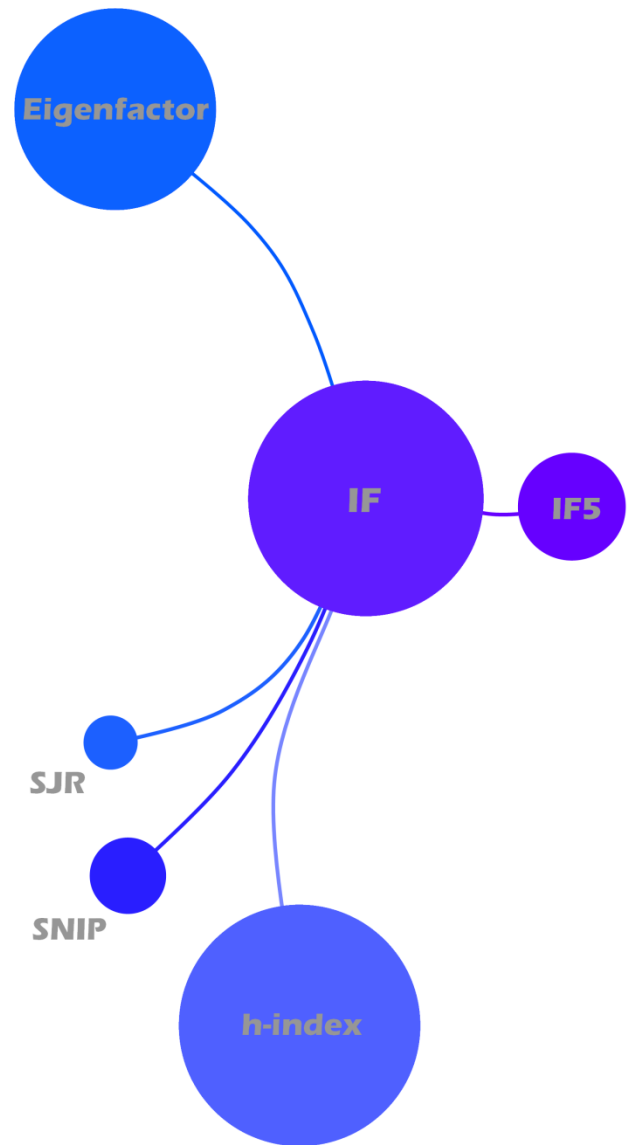


# So what?

Metrics can help you decide what to read, decide where to publish, benchmark yourself.

No single number is going to give the complete picture.

*Advice:* Use with care and use in combination.



# Research & Academic Relations at Elsevier

Scientometrics & Market Analysis

Customer Insights

