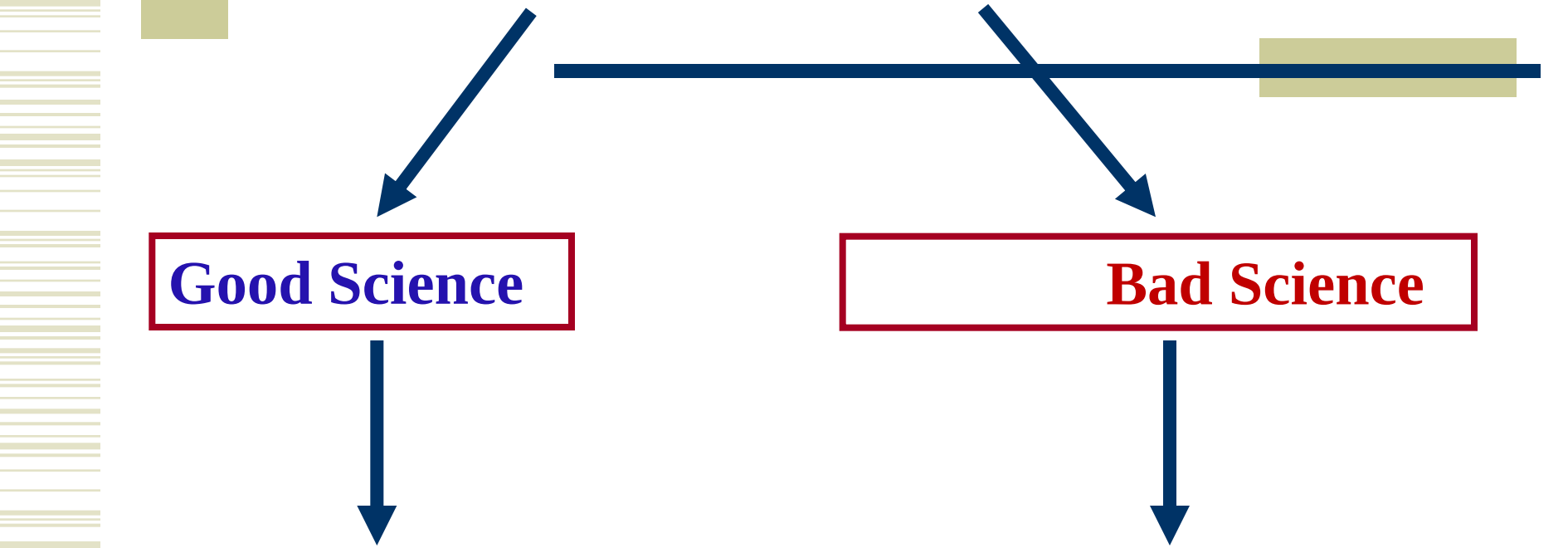

بسم الله الرحمن الرحیم

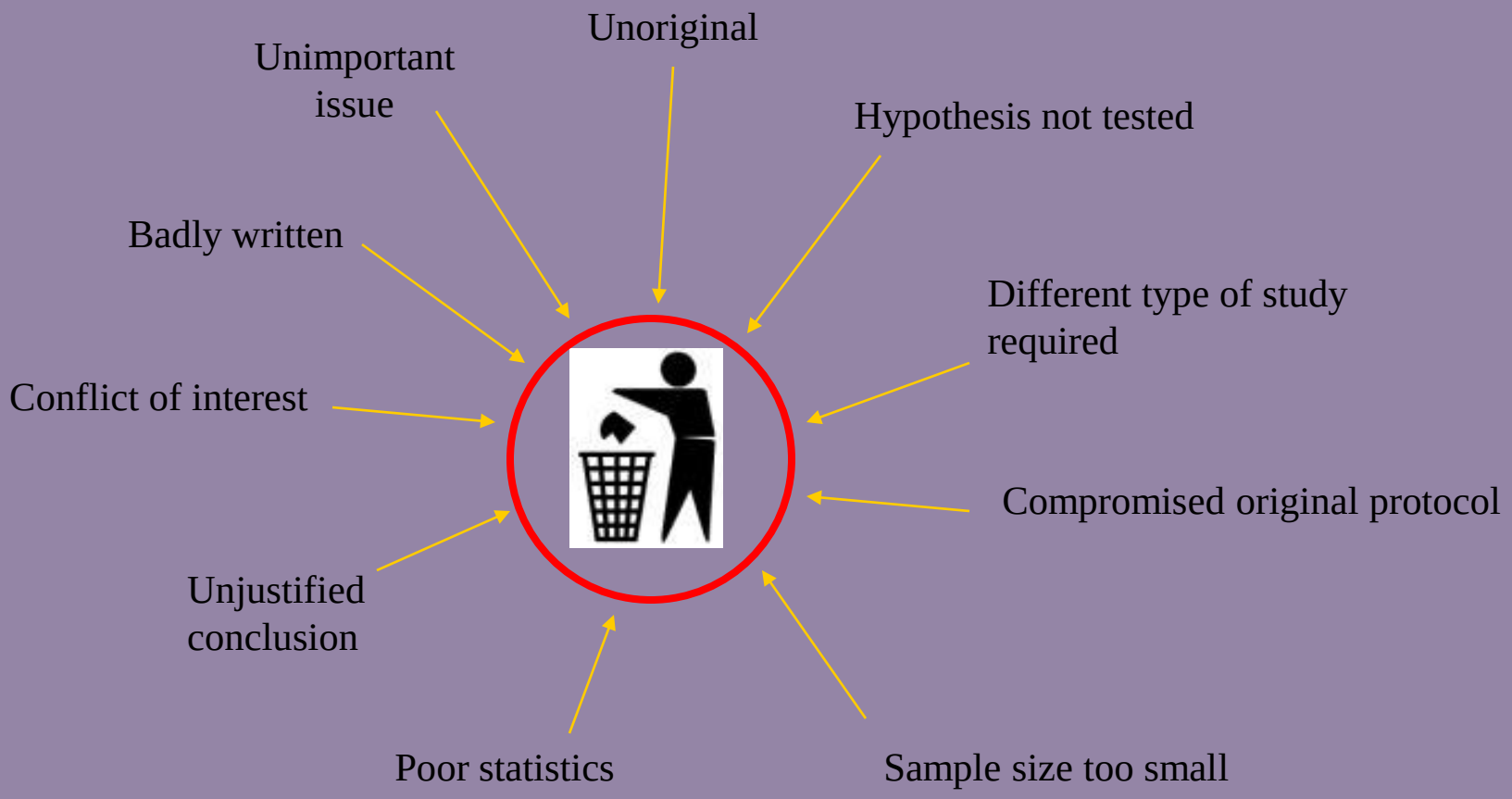
کارگاه آشنایی با مبانی و شاخص‌های علم‌سنجی

دکتر علی رشیدی

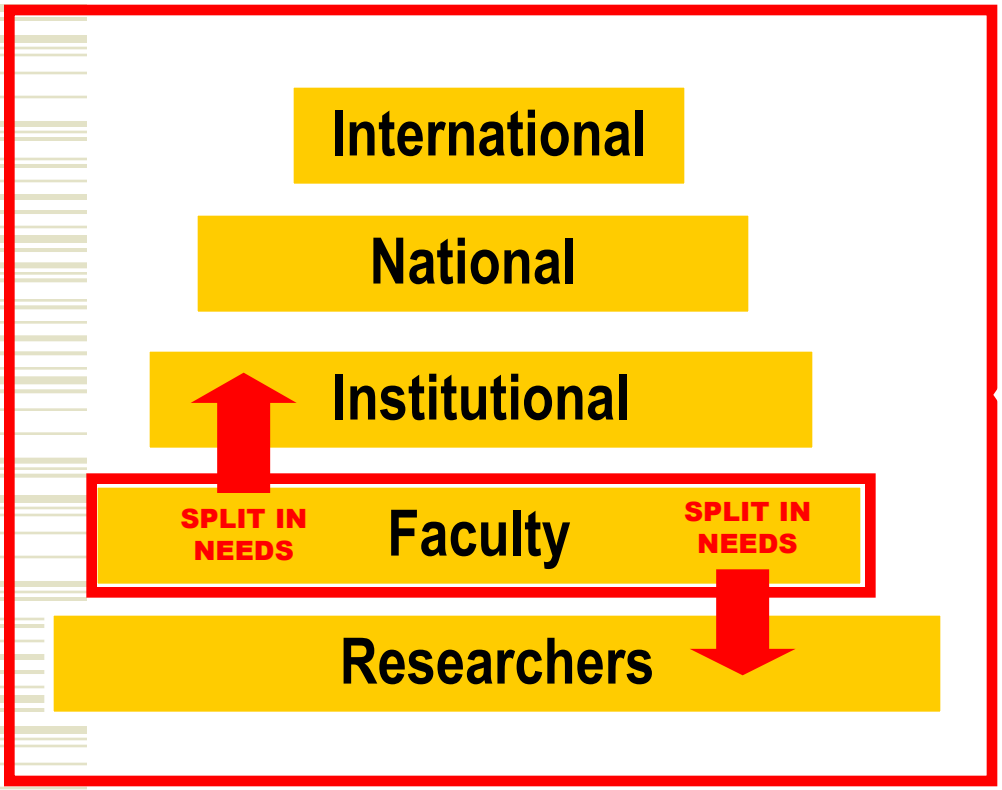
Not All Science is the Same



The science of ‘trashing’ a paper



Why do we evaluate scientific output



- Grant Allocations
- Policy Decisions
- Benchmarking
- Promotion
- Collection management
- Funding allocations
- Research
- Hiring
- Making the right investment

Bibliometrics

The application of mathematics and statistical methods to assess science as an informational process

Measuring Productivity in Science

- Option 1: Number of papers published
  - This matrix emphasizes quantity (vs. quality)
  - What if most of papers are not important or have no influence in science or medicine?
- Option 2: Attempt to measure quality
  - Has the paper been cited by others?
  - Has the paper influenced the field?

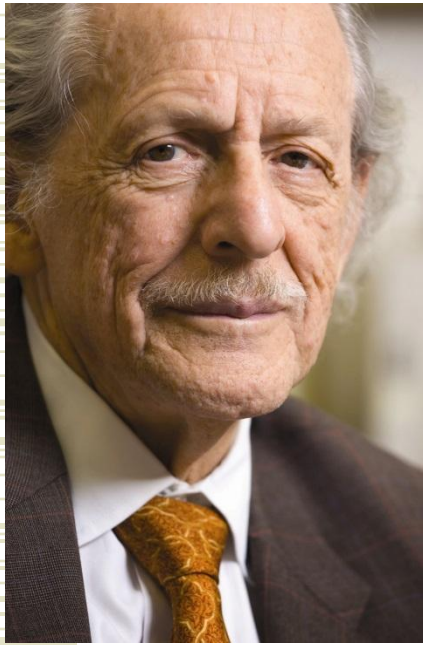
Why are Citations Important?

- "Attention is the mode of payment in science"
- "Money is not the main motive for engaging in science"
- "Success in science is rewarded with attention"
- Citations = attention

Conclusion

- “Citations are the fee paid through transfer of some of the attention earned by the citing author, to the cited author”

Eugene Garfield, PhD



http://garfield.library.upenn.edu/

- Informational scientist
- Proposed citation indices in 1955
- Journal Impact Factor in 1960
- Institute for Scientific Information (ISI)
- Journal of Citation Reports
- Web of Science/Knowledge
- Purchased by Thomson Reuters

Birth of the Science Citation Index

Citation Indexes for Science

A New Dimension in Documentation through Association of Ideas

Eugene Garfield

Science. 1955;122:108-11

Journal Impact Factor

Citation Analysis as a Tool in Journal Evaluation

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

Eugene Garfield

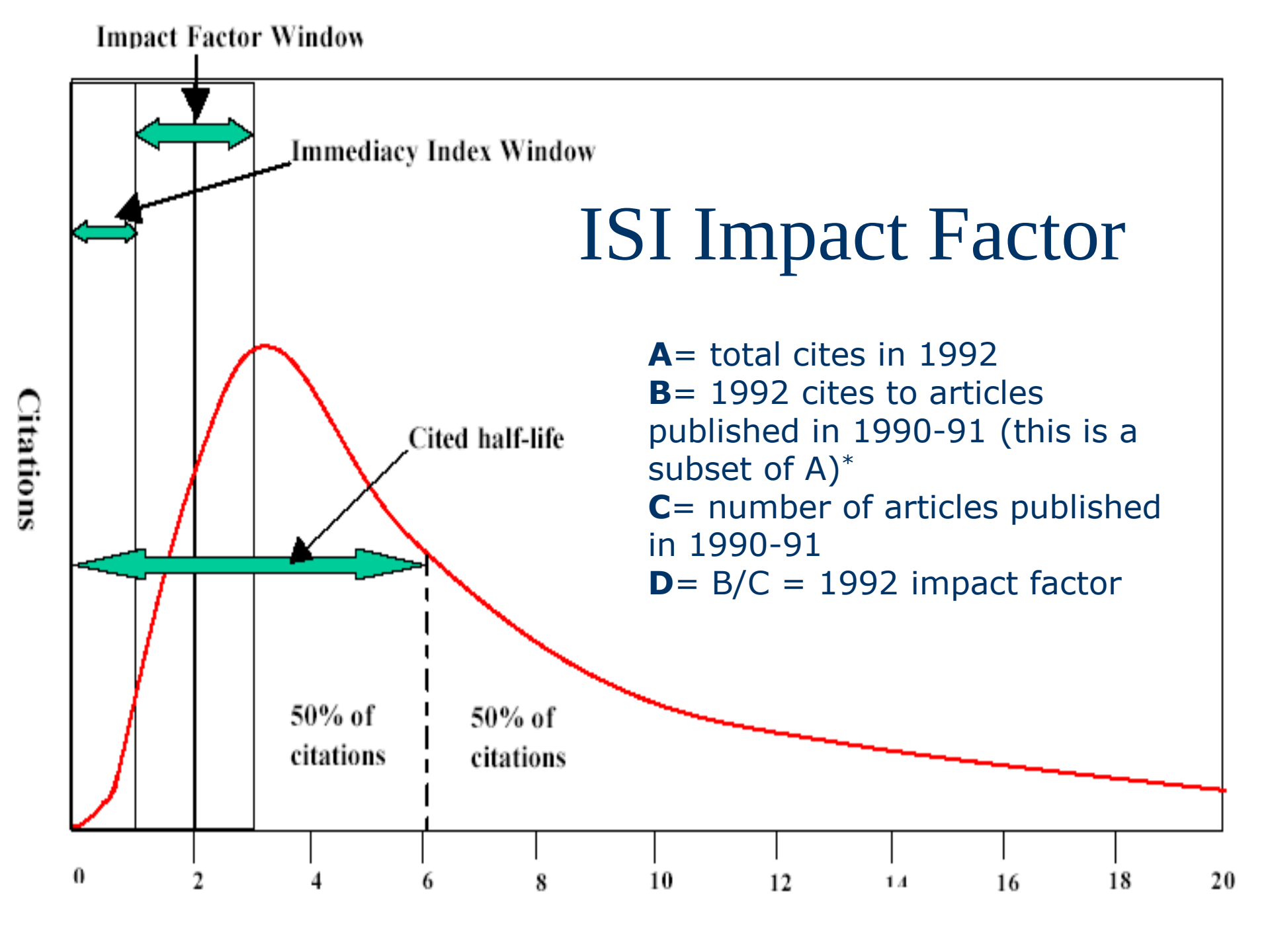
Science. 1972;178:471-9.

Definition of the Impact Factor of a Journal

Impact Factor =

$$\frac{\textbf{Nº of citations to all articles published in a particular year (e.g. 2015)}}{\text{Total Nº of “citable items” published in the 2 previous years (e.g. 2013 and 2014)}}$$

"Citable items" for this calculation are usually original articles or reviews; not Editorials, Viewpoints, Abstracts or Letters to the Editor.



ISI 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

Journal of Citation Reports

Mark	Rank	Abbreviated Journal Title (linked to journal information)	ISSN	JCR Data						Eigenfactor® Metrics	
				Total Cites	Impact Factor	5-Year Impact Factor	Immediacy Index	Articles	Cited Half-life	Eigenfactor® Score	Article Influence® Score
☐	1	HUM REPROD UPDATE	1355-4786	5799	8.657	9.464	1.833	48	7.1	0.01346	3.243
☐	2	HUM REPROD	0268-1161	27398	4.585	4.619	1.113	363	8.5	0.04470	1.363
☐	3	OBSTET GYNECOL	0029-7844	25283	4.368	4.755	0.993	294	9.1	0.04610	1.733
☐	4	FERTIL STERIL	0015-0282	28747	4.295	3.982	1.185	541	7.0	0.05607	1.068
☐	5	AM J OBSTET GYNECOL	0002-9378	32056	3.973	3.778	0.850	301	>10.0	0.05101	1.340
☐	6	BJOG-INT J OBSTET GY	1470-0328	12822	3.862	3.935	1.242	223	8.6	0.02457	1.390
☐	7	GYNECOL ONCOL	0090-8258	18375	3.687	3.915	0.771	432	7.0	0.03413	1.081

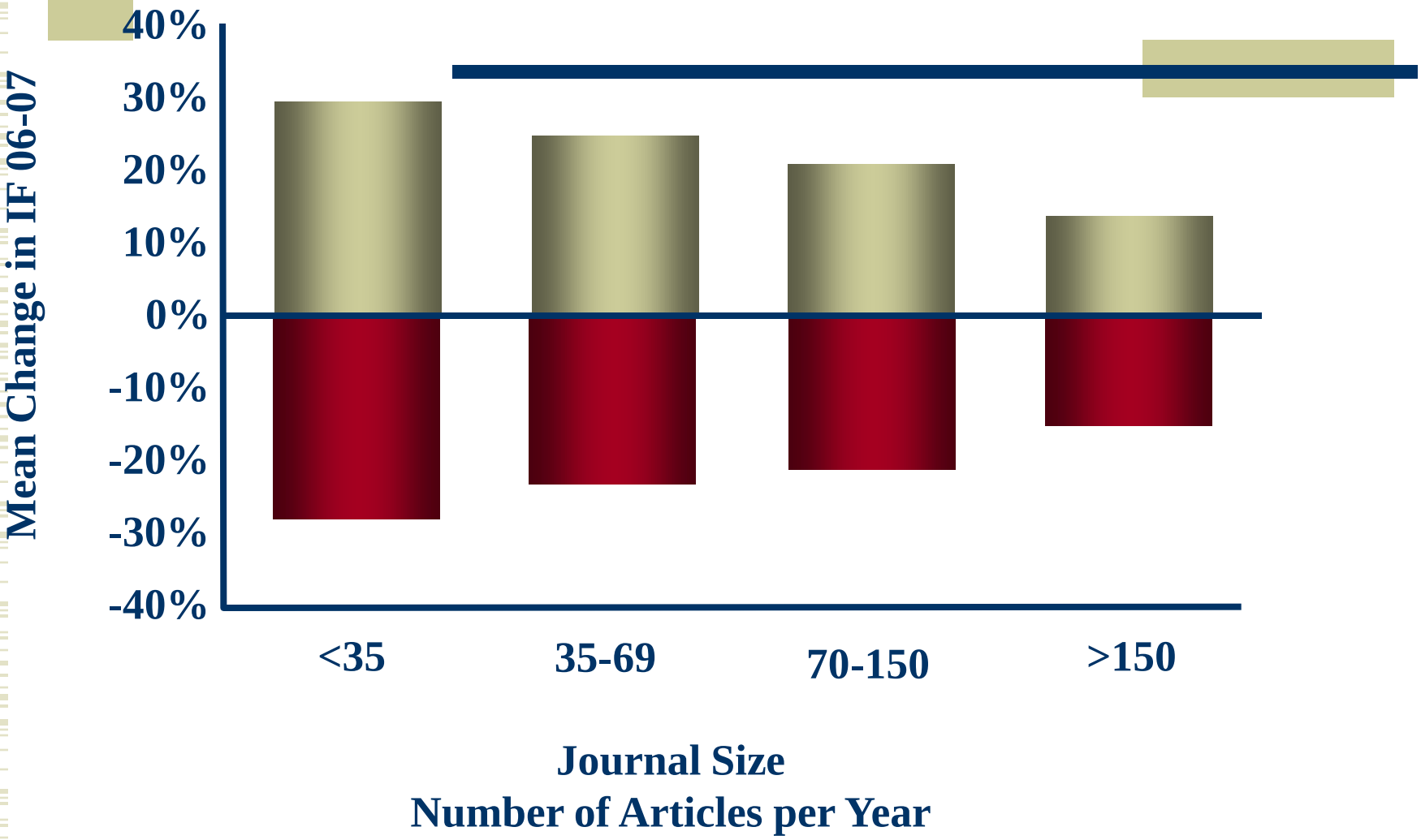
Journal Citation Reports 2014

Rank	Abbreviated Journal Title	Impact Factor	{2014} Total Cites	5-Year Impact Factor	{2014} Articles
1	HUM REPROD UPDATE	10.165	6625	10.818	60
2	OBSTET GYNECOL	5.175	26836	5.098	282
3	AM J OBSTET GYNECOL	4.704	33839	4.142	364
4	FERTIL STERIL	4.59	31236	4.255	490
5	HUM REPROD	4.569	28113	4.729	304
6	ULTRASOUND OBST GYN	3.853	9248	3.584	186
7	GYNECOL ONCOL	3.774	19159	3.843	408
8	MOL HUM REPROD	3.747	5078	3.956	111
9	BJOG-INT J OBSTET GY	3.448	13139	3.726	223
10	MENOPAUSE	3.361	4260	3.159	156

Impact Factor Interpretation

- Journals with a high impact factor are considered more prestigious than journals with a lower impact factor
- A paper published in AJOG has an average probability of being cited 4.7 times in the next 2 years
- Impact Factor: How Many People Read My Article?

The Impact Factor Variability and Journal Size



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Eigenfactor Score: A Sophisticated Measure of Journal Prestige

- A journal's Eigenfactor score is measured as its importance to the scientific community. Scores are scaled so that the sum of all journal scores is 100. In 2006, Nature had the highest score of 1.992.
- Percentage of *weighted* citations received by a journal compared to all 6, 000 journals analyzed from the 2004 Journal of Citation Reports dataset.
- Instead of each citation to a journal being counted as 1, each citation received by a journal is instead assigned a value greater or lesser than 1 based on the Eigenfactor of the citing journal

Eigenfactor Score

- Generally identifies journals that have most impact in their subject areas (**Eigenfactor: How Many People Read this Journal?)**
- Bigger and highly cited journals will tend to be at the top of rankings according to Eigenfactor
- Exclusion of journal self-citations in the calculation of the Eigenfactor minimises citation practices of some journals, but will penalize journals that serve small niches
- Review Journals are de-emphasised in Eigenfactor score

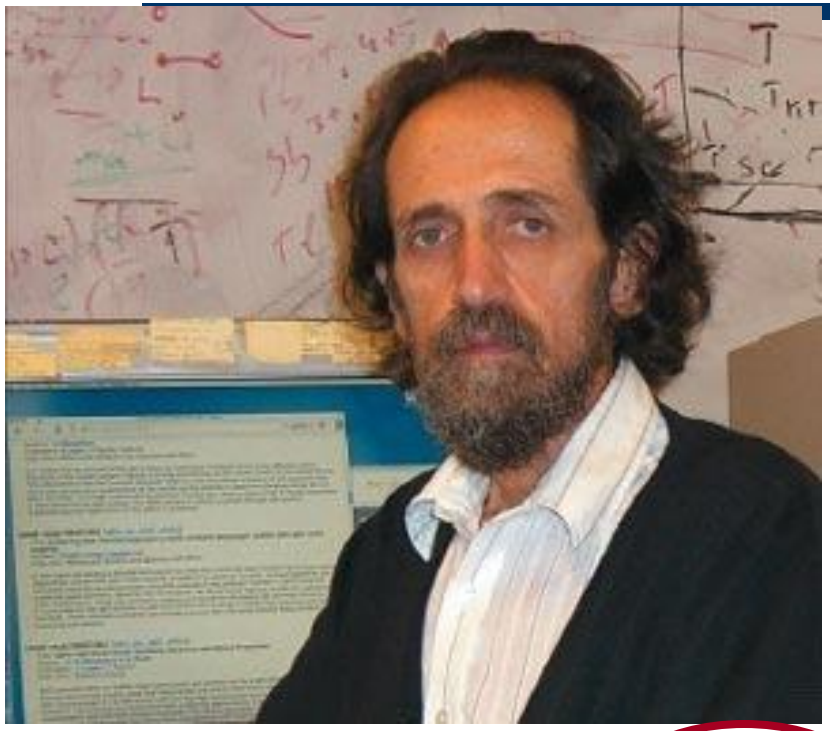
Eigenfactor Score

Rank	Abbreviated Journal Title	Eigenfactor Score
1	FERTIL STERIL	0.05759
2	OBSTET GYNECOL	0.04815
3	AM J OBSTET GYNECOL	0.04773
4	HUM REPROD	0.04172
5	GYNECOL ONCOL	0.03311
6	BJOG-INT J OBSTET GY	0.02324
7	ULTRASOUND OBST GYN	0.01839
8	HUM REPROD UPDATE	0.01442
9	MENOPAUSE	0.01063
10	MOL HUM REPROD	0.00804

Journal vs. Author

An index to quantify an individual's scientific research output

J. E. Hirsch*



www-physics.ucsd.edu

Professor Jorge E. Hirsch

H-Index

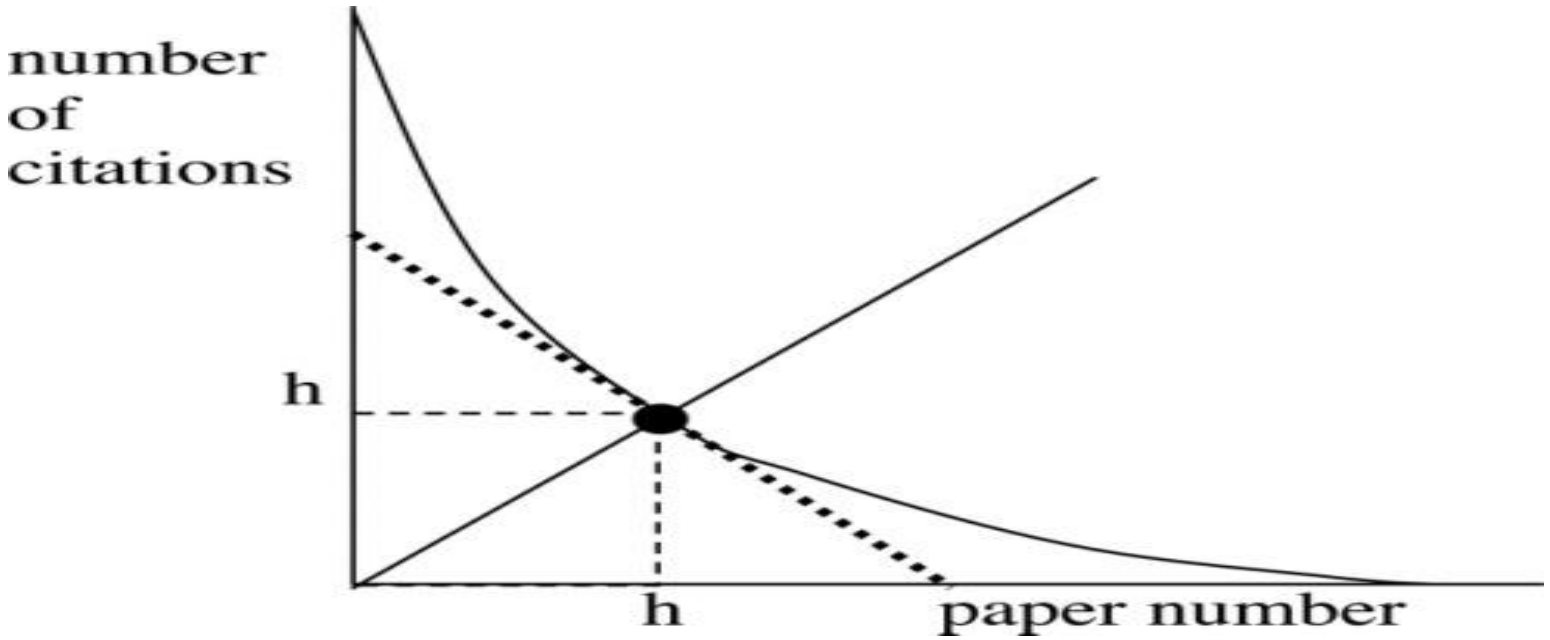
- Rates a scientist's performance based on his/her career publications, as measured by the lifetime number of citations each article receives

- Depends on both quantity (number of publications) and quality (number of citations) of a scientist's publications

H-Index

- Definition: "A scientist has index *h* if *h* of their *N* papers have at least *h* citations each, and the other (*N* – *h*) papers have no more than *h* citations each."

- Translation of definition: If you list all of an author's publications in descending order of the number of citations received to date, their h-index is 10 if at least 10 papers have each received 10 or more citations.



H-index example

Author A

Doc	1	2	3	4	5	6	7	8	9
Cit	55	45	20	10	5	4	3	2	1

Author B

Doc	1	2	3	4
Cit	25	20	9	6

H-index example

Author X has 5 published articles:

Article1, citations 5

Article2, citations 10

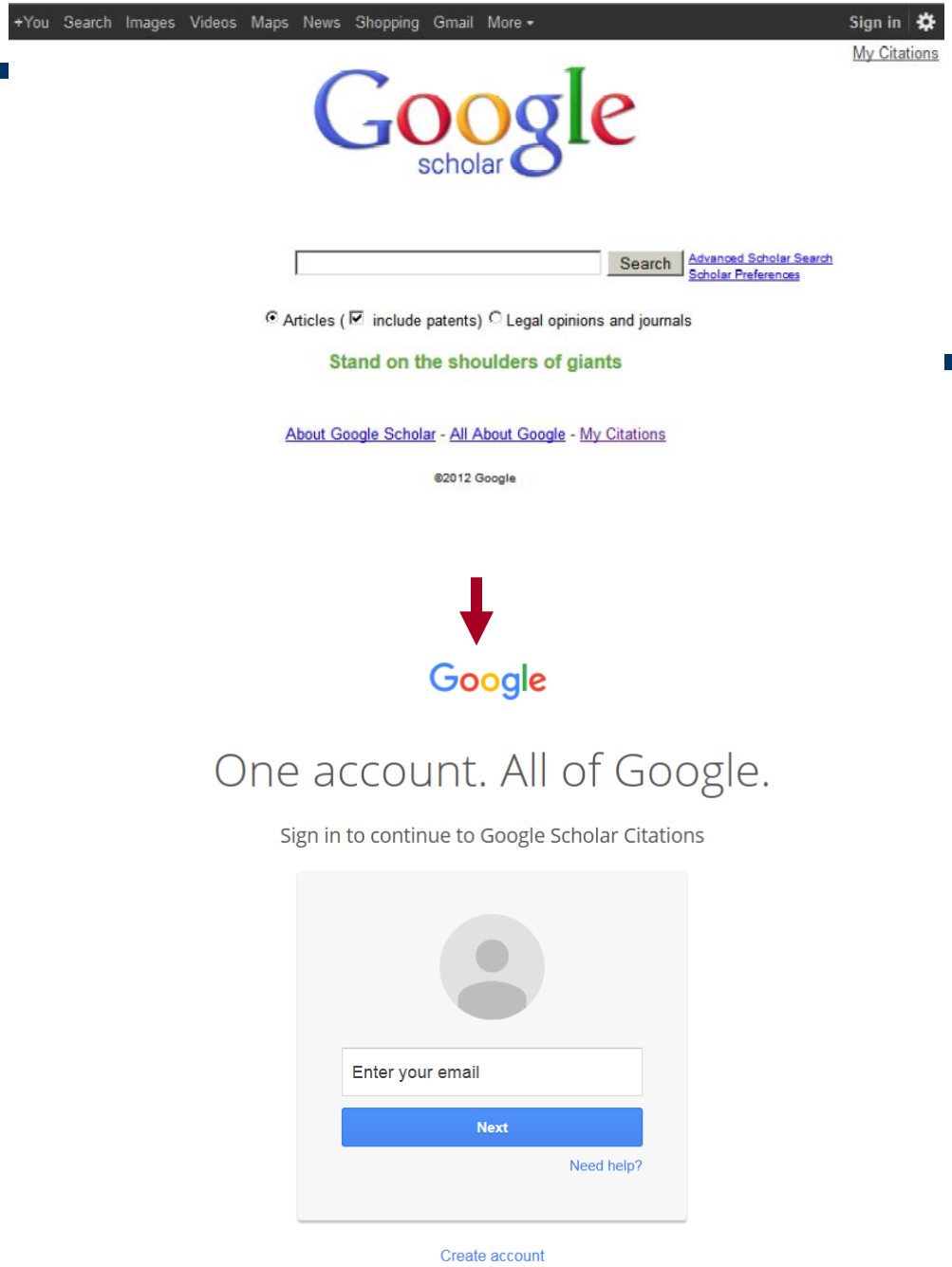
Article3, citations 100

Article4, citations 6

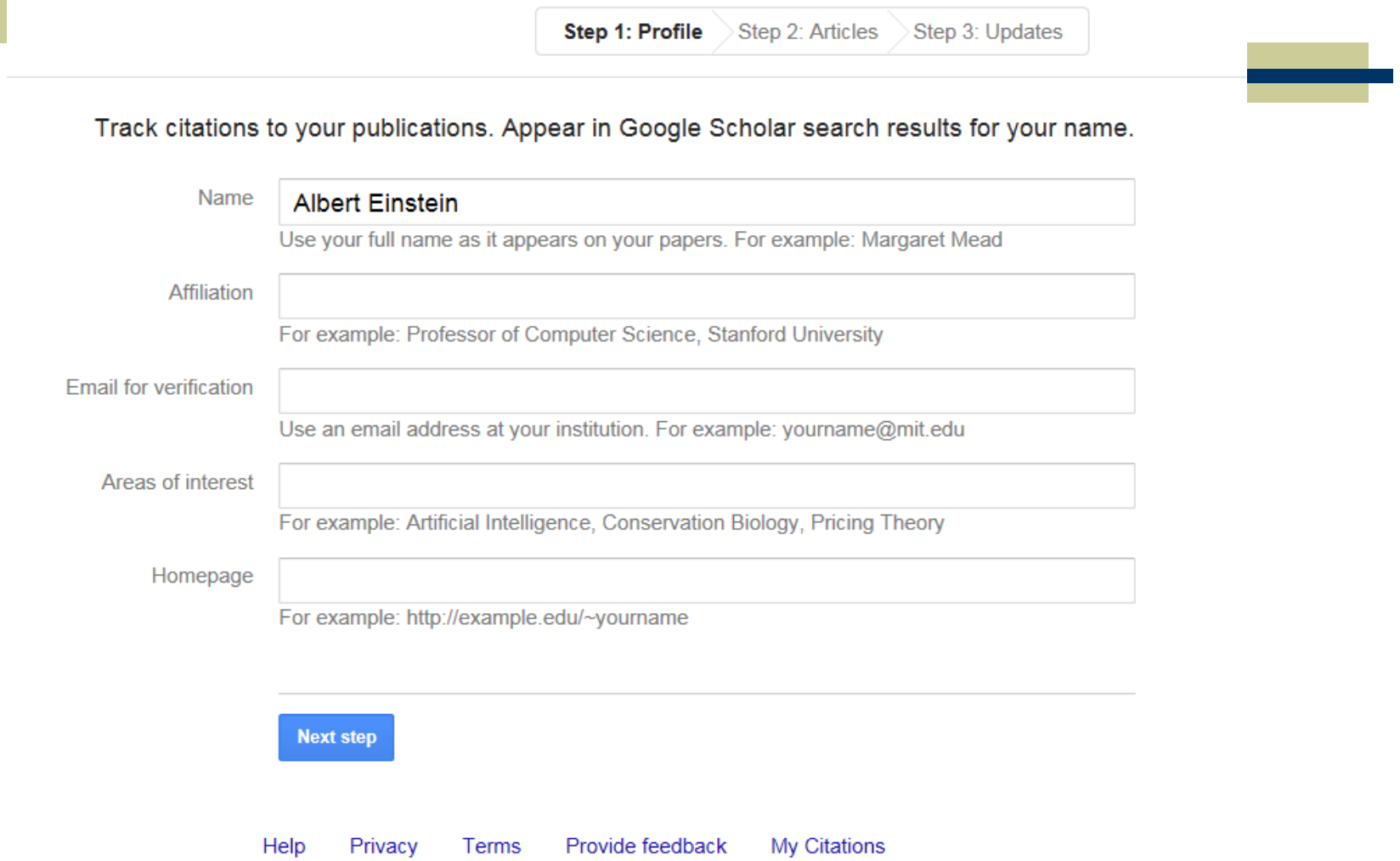
Article5, citations 4

The H-index of X is 4: there are 4 papers with at least 4 citations each.

How to Calculate Your H-Index


+You Search Images Videos Maps News Shopping Gmail More
Sign in
My Citations
Google scholar
Search
Advanced Scholar Search
Scholar Preferences
Articles (include patents) Legal opinions and journals
Stand on the shoulders of giants
About Google Scholar - All About Google - My Citations
©2012 Google
Google
One account. All of Google.
Sign in to continue to Google Scholar Citations
Enter your email
Next
Need help?
Create account

Step 1: Profile



Step 2: Articles

Step 1: Profile | **Step 2: Articles** | Step 3: Updates

Find articles that you've written and add them to your profile. Later, you can edit or delete the articles in your profile or add more articles to your profile.

A Einstein

Can quantum-mechanical description of physical reality be considered complete?
A Einstein, B Podolsky, N Rosen - Physical review, 1935

Zur elektrodynamik bewegter körper
A Einstein - Annalen der physik, 1905

Add all 940 articles See all articles

Step 3: Updates

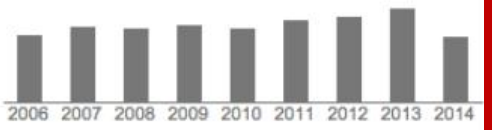
Albert Einstein

Follow

Institute of Advanced Studies, Princeton
Physics
No verified email

Google Scholar

Citation indices	All	Since 2009
Citations	86302	28107
h-index	103	62
i10-index	362	197



Title 1–20	Cited by	Year
Can quantum-mechanical description of physical reality be considered complete? A Einstein, B Podolsky, N Rosen Physical review 47 (10), 777	12721	1935
Uber einen die Erzeugung und Verwandlung des Lichtes betreffenden heurischen Gesichtpunkt A Einstein Ann. Phys. 17, 132-148	7091 *	1905
On the movement of small particles suspended in stationary liquids required by the molecular-kinetic theory of heat A Einstein Annalen der Physik 17, 549-560	5633 *	1905
Zur Elektrodynamik bewegter Körper A Einstein	3761 *	

Other Indicators of Journal Prestige: Citation Classics

The *g*-index

- Suggested in 2006 by Leo Egghe.
- The index is calculated based on the distribution of citations received by a given researcher's publications.

The *g*-index

- G-Index is calculated this way: "[Given a set of articles] ranked in decreasing order of the number of citations that they received, the G-Index is the (unique) largest number such that the top g articles received (together) at least g^2 citations."

The *g*-index

به عنوان مثال در جدول زیر عدد 6 شاخص جی است زیرا از 6 به توان 2 به بعد فراوانی تجمعی استنادات کمتر از کمتر از ضریب جی به توان 2 است.

تعداد مقالات	11	10	9	8	7	6	5	4	3	2	1
تعداد استنادات	0	0	1	3	4	5	5	6	6	7	8
فراوانی تجمعی استنادات	45	45	45	44	41	37	32	27	21	15	8
جی به توان 2	121	100	81	64	49	36	25	16	9	4	1

شاخص جی: برای برجسته کردن مقالات پراستناد و اصلاح شاخص اچ مطرح شد. بالاترین تعداد مقالات است که جی به توان 2 (g2) یا بیشتر به آن استناد شده است.

تعداد استناد	gتعداد (رتبه) مقاله	جمع کل استناد	g^2
22	1	22	1
17	2	39	4
17	3	56	9
15	4	71	16
10	5	81	25
9	6	90	36
Hi## 7	HI## 7	97	49
6	8	103	64
4	9	107	81
3	Gi ## 10	110	100
2	11	112	121
2	12	114	144

i10-Index \

Created by Google Scholar and used in Google's My Citations feature.

i10-Index = the number of publications with at least 10 citations. This very simple measure is only used by Google Scholar, and is another way to help gauge the productivity of a scholar.

Advantages of i10-Index

Very simple and straightforward to calculate

My Citations in Google Scholar is free and easy to use

Disadvantages of i10-Index

Used only in Google Scholar

Field-Weighted Citation Impact

Field-Weighted Citation Impact takes into account the differences in research behavior across disciplines.
(Connect to SciVal)

- Sourced from SciVal, this metric indicates how the number of citations received by a researchers publications compares with the average number of citations received by all other similar publications indexed in the Scopus database.
- A Field-Weighted Citation Impact of 1.00 indicates that the publications have been cited at world average for similar publications.
- A Field-Weighted Citation Impact of greater than 1.00 indicates that the publications have been cited more than would be expected based on the world average for similar publications, for example a score of 1.44 means that the outputs have been cited 44% more times than expected.
- A Field-Weighted Citation Impact of less than 1.00 indicates that the publications have been cited less that would be expected based on the world average for similar publications, for example a score of 0.85 means 15% less cited than world average.
- Similar publications are those publications in the Scopus database that have the same publication year, publication type and discipline.
- Field-Weighted Citation Impact refers to citations received in the year of publication plus the following 3 years.
- Field-Weighted Citation Impact metrics are useful to benchmark regardless of differences in size, disciplinary profile, age and publication type composition, and provide and useful way to evaluate the prestige of a researcher's citation performance.

Source Normalized Impact per Paper (SNIP)

در پاسخ به کاستی‌های ضریب تاثیر مجلات IF

1- ناکافی بودن بازه زمانی دو ساله برای رشته‌های ایستاتر که دیرتر به پختگی استنادی می‌رسند،

2- عدم تصحیح تفاوت رفتار استنادی در رشته‌ها و در نتیجه عدم قابلیت این شاخص برای مقایسه‌ی مجلات رشته‌های مختلف،

3- عدم تصحیح تفاوت پوشش پایگاهی رشته‌ها ،

4- سوگیری پایگاه های آی اس آی به نفع مجلات انگلیسی- امریکایی و

5- تفاوت در نوع منابع در صورت و مخرج کسر .

در این میان، عدم امکان مقایسه‌ی بین رشته‌ای از مهم‌ترین اشکالات وارده به آن بوده است که سنیپ می‌کوشد تا آن را برطرف سازد.

Source Normalized Impact per Paper (SNIP)

SNIP was created by Professor Henk Moed at the Centre for Science and Technology Studies (CTWS), University of Leiden. It measures contextual citation impact by weighting citations based on the total number of citations in a subject field, using Scopus data.

Or, as stated by the CTWS, “SNIP corrects for differences in citation practices between scientific fields, thereby allowing for more accurate between-field comparisons of citation impact.”

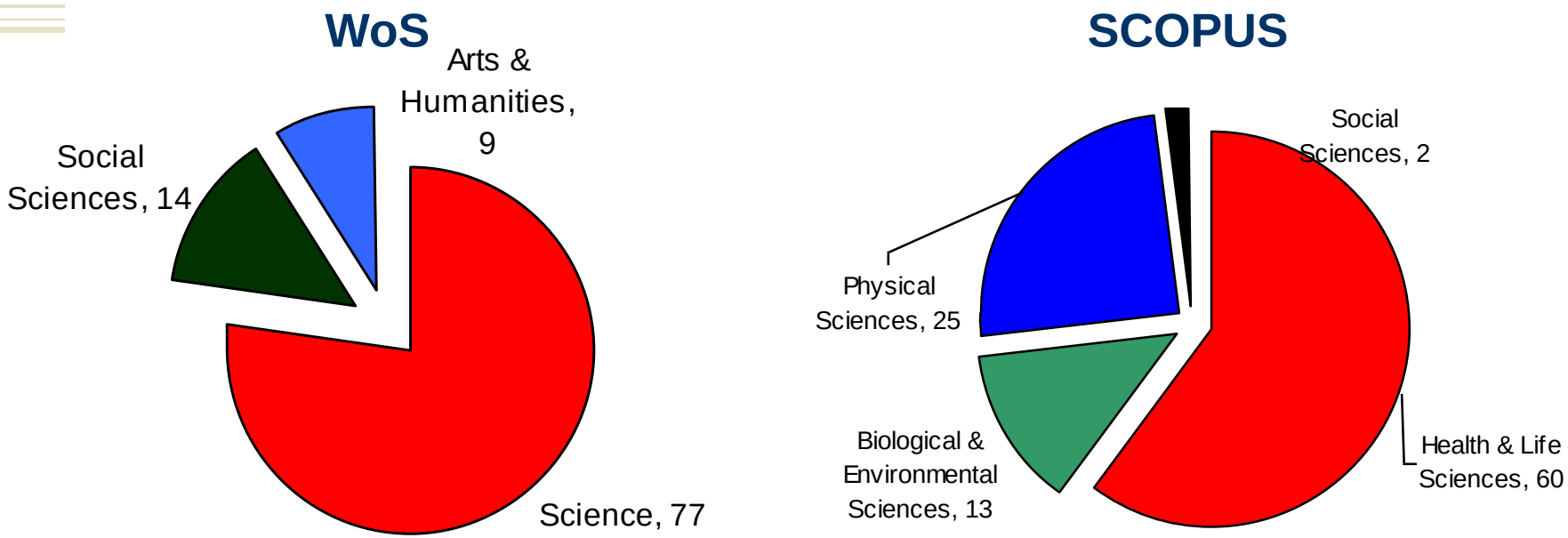
Citation Databases

- Web of Science
- Scopus
- Google Scholar

Other Tools Available

- Other bibliometric indicators:
  - Journal Citation Reports (JCR)
  - Other indicators databases (national, essential, university, institutional)
  - ISIHighlyCited.com

WoS and Scopus: Subject Coverage (% of total records)



Google Scholar ?

Web of Science

- Covers around 9,000 journal titles and 200 book series divided between SCI, SSCI and A&HCI.
- Electronic back files available to 1900 for SCI and mid- 50s for SSCI and mid-70s for A&HCI.
- Very good coverage of sciences; patchy on “softer” sciences, social sciences and arts and humanities.
- US and English-language biased.
- Full coverage of citations.
- Name disambiguation tool.
- Limited downloading options.

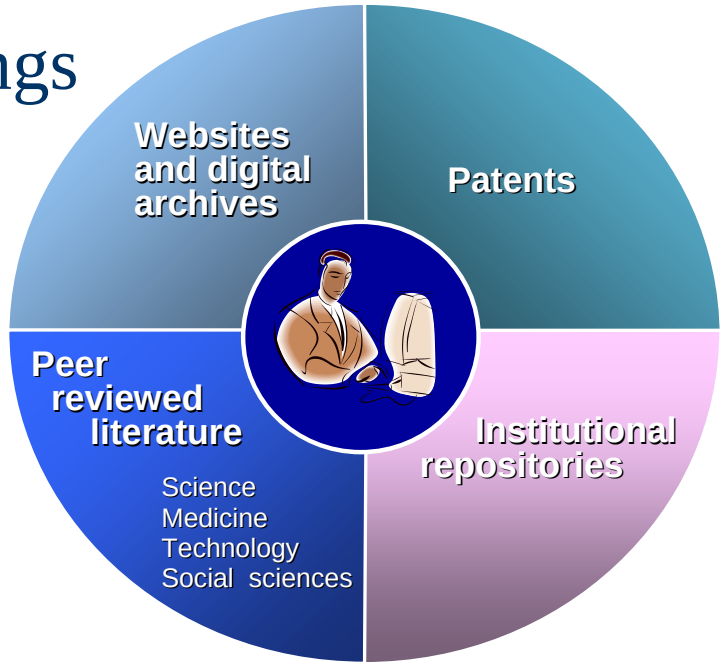
Scopus

- Positioning itself as an alternative to ISI
- More journals from smaller publishers and open access (+15,000 journals; 750 conf proceedings)
- Source data back to 1960.
- Excellent for physical and biological sciences; poor for social sciences; does not cover humanities or arts.
- Better international coverage (60% of titles are non-US)
- Back to 1996 ! (e.g. citation data for the last decade only)
- Not “cover to cover” and not up to date
- Easy to use in searching for source publications; clumsy in searching cited publications.
- Citation tracker works up to 1000 records only.
- Limited downloading options.

SCOPUS

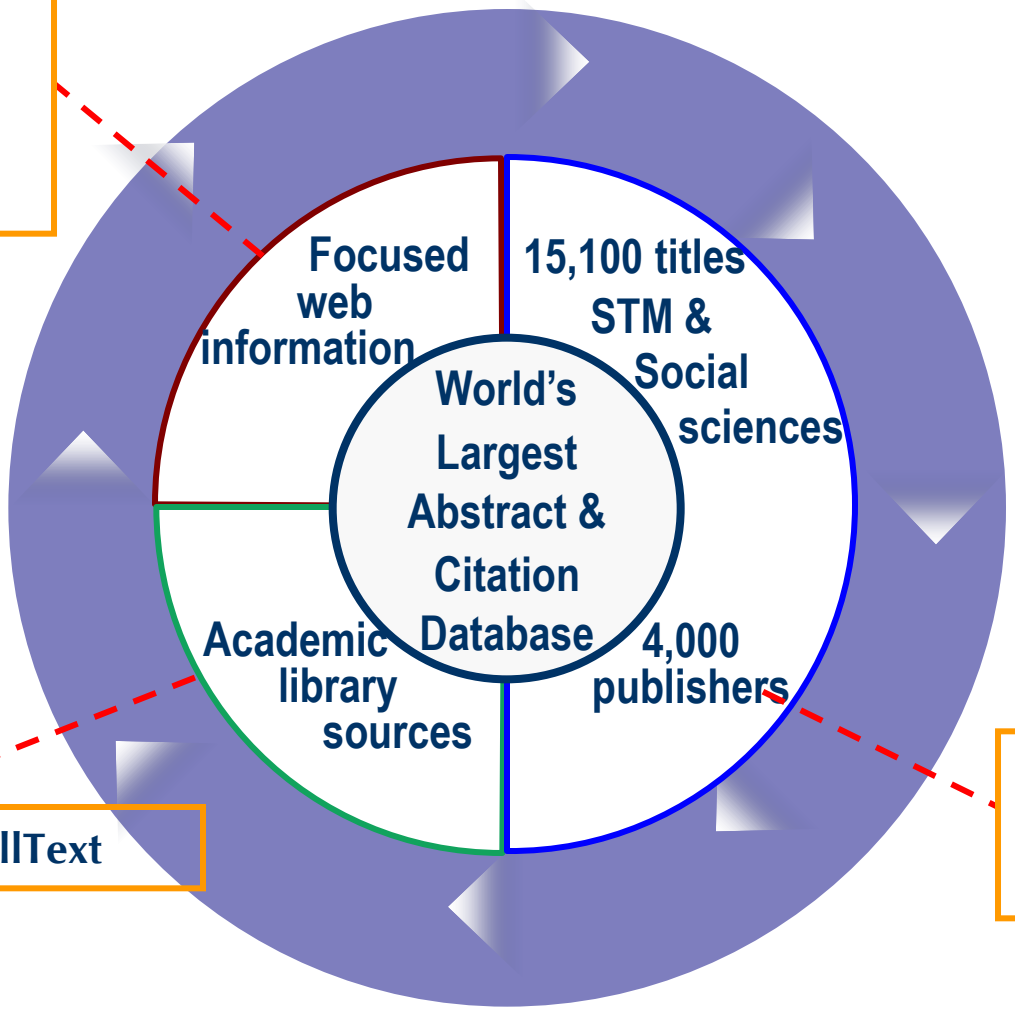
What is Scopus?

- +15,200 titles from more than 4,000 publishers
- +1,000+ Open Access journals
- +500 Conference Proceedings
- 400M web pages
- 21M patents
- Repositories
- Digital Archives



What *is* Scopus?

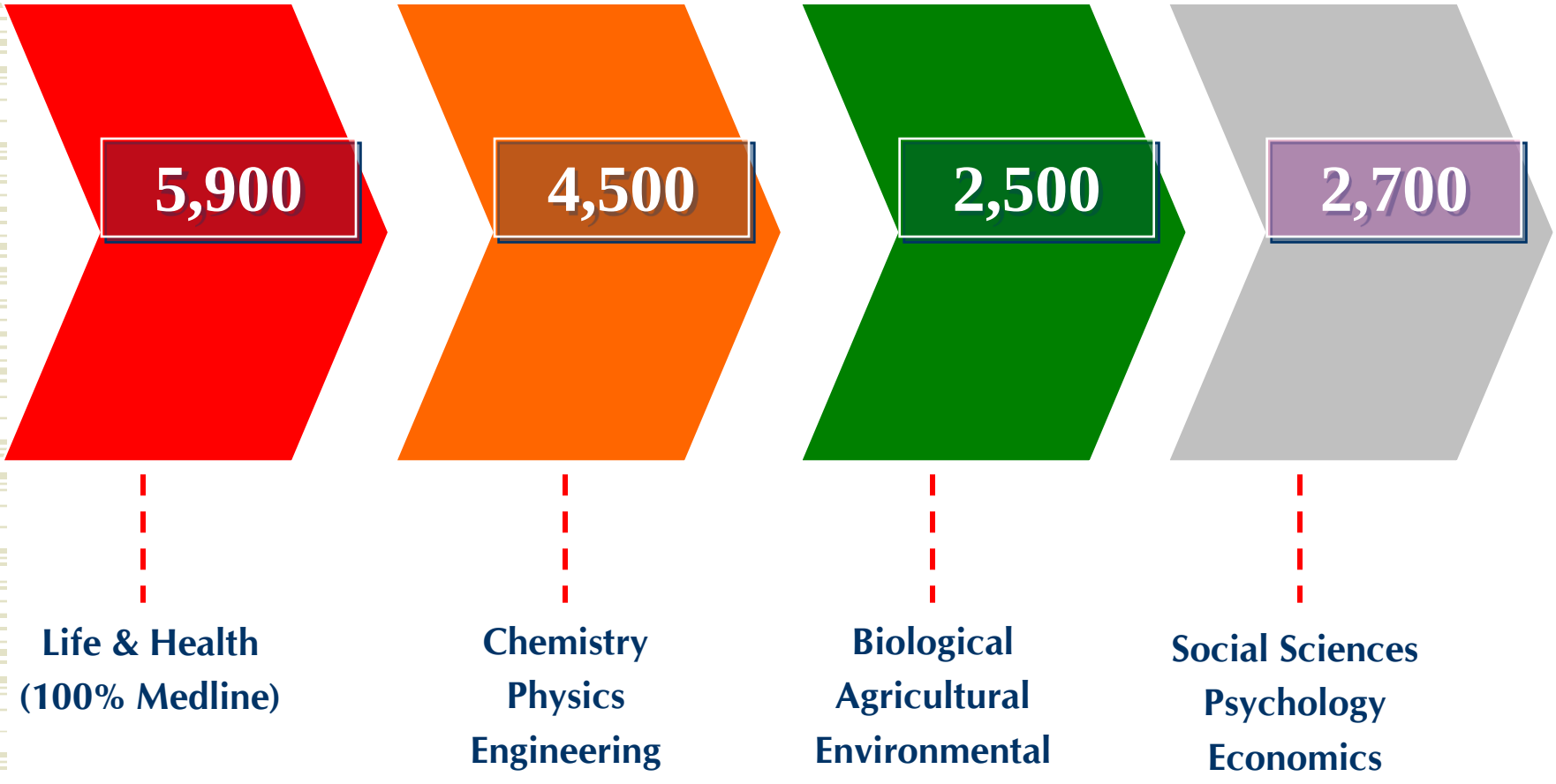
240 million scholarly Web items, E-prints, theses, dissertations, 13 M patents



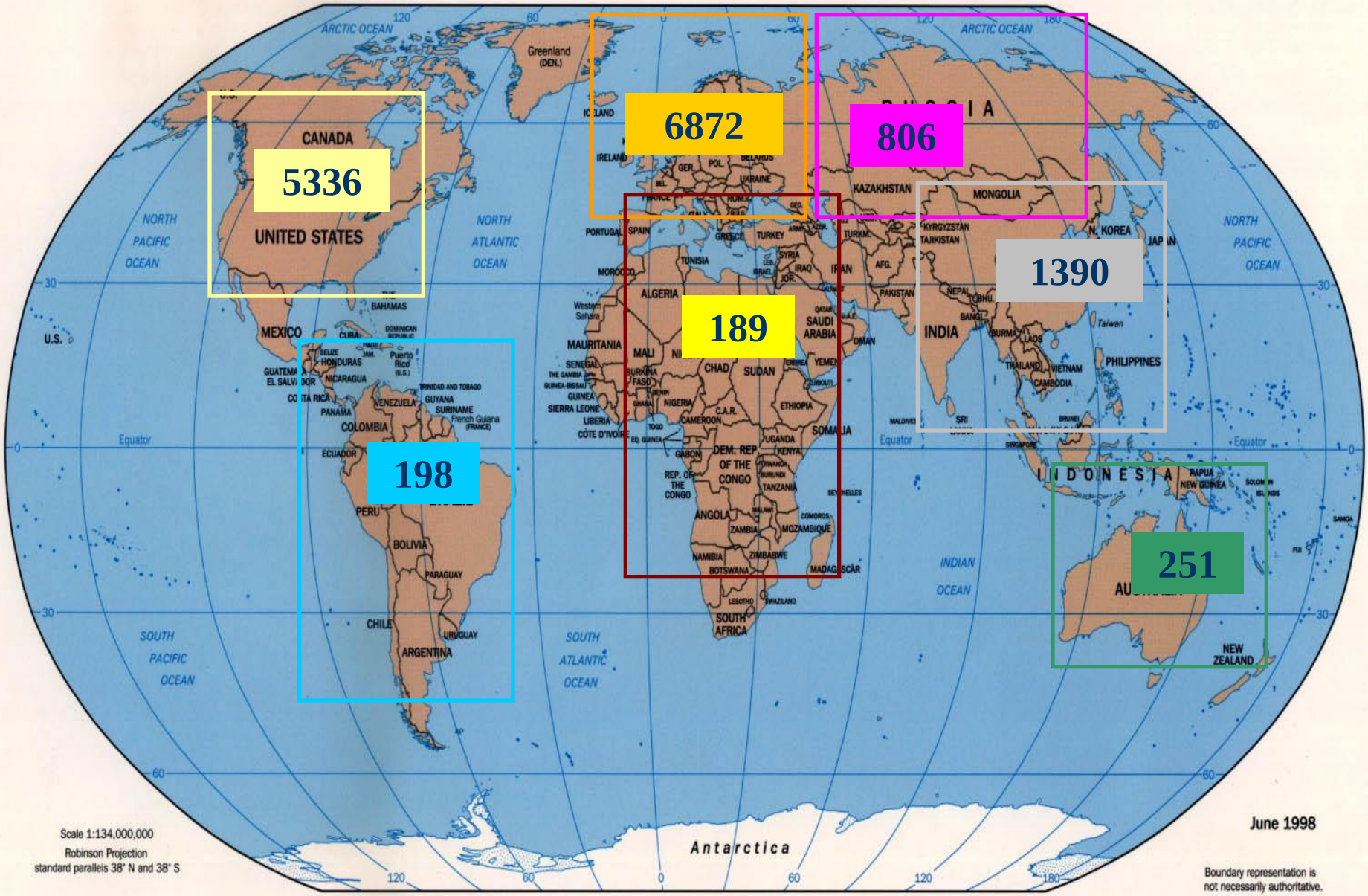
Fastest route to FullText

15% Elsevier sources
85% other publishers

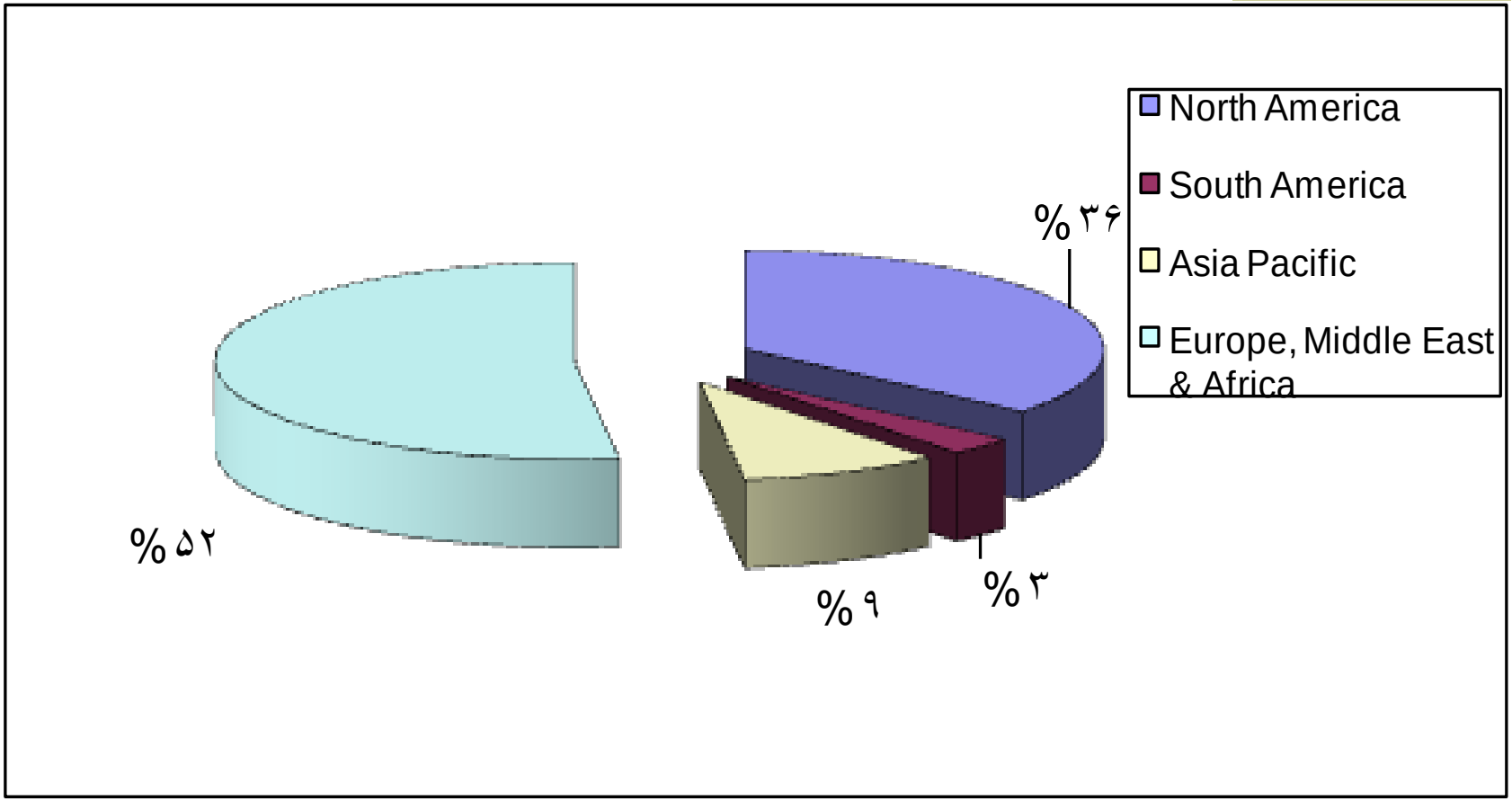
Scopus Coverage
15,100 Unique titles



International distribution of titles



Geographical spread of Scopus content



Iranian Titles indexed in Scopus

- Iranian Biomedical Journal
- Archives of Iranian Medicine
- Daru
- Iranian Journal of Diabetes and Lipid Disorders
- Iranian Journal of Medical Sciences
- Iranian Journal of Public Health
- Journal of Medicinal Plants
- Yakhteh

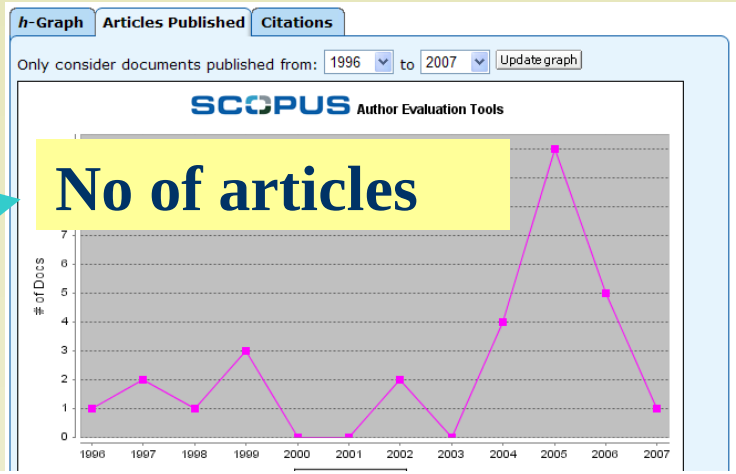
Google Scholar

- Better coverage for all citations as it retrieve web !
- More coverage of references also gray literature !
- Coverage and scope?
- Inclusion criteria?
- Very limited search options
- No separate cited author search
- Back to 1990 NOT more !
- Free!

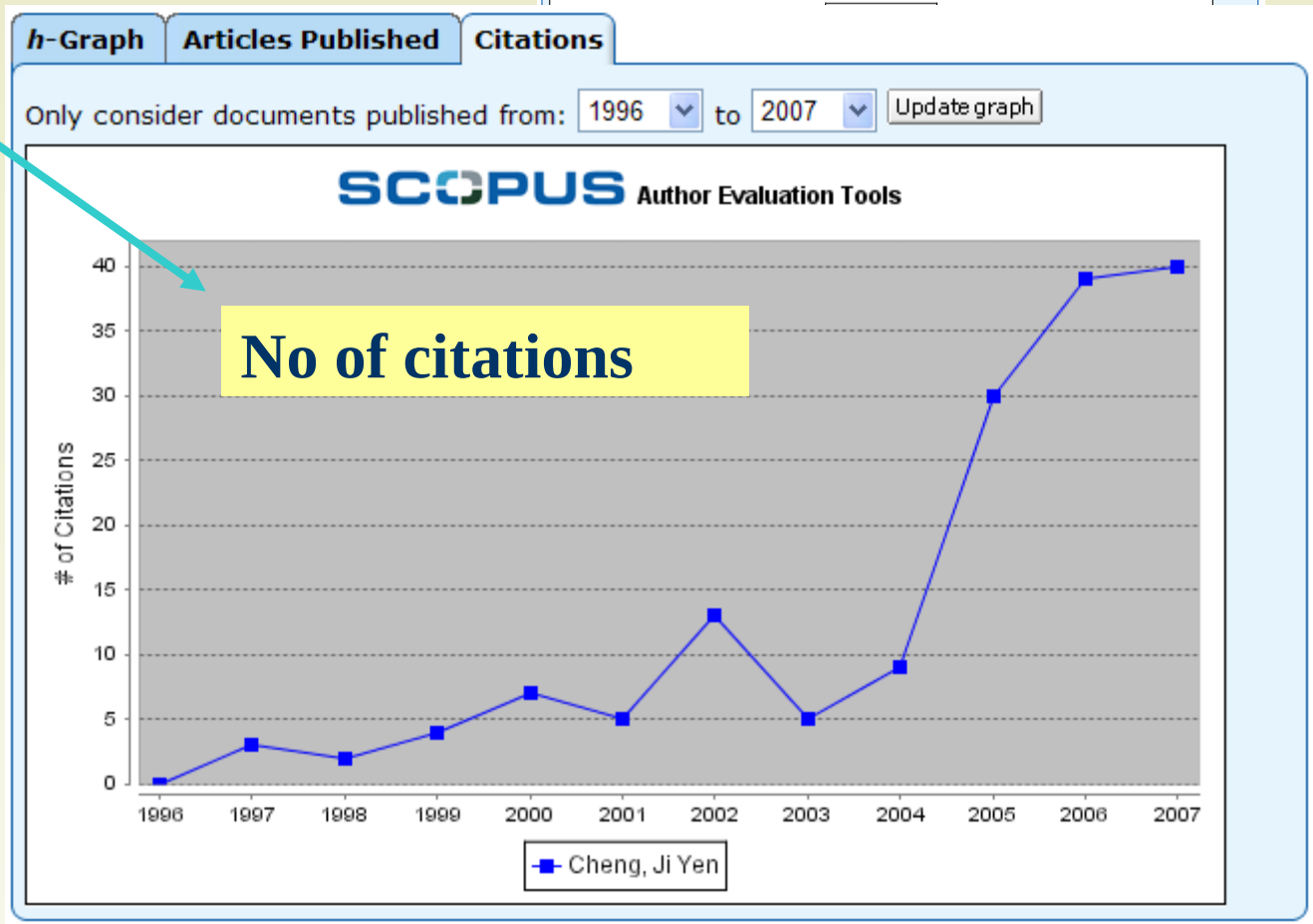
Google™ Scholar BETA

The H-Graphs in Scopus

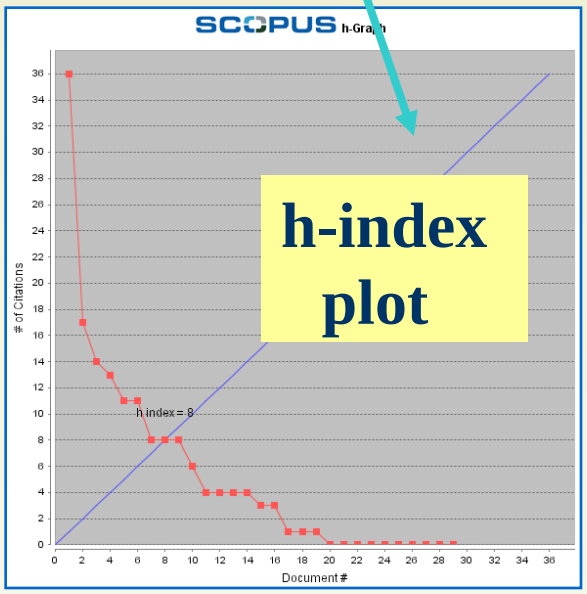
- A more comprehensive way evaluating an author
- Using Author Search, Scopus give us three different graphs
  - H-Index Graph of given Author
  - No of Author Papers (Articles) per year
  - No of Author Citations per year



No of articles



No of citations

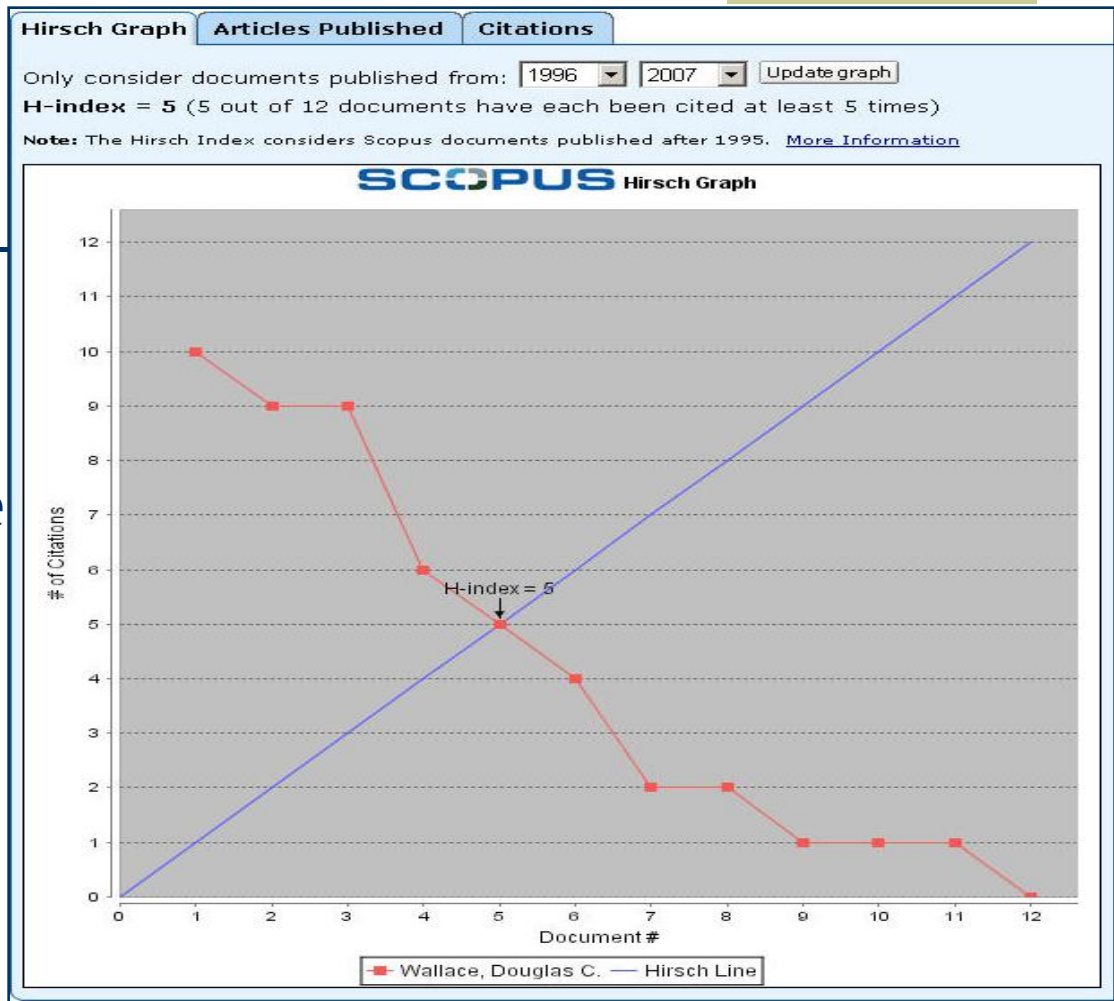


h-index plot

The *h*-index

- Plots citations per article
- Incision = *h*-index
- Shows low & highly cited-by counts
- Completely transparent
- The date range can change

Practical Interpretation:
Promotion, Evaluation, Funding, Tenure, Benchmarking



Author articles history

- Shows level of activity
- Shows peaks and troths in publication history
- Can change the date range

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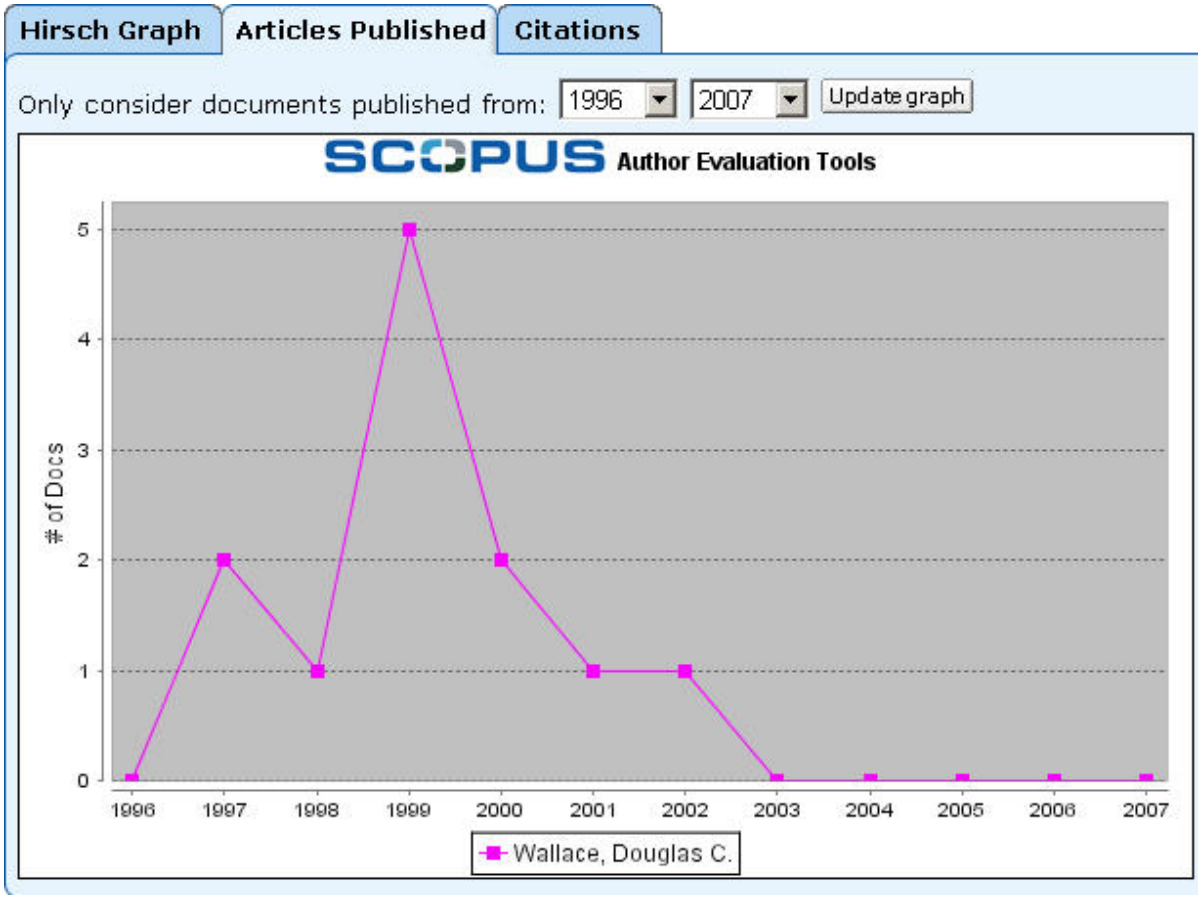
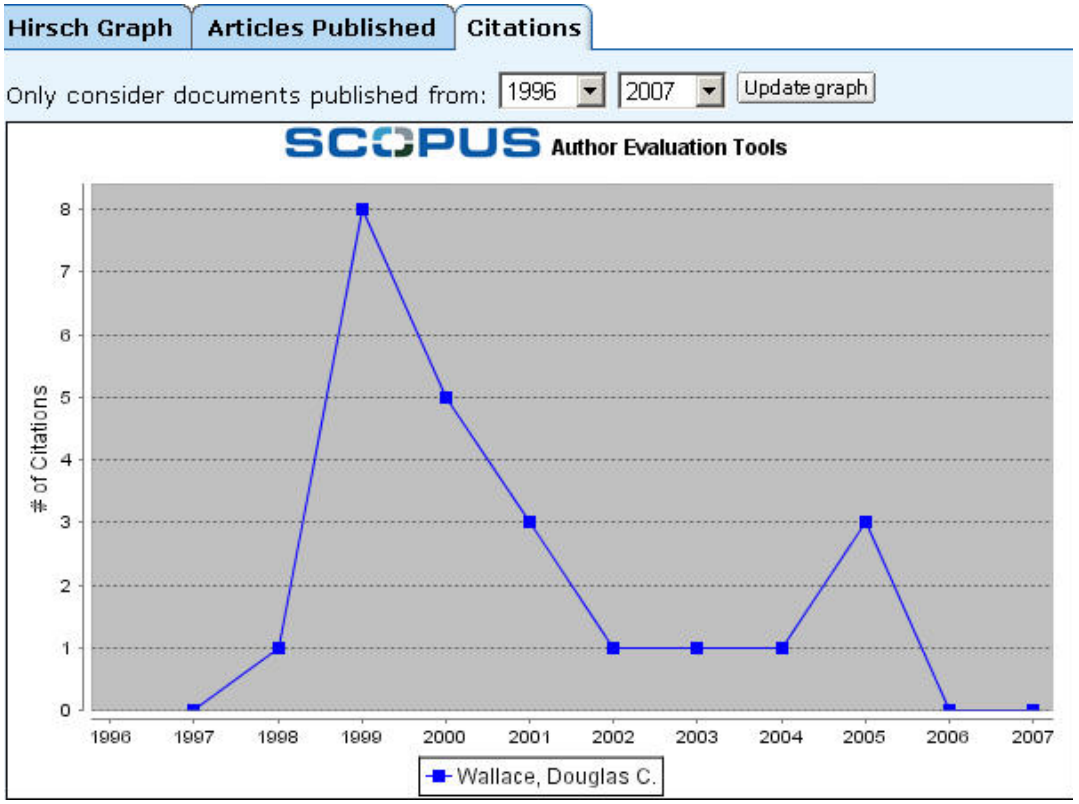


Author Cited-by's

- Shows level of activity
- Shows highs & lows
- Can change the date range
- Time lag!



Practical Interpretation: Promotion, Evaluation, Funding, Tenure, Benchmarking

How to calculate h-index through Scopus

- There is two way to calculate it according to the way you want:
- If you want it for an Author:
  - Search the Author, It will calculate it Automatically for you.
- If you want it for a group of Papers
  - Search them & then use the track citation & sort them out to count & calculate it Manually.

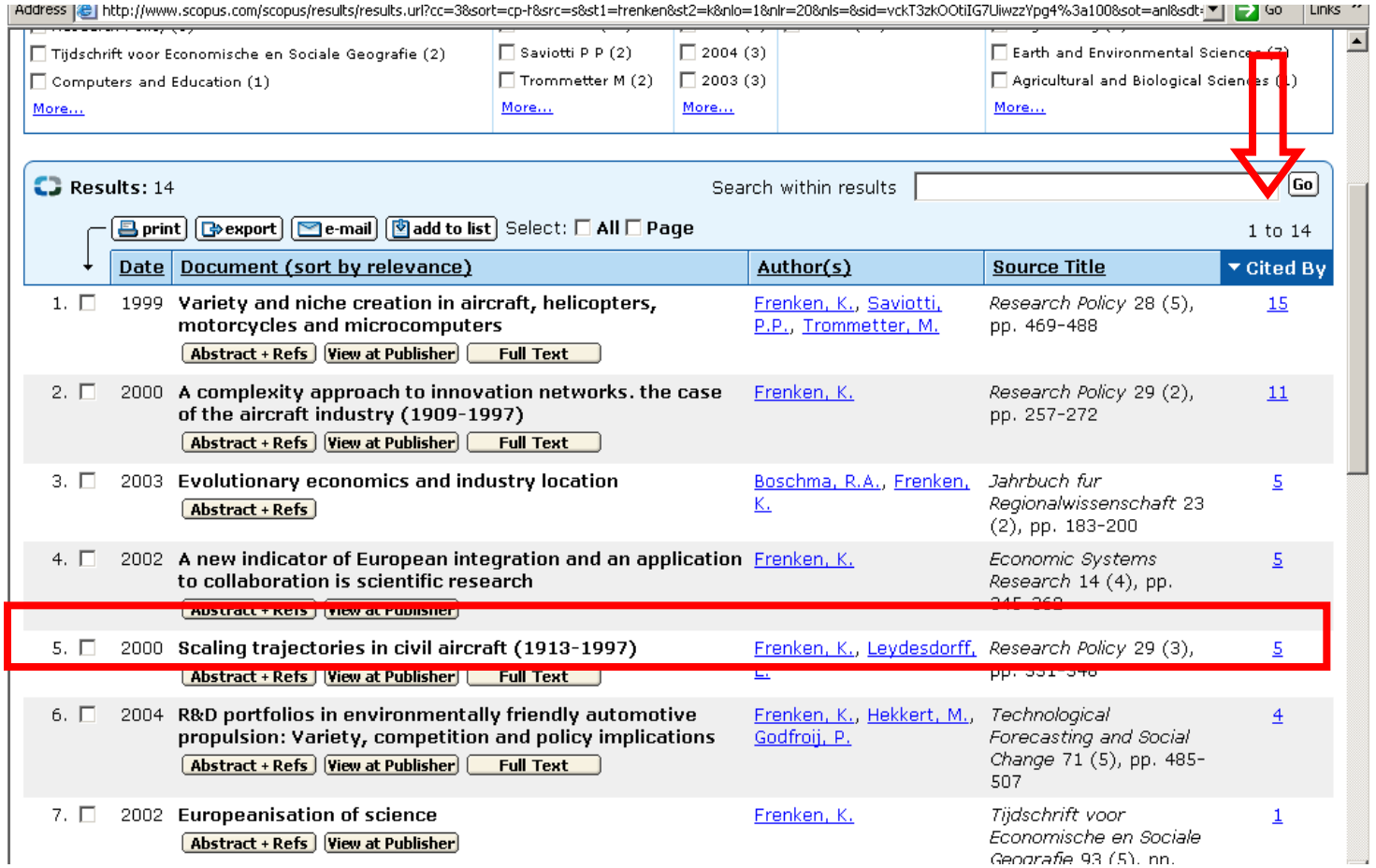
The Hirsch Index: For a Group of Papers

- Run an author search
- Sort result by citations, clicking on Cited by
- Scroll down the new display of results until the ranking number is equal or less than the number of citations.
- That ranking number is the Hirsch Index for that author.

Author Identifier functionality

- Author Identifier enables Scopus users to avoid two major problems which affect most A&I databases:
  - How to distinguish between an author's articles and those of another author sharing the same name?
  - How to group an author's articles together when his or her name has been recorded in different ways?
- With other databases, these problems can result in retrieving incomplete or inaccurate results.

Calculating the H-index: For a Group of Papers



Indicators of quality as measured using published outputs

- Number of publications
- Citation counts to these publications (adjusted for self-citations) -what "window" should be used? 4, 5, 10 years?
- Citations per publication
- Percentage of uncited papers
- Impact factors (of publishing journals)
- Diffusion factor (of citing journals) – profile of users of research (who, where, when and what)
- "Impact factor" of a scholar - Hirsh index (h index)
  - (numbers of papers with this number of citations).
  - Your h index =75 if you wrote at least 75 papers with 75 citations each.

Note: These should not be seen as "absolute" numbers but always seen in the context of the discipline, research type, institution profile, seniority of a researcher, etc.

Calculating *h*-index using Thomson ISI Web of Science

1) Conduct a General Search
2) Automatic: click on “Citation Report”, or,
3) Manual: sort by “Times Cited”

CWTS Journal Indicators

SJR : Scientific Journal Rankings – SCImago

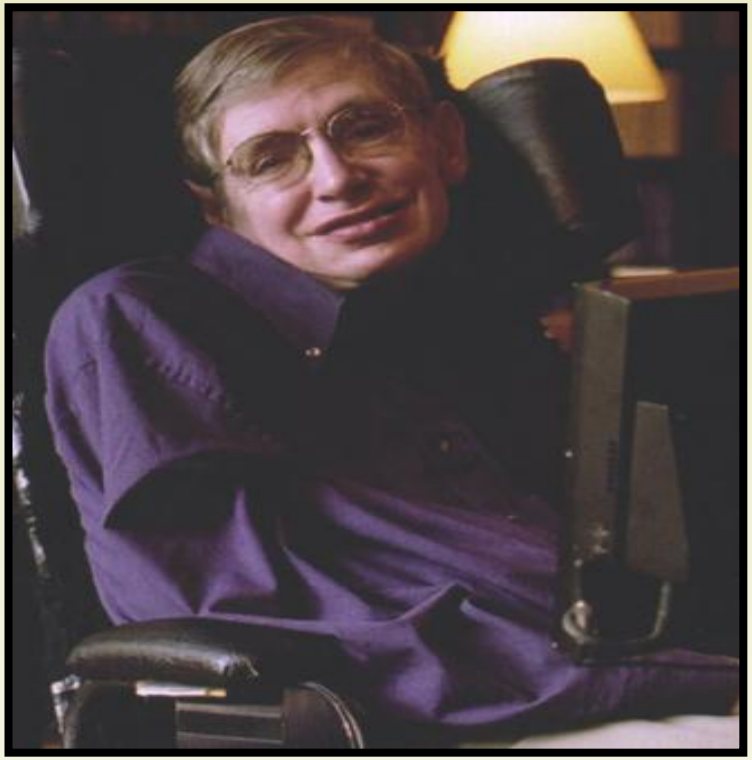
Journal Metrics - Scopus.com

CWTS Leiden Ranking 2016

My h-index is bigger than yours!

But more people know who I am!

Edward Witten
Physicist
h=132



Stephen Hawking
Physicist
h=62

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Examples of Scientific Social Networks

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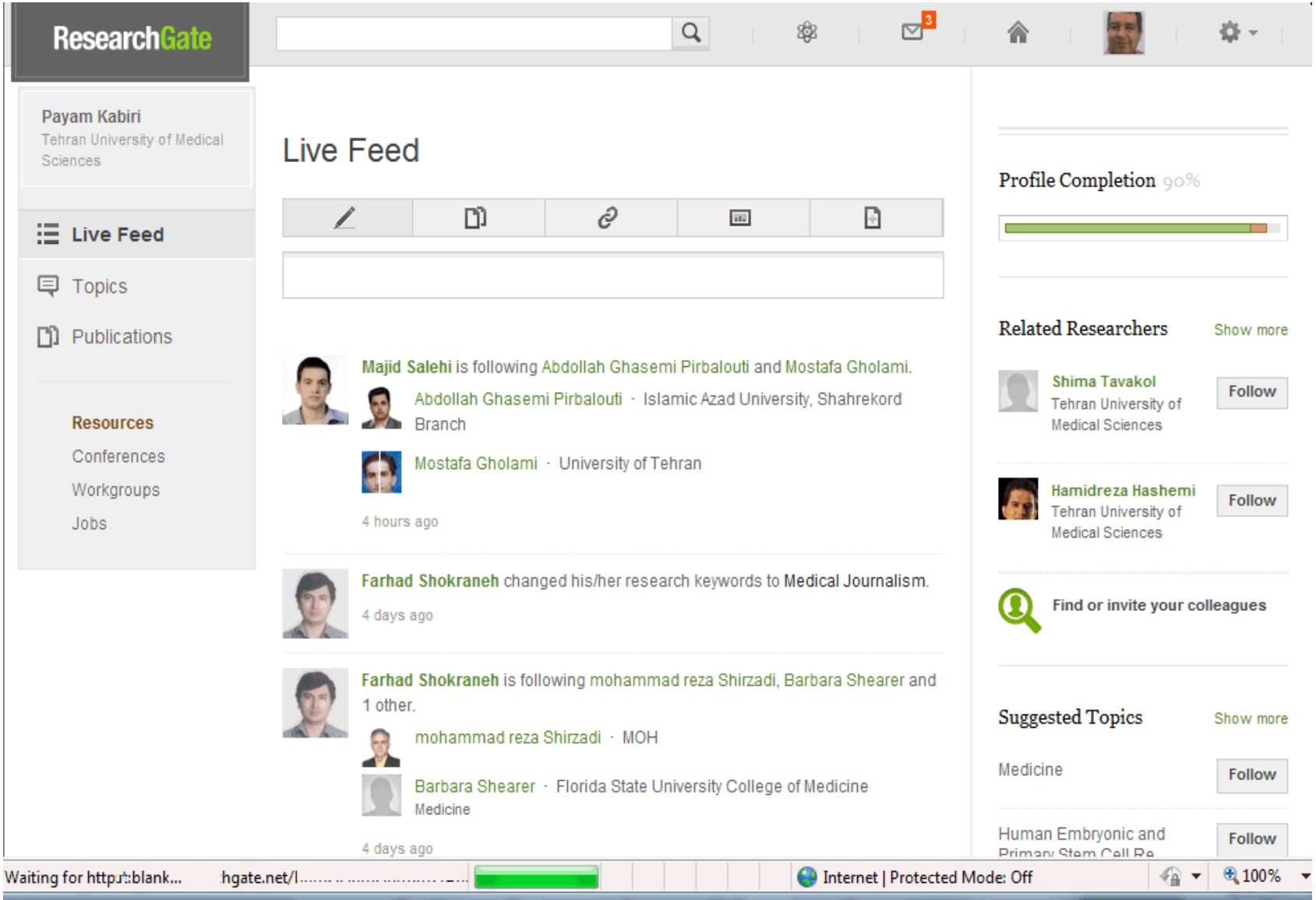

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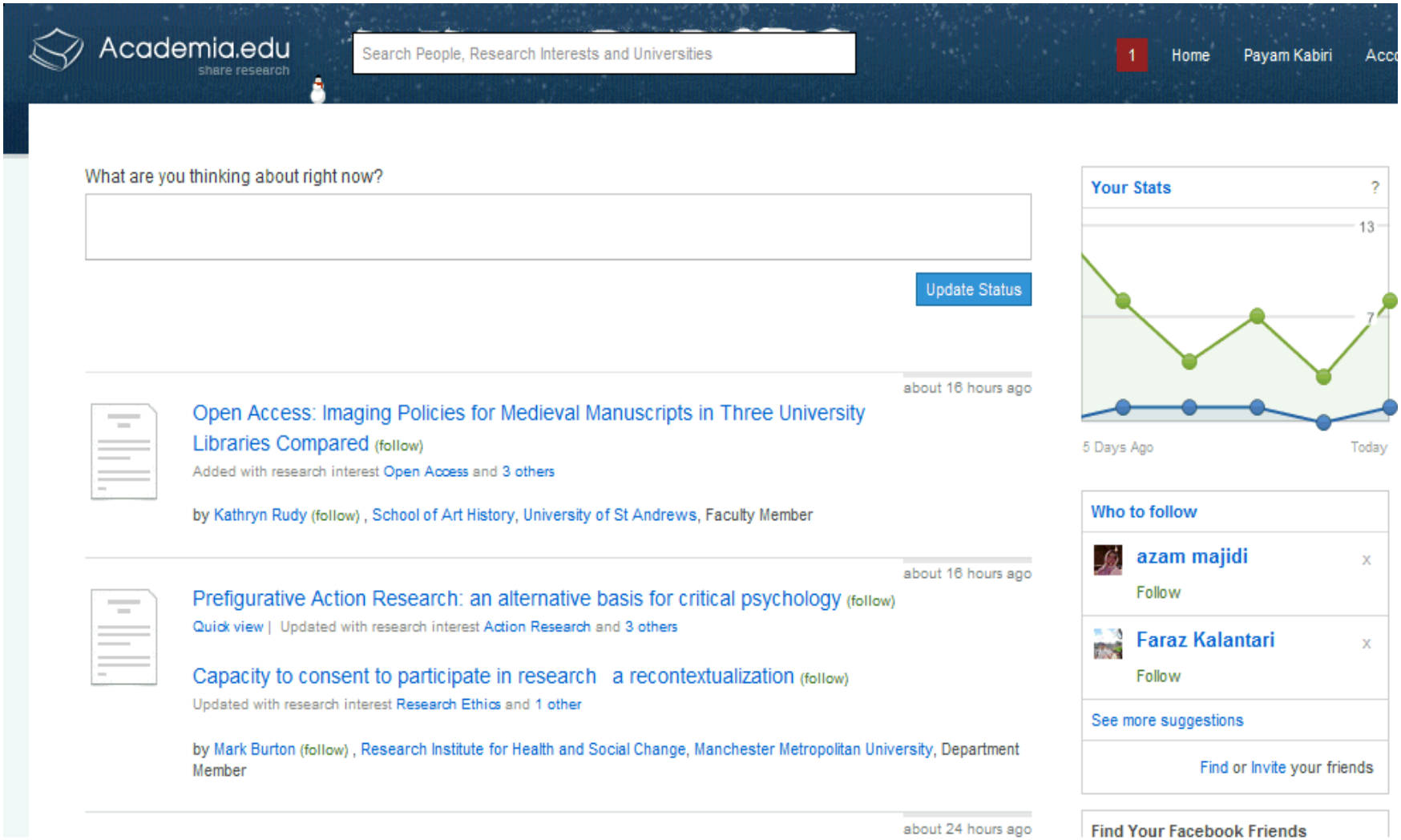
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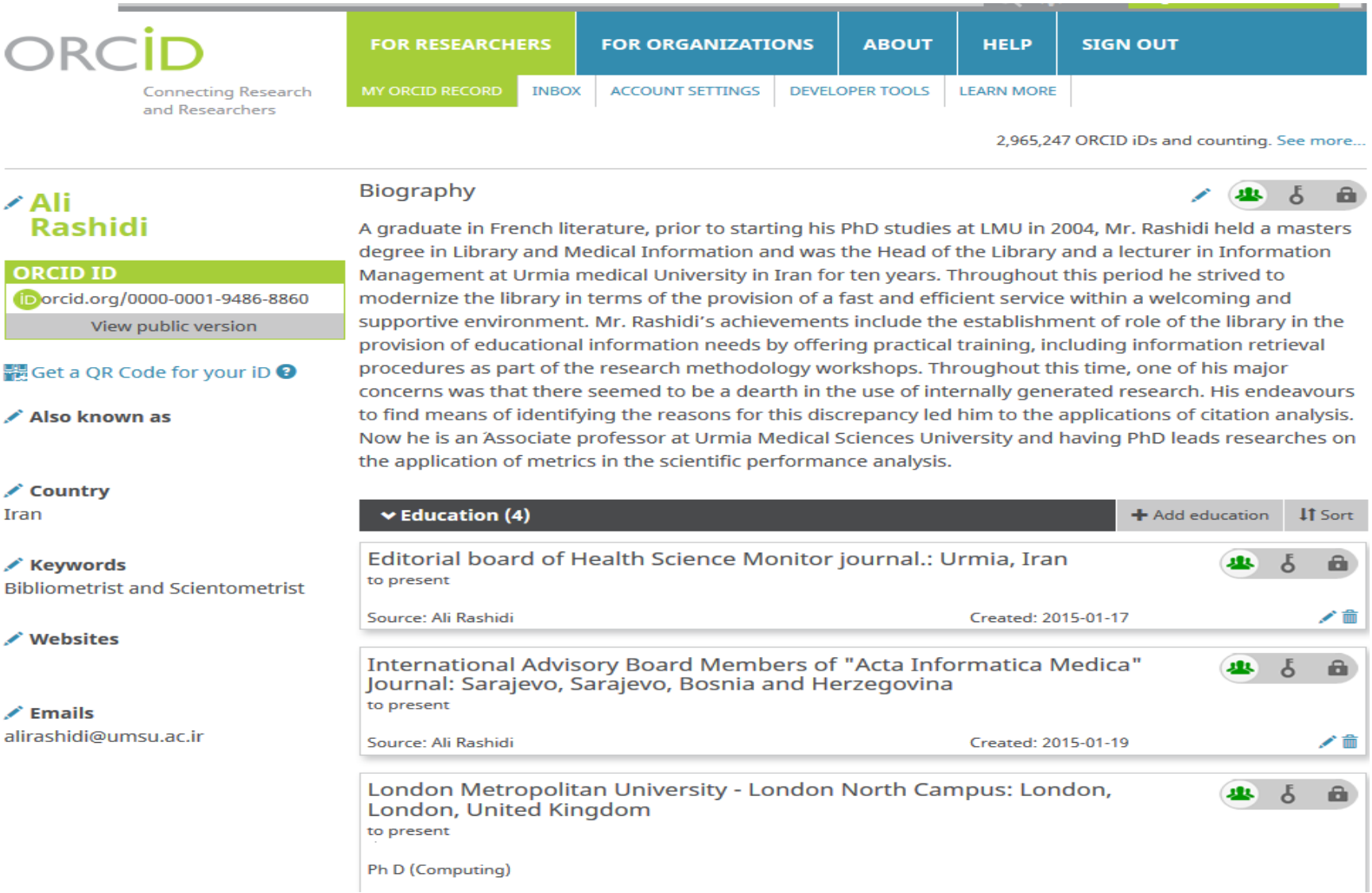

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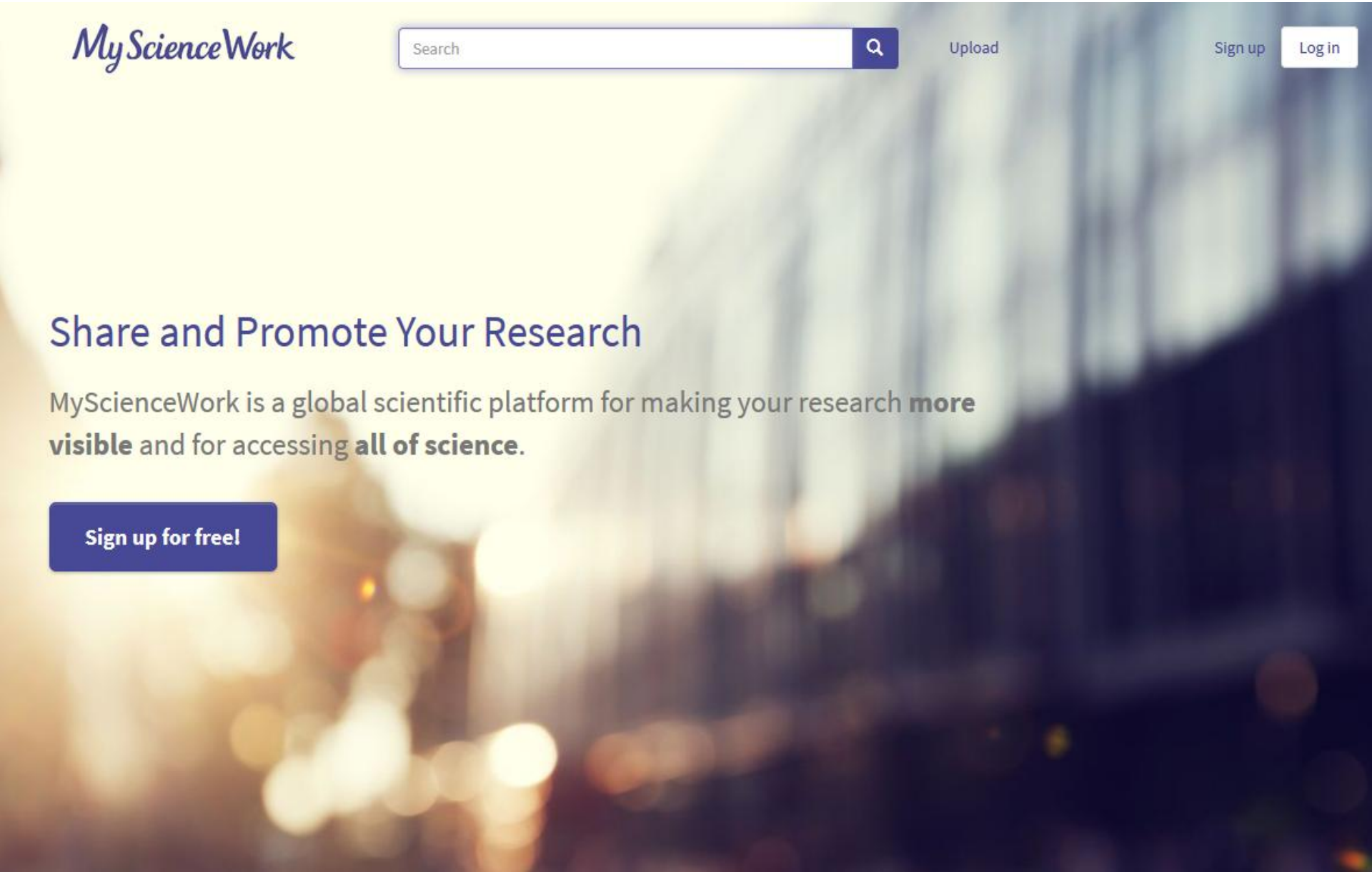

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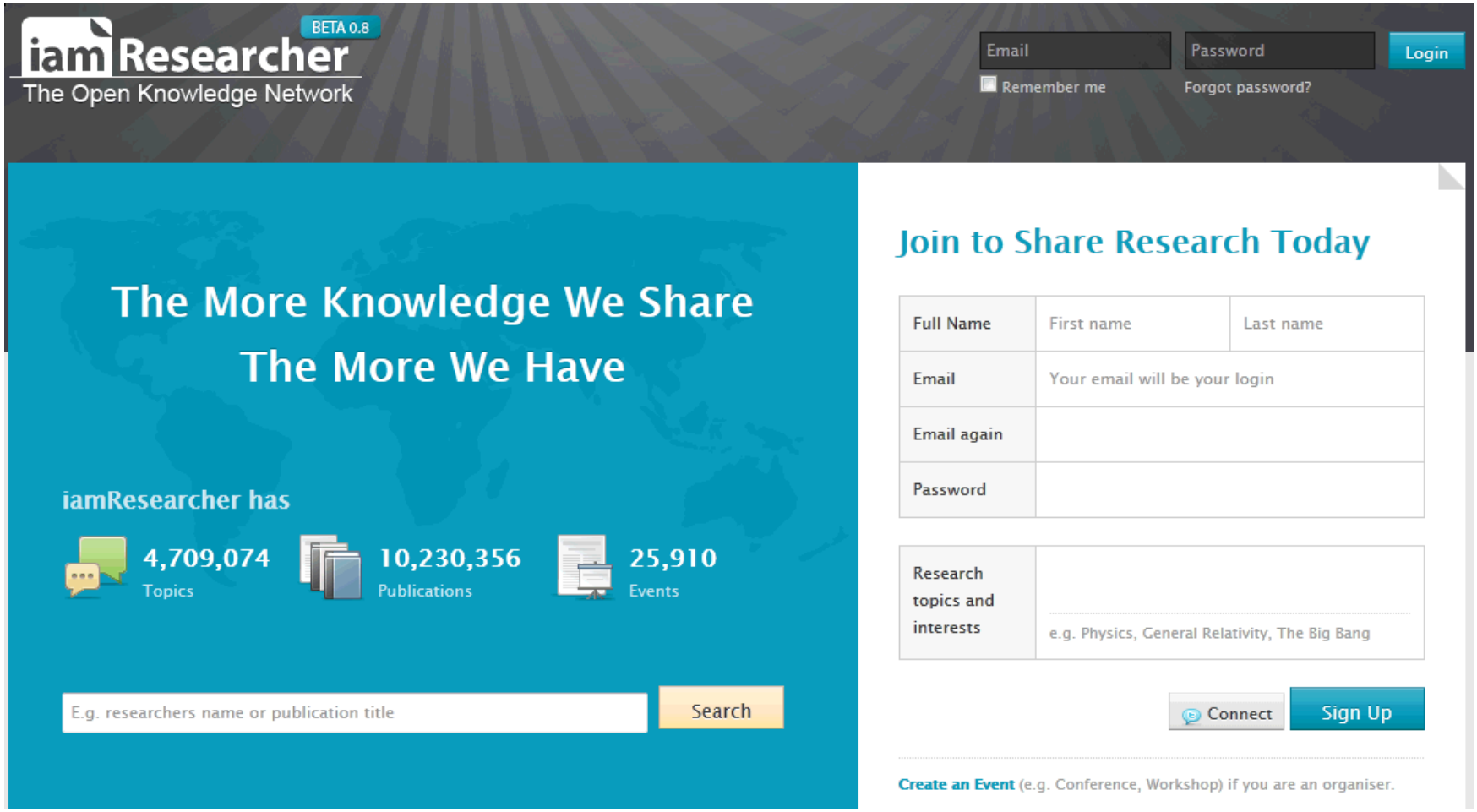

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