Research metrics

Anne Costigan
University of Bradford
Metrics

• What are they?
• What can we use them for?
• What are the criticisms?
• What are the alternatives?
Metrics

• Metrics
  – Use statistical measures
    • Citations
    • Accesses to online versions
    • Funding
    • Web 2.0
Metrics - What do we measure?

– Metrics for
  • authors
  • articles
  • journals
    – but often used as a proxy for other measures
  • institutions or part thereof

– There are many, many metrics out there!
Citation metrics – data sources

- Web of Knowledge (Thomson Reuters)
  - Web of Science
- Scopus (Elsevier)
- Google Scholar
Web of Science - Impact factors

• The most famous research metric
• Attempts to measure the importance of journals
• Rationale – the number of citations received by a paper is an indicator of its quality
• Thomson/Reuters Journal Citation Reports
  – [http://wok.mimas.ac.uk](http://wok.mimas.ac.uk)
  – Under Journal Citation Reports
• Science and Social Science versions
• Annual update
What are Impact Factors?

• Calculation
  • Number of citations in current year to papers published in previous 2 years divided by
  • number of papers published in the previous two years
  • Citations retrieved almost entirely from journals
    • Occasionally conferences
    • Not books
British Journal of Dermatology

- Citations in 2009 to items published in 2007 and 2008 = 2905
- Number of items published in 2007 and 2008 = 682
- IF = 2905/682 = 4.260
### Journal Citation Reports

#### Journal Summary List

### Sort by: Journal Title

<table>
<thead>
<tr>
<th>Mark</th>
<th>Rank</th>
<th>Abbreviated Journal Title (linked to journal information)</th>
<th>ISSN</th>
<th>JCR Data</th>
<th>Eigenfactor™ Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>BRIT J DERMATOL</td>
<td>0007-0953</td>
<td>Total Cites 17207, Impact Factor 4.250, 5-Year Impact Factor 3.955, immediacy index 0.727</td>
<td>Articles 373, Cited Half-life 7.4, Eigenfactor™ Score 0.03732, Article Influence™ Score 1.044</td>
</tr>
</tbody>
</table>

*Ranking is based on your journal and sort selections.*

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**Acceptable Use Policy**

Copyright © 2010 Thomson Reuters.
JCR – Rank in category

• Rank in Subject Category
  – Compares journals in similar subjects
• Choose Subject Category, then rank by Impact factor
• An important measure!
# Journal Summary List

**Journals from:** subject categories DERMATOLOGY

**Sorted by:** Impact Factor

**Journals 1 - 20 (of 48)**

*Ranking is based on your journal and sort selections.*

<table>
<thead>
<tr>
<th>Mark</th>
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<td>Total Cites: 5413</td>
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### Journal Summary List

**Journals from:** BIOCHEMISTRY & MOLECULAR BIOLOGY

**Sorted by:** Impact Factor

#### Journals 1 - 20 (of 283)

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<th>Articles</th>
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<tr>
<td>6</td>
<td>6</td>
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<td>0007-8506</td>
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<td>136</td>
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<td>0.434</td>
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<td>7</td>
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<td>IND MANAGE DATA-CYST</td>
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<td>925</td>
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<td>72</td>
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</table>
Currency of impact factors

• Impact factor trends
  – On full data screen, click on **Trends**
  – Gives a graph of Impact Factors over the last five years
  – Easy to spot anomalies

• 5-year impact factors
  – Number of citations in current year to papers published in previous 5 years
  – divided by
  – number of papers published in the previous 5 years
Impact Factor Trend Graph: BRITISH JOURNAL OF DERMATOLOGY

The journal impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The impact factor will help you evaluate a journal's relative importance, especially when you compare it to others in the same field. For more bibliometric data and information on this and other journal titles click on the "Return to Journal" button.

NOTE: Title changes and coverage changes may result in no impact factor for one or more years in the above graph.

2009 Impact Factor

Cites in 2009 to articles published in: 2008 = 1,251  Number of articles published in: 2008 = 350

2007 = 1,654  2007 = 352

Sum: 2,905  Sum: 662

Calculation: Cites to recent articles 2905 / Number of recent articles 662 = 4.260
The journal impact factor is a measure of the frequency with which the "average article" in a journal has been cited in a particular year. The impact factor will help you evaluate a journal's relative importance, especially when you compare it to others in the same field. For more bibliometric data and information on this and other journal titles click on the "Return to Journal" button.

NOTE: Title changes and coverage changes may result in no impact factor for one or more years in the above graph.
What is a ‘good’ impact factor in science?

- **Highest** impact factor for 2009 is 87.925
  - CA – A Cancer Journal for Clinicians
- **Median** impact factor for 2009 is 1.286
  - 3 journals tied, including Journal of Classification
- **Lowest** impact factor for 2009 is 0
  - 10 journals tied
What is a ‘good’ impact factor in social science?

• Highest impact factor for 2009 is 22.75 (Annual Review of Psychology)
• Median impact factor for 2009 is 0.875 (American Business Law Journal and 3 others)
• Lowest impact factor in 2009 is 0 (Shared by 14 journals)
Why do impact factors vary by discipline?

• In subject areas with low impact factors, citations are missed
  – Smaller number of journals indexed
  – Publication in non-journal sources
  – Just not as many publications out there!

• In life sciences
  – Largely journal-based literature
  – Well covered by ISI
Criticisms of the Impact Factor

• Self-citation
  – JCR now provides Impact Factor without self-cites, but the ‘main’ Impact Factor (which appears in the table) still includes them

• Reviews tend to be heavily cited
  – Review journals top rankings

• One controversial/wrong paper may be cited heavily and artificially inflate metrics

• Variation between subjects
Eigenfactor

- Aims to ‘rank journals as Google ranks Web sites’
- [http://eigenfactor.org/](http://eigenfactor.org/)
  - Details of algorithm
  - 1995-2008 Eigenfactor scores
- WoK
  - 2007+ - Eigenfactor scores
- Eliminates self-citations
- Citations from highly-cited journals ranked more highly
- Not transparent
- ‘Difficult’ numbers
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### Journals from: subject categories BIOCHEMISTRY & MOLECULAR BIOLOGY

#### Sorted by: Eigenfactor(TM) Score

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<tbody>
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<td>Eigenfactor Score: 1.09385, Article Influence Score: 2.222</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>NUCLEIC ACIDS RES</td>
<td>0305-1048</td>
<td>Total Cites: 95799, Impact Factor: 7.479, 5-Year Impact Factor: 7.279, Immediacy Index: 2.030, Articles: 1112, Cited Half-life: 6.6</td>
<td>Eigenfactor Score: 0.35247, Article Influence Score: 3.001</td>
</tr>
</tbody>
</table>
Metrics at different levels

• Is it fair to judge a paper by the journal in which it appears?
• An individual paper may be much
  – Better/worse
  – More popular/less popular
  – More cited/less cited

Than the journal in which it appears
Article-level metrics

- Web of Knowledge
  - Web of Science
  - Times cited per article
  - Basic but a very important metric

- Also available in Google Scholar and Scopus
The human hair follicle immune system: cellular composition and immune privilege

Author(s): Christoph T, Muller-Rover S, Audring H, Tobin DJ, Hermes B, Cotsarelis G, Ruckert R, Paus R

Source: BRITISH JOURNAL OF DERMATOLOGY  Volume: 142  Issue: 5  Pages: 862-873  Published: MAY 2000

Times Cited: 76  References: 64  Citation Map

Abstract: The immunology of the hair follicle, its relationship with the 'skin immune system' and its role in hair diseases remain biological intriguing and clinically important. In this study, we analysed the immunoreactivity patterns of 15 immunodermatological markers to determine the cellular composition and immune privilege of the human hair follicle immune system in anagen VI (growth phase). The most prominent cells located in or around the hair follicle were Langerhans cells, CD4+ or CD8+ T cells, macrophages and mast cells, whereas B cells, natural killer cells and gamma delta T cells were found rarely. Langerhans cells (CD1a+, major histocompatibility complex, MHC class II+), and T cells (CD4+ or CD8+) were predominantly distributed in the distal hair follicle epithelium, whereas macrophages (CD68+, MHC class II+) and mast cells (Giemsa+) were located in the perifollicular connective tissue sheath. Transmission electron microscopy confirmed low numbers of immune cells in the proximal hair follicle epithelium, and few macrophages and Langerhans cells were seen in the dermal papilla. Melanophages were observed in the connective tissue sheath and dermal papilla, MHC class I (HLA-A, -B, -C) and beta(2)-microglobulin immunoreactivity was found on most skin cells, but was substantially reduced on isthmus keratinocytes and virtually absent in the proximal hair follicle epithelium. Apart from the absence of Fas ligand immunoreactivity, the sharply reduced numbers of T cells and Langerhans cells, and the virtual absence of HUG class I expression all support the concept of immune privilege.
Melanin pigmentation in mammalian skin and its hormonal regulation
A Slominski, DJ Tobin, S Shibahara... - Physiological ..., 2004 - Am Physiological Soc
Cited by 288 - Related articles - SFX at Bradford - BL Direct - All 4 versions - Import into RefMan

The human hair follicle immune system: cellular composition and immune privilege
...., S Müller-Röver, H Audring, DJ Tobin... - British Journal of ..., 2000 - Wiley Online Library
Summary: The immunology of the hair follicle, its relationship with the 'skin immune system' and its role in hair diseases remain biologically intriguing and clinically important. In this study, we analysed the immunoreactivity patterns of 15 immunodermatological markers to ...
Cited by 129 - Related articles - SFX at Bradford - BL Direct - All 5 versions - Import into RefMan

In vivo and in vitro evidence for hydrogen peroxide (H2O2) accumulation in the epidermis of patients with vitiligo and its successful removal by a UVB-activated ... 
...., WD Beazley, DC Gaze, DJ Tobin... - The journal of ..., 1999 - ncbi.nlm.nih.gov
To date there is compelling in vitro and in vivo evidence for epidermal H2O2 accumulation in vitiligo. This paper reviews the literature and presents new data on oxidative stress in the epidermal compartment of this disorder. Elevated H2O2 levels can be demonstrated in vivo ...
Cited by 122 - Related articles - SFX at Bradford - All 2 versions - Import into RefMan

Melanocytes are not absent in lesional skin of long duration vitiligo
DJ Tobin, NN Swanson... - The Journal of ..., 2000 - interscience.wiley.com
Desmond J. Tobin1, Nelle N. Swanson2, Mark R. Pittelkow2, Eva M. Peters1 and Karin U. Schallreuter1,3* 1 Clinical and Experimental Dermatology, Department of Biomedical Sciences, University of Bradford, Bradford, UK 2 Department of Dermatology, Mayo Clinic,...
Cited by 114 - Related articles - SFX at Bradford - BL Direct - All 3 versions - Import into RefMan


Author metrics in Web of Knowledge

• Create Citation Report
• Times cited
  – Self-citations can be removed
  – Find your most popular papers
H-index (Hirsch J, PNAS, 2005)

• The value of $h$ is equal to the number of papers ($N$) in the list that have $N$ or more citations

• Prof Tobin has h-index of 34
  – He has 34 papers that have at least 34 citations
  – discounts the disproportionate weight of highly cited papers
H-index

- First $h$ papers
- Citations = papers = $h$
- More than $h$ citations
Criticisms of the H-index for authors

- Favours older authors
  - They will have more papers
  - They will have older papers, which have had more time to be cited
- Never decreases
- Methods papers, reviews increase H-index disproportionately
- Ignores small numbers of highly cited papers
- Variants on the H-index
  - G index
    - Aims to restore the effect of highly cited papers
  - Contemporary h-index
    - Gives less weight to older articles
91. Title: A natural canine homologue of alopecia areata in humans
Author(s): Tobin, DJ; Gardner, SH; Luther, PB, et al.
Source: BRITISH JOURNAL OF DERMATOLOGY Volume: 149 Issue: 5 Pages: 938-950 Published: 2003
Times Cited: 3

92. Title: Characterization of hair follicle antigens targeted by the anti-hair follicle immune response
Author(s): Tobin, DJ
Source: JOURNAL OF INVESTIGATIVE DERMATOLOGY SYMPOSIUM PROCEEDINGS Volume: 8 Issue: 2 Pages: 176-181 Published: 2003
Times Cited: 12

93. Title: Indium phosphide (001)-(2x1): Direct evidence for a hydrogen-stabilized surface reconstruction
Author(s): Chen, G; Cheng, SF; Tobin, DJ, et al.
Source: PHYSICAL REVIEW B Volume: 68 Issue: 12 Article Number: 121303 Published: SEP 15 2003
Times Cited: 8

94. Title: Functional activity of serotoninergic and melatoninergic systems expressed in the skin
Author(s): Slominski, A; Pisarchik, A; Zbytek, B, et al.
Source: JOURNAL OF CELLULAR PHYSIOLOGY Volume: 196 Issue: 1 Pages: 144-153 Published: JUL 2003
Times Cited: 57

95. Title: Regulation of human epidermal melanocyte biology by beta-endorphin

Who’s Who

- Disambiguation
  - REF working on this
- WoK
  - Author search/Distinct Author Sets
    - Allows you to select specific authors and regenerate metrics
  - Use Author Finder for Author search
    - Can refine by subject and institution
  - ResearcherID
    - Assigns an identifier to researchers
    - Self-register via Web of Knowledge or at:
      - http://www.researcherid.com/
Other sources of citation data

- **Scopus**
  - Elsevier
    - Author metrics
    - Journal metrics
    - Not just journals

- **Scimago**
  - [http://www.scimagojr.com/](http://www.scimagojr.com/)
  - Uses Scopus data
  - Many metrics for journals, including H-index
  - Free

- **Google Scholar**
  - Times cited BUT Author searching tricky
  - Not just journals
  - Publish or Perish software to calculate H-index etc
Other general criticisms

• Self-citation – a bad thing for authors and journals?
• Few accurate metrics for arts etc
• Can they measure value of work?
Metrics and open access

• Many metrics are journal-based – How will these fare in the world of repositories?
• Author/article/institutional metrics may supercede journal-based metrics
• Citebase and others
  – Citation metrics for repositories
Responses to criticisms - Mapping/networking measures

- Eigenfactor
- CiteRank – citation networks
- MESUR
  - [http://www.mesur.org/MESUR.html](http://www.mesur.org/MESUR.html)
  - Combine usage and citation measures
  - Very large database, collated from publishers etc
  - Free
Responses to criticisms - Other metrics

• Funding - Self-perpetuating?
• Impact
  – REF
• Usage
  – COUNTER
  – MESUR
  – Repositories
• Web 2.0
Simple versus complex

- Complex measures require trust
- Harder to ‘game’
- Or do we go for easy to understand metrics like the H-index and Impact Factor?
Uses of citation metrics

• Journals
  – Where to publish?
    • Impact Factors
    • A highly-cited, high Impact Factor journal is still likely to be best
    • Good rough indicator for those new to a field
  – Supporting library purchasing decisions

• Authors
  – Recruitment

• Most only valid within field
Institutional-level citation metrics

• Institutional metrics may be purchased from Thomson Reuters or Scopus
• REF working in this area
RAE, REF and research metrics

• Largely dependent on expert panels - may have the support of metrics in some areas
  • ‘Building a picture’
  • ‘Informed by’
  • Will also include ‘Impact’
Overall

• No measure is perfect
• Use in combination