

## EDITORIAL

# The intricacies of characterizing a scientific journal's performance

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In May 2013, the recommendations of the San Francisco Declaration on Research Assessment (DORA; <http://am.ascb.org/dora/>) were published in a concerted effort to encourage institutions, funding bodies, researchers, publishers and metrics-providers to move away from treating the Journal Impact Factor as the 'golden calf' of bibliometry and to discourage the inappropriate use of this single (and somewhat simplistic) metric to assess the value of an individual's or journal's research quality.

*The Journal of Experimental Biology* (JEB) fully supports the DORA initiative (Hoppeler, 2013) and is listed as one of the original signatories; in line with this, we display article usage data and author contribution statements on all articles, do not limit the number of reference citations in Research Articles, and include a variety of bibliometric data, in addition to the impact factor (IF), on our website to provide a rich view of the journal's performance ([http://jeb.biologists.org/site/about/about\\_jeb.xhtml](http://jeb.biologists.org/site/about/about_jeb.xhtml)).

However, in discussions amongst the journal editors and wider JEB community, it has become clear that many researchers do not understand how these bibliometric data, including the IF, are calculated and, as such, their relative merits (and/or limitations). We therefore thought it would be useful to provide a short guide to help put our own bibliometric data in context.

The Journal Citation Reports® (JCRs) are published by Thomson Reuters every June/July and, in addition to basic citation data, include a number of different measures: IF, 5 year IF and cited half-life.

The most familiar of these metrics is the annual IF, which for JEB is currently 3.0. It is calculated as the total number of citations received by the journal in a given year (in this case, 2013) divided by the total number of citable items published in the journal during the preceding 2 years (2011 and 2012) [citable items are defined as 'scholarly works' (McVeigh and Mann, 2009) and, for JEB, comprise Research Articles, Short Communications, Methods & Techniques, Commentaries and Reviews]. Note that citations to all article types are included in the numerator, but only scholarly works are included in the denominator. An IF of 3 essentially means that articles in JEB get cited about 3 times on average. To put this in context, the multidisciplinary 'prestige' journals *Nature* and *Science* have IFs of 40.7 and 34.4, respectively.

IFs vary by field of research, depending, among other things, on the size, status, funding level, research activity and citing behavior of the field. Comparative physiology is not exactly a growing research field and, compared with biomedical research, there is precious little public money directed towards supporting basic research in animal physiology. This does not help the IF of the field or of the journals that publish in the field, which puts our community at a disadvantage, especially now that, in some career and research assessments, publications in journals below an arbitrarily set IF threshold are simply discounted. Added to this, JEB

has been misplaced in the JCR in the category 'Biology', being ranked against much broader journals such as *PLOS Biology* (IF 11.8) and *The FASEB Journal* (IF 5.5). Among the 83 journals listed in this category, JEB ranks 18th, putting it among the top 20% of Biology journals. However, if one was to correctly list JEB among the 152 journals in the 'Zoology' category, where the other competing 'comparative' journals are listed, it would rank 9th, well within the top 10% of journals.

By definition, the IF uses the total number of research and review articles in the denominator. This makes life for high-volume, fortnightly journals such as JEB difficult, as the denominator is much larger than on smaller, less-frequently published journals. One could well argue that the overall impact a journal has on science might better be reflected by the total number of citations it receives; the 26,376 citations for 2013 would rank JEB 2nd in the 'Zoology' category and 4th in the 'Biology' category.

The fact that the annual IF is based on articles published in a 2 year window also penalizes journal articles that accrue citations a long time after they are published. In recognition of this, the JCR also publish a 5 year IF, in which the denominator represents the number of research articles and reviews published in the preceding 5 years. For 2013, the 5 year IF of JEB is 3.3, slightly higher than the annual IF. This indicates that our articles get well cited over longer periods of time, which is also reflected in a cited half-life of 9 years. Cited half-life indicates the median age of the articles that were cited in the year reported.

An interesting aspect of citation behavior is reflected in the Eigenfactor® and Article Influence® scores, which are generated from the citation data published in the JCR and are available online at <http://www.eigenfactor.org/> and also as part of the JCR on the ISI Web of Knowledge<sup>SM</sup>. The Eigenfactor® score rates the total 'importance' of a journal and weights the 5 year IF of a journal in an iterative process that takes the influence of the citing journal into account; for example, a citation from *Nature* or *Science* is valued higher than that from a lower-impact journal with a narrower readership. Moreover, the Eigenfactor® is influenced by the total number of citations to a journal, i.e. journal size, and accounts for differences in citation frequency between fields. The 2013 Eigenfactor® score for JEB is 0.041, ranking it 1st in the Zoology category. Similar to the Eigenfactor®, the Article Influence® score relies on citations during the first 5 years after an article is published and ranks the citations according to the prestige of the citing journal but, by contrast, it measures the average influence of each article rather than the whole journal and therefore is more comparable to the IF. It is normalized such that the mean article in the entire JCR database has an Article Influence® score of 1 (i.e. journals with a rank higher than 1.00 have a higher than average influence). JEB has an Article Influence® score of 1.079, ranking 12th amongst the journals in the Zoology category.

The h-index (Hirsch index) was initially suggested by Jorge E. Hirsch as an improved estimate of a scientist's impact by accounting for both the quantity and quality of their scientific publications (Hirsch, 2005). In addition to measuring an individual researcher's

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impact, the h-index can be expanded to measure the impact of a whole journal by the same algorithm. The JEB h-index of 119 indicates that there are 119 papers in JEB that have received at least 119 citations. As the JCR does not include the h-index, it is not possible to immediately rank 'competing' journals according to their h-index, although these data are available in the SCImago Journal & Country Rank (see below; <http://www.scimagojr.com/>). Of the journals publishing the major share of comparative physiology, only the *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology* enjoys a larger h-index (126) than JEB.

The final metric that is important with respect to journals is the SCImago Journal Rank (SJR), which aims to measure the scientific 'prestige' of a journal (Gonzalez-Pereira et al., 2010). Analogous to the Eigenfactor®, the SJR is based on citation weighting but uses data obtained from Elsevier Science's Scopus database and citation network rather than the JCR. JEB has an SJR of 1.72. When compared with the other comparative journals, it is again surpassed only by the *American Journal of Physiology – Regulatory, Integrative and Comparative Physiology*, with an SJR of 1.77.

In summary, as is obvious from this short description of the journal's bibliometric data as published on JEB's website, various bibliometric parameters measure various aspects of a journal's performance and scientific status. Looking solely at the IF is

certainly short-sighted, as the IF just describes one (and probably not the most meaningful) citation parameter. However, because of its intuitive significance, it has remained the best understood and most widely used single descriptor of a journal's performance to date. Information about how often articles in a journal are downloaded and discussed in social networking forums and the media would give a wider view of research impact in the scientific community and in the lay world, and this will be the subject of a future Editorial. Foremost, and possibly most important, any scientist needs to publish their research for their particular audience of peers. If this scientist happens to be a comparative physiologist, the chances are that JEB is the journal of choice to publish the best of their research to ensure that it reaches its intended audience and is read, cited and discussed.

#### References

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