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EDITORIAL

Journal Impact: Brave New World OPEN

The InCites™ Journal Citation Reports® (JCR), a product of Clarivate Analytics, was released recently for the citation year 2016. We were pleased to see that *The Plant Cell* 2-year and 5-year journal impact factors (JIFs) rose slightly compared with 2015, to values of nearly 8.7 and 10.0, respectively. *The Plant Cell* also scored highly in other metrics provided by the JCR, such as the cited half-life, immediacy index, and the Eigenfactor and article influence scores. These metrics reflect the long-standing high quality of the journal and its editorial board, and the aim of the journal to publish the most cutting-edge research, but also full stories that are foundational and stand the test of time. However, *The Plant Cell* no longer stands alone at the top of the list of primary research journals in plant biology with respect to the most recognized output of the report, the 2-year JIF. Given the widespread obsession with this number, we decided to offer our readers an analysis of the underlying data.

A journal's 2-year JIF is calculated as the average number of citations in a single calendar year to articles published by that journal in the previous 2 years. Thus, the 2016 JIF for a journal is the average number of citations in 2016 to articles published in that journal in 2014 and 2015. An interesting and not entirely logical aspect of the JIF calculation is that the numerator includes citations to all items published in the journal, whereas the denominator equals the number of so-called citable articles, mainly research articles and reviews. Thus, items categorized as editorial material are not counted in the denominator, but citations to editorial material are included in the numerator. The JCR database is not publicly available. However, Clarivate also publishes the Web of Science, a subscription-based scientific citation database that is widely available at many academic and research institution libraries, which can be mined to undertake journal- and article-specific analyses (described by Larivière et al. [2016], A simple proposal for the publication of journal citation distributions. bioRxiv doi/10.1101/062109).

Using this approach, we calculated mean citation frequencies corresponding to the JIF, as well as citation distributions, for eight highly regarded plant biology primary research journals. To approximate the JIF, data were retrieved from the Web of Science for each journal for citations in 2016 to all items published in 2014 and 2015, and this value was divided by the number of items retrieved in a search for "articles" plus "reviews" published in 2014 and 2015 in the same journal. We also computed the mean and median citation frequencies specific to research articles and reviews, without including citations to other items in the numerator.

The data for these journals are presented in the table below. The JCR JIF denominator value was precisely replicated for all journals in question by searching for "articles" plus "reviews" (with one minor exception; see Table 1). The Web of Science JIF numerator (total citations to all documents) was within 3 percentage points of the JCR JIF numerator for all journals, with two exceptions: Citations to all documents in Web of Science returned a numerator that was 10% lower than the JCR JIF numerator for *Plant Biotechnology Journal* (1569 versus 1749) and 18% lower than the JCR JIF numerator for *Nature Plants* (678 versus 824), yielding substantially lower Web of Science JIFs relative to the JCR JIFs for these two journals.

Clarivate Analytics reported that differences between the JCR and Web of Science databases can be due to the facts that (1) JCR citation aggregation is at the journal level and more inclusive than Web of Science cited-to-source linking (i.e., JCR includes citations that can't be linked to a specific citing article but are considered to be unequivocal for the cited journal; see also the description of "unmatched citations" by Larivière et al. [2016]); (2) JCR citations were extracted in mid-March, but Web of Science coverage is continually expanding throughout the year (i.e., neither database is fully populated for 2016 citations until later in 2017; see Table 1); and (3) the Web of Science includes citations from the Book Citation Index, but JCR does not (T. Ciavarella, personal communication). The first observation is expected to yield a higher number of citations in the JCR relative to the Web of Science database, whereas the other two will yield lower JCR citations relative to the Web of Science. Thus, for example, *Nature Plants* saw a higher than average number of unmatched citations and relatively few book citations, whereas *The Plant Cell* was associated with a higher than average number of book citations that outweighed the inclusion of unmatched article-level citations (T. Ciavarella, personal communication). The high rate of book citations to recent articles might suggest that *The Plant Cell* continues to publish a large number of manuscripts that are foundational, provide substantial insight to biological processes, and are critical to moving the field forward.

It should be noted that the data for *Nature Plants* include citations to articles published in only one year, 2015, as this journal had zero publications in 2014. Therefore, we might expect next year's JIF for *Nature Plants* to be higher, as the 2015 publications are likely to accrue more citations in the second year after publication relative to the first year (and the JIF values for all other journals already include second-year citations).

Retrieving citations to individual article categories allowed us to calculate the mean citation frequencies specific to research articles and reviews and to estimate the "boost" to the Web of Science JIF for each journal resulting from citations to editorial material. There is a notable difference in the contribution to the JIF from citations to editorial material between these journals, with *Nature Plants* and *Molecular Plant*, in particular, receiving a 10% and nearly 30% boost, respectively, due to citations to editorial material. *The Plant Cell* received a 1% boost due to editorial material, and the boost for each of the other five journals was no more than 3% (*Plant Physiology* and *The Plant Journal* receiving essentially no boost).

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Table 1. Citation Data for Eight Plant Science Journals from the Web of Science Database

	Mol. Plant	*Nat. Plants*	*New Phytol.*	*Plant Biotechnol. J.*	*Plant Cell*	*Plant Cell Environ.*	*Plant J.*	*Plant Physiol.*
Number of Articles								
Citable items (JIF denominator)	220	80	920	235	526	415	669	942
Articles	175	76	785	194	511	357	649	935
Reviews	45	4	135	41	15	58	20	7
Editorial items	134	113	121	13	100	32	22	37
Editorial material	40	59	105	11	86	30	4	22
Letters	87	3	1	0	0	0	0	0
News items	0	23	0	0	0	0	0	0
Biographical items	1	0	1	0	0	0	0	0
Corrections	6	28	14	2	14	2	18	15
Total items	354	193	1041	248	626	447	691	979
Number of Citations								
Total citations in JCR (JCR JIF numerator)	1942	824	6751	1749	4570	2562	3948	6075
Total citations in WOS (WOS JIF numerator)	1911	678	6597	1569	4597	2484	3972	6048
WOS citations to citable items	1481	613	6425	1548	4553	2422	3959	6035
WOS citations to editorial items	430	61	172	21	44	62	13	13
Boost from editorial items (%)	29	10	2.7	1.4	1.0	2.6	0.3	0.2
Citation Means								
Mean citations/citable item	6.7	7.7	7.0	6.6	8.7	5.8	5.9	6.4
Mean citations/article	**5.7**	**7.6**	**6.0**	**6.9**	**8.3**	**5.4**	**5.7**	**6.4**
Mean citations/review	**10.8**	**10.3**	**12.8**	**5.3**	**20.5**	**8.7**	**11.8**	**13.9**
JCR JIF	8.827	10.300	7.330	7.443	8.688	6.173	5.901	6.456
WOS JIF	**8.686**	**8.475**	**7.171**	**6.677**	**8.740**	**5.986**	**5.937**	**6.420**

WOS, Web of Science. Data were downloaded from the WOS database on July 12, 2017. This database continues to add citations for an indeterminate time period; thus, for direct comparisons, all data must be downloaded on the same date. For 2016 citations, we expect it to be nearly fully populated by July 2017. For example, for *The Plant Cell* and *Nature Plants*, searches run on August 17, 2017 returned total 2016 citations of 4598 and 681, respectively, compared to respective values of 4597 and 678 shown in the table, whereas a search run on February 24, 2017 returned total 2016 citations of only 4368 for *The Plant Cell*. Although this value is 95% of the value obtained in July, it would yield a JIF value of only 8.3 relative to the July value of 8.74. Citable items in WOS correspond with the JCR JIF denominator in all cases, except that the JCR JIF denominator for *The New Phytologist* was 921, whereas the *The New Phytologist* WOS JIF is based on a denominator of 920 citable items returned in the WOS search. Items classified as "articles" in the WOS database may be used as a proxy for research articles, but, depending on the journal, they may include some review-type articles that are not primary research articles per se, but are labeled as "articles" rather than "reviews" in this database.

The discrepancies in the data from the different databases and differences in the contribution from editorial material underscore the notion that the data do not support reporting, or placing any significance on, a JIF out to three decimal places. Indeed, based on this data, one is hard-pressed to justify a significant difference between JCR JIFs of 10.3 and 8.6. As far as individual authors are concerned, a better measure of journal impact may be obtained by comparing the mean, or better, median, citation frequencies specific to research articles alone.

Larivière et al. (2016) advocate publishing frequency distribution plots of the citations to provide a clearer view of the underlying data. We agree that showing the underlying frequency distribution of citations "echoes the reasonable requests that journal reviewers and editors make of authors to show their data in justifying the claims made in their papers" (Larivière et al., 2016). Distribution plots corresponding to the data on "articles" alone (i.e., not including editorial material or reviews) are shown in the figure below for the eight above-mentioned plant science journals. As noted by Larivière et al., these distributions are skewed to the right, with the left-hand portion dominated by papers with lower citations. These authors report that "typically, 65 to 75% of the articles have fewer citations than indicated by the JIF" (Larivière et al., 2016). *The Plant Cell* scored well in this respect, with only 61% of research articles (as retrieved from the Web of Science) accumulating fewer citations than the JIF. By contrast, the value for *Molecular Plant* was 82%. The only other journals to achieve less than 65% in this respect were *The Plant Journal* and *Plant Physiology* at 60% and 63%, respectively. *The Plant Cell* also scored well for the number of research articles with zero citations in the Web of Science during this time period, at 1%; the other journals analyzed had 4 to 5% of articles showing zero citations, with the exception of *Plant Physiology* with 3% (Figure 1). These plots, together with the information in the table, suggest that both primary research papers and review articles in *The Plant Cell* accumulated, on average, higher citations than any other primary plant science journal for this time period.

Nevertheless, it is clear that *Nature Plants* and *Molecular Plant*, as well as all of the other high-profile plant science journals shown here, are increasing their output of high-impact plant science. The rise and success of new journals is to be applauded, as it signals the overall importance and impact of plant biology in the global life science community. The rise of online publishing and open access makes it likely that there will be an increasingly larger number of

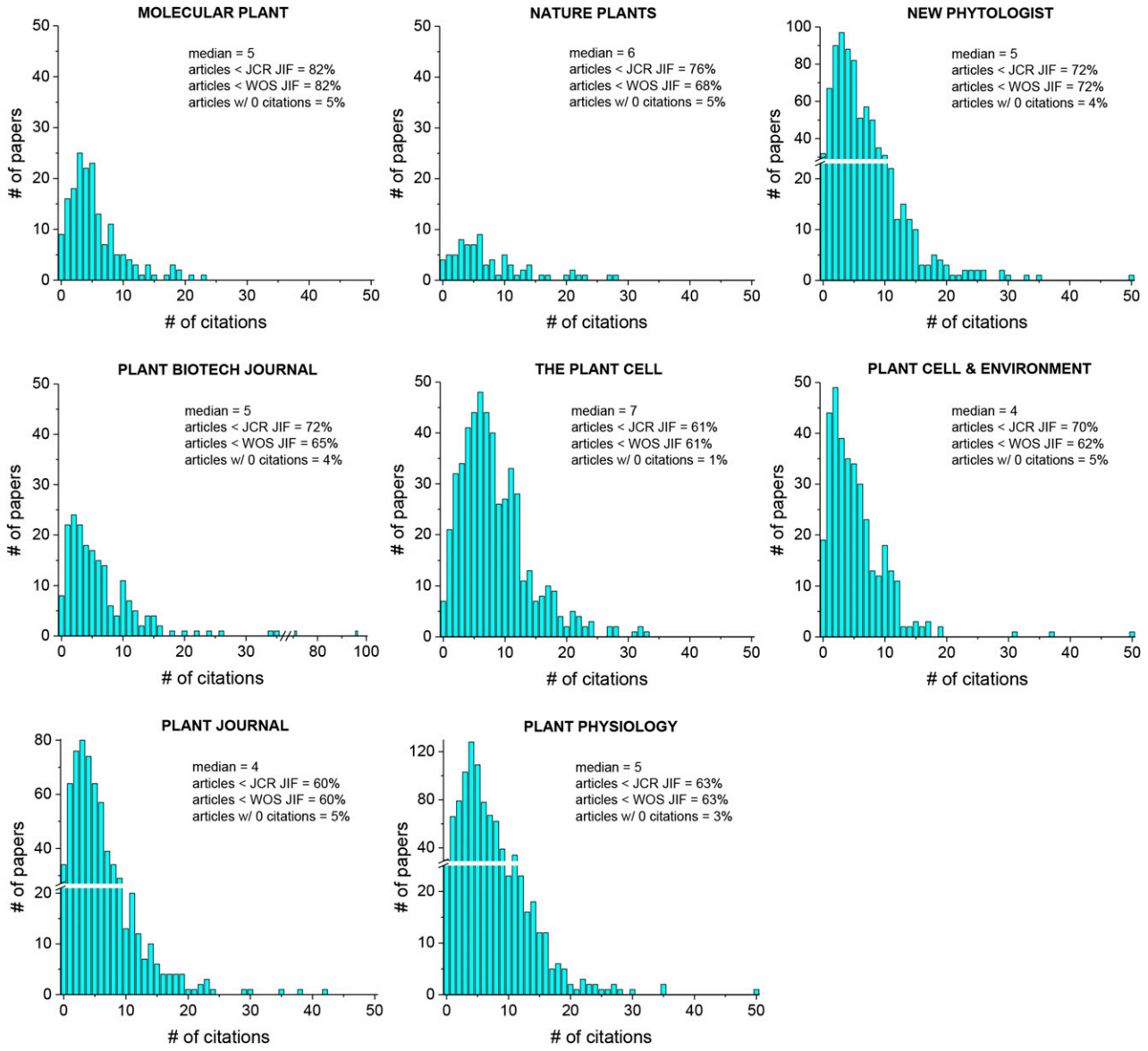

Figure 1. Citation Distributions of Eight Plant Science Journals.

Citations are to items categorized as "articles" in the Web of Science database, which are mainly primary research articles and equivalent to JCR "citable documents" minus those labeled as reviews. Citations are accumulated in 2016 to articles published in 2014-2015. Data were downloaded from the Web of Science (WOS) on July 12, 2017. Articles < JCR JIF and articles < WOS JIF, the percentage of primary research papers (those categorized as "articles" in WOS) published in 2014 and 2015 having a total number of 2016 WOS citations below the value of the JCR JIF or WOS JIF, respectively. (*Figure courtesy of Colleen Hui.*)

essentially equivalent journals—in terms of citations—reporting the latest research in plant biology in the near future. Differences among these journals will therefore be measured in terms of the scope of the work published, the quality of their editorial boards, and the submission, reviewing, and publication processes and speeds.

At *The Plant Cell*, we remain committed to providing fair and fast evaluation of your work by a world-class editorial board of your peers (http://plantcelledboard.weebly.com/) and to publishing the most exciting, cutting-edge research in plant genomics, development, and cell and molecular biology. All manuscripts are evaluated by a team of editors who are active researchers and who engage in pre- and post-review consultations to arrive at a thoughtful and thorough evaluation of your work in the shortest time possible. We aim to write decisions that are clear and provide sound reasoning for either declining or requesting revision of your work, to avoid multiple rounds of extensive revisions and help you publish your work as quickly as possible—whether in *The Plant Cell* or elsewhere. To increase the transparency of the review process, we now publish Peer Review Reports, with author approval, including decision letters, anonymous reviewer comments, and author responses for all versions of a manuscript, along with timelines showing the dates of each submission and decision.

As always, we help our authors disseminate their findings in an accessible manner to a wide audience, and we will continue to seek out new ways of doing so in the rapidly changing communication space. For example, we provide post-acceptance scientific editing by a team of professional science editors, who polish the writing and presentation and help us to ensure that all manuscripts adhere to high standards of data reporting (transparency and availability) and data presentation (clarity and accessibility). We help authors to learn about Altmetrics and how they can boost the visibility and impact of their work by issuing press releases and writing plain-language summaries (see *The Plant Cell* in a Nutshell at https://plantae.org/research/the-plant-cell/#nutshell). In addition, we have appointed a team of assistant editors who will join Mary Williams, Kevin Folta, and Nancy Eckardt to form a team of Feature Editors who will write articles, contribute blog posts, and create podcasts highlighting our authors and their work (see our Medium publication *Plant Cell Extracts* at https://medium.com/plant-cell-extracts).

In addition, *The Plant Cell* (and our sister journal *Plant Physiology*) is published by the American Society of Plant Biologists, a nonprofit international scientific society devoted to the advancement of plant science and plant scientists. The Society supports travel awards for early-career scientists, undergraduate research fellowships, education and outreach programs, and important work on legislative and public affairs. Submit your best work to *The Plant Cell* and experience the difference!

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