My Word

Citation opportunity cost of the high impact factor obsession

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The pressure to publish in high-impact journals has never been higher and has led to growing distortions in the use of the impact factor [1,2]. With increasing quantification of scientific impact and the growing dependence on easily-calculated statistics — for example, impact factors, the h-index [3] and the number of citations — by academic bodies to make critical career decisions, a few high-impact journals get a deluge of submissions, up to 94% of which are rejected. The rejection rates are steadily getting higher.

Publication in a high-impact journal is not only a major career boost which can be vital for early career scientists, but it also increases the chances of the paper being seen and cited. It is also clear that a paper reporting a particular finding will be cited differently depending on the journal in which it is published, with the number of citations being higher for essentially the same paper if it is in a higher-impact journal [4].

However, this ‘mania’ [2] to publish in high-impact journals can be exhausting and demoralizing; it can substantially increase the time to publication; it means that high-impact journals are often overwhelmed with submissions; and it punishes very original, risky science [1,2]. Stories abound about now classic, highly-cited and even Nobel-caliber papers that were initially rejected by high-impact journals ([5], but see [6]), sometimes delaying their time of publication by years.

Authors need to factor in the opportunity cost (in citations) of the publication delay due to rejections when choosing one's first journal of submission. The citation rates of journals are right-skewed and the median citation rate is often substantially lower than the average citation rate. Conversely, even when published in a lower-impact journal, good papers are usually recognized quickly by the scientific community, often achieving citation rates higher than those of high-impact journals. Furthermore, the strict page limits of high-impact journals can force authors to omit valuable information [1], sometimes reducing the reach and citation rate of a paper. A rejection also forces a scientist to spend time revising and resubmitting, instead of working on new papers. The rejection–resubmission cycle sometimes demoralizes a scientist sufficiently that the paper is never published. Many of these papers have valuable ecology, natural history and life history data, often from the developing world, that are essential for improving the biodiversity databases and the global analyses based on them [7].

To calculate the opportunity cost in citations as a result of delayed publication, I analyzed my first-authored papers that were first submitted to a high-impact journal and rejected. For each paper, there is a linear or quadratic relationship ($r^2 > 0.97$) between years since publication and its number of citations in Google Scholar. If I had submitted each paper only to the journal it was published in, this would have resulted in an earlier publication date and more time to accrue citations. I calculated this opportunity cost. For example, the equation Citations = 2.3 * YEARS^2 + 12.7 * YEARS – 3.9 ($r^2 = 0.996$) describes the relationship between years since publication and number of citations of my most cited paper [7]. If I had first submitted this paper to the journal where it was eventually published in and had not lost time due to rejections and resubmissions, it would have been published 1.27 years earlier and would have accumulated approximately 70 more citations. On average, each resubmitted paper accumulated 47.4 fewer citations by being published later, with an overall opportunity cost of 190 lost citations.

I also calculated the difference between my papers' citations and the median number of citations for ecology research articles published in my first-choice, high-impact journal in the year I published each paper. Each of my papers received more citations than 64–78% of comparable papers and received 44 more citations, on average, than the papers with median citation rate in my journal of first choice. This indicates that I paid an opportunity cost in lost citations for papers that are actually being cited more than the median paper in my first-choice journal. Interesting papers are often highly cited by the scientific community regardless of journal.

The review and rejection process can improve a paper and increase its subsequent citations [8]. However, many rejections from high-impact journals are curt, provide little to no feedback, and often do not help improve the paper. Given the growing pressure on editors and reviewers, there is little incentive to provide detailed and helpful reviews to rejected authors.

High-impact journals are important for communicating some of the best science conducted and a good fit between a paper and target journal should be the most important criterion in choosing the journal. However, the pressure to publish in high-impact journals is resulting in a surge of submissions that are not appropriate and are unlikely to be accepted [2]. This surge has greatly increased the workloads of editors and peer reviewers, resulting in increases in rejections without review, more scientists turning down review requests, growing delays in getting papers properly reviewed, thereby decreasing the quality of reviews and delaying the time-to-publication even further. This also reduces the quality of some papers, especially for those that are forced to remove essential scientific content, oversimplify or even exaggerate findings in order meet the word limits and ‘broad interest’ requirements of high-impact journals [1].

A valuable benefit of high impact journals is the service they provide in promoting papers in the media through their active press offices. However, by taking initiative in engaging the social and traditional media, scientists can make up for not having the media outreach services of a high-impact journal. Quite often, researchers are unaware that many journals and universities have press offices that can promote papers through press releases. Nevertheless, some do not have press officers and it is often up to the authors to prepare and distribute press releases. Scientists usually do not receive press training and may be reluctant to engage the media. However, many universities employ press officers with journalism background and keen to work with scientists in communicating their papers to the media. Scientists need to be more proactive in working with traditional and new media, recruiting the help of their press offices, and communicating their findings to the general public through social media. This is essential for increasing the scientific literacy of the public and its support for science, as well as increasing the visibility and citation rate of one's papers. With the exploding use of social media, researchers have many excellent tools to communicate and promote their papers to their peers, colleagues, and the public in general.

There is high pressure for early career scientists to publish in high impact journals, but rejection rates have exceeded 90% in the highest-impact journals. There is a high opportunity cost, in citations, of a publication delay, not to mention the possibility of getting scooped by a competitor. Scientists need to be more strategic about their journals of first choice, steadily building a portfolio of good papers in a diversity of good-fit journals, rather than succumbing to the winner-take-all mentality of submitting everything to a handful of high-impact and high-rejection journals, losing precious time, energy, morale, papers, and citations to the worsening rejection-resubmission cycle.

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Obituary

Hugh E. Huxley (1924–2013)

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The field of structural biology lost a giant on July 25, 2013 when Hugh E. Huxley passed away at age 89. At the time of his death he was Professor Emeritus of Biology, Brandeis University. But for much of his career he was at the MRC Laboratory of Molecular Biology (LMB) in Cambridge, England. Huxley was a Ph.D. research student in Cambridge, England from 1948–1952, after reading Physics for his undergraduate degree. After entering Christ's College, Cambridge in 1941 to study Physics, his studies were interrupted by service in the RAF from 1943–1947. During that time he worked on the development of improved radar surveillance systems, and he found his passion in developing mechanical and electrical devices. He was to continue in that path for his entire career. Huxley then returned to Cambridge to finish his Physics studies, and in 1948 he joined an extraordinary adventure in Cambridge by becoming the first Ph.D. student of a newly formed small MRC Unit founded by Max Perutz and John Kendrew, housed in a temporary hut outside the Cavendish in Cambridge, and named the Laboratory of Molecular Biology. As Kendrew's Ph.D. student, Huxley began his life-long interest in exploring the structural basis of muscle contraction. For his Ph.D. thesis, he used low-angle X-ray scattering of live muscle fibers to reveal a fascinating pattern of reflections in resting (pre-contraction) versus 'rigor' (post-contraction) muscle. His Ph.D. thesis, completed in 1952, was entitled "Investigations in Biological Structures by X-ray Methods. The Structure of Muscle".

To put Huxley's work in perspective, Albert Szent-Györgyi and his colleagues had shown in the 1940s that both actin and myosin were needed to give artificial fibers that would contract in ATP, and the general conclusion at that time was that the contractile apparatus in the muscle involved composite filaments of colloidal actomyosin that underwent some form of ATP-dependent phase transition. An early pivotal contribution from Huxley, which derived from the changes in equatorial reflections from his X-ray patterns between muscles at rest and in rigor, was his conclusion that actin and myosin were present as separate sets of filaments in a double hexagonal array.

Those were the years that electron microscopy entered the world of biology as a tool to reveal details of organelles and molecular assemblies in ways that were impossible to see by light microscopy. Huxley was determined to understand the molecular basis of the diffraction patterns he was observing in muscle preparations, and not having an electron microscope readily available in Cambridge, he went to MIT in the late summer of 1952 as a post-doctoral fellow on a Commonwealth Fellowship to work in F.O. Schmitt's laboratory. There he quickly obtained electron micrographs of cross-sections of plastic-embedded muscle (a very new technique then) and clearly saw the double hexagonal arrays of thick and thin filaments in end-on view, presumably myosin and actin respectively, just as he had deduced from the equatorial X-ray diffraction patterns of living and rigor muscles.

Then in early 1953, Jean Hanson arrived at MIT, and they began a very