7. Scientific Writing and Publishing

PUBLISHING AT THE TOP OF THE HEAP

by Jeremy M. Boss and Susan H. Eckert

Wow, an article in *Big-Time Science Magazine!* Congratulations! You're sure to get tenure now!" So you say to your buddy with the curly red hair as you walk down the hall. During this walk/conversation, the two of you may question why you made this statement, what the real differences are between journals, and why some are considered to be more prestigious than others. This article will discuss these issues and shed some light on the process of the peer-review publication process.

To begin to look at the reasons behind that statement, it is important to consider the functions of different journals. Although all journals strive to publish the best science, the areas that they cover differ. Some are broad in their coverage of scientific disciplines, whereas

others deal with a discrete area of science. Still other journals publish work from the members of their scientific society, such as the American Society for Microbiology's *Journal of Bacteriology* or the American Association of Immunologists' *Journal of Immunology*. Additionally, by publishing articles discussing the political and sociological aspects of science, some journals, such as *Science* and *Nature*, serve as information resources on the pulse of all science.

Types of Journals

Journals can be divided into four general classes: broad top-of-the-heap, near-the-top, society-level, and specialty or subspecialty journals. The broad top-of-the-heap journals have very low acceptance rates and attempt to publish articles that make conclusions that shift the current paradigm in a field. Articles in these journals tend to be highly focused and may not provide in-depth coverage of the area. Like the authors contributing the articles, these journals are also concerned with being the *first* to publish information that may be of interest to their broad audiences. Thus, there is some competition between these journals. It is also true that manuscripts may get rejected from broad top-of-the-heap journals not because the science isn't spectacular but because the area is no longer "hot."

The near-the-top journals typically represent specific fields or general areas of science (e.g., immunology, neurobiology, developmental biology, structural biology, cell biology, or molecular biology). Over the last few years, some of the top-of-the-heap journals have created high-profile spinoff journals that specialize in a particular area. These are, typically, near-the-top journals. These journals attempt to publish cutting-edge manuscripts that tell complete and in-depth stories. They, too, have low acceptance rates.

Society-level journals publish the bulk of the work coming out of most laboratories and are the workhorses of the scientific publishing industry.

These journals have moderate acceptance rates and—surprisingly—may have more citations per year than do the top and near-top journals discussed above. This last fact indicates that these are important journals and that the work published in them is of high quality.

Specialty and subspecialty journals publish work in a restricted area. Although this work may be of high quality, too, the readership may be limited to only those in the field.

The Review Process

It is important to appreciate how manuscripts are processed, and how and when peer review plays a role. Several different systems are used, and each journal has its own system in place. One thing that's important for you, the author, is the quality of the review and the length of time it takes for your work to get reviewed and, once accepted, into print.

The most basic distinction between journal review processes is whether manuscripts are triaged. Triaging processes are used by editors who

attempt to prescreen manuscripts so that they send out for review only those that have a chance of being selected for publication. Many of the broad top-of-the-heap and near-the-top journals employ triage systems. An advantage to you as a manuscript submitter is that the triage review may take only a few days, so you really don't waste a lot of time waiting to find out if the manuscript has a chance of being published. Of course, the disadvantage is that the editor may not appreciate the significance of your title and abstract, and your paper will be returned without the input of an expert in your field.

Journals that review every paper before a publication decision is made run their editorial processes in different ways as well. In a single-step, hierarchical organization, an editor-in-chief is responsible for each decision and relies on an editorial board and a host of reviewers to help make accept/modify/reject recommendations. The editor-in-chief's office finds the reviewers and solicits reviews before making a decision.

Other journals use a multiple-level editorial board to spread out the work of handling the large number of manuscripts received each year. In a two-step system, the journal office receives the manuscript and assigns it to a member of the editorial board, who, in turn, either solicits reviews or reviews the manuscript personally. These editorial board members make recommendations directly to the editor-in-chief.

If the journal receives thousands of manuscripts a year, a system such as this one will require a huge editorial board. For this reason, many large journals use a multistep system, with three (or more) levels of editors. One of these editors will solicit reviews and make a recommendation to the editor at the next level up in the chain. This system works best for journals that receive a lot of manuscripts and maintain their efficiency and quality by having a small number of people making the final decisions on the manuscripts.

Although the editorial decision-making processes are different for different journals, perhaps the most critical question from the author's point of view is: Do reviewers rate a paper differently if it is sent to the top-of-the-heap as opposed to lower-ranked journals? In general, the answer is yes! The biggest difference, though, is not one of absolute quality, as you might expect. A good experiment is a good experiment, regardless of where it is published. All journals expect this. The difference lies in the reviewer's perception of the novelty and importance of the work for the broad field to which it relates. Thus, similar comments about experimental design and interpretation are often seen in manuscript reviews from different journals, and the same reviewer may accept the work for the society-level journal but not for the top-of-the-heap journal if he or she feels that the work is not novel enough.

Journal Rankings

Going back to the hallway discussion, that comment you made about your buddy being assured of getting tenure was based on your perception that the journal *Big-Time Science* is better than other journals. Your perception may be due to the journal's low acceptance rate and/or the large number of people who would read the article. Together, these reasons might begin to describe your view of the likely scientific impact of your buddy's manuscript. Your view, though, might not be correct.

The impact of an article or journal can be measured directly by the number of times the average article is cited in other articles. This number—the Impact Factor—is a real measurement often used by chairpersons (or tenure dossier reviewers) to measure the prowess of a faculty member coming up for promotion. The assumption here is that articles published in journals with high impact factors count more than do articles published in journals with lower impact factors.

What exactly is an Impact Factor? The Institute for Scientific Information's Web of Knowledge (www.isinet.com) provides such comparisons between journals, and it can tell you how many times a particular article has been cited. For a journal, the Impact Factor is defined as the number of citations a journal receives in a given year for articles it published over the previous two-year period, divided by the number of articles it published in that period. Although this math may seem fuzzy, the bottom line is that the higher the number, the higher the journal's ranking. See the table below for a comparison of journals in the field of immunology.

Journal Citations and Impact Factors for 2005*

Journal**	2005 Total Citations	Impact Factor	Articles
Reviews			
Annual Reviews of Immunology	14,745	**47.4**	29
Trends in Immunology	4,538	**10.174**	108
Current Opinion in Immunology	7,715	**9.103**	92
Advances in Immunology	2,310	**5**	23
Articles			
Science	345,991	**30.927**	827
Cell	132,371	**29.431**	319
Nature	372,784	**29.273**	1,065
Nature Immunology	16,989	**27.011**	130
Genes & Development	47,853	**15.61**	273
Immunity (Cell Press)	21,730	**15.156**	115
J. Experimental Medicine	64,170	**13.965**	354
Proceedings National Academy Sciences	357,239	**10.231**	3,200
J. Allergy & Clinical Immunology	21,872	**7.667**	169
Molecular and Cellular Biology	68,516	**7.093**	950
J. Immunology	112,686	**6.387**	1,916
AIDS	18,968	**5.835**	351
European J. Immunology	21,352	**4.876**	359
Infection & Immunity	45,582	**3.933**	1,023
Immunology	8,008	**3.507**	169
Cellular Immunology	3,925	**1.558**	95

* Data derived from ISI Web of Knowledge
** Ranked by Impact Factor

For the sake of comparison, some top-of-the-heap and near-the-top journals are included. Notice in this example that the society-level *Journal of Immunology* has an impact factor of 7, whereas the near-the-top immunology journal *Immunity* has an impact factor of 17.5. However, the *Journal of Immunology* publishes 11.2 times more papers and has nearly 5.3 times the number of total citations as *Immunity*. Thus, it is likely that some papers in the *Journal of Immunology* have more citations than those in *Immunity* do. Also note that *Science*, *Nature*, and *Cell* have the highest impact factors in this list, suggesting that these journals are, as you would expect, the top of the heap.

If you continue your search on the Web of Knowledge site, you will find that review journals and review-and-methods articles have the highest impact factor. Surprised? Consider that when you're writing a paper, it's easier to reference a whole field of work with a single citation than it is to cite all the relevant primary papers. Review articles, therefore, are usually cited more than primary work is. Although this kind of objective quantification is something that we, as scientists, like, the high ratings of review articles show that these measures can be biased. Importantly, such quantitative measurements do not *evaluate* the science itself, which, of course, ought to be the most important measurement.

Publishing in High-Quality Journals

Do the journals I publish in really matter when it comes to my tenure decision? Your tenure decision will be based on an evaluation of your scholarship, teaching, and service to your institution. Depending on where you work, scholarship may be the predominant (or even the only) area considered. If this is the case, you will be judged on the impact your publications have on your field and the promise that you show for future productivity. Thus, you will need to publish your work in strong, highly visible journals that are read by members of your broad field of interest. Remember that in making your promotion/tenure decision, your department will seek the advice of leaders in your field and the broader area of your research. These outside reviewers will—let's hope—have seen your papers as they came out, and they will have followed your career through the literature. Your publications are more likely to be noticed if they are published in quality journals, so publishing in society-level, near-the-top, and broad top-of-the-heap journals will help your cause.

This doesn't mean that publishing your work in specialty or subspecialty journals is bad. It's a very rare lab that produces only science of high potential impact and broad relevance; even if you're focused on important problems, you're bound to produce some science that's just as good but of significance to a narrower audience. Although publishing in specialty or subspecialty journals may not aid your case as much as papers that are published

in higher impact journals will, it does help in terms of promotion, as long as the sum total of your published work influences your field.

The Bottom Line

Almost 20 years ago, an adviser commented to a group of us discussing where to send our papers that it doesn't really matter what journal your work is published in, because if the science is good enough people will find it, read it, and cite it. This statement is even truer today, thanks to the ease with which the literature can be searched and articles can be downloaded, which saves scientists the effort of trudging over to the library stacks.

Some may believe that publication in *Big-Time Science* is equivalent to two or three society-level articles, but the most important thing is to get your work out there where people can see it by publishing regularly in journals that are widely respected, read, and cited by your peers. Make sure your most important work is published at least at the level of your scientific society journals. If your work has more heat and is closer to the cutting edge, you should definitely send it to the journals closer to the top of the heap; after all, you can't publish there if you never send your papers to them in the first place. Good luck!

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I CAN'T BELIEVE THEY DIDN'T LIKE IT!

by Jeremy M. Boss and Susan H. Eckert

What do they mean, it's 'too ambitious'? How do they think I am going solve the Big Problem if I'm not ambitious? Who are these idiots? They aren't qualified to review my work! None of the experiments they say we need to do will tell us anything! They are just giving us busy work!"

Whew! Wasn't it a relief to get that out of your system? If you have made statements like these, you know that within a few minutes, or days, you will collect your thoughts and decide on a reasonable response to that negative grant review or rejected manuscript.

Almost everyone in science has received a nonfundable grant score or had a paper rejected, usually both. If this is your first experience with such a rejection, congratulations and welcome to the club! The key now is to know how to move forward, to understand the appropriate roles of the reviewer and the reviewed, and to determine how to respond to critiques so that you get that grant funded, eventually, or that paper accepted. In Part 1 of this series we will discuss the ins and outs of dealing with manuscript peer review. Part 2 will focus on responding to grant critiques.

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The Job of the Reviewer

The reviewer is just fulfilling a role. It's not personal. And although you may think that you know the name of the person who reviewed your work—you may even be sure of it—you're probably wrong. Journal editors tell us that when authors blame Dr. Stukittume for a negative review, Dr. Stukittume usually wasn't even on the list of potential reviewers. Besides, even if Dr. Stukittume did in fact review your paper, it doesn't matter. The need is the same, whoever the reviewer might be: to move the work forward and figure out how to satisfy the reviewer.

The job of the reviewer is to determine if the work is suitable for publication in the journal to which it is submitted. As discussed in "Publishing at the Top of the Heap" (above), different journals have different criteria that the work has to meet. Reviewers must justify their opinions on acceptance, revision, or rejection of each manuscript. Reviewers justify their recommendations to you through their critique of the work.

However, what you see and what the editor sees are two different things. As you most likely are aware, as a reviewer you get to provide a numerical score or qualifying statement ranking the significance and novelty of the work, the quality of the data, and so on. Reviewers also recommend to editors whether the work should be accepted, returned for revisions, or rejected. But almost all journals have a section where reviewers can make "top-secret" comments to the editor about what they *really* think about the work. Because you don't get to see these comments, you must infer what you must do from the editor's letter and the anonymous reviews. Sometimes it's easy. Sometimes it's not.

The Job of the Reviewed

That's you. Your job is simple: to get the work published. The reviewer of your manuscript expects that you will at the very least address his or her comments. This is very important, since most revisions are re-reviewed by the same people, so they will be looking for you to acknowledge and consider their comments. Reviewers' comments address a range of categories, including novelty, significance, and relevance; the quality and novelty of the experimental design; data interpretation; and style and presentation of the data. The approaches we recommend for responding to each of these categories are discussed below.

Assessing Comments on a Rejected Manuscript

If your manuscript was rejected, the first question to ask is "Why?" Consider the categories listed above. Rejections based on novelty or significance and relevance to a field indicate that the paper was submitted to the wrong journal. To correct this, reassess your work and choose a more appropriate journal. If the paper originally went to a top-of-the-heap journal that publishes only work of broad significance, then consider sending the manuscript to a journal closer to your field, such as the journal of

your scientific society. But if the work was rejected for these reasons from a journal that represents your field, you will need to point out the work's significance and how your work adds to what has already been published before you send it out again. However, if you cannot point out how your work adds to your field, then perhaps you will need to wait on publication until your results do in fact add to your field.

Some top-of-the-heap or near-the-top journals reject all manuscripts they do not immediately accept—that is, there aren't any conditional acceptances—and the letters they send out do not explain this fact. If you need clarification on what a rejection letter really means, call the editorial office and ask. If you still can't figure out what to do, seek the advice of a senior colleague in your department. Your colleague may be able to suggest some options that did not occur to you.

Before you press the reformat button and hit the print keys to produce another version of the manuscript for a different journal, you may want to consider the rest of the comments. You may think it unlikely that Dr. Stukittume—the one who *really* stuck it to you, not the one you thought it was—will get your manuscript again if you send it to a different journal. But the world of science is small, and even if you're changing journals, you aren't changing disciplines, so there's a good chance you might get the same reviewer. Some of those comments may improve your work and increase the likelihood that it is accepted. All in all, responding to those comments would be prudent, even if you send the paper elsewhere.

Reviewers almost always comment on the experimental design and the quality of the data. While everyone has a different way of doing an experiment, in the end the data and method of data collection must support the conclusions that you draw. When reading the comments and looking through your paper, ask yourself these questions:

» Is the title of the manuscript supported by the data?
» Do the data support your interpretation?
» Is your interpretation the only interpretation the data support?
» What controls are necessary to nail the point you're making?
» Is there a better way to collect the data?
» Are the results statistically significant?
» Can you get a better autorad reading, etc., than the one that you submitted?

If the reviewer comments on any of these issues, you will need to address them either by doing additional experiments or by providing more information, discussion, or justification before resubmitting your manuscript.

Assessing Comments for a Major Revision

Many journals provide authors with a second or, sometimes, a third chance to get their work accepted. This is most likely when the work is sound and interesting to the reviewer but is incomplete in either experimentation or interpretation. The letter you receive will likely state that the work is not acceptable in its current form. The letter may also state that if you wish to submit a revised manuscript after more work has been done, you will need to indicate how you responded to the reviewer's concerns. A journal editor's assumption is that you will follow the reviewer's advice whenever

Yes, you can rebut a rejection decision: You write the editor a letter explaining why you believe the reviewers came to the wrong decision.

possible, even if you aren't happy about it.

Responding to experimental/data issues requires work—sometimes lots of it—and work takes time. To minimize the amount of time and effort, you must prioritize: What are the most important points that the reviewer wants addressed experimentally? Start doing those experiments right away. But sometimes the experiment being recommended simply can't be done in your system. This is not the end for this paper; you may be able to perform a different experiment that would support the conclusion just as well. Often reviewers and editors are happy with this "bait and switch" tactic. If a requested experiment is easy to do, just do it, even if it doesn't tell you anything you did not already know. This sends a message to the reviewer and editor that you are doing your best to follow their advice.

Assessing Comments in a Minor Revision

Sometimes you will receive a letter that tells you that the work is "accepted upon satisfactory responses to the reviewer's concerns." Congratulations! You are almost there. Don't mess it up now! The concerns here usually can be addressed by doing simple experimentation, acknowledging the reviewer's interpretation in the manuscript, or adjusting a few words here and there. These are all easy to fix, so do it. You can actually say: "The possibility exists that the system may also include the brilliant interpretation of reviewer 74; however, much of the data presented here and also by Superstar *et al*. argues that the system will behave as predicted." It might be best to leave out the "brilliant" part, though; the reviewer may think you're being sarcastic. If a reviewer suggests that you change some of the wording to make it more palatable, do it. In the end, the copy editor may change the wording to something completely different anyway.

Responding to Critiques

Your letter to the editor should start politely. Response letters should state that the author thanks the reviewers for their time and effort and their contributions to the work. Moreover, almost all say that addressing the comments of the reviewers and/or doing the recommended experiments strengthened the work. This is basically true, and it tells the editor that you paid attention. Of course, if you decided to do nothing, do not say that you followed the advice of the reviewers. Instead, you should provide a point-by-point response to each reviewer's concerns. If your response is supported by the literature, quoting papers and supplying references will strengthen your point. In places where you and the reviewer agree, you should note in the manuscript where you have made revisions reflecting the reviewer's concerns. This will help the editor and the reviewer (if the manuscript is sent out for re-review) locate your changes and determine if you have really addressed the issues. These point-by-point letters are often very long, sometimes longer than the article itself. Be as succinct as

you can be while also being clear, and avoid derogatory remarks about the review.

Rebutting a Decision

Yes, you can rebut a rejection decision: You write the editor a letter explaining why you believe the reviewers came to the wrong decision. Note how the above sentence is phrased. It doesn't blame the reviewers for not doing their job. If the rejection was based on a misinterpretation of the results by the reviewer, or the lack of an experiment for which you have the results but did not include, then you may have a shot at getting the manuscript re-reviewed. There is the chance that Dr. Stukittume may see your work again, so saying that the reviewer is an idiot and missed the point won't help your cause. You may, however, say, "Reviewer 2 did not realize that the results said blah, blah, blah, and therefore we have now reworded the section to make it more clear."

Before you rush to rebut your rejection, realize that there is a good chance that rebuttal will be rebutted. Your best bet may be to make the changes and submit your manuscript to another journal.

Data Presentation and Poor Writing

Sometimes reviewers have trouble with the way a figure or table is assembled or presented. Certainly, if a reviewer comments that data are not presented clearly, you should fix it. However, to avoid such statements, show the figures to colleagues and ask for their suggestions before you submit your paper.

Receiving a comment that the work needs to be edited by someone who speaks and writes English as his or her primary language is one that should be taken seriously. There are professional science writers who can help. Use them.

Bottom Line

As hard as it is to receive a rejection letter, the key to success in science is to receive criticism as openly as possible and without bitterness, and to respond by incorporating or debating the critique in your revised manuscript. It isn't personal. And remember: You can always revise the work and resubmit it to another journal. Good luck, and happy publishing.

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NOTE: Part 2 of this article can be found at: http://sciencecareers.sciencemag.org/career_development/previous_issues/articles/2730/academic_scientists_at_work_i_can_t_believe_they_didn_t_like_it/part_ii_grant_proposals/