Ten Tips for Research Scholars Aiming for Their First Significant Publication

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In many scientific disciplines, research scholars not only hope to get published but aspire for a prominent authorship position on a journal paper. There is nothing vain about this; for a research scholar, a first-author publication opens doors to advancement because it shows that they can contribute substantially to a research project.

But first, who is a research scholar? Definitions and notions vary. For this article, I define a research scholar as a student in a PhD program or a research-intensive Master's program, or a research assistant in a similar league. If you are an early-stage research scholar in a scientific discipline, you might have some experience with research and even gained authorship credit, but have you played a major role in a collaborative project? Such a role is essential if you hope to see your name as the first author on a published research paper or obtain weighty authorship credit in another form.

In this primer, I concentrate on the outcome—which I call "first significant publication"—and provide a set of tips to help you navigate your way.

1. Leadership: Take the Initiative to Lead

By "lead," I mean leading a research project, or a particular aspect of a project, under the direction of your research advisor.

Perhaps everything has been agreed on and you find yourself playing a lead role without much deliberation. But sometimes—especially in research groups with many students, scholars, and postdocs—you should put yourself forward. You might have to be competitive.

The first step is to discuss the lead role you are hoping for with your research advisor. Do they have an opportunity for you? Or can you think of an opportunity?

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Research scholars in many scientific disciplines often work within a team. Some research colleagues could be less experienced than you and some could be senior (e.g., faculty members). How are you going to convince your team that you are the right leader (or one of the leaders)? Having a positive attitude and a collaborative spirit will go a long way.

2. Teamwork: Agree on Research Questions, Goals, and Authorship

Research scholars do not usually form their project team; this is the responsibility of the research advisor (along with research funding, assistantships, and other matters). However, as a lead project member, you should have a say in the following matters and reach a consensus with your team:

- **Research questions or hypotheses.** What exactly are you going to investigate in your research project? Why does it matter? Reading relevant publications (covered in Tip 6) will help you come up with good research questions.
- **Goals.** This primer is focused on one of the typical goals of a scientific research project: publication in a scholarly journal. In which journal do you hope to publish the paper (or the first paper) emerging from your project? And why? Identify a few target journals at the start of your project, recognizing the many factors to consider.[1] Read the instructions for authors given by your target journals to find out if you need to be aware of anything that concerns the research process. These instructions often cover a lot more than how to format your paper.
- **Authorship.** Use authorship guidelines, such as the International Committee of Medical Journal Editors guidelines,[2] to determine who is eligible to be an author. Then comes the tricky question of the order of authors. Often, the biggest question is who should be the first author? There are many viewpoints and norms on this matter (and much vexation), which you can find online. Authorship pieces in *Science* and *Nature* are

particularly instructive (e.g., Google *site:science.org authorship*). Discussing the order of authors, at least provisionally, at the start of the project can prevent authorship disputes later.

3. Timeline: Be Realistic and Avoid Haste

When you take up a significant role in a collaborative research project, it can be unreasonable to expect that you will reach your publication goal by a certain date. Master's students should be especially careful because they tend to have a graduation date in mind and may not have much flexibility.

Working with your team members and your research advisor, draft a project schedule in the form of a Gantt chart[3] or some other approach. Clarify who is responsible for what. It is likely that not everything will go as per the plan. Update the project schedule as needed; don't give up on it! When a research project seems to drag on indefinitely, it is not necessarily because the research is difficult. Perhaps the research was not treated as a project.

4. Support: Seek Fellowship and Mentoring

By "fellowship," I mean collegiality and a sense of belonging. You will hopefully find this within your own research group but look for it elsewhere too. Join scientific societies in your field and see how you can become an active member. Are there networking or volunteering opportunities?

A mentor is different from your research advisor. A mentor is not formally responsible for your work, and you do not report to your mentor. A mentor is someone who can capably and willingly guide you when you need support and might even be proactive in helping you progress. Is there someone in your research group who can mentor you?

Finally, take care of your health. Burnout is real.[4] Speak with your advisor or mentor if you are struggling to cope. Check if your institution provides support for wellness and mental health.

5. Ethics: Practice Responsible Conduct of Research

Responsible conduct of research (RCR) is a big deal. It encompasses protections for research participants, handling research data, writing and publication practices, dealing with conflicts of interest, and other matters. Another name for RCR is responsible and ethical conduct of research.

Consider this: From July 2023 onward, *all* researchers named on proposals submitted to the US National Science Foundation—not just students as before—must complete RCR training.[5] This shows that RCR is not just something for research scholars to learn. After all, high-profile cases of research misconduct are in the news every now and then.

Even if you are not required to undergo RCR training, it is your responsibility to learn about RCR and practice it. The US Office of Research Integrity provides a detailed introduction to RCR.[6] Your university might provide further guidelines, and you should look up guidelines given by your target journals as well.

6. Reading: Learn How to Read Science

A basic goal of a scientific research project is to advance knowledge. So early on, you need to have a strong grasp of the knowledge that already exists—in other words, the knowledge and findings disseminated through publications (and other sources perhaps, but primarily scholarly publications). With this foundation, you can develop your research questions, make a case for why your research is relevant, design your research methodology, compare your research findings with previous findings, and so on.

Good reading skills are essential to carry out a research project. But it can be hard work to make sense of scientific research papers. What's more, a study in 2017 found that the readability of scientific texts is decreasing.[7]

Instead of assuming you somehow need to get smarter to make sense of papers, look for resources online: there are many; for example, a *PLOS* "ten simple rules" article[8] and a guide published in *Science*.[9]

Upstream from the reading stage is the research access stage. To read research publications, you need to be able to access them. How can you locate the most relevant publications in the ocean of scientific literature? And how can you read publications that are behind a paywall or available only to subscribers? A subject librarian or reference librarian at your university can help you with both. You can also look for online library guides (commonly called "libguides") published by your university or others.

While accessing research, build your own collection of research publications using a reference management tool. Compare the popular tools[10] and find one that works for you. When you write your paper, use the same tool to cite the publications you have used.

7. Focus: Keep the Research Questions in Mind

Recall Tip 2: agreeing on the research questions before you start your research project. Exploratory research has its place, but to orient a research project toward an outcome, such as a publication, you need to set up research questions or hypotheses in advance. The questionable practice of HARKing—hypothesizing after the results are known—was described in 1998,[11] and you can find more recent commentaries online.

A research project can go on for months or even years, and during this journey with all its ups and downs, it is

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possible to lose track of the research questions. Make it a point to always keep the research questions at the center of your project. One easy way to do this is to include them in status updates about your work to your team. This way, you can also gauge how far you have progressed toward answering the questions.

8. Writing: Don't Wait Until the End

"A paper is not just an archival device for storing a completed research program; it is also a structure for *planning* your research in progress," is the advice in a classic essay on scientific writing.[12] Consider using the "outline method" described in that essay to develop your paper.

If you want to learn the nuts and bolts of scientific writing, such as how to write the different sections of a paper or how to write effective sentences and paragraphs, you can find books, library guides, and online courses on this topic. But it can be difficult to get feedback on your own writing beyond what your research advisor offers. If your university has a writing center, do they offer feedback for research scholars? If you have a research mentor (see Tip 4), ask if they can give you feedback on your writing. If you do not have much support locally to improve your writing skills, look at the training or mentoring offerings from the AuthorAID project.[13] (Disclaimer: I work for this nonprofit project.)

When developing your paper, your target journal's instructions for authors can be your friend or your enemy, depending on when you refer to these instructions and how seriously you follow them. Referring to these instructions only after you finish writing your paper will likely result in much frustration and lost time. Keep the instructions handy throughout your research-and-writing journey, and do not ignore anything in the instructions.

Finally, do not forget to cite as you write, making use of a reference management tool (see Tip 6). A good citation habit can be a bulwark against plagiarism.[14]

9. Visuals: Master Tables and Figures

Tables and figures are crucial elements of scientific communication in many disciplines. Tables, well, present data in a tabular format. They can be complex, but figures are certainly more diverse: images obtained from scientific processes or equipment, diagrams of experimental setups, charts showing data, etc. A sustained reading of scientific papers (see Tip 6) will help you get a sense of how tables and figures are presented and how they are referred to in the text.

Designing effective figures can be especially challenging. Researchers in the biological sciences (and possibly other disciplines) will benefit from the large collection of articles on data visualization available on the *Nature* website.[15] Guidelines can also be found in style guides such as *Scientific Style and Format*[16] and in the instructions for authors given by journals.

Be careful to avoid image manipulation, a matter of increasing concern[17] and related to RCR (see Tip 5).

10. Peer Review: Keep Calm and Carry On

Once you have completed your research-and-writing journey and double-checked that your paper complies with your target journal's instructions for authors, you will submit the paper and wait for the peer review process to run its course. (Rejection before peer review can happen, but let's stay positive.) You should then be prepared to get a variety of comments from multiple peer reviewers. These comments can be minor, major, constructive, affirming, annoying, upsetting, disheartening … as you go through your research career, you will likely attach further adjectives.

Dealing with reviewers' comments can sometimes be easy, and it can sometimes require not just much revision to your paper but also much tact in responding to the comments. The first thing to recognize is that the first author should not automatically be saddled with the bulk of the work. All the authors should be involved in this effort, taking responsibility for the part of the paper (and the related part of the research) in which they had a role to play.

Responding to reviewers' comments is often the last mile to publication, and the going can get tough. You are not alone: the complexity and emotional toil of this stage is understood, and you can find advice online.[18]

Closing Words

Your first significant publication is a milestone—and something you want to be proud of. I hope this primer is of some use in helping you get there.

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