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How to navigate authorship of scientific manuscripts

By **Elisabeth Pain** | May. 6, 2021 , 1:35 PM

"There hasn't been any point during my career when recognition through authorship has not been essential," says **Martin Rolfs**, a professor in experimental psychology at the Humboldt University of Berlin in Germany. As a Ph.D. student and postdoc, a good publication record was crucial for proving himself capable of successful and independent research and securing that next academic job. Now as a principal investigator (PI), "I need publications to ensure the visibility of my lab, to attract good students, and to continue to secure funding."

The importance of publications won't come as news to anyone who has been in academia for a while. Still, Rolfs's comments underscore the importance of not just doing good science, but also ensuring you receive appropriate recognition for it—particularly when it comes to authorship. For early-career researchers, in particular, it can be difficult to assess what contributions to a project

warrant authorship, and negotiating a fair spot on the author list may feel like walking a tightrope. But, Rolfs emphasizes, because there is a snowball effect whereby "academia rewards those that have been rewarded in the past … getting credit for contributions could not be more important for early-career researchers."

Norms and culture vary among research disciplines, countries, and even institutions, and early-career researchers need to make sure they are familiar with the rights and responsibilities that come with authorship in their field. But there are some commonalities in the issues surrounding authorship and the possible approaches to tackling them. To offer some guidance, *Science* Careers spoke with scientists in a range of fields and career stages about their practices and experiences. The responses have been edited for clarity and brevity.

In your experience, what constitutes authorship and how is author order determined?

Typically in my field, the first author is the one who makes the most significant contributions to the research work, such as acquiring and analyzing the results, or to writing the manuscript. The last author is the lead PI, who has supervised, financed, or otherwise been the main person responsible for the project. The order of the co-authors typically reflects the relative significance of their contributions. But since projects and contributions vary in nature, in practice it may require case-by-case assessment and even negotiations between the authors. The originality and volume of researchers' contributions and the time spent can all be taken into consideration. It may be easier for a more senior scientist, ideally the PI, to be responsible for assessing and negotiating authorship between contributors. As for the corresponding author, it used to be a mostly administrative role, taken by either the first or the last author. But in my experience, this role is gaining importance and recognition and may also be discussed during authorship negotiations.

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Most often in my field, it is the researcher who developed the experimental design and did most of the work who signs first and decides the authorship of the rest of the team in negotiation with them. Other times, for instance when the collaborative work is divided equally between authors or for papers in high-impact journals where the stakes are higher, it is the leader of the research group who decides who is listed as an author and in what order.
- Nohemi Sala, researcher in paleobiology at the National Research Center on Human Evolution in Burgos, Spain

In my discipline, there are many large collaborations—each with its own set of rules. Usually there is a memorandum of understanding to sign when entering the collaboration that clarifies publication policies. Because often there are hundreds of collaborators, adopting an alphabetic author list is a common practice. However, in most other cases, a contribution-weighted author list is a fairer recognition of everyone's work.
- Eleonora Troja, associate research scientist at the University of Maryland, College Park, and program lead at NASA Goddard Space Flight Center

In my field, the first author is usually the person who conducted most of the research tasks and wrote the first draft of the manuscript. Other collaborators might have been involved in the conceptualization or validation of the work, and they will revise or comment on the paper. Authors are listed according to the degree of their contributions, with the last position reserved for the supervisor or most senior person. The corresponding author is usually the one who had the main idea and invited other collaborators or delegated tasks. While all authors are responsible for the work and review the final version of the manuscript with a fine-tooth comb, the corresponding author is ultimately in charge of submitting the paper and is responsible for the overall integrity of the work.

paper
By Elisabeth Pain | Mar. 21, 2016

- *Mohammad Hosseini, recent Ph.D. graduate in research ethics and integrity at Dublin City University in Ireland*

In my lab, first authorship usually goes to the person who invested the most time in the project and wrote the paper. Senior authorship goes to the adviser who not only secured funding and provided a lab, but also contributed intellectually at all stages of the project. If another lab member gets involved, then they would become middle author. One of the reasons for these slim author lists is that our projects often have a time frame of several years, and because authorship entails responsibility for the final content of the paper, contribution requires a long-term commitment. Longer author lists are usually the result of collaborations outside the lab, often with researchers from other disciplines, and authors from the lab that contributed less are sandwiched between authors from the lab contributing more. Now, not every type of task warrants authorship. Data collection alone, for instance, or the occasional feedback that I consider part of a healthy lab culture is usually listed in the acknowledgments instead. Intellectual contributions to the project's idea, key contributions to the experimental design, or specific data analyses do warrant authorship. The corresponding author is usually the person assuming responsibility for future exchanges about the project—so the Ph.D. student or postdoc, provided they intend to continue to do research in this domain. Otherwise, it would be the PI (me).
- *Rolfs*

Clarifying with your PI what is and is not deserving of authorship will help you objectively assess whether you should spend time and resources on a specific project, and if so what your contribution should look like to result in authorship. Many early-career researchers fall into the trap of doing tedious work like changing media on cells and running assays, only to find out later that this is not authorship worthy. In most labs, authorship will reflect the intellectual nature of your work, such as generating a hypothesis, designing experiments, conducting analyses,

doing literature reviews, preparing data figures, and writing the manuscript's discussion.
- *Timothy Kassis, lead machine learning engineer at Matterworks in Boston, Massachusetts, and former academic who studied authorship criteria*

What has your experience been establishing and negotiating authorship? Were there any strategies you found helpful?

Most research is unpredictable, and deciding authorship at the beginning of the project can lead to many issues down the road. Authorship should be determined by the lead author once the research is complete and the team is about to start writing the manuscript. For this to work correctly, however, there need to be clear guidelines in the lab based on a field-level understanding of what it means to see a name on a manuscript. Every lead author I worked with made a fair decision of where in the authorship list I should be without me negotiating. I attribute that to me being explicit about the work I was doing throughout the research process. I have also been fortunate to work with PIs who always understood and respected my contributions.
- *Kassis*

As an early-career researcher, it has in most cases been clear that I would be the first author because I was the main person responsible for planning and carrying out the project and writing the manuscript. But in international collaborations and interdisciplinary projects, expectations and conventions for assigning authorship may differ significantly between countries and research fields. I have taken part in larger collaborations where authorship was discussed at the stage of either planning the research or starting to write the manuscript. My best advice is to agree explicitly and in writing about contributions, roles, and authorship, and to discuss the corresponding obligations and responsibilities as early in the process as possible. Because research projects do not always go as

planned, it may also be useful to agree on conditions or a specific time for re-evaluating authorship. And if during the project you feel you are being required to make contributions that are not in line with this agreement, raise the issue as early as possible. Perhaps because they are used to collaborating under implicit understanding with their peers, some researchers may be offended by newcomers seeking a written agreement before committing to a project, or they may try to convince you that this practice is somehow inappropriate. However uncomfortable this may get, remember that it is much preferable to facing misunderstandings or disagreements at a later stage, when the stakes are higher. In case of disagreement, find an arbiter whose judgement and authority all parties trust and respect.
- Prisle

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It is often difficult to know the extent of our contributions to a project in advance. I recently published a paper with four other researchers who were initially also finishing their doctoral studies at my institution. Upon graduating, we all took jobs in different parts of the world, which considerably shifted our contributions. It was key to keep the communication channels open and to renegotiate the authorship order based on our actual contributions.
- Fabio Ferraz de Almeida, postdoctoral researcher in

language and communication studies at the University of Jyväskylä in Finland

I always negotiate publication authorship at the start of a project or when the outputs of a project are being agreed upon, with the whole team or with the PI. I think it is helpful for everyone to sit together early on to clarify tasks, roles, and authorship. In the rare situation that an issue has arisen, I discussed it with the PI. Thus far, I have always been able to resolve any issue this way. If this failed and I did not believe things had been handled fairly, I would think about approaching a senior colleague within the department for advice. Discussing a difficult situation with an impartial colleague or a coach can help to clarify your thinking and to prepare your rationale for a negotiation.
- ***Anjali Shah**, medical researcher and part-time researcher developer at the University of Oxford in the United Kingdom*

Our PI has individuals in his group undertake very different projects that are not directly related. This way, everyone gets credit for their work in a supportive, multidisciplinary environment. When establishing outside collaborations, we have an open discussion and collectively agree on how individual contributions will be credited. It is always useful to document any form of agreement about what will constitute authorship and what will constitute acknowledgment in an email summarizing the meeting. This way, there is a record of the consensus that was reached in the unfortunate circumstance that recognition becomes threatened or ambiguous.
- ***Daniyal Jafree**, M.D.-Ph.D. student in vascular biology and renal medicine at University College London Great Ormond Street Institute of Child Health in the United Kingdom*

When no formal framework is in place, contributions and authorship should be discussed at the beginning of the project and in very clear terms, especially for a high-impact publication or if it is the first time two groups

collaborate. If I feel that my contribution is fundamental to the work, then it is particularly important to negotiate a good placement in the author list—and if my collaborator is bringing substantial value to the work, it is important to recognize that as well.
- *Troja*

As a postdoc, discussing authorship upfront made it possible to collaborate with other postdocs on a couple of projects such that each of us could be first author on one of them. I also found that when working with colleagues from other disciplines, raising awareness of the publication culture in your own field and learning about your collaborators' can help find solutions that serve everyone.
- *Rolfs*

Have you dealt with any authorship disputes? How were they resolved?

I ran into a very uncomfortable situation once when an early-career researcher, also working under my postdoc adviser but on a different continent, wanted authorship on a paper I had already written as first author. This was a result of miscommunication, as I had discussed the topic of the project with them at a conference, so they felt like they had been part of its conception. Fortunately, my adviser was able to weigh in, reconstructing the genesis of the idea by going through my email exchanges with him and recorded workshop presentations prior to the conference. Ultimately, the author list was kept unchanged. One lesson I learned is to follow up on discussions, however informal they may seem, with a short email clarifying what I took home from the conversation. I was also in a situation as a Ph.D. student where my contribution to a project did not explicitly make it into the final publication due to space constraints during the revisions. The more senior authors of the paper persuaded me to stay onboard, partly to document the collaboration between psychology and physics (a political reason) but also because the dataset I had

collected and analyzed had independently validated the method that was the object of the paper. This shows that contributions at all stages of a project should be considered for authorship, and communication should remain open and fluid between authors.
- *Rolfs*

Early in my career, more than once senior colleagues either took my spot in the list or replaced me with their protégé. From this, I learned to negotiate authorship *before* sharing any proprietary data or giving up any leverage you may have, and to avoid sharing ideas before confirming your role in a project. It can also be important to clarify in advance how the young researchers will fit into the political scheme. My first high-profile publication created turmoil—but then, many high-profile publications do, I later learned—as a senior member of the collaboration was not happy about a potentially important article being led by an unknown second-year grad student. I was lucky that some rules were in place and allowed me to keep my first-author position, but senior colleagues who acted as mediators advised me that it was better not to create further tension and to avoid a high-impact journal; the paper was eventually published elsewhere. This and other times when I felt that my contribution was not fairly recognized I usually spoke with my supervisor. A few times he intervened, but most of the time he would advise me on who would be the best person to talk to or how to present the problem without creating a fracture in a professional relationship.
- *Troja*

For most junior researchers, the biggest challenge is asserting themselves respectfully. This means raising issues in a calm and sensible manner, without feeling paralyzed by concerns about potential repercussions or the reactions of other collaborators. My strategy is to book an appointment for a chat with a neutral person outside the collaborative group to get some perspective. Before the meeting, I describe the issue on paper in a few bullet points, sleep on it, and reword it if needed. This

way, I can present my story clearly. More importantly, writing about the issue releases some of the anger and stress, so the meeting is more constructive and less tense.
- *Hosseini*

What skills and qualities are valuable in authorship negotiations?

First, it is important to do your work competently and to develop excellent science. Then it is easier to gain recognition if you have leadership skills and become one of the main authors than if you wait passively for tasks to be sent your way. A participative, communicative, and open-minded attitude also helps. Also, be cautious when weighing your degree of participation in a project or paper, especially when you are early in your career. You can make the mistake of overestimating your contribution by belittling the work of other colleagues. Try to be equitable when evaluating the degree of authorship emerging from your work.
- *Sala*

As an early-career researcher, sometimes it can feel awkward or out of place to speak up about whether and how you are going to be acknowledged for your contribution. It can help to just be pragmatic and voice your opinion. It can also help to be proactive and keep a permanent record of individual contributions in case a situation arises where you need to justify why you deserve authorship.
- *Jafree*

Assertiveness, and a good sense of respect for yourself and others. In many situations, we overestimate our own contributions while underestimating those of others. When you are upset or in a crisis, communicate your worries to a more experienced, neutral colleague or mentor instead of judging your collaborators or ruminating in your own head. The most important quality when seeking advice is honesty, combined with the

willingness to provide a full account of events and the preparedness to be told that you are wrong.
- *Hosseini*

It is the responsibility of each researcher to speak up for themselves and to do so in a considerate manner. If you wish to bring up an issue of authorship, it is important to be simultaneously humble and confident. Be as transparent as possible by addressing all co-authors collectively, for example in a common meeting or email. Try to express yourself in a clear and neutral way, to be open to the experiences and perspectives of others, and to be fair. When presenting the case to a senior colleague or mentor, be honest to yourself about whether you seek to be comforted in your own perspective or to truly understand the situation. Both aspects are needed at times, but if you act on a perspective that was offered as comfort as if it were a fair and impartial assessment, you may end up doing yourself a disservice.
- *Prisle*

Everyone should develop communication and negotiation skills throughout their career. Attending courses on assertiveness and how to have difficult conversations can help.
- *Shah*

Make sure you communicate with the lead author and your PI during the entire research process. Be explicit about the work you are doing in one-on-one research updates and send weekly or monthly summary emails to the lead author describing what you have done and the results you have.
- *Kassis*

I learned to be proactive and make my contribution visible in a more tangible way by bringing in resources. For example, I started to write funding and observing time proposals to pursue my research. There is a world of difference between saying, “I had this idea first” and “I am the Principal Investigator of this project.”
- *Troja*

What guidelines or sources of advice have you found most helpful in determining authorship?

First, make sure you know both your rights and your obligations, including the general ethical and authorship guidelines at your institution and in your research field. In case of doubt, ask a trusted senior colleague for their perspective. I have also in some cases asked for advice and specific guidelines from the editorial office of the target journal. Many institutions also have research ethics counselors, and it could be a good idea to contact them for advice before raising any major concerns.
- *Prisle*

The **ICMJE [International Committee of Medical Journal Editors] guidelines defining the roles of authors and contributors** are one of the most useful sources. **The Embassy of Good Science** platform for research integrity and ethics also contains a myriad of useful resources. In addition, almost all journals and institutions offer guidance on authorship, and those that have adopted the **CRediT taxonomy** provide further clarity about contributor roles. It is important to realize that conventions may differ by discipline, country, institution, or even departments. Especially in international environments, where the cultural imprints and communication styles of team members might vary significantly, nothing in authorship attribution should be assumed or taken for granted.
- *Hosseini*

Guidelines on authorship will never be completely clear due to the open texture of language. What constitutes a "significant contribution," for example, varies considerably across disciplines and can only be determined on a case-by-case basis. It can be useful to contact and discuss these issues with senior academics, especially your former supervisors.
- *Ferraz de Almeida*

Concrete recipes like the one proposed by Stephen M. Kosslyn, which **determines authorship by distributing**

points among researchers based on their contributions, can help make criteria and responsibilities more transparent. Another resource I find useful is **Alex Holcombe's tool Tenzing**, which helps keep track of the initial expectations and actual contributions throughout the lifecycle of the project to facilitate their reporting in the final publication.
- *Rolfs*

What further advice do you have for early-career scientists about authorship?

There will always be more ideas than you can work on, and you do not need to be part of every project. Over time, I learned to balance the effort with the outcome. Also, there may be times when you realize that someone else would take your project to a different level. If so, make that happen, give them the credit they deserve, and learn as much as you can in the process. If, however, an authorship disagreement persists during a collaboration, you may want to suggest that you take the lead on a different project you are working on together. And if you find the working atmosphere becomes unbearable, moving on entirely might be the healthiest option.
- *Rolfs*

Choose to work under a PI who fairly values each lab member's contributions and gives credit to all deserving parties. You may get an idea of this by speaking to the PI, reading their papers, and examining how many times early-career researchers are co-authors. It can also be useful to speak to past or present group members who are willing to discuss how authorship and credit are handled in that lab.
- *Jafree*

We all know stories about senior academics bullying early-career researchers to include their names in academic outputs, even though they have done nothing more than sharing insights during a meeting or commenting on a draft of the paper. Before deciding to

collaborate with someone, it may be worth asking around about the person's professional reputation. Do they value teamwork? Have there been any issues regarding authorship or recognition in previous collaborations? Academic pirates are everywhere, and early-career researchers are best off steering away from them.
- Ferraz de Almeida

Being a co-author means accepting shared responsibility for the work. As science becomes more and more interdisciplinary and based on large collaborations, this involves increasing levels of trust in the quality assurance provided by your co-authors for the parts of the work where you are not an expert.
- Prisle

While a discussion at the beginning of a research project might reduce the likelihood of disagreements, it is not a guarantee for seamless and fair attribution of authorship. All along the project, the collaborative environment should be such that members are able to communicate their concerns without being ignored or feeling like they are walking on eggshells. For young researchers, refraining from raising their concerns could lead to grudges and resentment toward more senior colleagues. Experienced researchers, on the other hand, should beware taking their juniors' apparent lack of disagreement with authorship decisions as synonymous with content.
- Hosseini

Don't rely too heavily on external recognition as a validation of your work. It is important to first be aware and confident about the value that you bring and then to seek proper credit for it. Another potential mistake is to get lost in large collaborations and routine work without cultivating your own scientific identity and independence. Authorship is the most immediate way to associate a researcher with their work, but you can also actively pursue other avenues of recognition.
- Troja

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