FACETS
a multidisciplinary open access science journal

PERSPECTIVE

Ten strategies for avoiding and overcoming authorship conflicts in academic publishing

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OPEN ACCESS

Citation: Cooke SJ, Young N, Donaldson MR, Nyboer EA, Roche DG, Madliger CL, Lennox RJ, Chapman JM, Faulkes Z, and Bennett JR. 2021. Ten strategies for avoiding and overcoming authorship conflicts in academic publishing. FACETS 6: 1753–1770. doi:10.1139/facets-2021-0103

Handling Editor: Yann Joly

Received: July 19, 2021

Accepted: September 13, 2021

Published: October 21, 2021

Published by: Canadian Science Publishing

Abstract

For better or for worse, authorship is a currency in scholarly research and advancement. In scholarly writing, authorship is widely acknowledged as a means of conferring credit but is also tied to concepts such as responsibility and accountability. Authorship is one of the most divisive topics both at the level of the research team and more broadly in the academy and beyond. At present, authorship is often the primary way to assert and receive credit in many scholarly pursuits and domains. Debates rage, publicly but mostly privately, regarding authorship. Here we attempt to clarify key concepts related to authorship informed by our collective experiences and anchored in relevant contemporary literature. Rather than dwelling on the problems, we focus on proactive strategies for creating more just, equitable, and transparent avenues for minimizing conflict around authorship and where there is adequate recognition of the entire process of knowledge generation, synthesis, sharing, and application with partners within and beyond the academy. We frame our ideas around 10 strategies that collectively constitute a roadmap for avoiding and overcoming challenges associated with authorship decisions.

Key words: authorship, conflict, peer review, academic publishing, power imbalances, editors, authors

Introduction

For centuries, the scholarly periodical (herein called a "publication") has served as the primary mechanism by which knowledge is shared and archived (McKie 1948; Kronick 1991). Such publications create a legacy and allow one to track developments of knowledge, ideas, and disciplines through time and use various peer-review models to (imperfectly; Henderson 2010) ensure that contributions meet disciplinary standards (Burnham 1990; Spier 2002). The scholarly publishing world has evolved from handwritten text and illustrations to the transformative printing press era (Eisenstein 1980), and finally the electronic periodicals of today that reside in online archives (Trealor 1996; Kling and McKim 1999). Other somewhat recent changes include the emergence of open access publishing (Laakso et al. 2011; Lewis 2012), greater transparency by publicly sharing the data and materials upon which a publication is based (O'Dea et al 2021), and enhanced

peer-review processes intended to reduce bias and increase rigour (e.g., double blind referee models or, conversely, open review processes; Rowland 2002; Lee et al. 2013; Fresco-Santalla and Hernández-Pérez 2014). Through time, the scholarly publishing world has also become a highly profitable sector—this is increasingly regarded as problematic given that most labour is borne by the scientific community, which is overwhelmingly funded by public money (Buranyi 2017). What is certain is that the publishing world will continue to evolve such that the scholarly "paper" of the future will look and be very different from the scholarly paper of today (Sopinka et al. 2020).

One issue that has existed since the emergence of the scholarly literature is authorship. Early publications tended to be sole author or with very few authors. Such practices may have overlooked other individuals potentially deserving of authorship. Although it is impossible to know, we speculate that discussions around authorship may have been common at that time among those excluded from authorship. For example, Rosalind Franklin should clearly have been an author on Watson and Crick's (1953) paper describing the structure of DNA (see discussion in Maddox (2002) and Percec and Xiao (2021)). Through time, the number of authors on a given publication has increased dramatically. From 1960 to 1980, the number of authors per article in 10 psychology journals increased by 48% (Sacco and Milana 1984). Aboukhalil (2014) reported a five-fold increase in the mean number of authors since 1913 and predicted that by 2034, publications will have an average of eight authors. The reasons for this increase in number of authors are complex and varied (see Stephan 2012) and appear to be most common for massive international experiments that require specialized infrastructure (e.g., sequencing genomes, revealing the mysteries of matter using particle accelerators), large data sets, and (or) team production models (Kuld and O'Hagan 2018). For example, the emergence of big team science (Wuchty et al. 2007), such as in experimental particle physics, has seen the emergence of multi-authored publications arising from consortia with thousands of coauthors (called hyper authorship; Cronin 2001). Modern communications technology and efficient travel networks enable scholars to reach out and connect with collaborators and build teams more easily than centuries or even decades ago (Rosenblat and Mobius 2004; Sonnenwald 2007). Moreover, there is greater appreciation for interdisciplinarity, which inherently requires multiple scholars (Porter and Rafols 2009; Andersen 2016; Cooke et al. 2020). Nonetheless, increasing the number of authors also has the potential to improperly credit individuals who failed to be meaningfully engaged with the research through various processes such as gifting authorship (Smith 1994; Wislar et al. 2011) or bullying (often by senior scholars given power differentials; Avila 2014).

Today, discussions continue around what constitutes authorship and who is deserving of such credit, fueled by what some regard as a worrying trend towards increasing the number of coauthors. Some of these discussions occur very publicly (as blogs, news items, or formal investigations led by journals or institutions; see Fleming 2021) but we presume that most are dealt with privately (or not at all), where individuals may hold grudges for being excluded or other coauthors (or members of the scholarly community) think individuals listed as authors are undeserving. At its core, authorship is about credit for activities that directly (or indirectly) enable the research as well as accountability for the outputs (both how the work was conducted and how it is reported). Often, authorship is thought to require some combination of idea generation, funding/project administration, data collection, analysis, interpretation, and reporting (e.g., COPE guidelines, the CRediT Taxonomy; see Allen et al. 2014; Brand et al. 2015). Yet, increasingly, other contributions are also being recognized (e.g., co-production, knowledge brokering) and may extend to include stakeholders and rightsholders (Cooke et al. 2021). The responsibility and accountability that accompany authorship emphasize that such positions are not trivial (Wager 2019; note that some have argued for decoupling credit and responsibility—see Paneth 1998). Authorship is used to assess performance and thus influences hiring decisions, promotions, awards, scholarships, salaries, funding, and invitations to serve or participate in prestigious activities that are beneficial to career advancement (Cronin 2005; Wager 2019).

The questions are many: Who deserves authorship? What are the ways in which contributors can earn authorship? How do we guard against gift or unwarranted authorship? What does authorship signal or mean to the broader community? And how do we overcome issues and conflict around authorship? Arguably, answers to these challenges are not straightforward. Indeed, these topics are timely and have been raised in a recent *Nature* Careers article (Fleming 2021). Here, we discuss key elements of authorship decisions informed by our collective experiences and relevant contemporary literature. Rather than dwelling on the problems (see Horton and Smith 1996, for example) we focus on proactive strategies for creating a more just, equitable, and transparent future where conflicts around authorship are minimized and where there is greater respect for the entire process of knowledge generation, synthesis, sharing, and application with partners within (including in other disciplines) and beyond the academy. We frame our ideas around 10 strategies for avoiding or overcoming perpetual conflict around authorship that collectively constitute a roadmap.

We focus on authorship in the context of credit and contributions but acknowledge that accountability and responsibility for research outputs is also an important topic. Indeed, potential authors need to have a full understanding of the responsibilities assumed when they assign their name to a publication. Yet, we submit that issues of accountability and responsibility are far less likely to lead to conflicts about authorship than issues of credit and contributions. There certainly could be instances where there is conflict related to research ethics, analysis, or interpretation which may be best addressed by Strategy 8 below. We take accountability and responsibility seriously and encourage ongoing discussion with potential authors about what being an author means beyond credit (see Rennie et al. 1997; Weltzin et al. 2006; Alfonso et al. 2019). It is worth noting that the Council of Science Editors suggests that "The ultimate reason for identification of authors and other contributors is to establish accountability for the reported work" (CSE 2018). We anticipate more discussion on this topic in the coming years as there is a move towards more inclusive authorship practices (e.g., see Cooke et al. 2021).

Our team is based mostly in North America and includes established scholars (including those who hold positions as journal editors) and early-career researchers, many of whom work at the interface of the natural and social sciences (focused on environmental problems and solutions). Thus, the perspectives shared here are informed by this context. We acknowledge that failure to attribute authorship to someone deserving of such credit and the attribution of authorship in cases where unwarranted are both problematic. We also recognize that there are different disciplinary cultures regarding practices such as author order and typical numbers of coauthors (Teixeira da Silva and Dobránszki 2016; Marusic et al. 2011). Moreover, some types of papers such as horizon scans or evidence syntheses may inherently have more authors than other article types (figshare.com/articles/poster/sys_rev_authorship_pdf/3178735/2#:~:text=Systematic%20reviews%20are%20generally%20considered,into%20question%20their%20methodological%20rigor) while books, especially in the humanities, often have a single author. In other words, there will always be exceptions to the examples we present here. Although we do not specifically target early-career scholars, we submit that our ideas are most salient for them as they navigate the world of scholarly publishing and co-authorship in the spirit of trying to achieve an increasingly equitable, inclusive, and fair publishing system.

Ten strategies for avoiding or overcoming conflict

We identify 10 proactive strategies for avoiding and overcoming conflict related to authorship in academic publications. We acknowledge the inherent interconnectedness of both issues and strategies, so we have identified linkages by flagging connections among strategies where relevant.

Strategy 1: Initiate discussions about authorship expectations early

Authorship issues are best tackled at the beginning of a project rather than when papers are being prepared for submission (Erlen et al. 1997). Unfortunately, that rarely happens. In fact, discussions about authorship should be tackled when research teams are being assembled for specific projects (Dulhunty et al. 2011). There may be scenarios where, for example, a trainee is being recruited into a program where there are norms around collaboration and joint authorship. This should be made clear to the trainee at time of recruitment (Arthur et al. 2004). Similarly, there may be instances in which a collaborator is invited to join an existing team. If the idea is to work collaboratively on joint outputs, then that should be made clear from the beginning. Discussing authorship issues during the earliest phases of project development (and even potentially developing an authorship contract not unlike a so-called prenuptial agreement used in some marriages; Gadlin and Jessar 2002; APA 2006; Flemming 2021) represent a good practice for reducing related conflict. More broadly, there is a need to engage in debate and discussion around authorship as a scholarly community starting during undergraduate training. Much effort is devoted to educating students about issues such as plagiarism and academic integrity but rarely does that extend to issues of authorship. Not only are most trainees naïve to authorship issues and practices, but mentors are also often ignorant of the lack of knowledge about authorship held by their trainees, emphasizing the complexity of the problem (Abbott et al. 2020). We acknowledge that most undergraduates are not publishing in scholarly journals but argue that this early training stage is the time to begin such discussions and explore what authorship means (Abbott et al. 2020). In graduate school, such discussions should be more extensive and common whether during lab meetings or in formal graduate courses dealing with professional development and scholarly communication (Jahanfar et al. 2017). Mentors of undergraduate and early-stage graduate students play a key role in introducing new scholars to the world of scholarly publishing and authorship (Oberlander and Spencer 2006). This responsibility should not be taken lightly because early-career scientists are particularly vulnerable to the repercussions of authorship conflicts (Eden et al. 2018). Early communication within research teams and better training (formal and informal) opportunities for aspiring scholars both have the potential to reduce conflict.

Strategy 2: Consult guidelines but don't be constrained by them

Guidelines can serve as a resource for avoiding or navigating authorship disputes. Guidelines are typically divided into two categories: (*i*) emphasis on best practices to avoid authorship problems from the outset and (*ii*) strategies for managing authorship issues once they have occurred. Although preventing the problem is certainly most desirable, it can be challenging to account for all possible authorship issues in advance. Guidelines often promote the need for transparency around contributorship (i.e., a clear indication of who contributed to the research and in what capacity). In cases where a dispute does occur, guidelines often recommend that there be a process in place to manage and resolve disputes in a fair manner. There are various sets of guidelines that can provide helpful direction (Osborne and Holland 2009). Authorship guidelines come in many forms and are provided by a range of stakeholders, including organizations or scholarly societies, publishers or journals, research institutions, and the authors themselves. For example, the Committee on Publishing Ethics (COPE) provides guidelines, best practices, and resources to help authors, editors, publishers, and others navigate a range of authorship disputes (Dance 2012), including a guide for new researchers to deal with authorship disputes and a flow chart to recognize potential authorship problems. The Council of Science Editors has prepared a report on the promoting integrity in journal publications which includes discussion of conflict and best practices (CSE 2018), and the International Committee of Medical Journal Editors has generated recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals (ICMJE 2019). Transparency among authorship has been investigated by researchers (e.g., Clement 2014) and further developed by taxonomies such as CRediT that provide a framework for authors to identify contributorship and

promote transparency around "who does/did what". Many publishers provide general or journal-specific guidelines on authorship (Resnik et al. 2016) and these resources may serve as an initial starting point for discussion among co-authors. Research institutions or departments may also provide guidance for authorship in scholarly publications (e.g., Yale's Office of the Provost). Ultimately, authors themselves may benefit from developing their own authorship policies and guidelines, perhaps based on the examples provided by the journals to which authors frequently submit. The key aspect to consider about guidelines is that "best practices" are just that; there is rarely a one-size-fits-all strategy that works for all authorship issues. Guidelines can be an important mechanism to avoid and manage authorship disputes, but much of the responsibility falls on the authors themselves, particularly the lead author and corresponding author, to ensure that they are familiar with the guidelines that are available to them and that they strive to follow best practices to mitigate potential conflicts.

Strategy 3: Document contributions and communicate frequently

In collaborative environments, keeping track of ideas and contributions can be tricky. A conversation in a pub or coffee shop can turn into a major paper. Lab members can make key (and potentially unrecognized) contributions to papers through informal meetings, for example a postdoctoral fellow providing frequent statistical help to a graduate student. Group members can express an interest in a particular paper, and then the persons leading the paper can forget to follow up. Conversely, people can make commitments or even stake claims to ideas and never follow through. A key to solving this is to keep good records (Fleming 2021). Maintaining a document with group project ideas can help collaborators determine how their own ideas can contribute to the group's work (Strategy 2). Such a document can also be used to solicit help on projects, so early contributions and commitments are not forgotten (APA 2006). Once a paper has been initiated, the contributions of authors can be tracked in a summary document. Contributions can also be invited via this document, and then periodically updated as people's roles (inevitably) change. An excellent example of a collaborative group in the realm of ecology that carefully documents authorship is the Nutrient Network (NuNet; nutnet.org/authorship), which tracks papers and authorship using a clear stepwise process, including authorship summary documents whereby authors track their contributions to every paper. In addition, it is good practice to clearly communicate any changes in vision or scope for a project when they occur, so disagreements can be resolved quickly. This is particularly important for interdisciplinary papers, where authors from different knowledge backgrounds need to develop and maintain a cohesive vision. Although documenting and communicating paper contributions can seem burdensome, it is worthwhile. Journals increasingly require authors to outline their contributions to papers (e.g., CRediT Taxonomy; Strategy 2). Tracking contributions from the beginning can avoid any problems with this. In addition, having clear documents can help authors refresh their memory on original vision and help them keep to their commitments to contribute.

Strategy 4: Transparency and open scholarship can help

Open and transparent communication among team members is a cornerstone of respectful and rigorous authorship decisions. In situations where deception or bullying can occur (see Strategy 10), traceability of authorship discussions and decisions will help avoid conflict. In this regard, the practice of preregistering decisions about data collection and analysis for a research project can assist with authorship attribution (see Mellor and Nosek 2018; Nosek et al. 2018). In practical terms, this means archiving a document outlining planned author contributions on an online repository (e.g., osf.io), where it can be time stamped and version controlled. In this way, the document can evolve to reflect changes and progress in author contributions while providing an unalterable record of decisions made throughout the process (Strategy 2). At the onset of the project, group members should decide to keep this record private (i.e., accessible only to group members) or to make it publicly available for

added transparency (the document can be shared publicly at any point in the research project). Other practices associated with open scholarship can also help adequately credit contributions to a paper. Namely, authorship should be discussed in the context of research outputs other than the scientific paper. Data, code, software, and other research materials (e.g., questionnaires, protocols) are increasingly recognized as important, standalone scientific products (O'Dea et al. 2021). As with papers, these outputs can be given permanent identifiers (e.g., a DOI), allowing them to be cited. However, there is little discussion of authorship decisions pertaining to such outputs. For instance, one key question is "Who should be an author on the data set and (or) code associated with a published paper?" Should authorship include all contributors to the paper, only the data and (or) code generator(s), or the data and (or) code generator(s) and the supervisor(s) who might have contributed to the study design but not the data collection or analysis? These questions are ripe for reflection since authorship decisions in this broader context are key to recognizing individual contributions and establishing accountability. Proper attribution of credit through authorship of these scientific contributions can also help career advancement, particularly for early-career researchers, as a growing number of scientists and institutions recognize the value of sharing research products beyond scientific papers (Moher et al. 2018).

Strategy 5: Responsible inclusion in scholarly authorship

Publication is the core currency of science, and research teams have a responsibility to be inclusive of those that contribute to realizing a project. Even best intentions for generating an author list can struggle to strike the correct balance between exclusivity, and inclusivity is challenging as expectations and norms differ among disciplines and shift with time and space (Patience et al. 2019; Strategy 9). Therefore, responsible inclusivity is challenging; being exclusive can be viewed as gatekeeping and bullying to hold others down, but being inclusive can inflate metrics and may be a form of tokenism in which authorship is exchanged as a token offered to motivate data collectors, foster better relationships, embellish grant or scholarship applications, or compensate for favours (Brand 2012). But what are the sanctions for being inclusive and including honourary authors or exchanging authorship as a token? Some have supported fractional authorship such that credit for a co-authored paper is assigned based on the number of authors (i.e., 1/N; see Van Hooydonk 1997). But ultimately, it seems that the consequences faced by those that are inclusive are often relatively immaterial despite the benefits being very tangible, for example for reputation and network building. Deciding who to include must consider the historical contexts in which individual contributors exist and authorship should be built on the concept of equity. Unlike equality, which considers all participants and their contributions in exactly the same way, equity acknowledges differences in position and historical context of marginalized groups when making decisions (Liboiron et al. 2017). Equitable approaches to author inclusion should consider how implicit biases that are documented to affect marginalized groups may creep into decisions about authorship (RSC 2020; Davies et al. 2021; Myers et al. 2021; but see Elliott et al. (2017) for discussion about potential for unintended consequences that deserve consideration but can be addressed through good practice). Thus, final decision-makers on authorship should account for present contributions along with the historical contexts of scientific inequity that have affected representation. In practice, this means that potential authors from under-represented groups may be considered by different criteria to merit authorship, thereby acknowledging the existence of unconscious biases that may have led to their contributions having been overlooked or underappreciated (Strategies 6 and 9). As a scientific community, we have access to the tools we need to be inclusive in a responsible way and these should be openly discussed and refined to strive for a more equitable distribution of credit for scientific work.

Strategy 6: Value diverse contributions

Adopting a narrow scope for what constitutes meaningful contributions can perpetuate systemic biases in science (Davies et al. 2021). When considering authorship specifically, supporting a diversity of mechanisms for contribution that is acknowledged through authorship promotes a more inclusive and supportive environment. Intellectual contributions that should be considered meaningful for authorship can involve forms of knowledge generation and documentation beyond quantitative data generation, including lived experiences, oral history, and traditional knowledge held and shared by nonscientists. Research facilitation, data interpretation, and feedback on research methods and objectives that shift research plans are also meaningful contributions in many projects (for a comprehensive list see Cooke et al. 2021). The richness and value of these "alternative" forms of contributions to science are being touted across disciplines (Kimmerer 2013) and more commonly included in boundary spanning or interdisciplinary research in natural sciences (Cooke et al. 2021). However, the issue of knowledge appropriation remains with the potential for research that is conducted collaboratively to turn exploitative when credit is not properly attributed (Sarna-Wojcicki et al. 2017). Consequently, coauthorship conversations are critically important when collaborating with groups that are chronically under-represented or even exploited in science (e.g., Indigenous knowledge holders, Koster et al. 2012; Strategies 5 and 9). Transitioning from knowledge appropriation to knowledge co-production requires acknowledging the array of contributions beyond recording, analyzing, and reporting; however, such contributions are often not quantifiable and can be easily overlooked when projects reach the publication stage. Expansion of eligible categories available through author contribution taxonomies such as CRediT could "formalize" more diverse roles and normalize authorship for such contributions, contributing to more inclusive science (Cooke et al. 2021). How a team will approach authorship should be discussed early and openly among academic and nonacademic contributors (Strategy 1). We encourage project leads to reflect upon their own biases and acknowledge meaningful contributions that shape publications from start to finish.

Strategy 7: Consider contributions to be intellectual property

An individual scholar working on an idea, method, database, analysis, or writing is considered by scientific norms and copyright law to be generating a form of intellectual property (IP). Their research is protected by principles of academic freedom and they retain the right to be recognized as the generator of intellectual outputs (publishers might claim a different set of rights over distribution). It would be unethical and potentially illegal for a colleague or a supervisor to claim rights to their independently generated IP (Biagioli and Galison 2014). However, if this individual scholar enters into a collaboration, things get normatively and legally murky (Dreyfuss 2000). With collaborations, individuals contribute intellectual property that is subsequently attributed to a group. It is often the case that these groups have leaders (first authors, principal investigators, and (or) senior scholars) who assemble a collective product from different pieces, sometimes modifying ideas or analysis to generate something novel. Other contributors provide comments and edit text. This process raises some key questions. Is the collective output a standalone piece of original IP, or simply an assemblage of distinct parts that retain their a priori independence? What does each individual contributor retain as IP when others are modifying and building off their contributions? What obligations do the leader(s) have to contributors of particular pieces during and after the collaboration? In our view, many authorship disagreements hinge on different responses to these questions (see McSherry 2009 for a range of case studies). There are no silver bullet strategies, but we recommend that leaders of research and writing projects explicitly address this problem with collaborators by drawing clear lines between group and individual IP. The guiding principle should be that collaboration functions best when people bring their individual ideas to a collaboration that collectively generates something new and unique that is more than the sum of the parts (hence positive-sum with respect to IP).

In other words, collaboration generates new standalone outputs (ideas, methods, analysis, or writing) that are group IP, but does not negate, devalue, or alter the original components that remain the IP of contributors. In practice, this means that individual contributors can further develop their key ideas in other outlets, as sole authors or as part of other groups.

Strategy 8: Seek external input

Authorship decisions are typically made by project participants. Some editorial guidelines recommend that editors not get involved in authorship disputes (Albert and Wager 2003). But such insularity increases the potential for conflict. Individuals have their own self interests, and may not be able to assess their own contributions objectively (Ivaniš et al. 2011). Researchers, particularly those who are early in their careers, may not know what the common authorship practices for their research field are. Therefore, people concerned about authorship disputes would do well to learn more about practices (e.g., via involvement with professional societies, conversations with peers, training by institutional Research Integrity Offices) and if needed seek outside aid (Faulkes 2018). People often ask others for help in resolving conflicts. Such intervention can be informal, e.g., asking someone to give their perspective and act as a "fair broker". Experienced professional colleagues can provide valuable insight into what reasonable expectations for authorship are. For example, researchers who expect first author status may need someone else to confirm to them that authorship is normally alphabetical in some fields (e.g., in economics; see Henriksen 2019). Informal consultation can help individuals navigate authorship decisions from an informed viewpoint. Formal conflict resolution can take many forms, including mediation (assisting participants come to a mutual agreement), arbitration (removing the decision-making from the participants), or some combination of both. Professional mediation and arbitration services exist, but they may be difficult and expensive for researchers to hire, particularly for early-career researchers. Research integrity offices should be involved if the authorship dispute involves misconduct (e.g., gift authorship), although disputes can arise where there are no such ethical breaches. Some institutions may have ombuds offices that can assist with conflict resolution. Some journals now have scientific integrity officers whose remit can include investigation of author disputes (Oransky and Marcus 2018). Scientific integrity officers are a relatively new role in scholarly publishing, and their roles are still being established. For students and post docs, the logical path may first start with their advisor, move to the Graduate Coordinator or Director, to the Department Chair, to the Dean's Office, and so on.

Strategy 9: Realize that authorship norms vary and some perspectives are ingrained

Authorship conventions and norms vary among individuals, research groups, disciplines, and cultures (Teixeira da Silva and Dobránszki 2016; Jabbehdari and Walsh 2017), and perspectives about what constitutes author-worthy contributions can be ingrained. Some hold that large author teams erode responsibility and accountability (Cronin 2005) and dilute the value of individual contributions to research (Allen et al. 2014), while others embrace inclusive author teams and value diverse contributions (Cooke et al. 2021). In addition, perspectives vary on the order that authors should be listed (Smith et al. 2020). Biases exist toward or against various types of contributions. For example, the technical contributions tend to be undervalued compared with theoretical contributions (Lariviere et al. 2016) and some roles (e.g., partnership development) are not yet recognized in current authorship taxonomies (Cooke et al. 2021; Strategy 6). There are also documented and felt biases, whether conscious or unconscious, against contributions from people from underrepresented backgrounds (Oliver et al. 2018; Desai et al. 2021; Strategies 5 and 6). Despite these ingrained perspectives, the current trend towards participatory, collaborative, and interdisciplinary research, and acknowledgement of the wide variety of ways that people can contribute to research challenges normative ideals of who are contributors and who merits authorship (Smith et al. 2020; Cooke et al. 2021).

Recognizing when your own perspectives are ingrained (e.g., through reflection on potential unconscious biases) and being aware of potential biases that exist within the team is a first step to interrogating current practices. Furthermore, fostering discussion about team structures, leadership styles, responsibilities, and expectations (Smith et al. 2020) and facilitating early and inclusive agreements on co-authorship practices and expectations can circumvent conflict and misrepresentation (Oliver et al. 2018; Cooke et al. 2021; Strategy 1) and ensure equal and fair treatment of all team members. Likewise, amplifying the understanding that larger interdisciplinary author teams are likely to have members who contribute specialized skills, perspectives, and knowledges that are critical to the manuscript, even if the contribution is seemingly "small" can help to challenge biases that exist (Lariviere et al. 2016; Jabbehdari and Walsh 2017).

Strategy 10: Be aware of power differentials

There has been a growing media spotlight on academic bullying with discourse on its prevalence and severity (e.g., theguardian.com/education/2018/sep/28/academics-uk-universities-accused-bullying-students-colleagues; sciencemag.org/careers/2021/05/academic-bullying-too-often-ignored-here-are-some-targets-stories). The power differential inherent to the relationship between students and their supervisors, along with the competitive and individual-centred promotion process in academia, leaves graduate students particularly vulnerable to academic bullying (Yamada et al. 2014), of which unfair crediting and violations of IP are considered serious forms (Mahmoudi 2019; Strategy 7). In Canadian psychology programmes, the prevalence of bullying by supervisors may be as high as 21%, with 20% of respondents to a survey reporting that they did not receive appropriate credit on a publication (Yamada et al. 2014). A broader survey of authors of collaborative published articles also found themes of bullying, coercion, secrecy, and intimidation when they solicited respondents for open-ended comments regarding "fair distribution of authorship in team research" (Smith et al. 2020). Often, distortion of authorship can manifest as a senior collaborator taking advantage of power asymmetry to claim the position of first authorship through intimidation and (or) coercion of a junior team member deserving of it, a phenomenon that has been coined the "White Bull effect" (Kwok 2005). Bullying in academia remains underreported for many reasons including lack of easy-to-access or clear protocols for reporting, insecure feelings about position or status, concern about being fired and loss of income, fear of unfair treatment, and concern over receiving poor recommendations or reference letters for future positions (Mahmoudi 2019). Such issues are magnified for international workers who are dependent on visas to maintain their student or work status (Mahmoudi 2018). In the cases of gift and missing authorship, simple options like including statements of each author's contributions will not likely resolve the issue, as an individual who is bullied into including an undeserving author's name could also be coerced into falsifying the contribution statement (Ranieri 2019). Often, students experiencing academic bullying will require other faculty and staff in positions of power to advocate, report, and hold their colleagues accountable (Yamada et al. 2014). Mentees can best be prepared for any potential conflicts by being educated about authorship decisions as early in their academic career as possible and by making themselves familiar with available resources (e.g., research integrity officers) (Strategy 1). It is important to teach students how to engage in ethical decision-making and how to advocate for themselves as part of this preparation. During discussions of authorship, which are best done at the beginning of projects or the onset of academic relationships, supervisors should be cognizant that a power dynamic exists. Even in very healthy and supportive relationships, the junior member may refrain from confronting a supervisor or more senior member of a team. Individuals in the positions of power should explicitly state that discussions of authorship can be honest dialogues free of negative repercussions. Institutions and (or) departments can also ensure they have clear reporting mechanisms and policies of role-modelling, community, and a collective action of support (Clancy et al. 2014).

Synthesis and conclusion

Authorship is a complex topic that can create significant anxiety and conflict (Wray 2006). Disciplinary norms and cultures around authorship are highly variable. Moreover, perspectives on authorship are evolving with much thinking in the last few years about how to ensure credit is given where credit is due (sensu Allen et al. 2014) while also ensuring that "free-riders" are excluded. We argue that beyond the ideas we share here there is a need to embrace a renewed vision of authorship that is more civilized, just, and equitable. Many of the authorship issues identified to date have effects that are most clearly manifested as negative impacts on marginalized (minorities, women) or precarious (trainees, early career) scholars (Rauhut et al. 2015; Chang et al. 2021). In other words, issues of authorship are intimately linked to issues such as justice, equity, diversity, and inclusion in the academy (RSC 2020; Davies et al. 2021; Garmire 2021). We do not have strategies to address the root of this problem but many of the strategies raised above have the potential mitigate or avoid authorship conflicts that normally would see collateral damage to individuals. Key to this is recognizing and considering power imbalances. Acknowledging and destigmatizing unconscious bias would also be helpful in overcoming these issues (Bourne 2019).

Although not shared as a specific strategy, in general the concept of flexibility is key to overcoming conflicts (Druckman and Mitchell 1995). Flexibility begins with a willingness to engage in difficult and uncomfortable conversations about authorship. Flexibility also means being willing to understand diverse viewpoints and moving in one's position to achieve consensus. Let's face it… it is way easier to be inclusive than exclusive. As new models to authorship emerge, flexibility and thoughtfulness about individual contributions should be central. Rigid rules and structures can be helpful but for

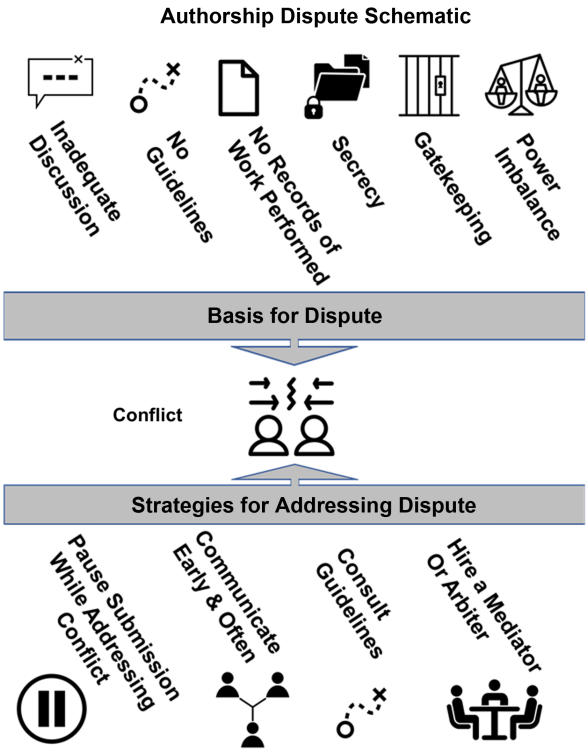

Fig. 1. Schematic illustrating some of the basis for authorship disputes as well as strategies for resolving authorship disputes.

topics as complex as authorship, a more nuanced perspective is needed given that authors are humans and collaboration is a social process (**Fig. 1**).

Although beyond the scope of this paper, we acknowledge that there is a dire need for better metrics related to tracking performance and contributions of different scholars. Authorship is an easy metric—we can count papers and citations and calculate indices such as h-index. Yet, we also know these are flawed, biased, and inequitable ways of assessing impact (Davies et al. 2021). These issues are all intertwined with authorship, what it means, and how we value it. Just as efforts have been devoted to envisioning the scholarly "paper" of the future (Sopinka et al. 2020) we submit that it is time to begin to rethink what authorship may look like in the future drawing on concepts related to intellectual property and transparency. In many ways these discussions are happening from the bottom up as individual lab groups and collaboratives take time to develop authorship policies (see Digiusto 1994, Dance 2012 and Liboiron et al. 2017 re process) and rubrics (Whetstone and Moulaison-Sandy 2020) that are more civilized and tailored to their needs. It is key that this conversation continues and is extended to learned societies, editorial boards, publishers, funders, and institutions. In addition, more work is needed on how to balance the concepts of credit and accountability and responsibility when addressing authorship conflicts.

Acknowledgements

Team members are supported by the Natural Sciences and Engineering Research Council of Canada, the Social Sciences and Humanities Research Council of Canada, Genome Canada, the Norwegian Research Council, and the European Union's Horizon 2020 research and innovation programme (Marie Skłodowska-Curie 838237-OPTIMISE). We thank Tara Lepine for formatting the references and two anonymous referees for providing thoughtful input on our manuscript.

Contribution statement

SJC instigated the idea for the paper and recruited the team of coauthors. SJC, NY, MRD, EAN, DGR, CLM, RJL, JMC, ZF, and JRB generated ideas that ultimately became the strategies, wrote text (one of the strategy sections), and provided edits on the manuscript.

Competing interests

MRD is an employee of Canadian Science Publishing and SJC is an Editor for *FACETS*. Neither of them was involved with the handling of this paper.

Data availability statement

All relevant data are within the paper.

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