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EDITORIAL

Perspectives for early-career researchers on plagiarism and scientific integrity

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Abstract

Lapses in scientific integrity, such as plagiarism, persist in the scientific realm. To be successful and contributory, early-career researchers (ECRs), including graduate students, need to be able to effectively navigate the literature, peer-review process, and scientific research with integrity. Here we discuss different aspects of scientific integrity related to ECRs. Our discussion centres on the concepts of plagiarism and intellectual property, predatory journals, aspects of peer review, transparency in publishing, and false advanced accreditations. Negative elements within these topics may be especially damaging to ECRs, who may be less familiar with the research landscape. We highlight the need for ECRs to approach scientific investigation cautiously and thoughtfully to promote integrity through critical thinking.

Key words: graduate student, predatory journal, plagiarism-detection software, peer review, transparency, education

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Introduction

Recently, while conducting research for a paper, we came across a 2017 published article with familiar sections in what was described as a "peer-reviewed" journal. Through attention to changes in tone and writing style we identified over 20 sections of writing containing nearly word-for-word matches to previously published material, with our suspicions supported by plagiarism-checking software. Following Fox and Beall (2014), we communicated our observation to the journal of publication and the authors but did not receive actionable response. While considering writing a piece on these types of integrity issues, we were advised against naming authors suspected of plagiarism, because of the possibility of legal ramifications. Although in our estimation, there seemed to be no practicable outlet for discussion of scientific integrity, leaving individual researchers to protect themselves from lapses in integrity.

The research and academic landscapes are changing with the increasing availability of platforms or journals to disseminate science, the increasing presence of collaborative science, an increasing focus on transparency, changes to peer review, and the ubiquity of people obtaining higher education. While best practices have been outlined for maintaining integrity in science, in the currently changing research landscape (Kretser et al. 2019) many principles apply at higher organisational levels but are not executable for individual researchers. What is an individual to do to avoid committing or being accessory to misconduct or reduced scientific integrity? Although having absorbed much information on proper academic conduct throughout our graduate education, we were not fully aware of the

pitfalls related to ethics and academic integrity and the potential resources available (e.g., American Psychological Association 2010; International Center for Academic Integrity 2017). Early-career researchers (ECRs) may not have the know-how or experience to avoid certain aspects of lapses in scientific integrity. In addition, while cutting corners in science is not a newly identified phenomenon or isolated to particular research areas (Skandalakis and Mirilas 2004; Penders 2018), new researchers competing for increasingly limited job opportunities (Woolston 2018) may be tempted to take shortcuts toward publication or recognition. Here, we touch on six current areas relating to integrity in science that we feel ECRs should be cautious and informed about when navigating the publication process and attaining recognition.

Plagiarism

Plagiarism (definition in **Box 1**) can come in a variety of forms: copy and paste, duplicate publication, incorrect paraphrasing, and the intentional or unintentional use of ideas of others without credit. ECRs should understand the types of plagiarism and how to avoid committing them, such as referring to available guides (e.g., Roig 2015). With the increase in the number of available platforms to disseminate and access science (e.g., open access journals, conference material online) as well as new ways to detect plagiarism (e.g., software), new and experienced authors alike need to be vigilant to avoid unscrupulous science. There is no single metric that can be used to assess the worthiness of work for citation, and so decisions are subjective (**Box 2**). When in doubt, ECRs can use plagiarism-detection software (e.g., Turnitin, Grammarly) and (or) consult experienced colleagues. To limit citing inaccurate or questionable material, having read and accessed the work is paramount. Mistakes can occur, and in one noted instance a nonexistent article was cited over 400 times (Mandelbaum 2017). Using a citation program and ensuring each entry has a saved copy of the referenced article can be helpful to avoid these situations. In collaborative publications, authors are expected to be accountable for work of all co-authors, so a critical eye should also be applied to all contributions.

Related to the concept of plagiarism, intellectual property is ideas or work protected through means such as copyrights or patents. Intellectual property is an important concept for ECRs to understand (e.g., see Carroll 2015), especially since the violation of these rights can have legal consequences. A good starting point is understanding the role of open publishing and creative commons rights

Box 1. Plagiarism definitions.

"taking over the ideas, methods, or written words of another, without acknowledgment and with the intention that they be taken as the work of the deceiver."

American Association of University Professors (1989)

"the theft or misappropriation of intellectual property and the substantial unattributed textual copying of another's work"

ori.hhs.gov/ori-policy-plagiarism

"ranges from the unreferenced use of others' published and unpublished ideas, including research grant applications to submission under 'new' authorship of a complete paper, sometimes in a different language. It may occur at any stage of planning, research, writing, or publication: it applies to print and electronic versions."

Committee on Publication Ethics (1999)

Box 2. Questions to evaluate work for potential citation, if suspected of plagiarism.

Article

- Do you recognize any of the writing as familiar? This method requires the reader to be attentive and know the literature in the field well.
- Are there changes in style, tone, and flow of the writing through the paper, which possibly indicates cut and pasted work?
- Has the paper received other citations; this is particularly applicable if it is an older article in an active field?
- Are seminal or more important articles for the field of research cited in the article suggesting that the authors of the paper were thorough in their research?
- Do the authors include the underlying data for the paper? If the information is missing it would be more difficult to check that the information has not been plagiarized or the results incorrectly reported.
- Does the work have dates associated with the collection of data and writing/publication?
- Does plagiarism-detection software indicate sections are similar or the same as earlier articles? Using this information, can you verify that sections were copied? Software includes Turnitin, ithenticate, Grammarly, and others. To start with, search engine (e.g., Google Scholar) searches of text are helpful.

Journal

- Is the publication indexed on credible citation indexing services important to the field of research, such as Web of Science?
- Does the journal impose retractions for scientific misconduct, such as plagiarism of text or data?
- Is the journal or journal group on a predatory journal list (e.g., predatoryjournals.com/journals/ and beallslist.weebly.com)? However, consider that lists can be misleading and biased (Crawford 2014; Berger and Cirasella 2015).
- What is the method of publication? If not a peer-reviewed source, then increased caution is recommended, such as for:
    - online blogs or similarly stylized comments
    - preprints placed online before peer-review acceptance (in spaces such as peerj.com)
    - conference proceedings

Author

- Are the authors not listed or indicated as fabricating data, producing duplicate publications, or conducting plagiarism in journal retractions or on resources such as Retraction Watch (retractionwatch.com/)? However, consider the evidence and that lists generated by software could falsely indicate that legitimately written articles are duplicates (Vihinen 2009).

(creativecommons.org/). Most public institutions have legal services for researchers to ensure their rights are protected. The commercialization of discovery from academia is not uncommon (Bawa 2016) and ECRs should be aware of their universities' policies on intellectual property, since

universities may claim ownership over workers' inventions, data, patents, licenses, and revenues. In the event of concern over conflict of interest with the institution, ECRs may also consider seeking independent legal opinions (Carroll 2015).

Research contributions

Theft of scientific work or improper recognition is another problem that is a necessary consideration for ECRs. Difficulties in recognition may arise when researchers have differing ideas on what constitutes a contribution to a research project, and the work of individual authors or peers may be acknowledged in inaccurate or difficult-to-qualify amounts. An increasing trend of collaborative research efforts and team science with multiple authors per paper can also create different interpersonal and credit-based issues (Kennedy 2003), although having a larger team can increase the visibility and impact of research (Larivière et al. 2015). Guidelines for authorship criteria are useful to consult in deciding and negotiating authorship, such as the International Committee of Medical Journal Editors authorship criteria (ICMJE 2019). To avoid uncertainty about authorship we suggest clarifying authorship with co-authors early on, when circumstances change, or based on mutually agreed upon contributions.

Theft of scientific work can be a real concern for researchers at all stages, and for ECRs theft can also occur by advisors; egregious cases exist where initial credit of the research is dishonorably taken by a senior researcher from an apprentice (Woolston 2002). Theft can occur through dissemination of research including through presentations at symposia or submission to peer review (Marcus 2019). In the case of conference presentations, ECRs may consult with experienced researchers regarding the context and, if concerned, may choose to present work that is close to publication or published. In the case of peer-review theft, keeping documented evidence and contacting the publishing journal (and potentially the institute and grant source) for an investigation are some options to protect oneself (Committee on Publication Ethics 2010). Science relies on accumulated knowledge to move forward, and this can sometimes present unclear boundaries of what constitutes theft especially in the case of ideas, which may not have memorable origins. To avoid inadvertent theft of ideas when it comes to novel research, ECRs should endeavour to maintain records of their progress, be mindful about the possibility of plagiarism, and give credit where it is due.

Predatory journals

There are a growing number of journals that can be described as predatory. These journals target eager-to-publish researchers such as ECRs depending on publication for their future careers, and they can contain scientific articles of questionable quality (Beall 2012). Predatory journals often promise publication for a price, with a quick turn-around and little or no peer review (Beall 2012). There is no agreed upon definition of a predatory journal (Cobey et al. 2018), causing confusion and hesitation for ECRs. Resources are available to check if a journal or parent publishing group is listed as potentially predatory (predatoryjournals.com/journals/ and beallslist.weebly.com). However, these lists should be referenced with caution, as they may be inaccurate or have prejudicial methods of construction. Lists have been criticized for favouring traditional publishers, having a bias against open access journals, and using the journal's country of origin as an indicator for being potentially predatory (Crawford 2014; Berger and Cirasella 2015). Using publishing indices as a criteria can also be problematic for new journals that might have vigorous peer-review practices and still be on a list or conversely for newly founded predatory journals that do not yet appear on watch lists. While it is not necessarily true that all articles in journals deemed predatory are of lower quality, as a researcher one needs to be careful to avoid relying on insufficiently reviewed or unreviewed science. To assess a journal's credibility and avoid predatory ones, ECRs can consult trusted colleagues, check for the journal or parent journal on credible indexing services (e.g., Web of Science), complete some online

research (e.g., retraction watch, predatory journal watch lists), and evaluate the journal website itself for the existence of policies on peer review, retraction, and misconduct.

Peer review and opportunities for experience for ECRs

Peer review is the cornerstone of science and, while not perfect, helps to increase the quality of science. As a human process, there are biases to peer review and publication (Ginther et al. 2011; Milkman et al. 2015). Awareness of these biases is increasing, and prominent journals are trying to address them. The review process will continue to evolve, with some advocating increased use of plagiarism-matching software while others suggest the use of artificial intelligence in place of first-pass reviewers (Price and Flach 2017). Understanding the complexities of review, often gained through participation in the process as a reviewer, can help ECRs increase their success at publishing. When asked to review, ECRs could be guided by trusted sources such as their advisor and refer to guidelines on how to peer review (e.g., Stiller-Reeve 2018), which often are provided on journal websites. ECRs should be conscious about the ethical agreement that they enter when reviewing such as not sharing the contents of the manuscript, not stealing research ideas or material, and not purposefully impeding the publication of topics similar to their own work for gain.

It has been suggested that more ECRs need to be called on to review (Osterath 2016), with a growing number of innovations moving to increase the reviewer pool. Some journals provide opportunities for graduate students to review under the guidance of an advisor. Another avenue for ECRs is PeerJ where potential reviews are posted on their website for people to volunteer for an assignment (peerj.com/reviewer-match/). Another example includes the Society for Neuroscience where a reviewer mentoring program aims to boost participation of ECRs in the review process (Picciotto 2018). While reviewing is a voluntary effort, some journals are starting to recognise reviewers for their contribution to science by publicly posting names of contributing reviewers. Another self-promotion option is Publons (publons.com), where ECRs can showcase how they have contributed to peer review. These examples provide ways where ECRs can at the same time learn about the process, address the need for qualified peer reviewers, and add to their own record of scientific contribution.

Transparency in publishing

Transparency should promote good scientific practices (but see Lewandowsky and Bishop 2016) and can make the integrity lapses, such as plagiarism or fabrication of data, more likely to be caught. An increased focus on transparency (Boulton et al. 2011; Fanelli 2018) has led to many journals now requiring data submission to reviewers during the review process and to readers after publication. A recent estimate suggested that as many as 64% of published articles lack full data to reproduce reported results (Roche et al. 2015). In our estimation, transparency should also include reporting null result efforts though publication, not often favoured by traditional journals (Moller and Jennions 2001). Null results research that has sound scientific basis can help to guide future research away from fruitless efforts. These studies can be published in specialised journals accepting of null result research while still having a rigorous review process (Kluger 2014; e.g., New Negatives in Plant Science, now discontinued). ECRs can make their work transparent and accessible even if not within the journal policy by publishing results or intermediate steps in supplementary files or other platforms and depositing code (e.g., GitHub, github.com) or genetic sequence data (National Center for Biotechnology Information, ncbi.nlm.nih.gov/) if applicable. This is beneficial for the individual ECR as well, to reduce the need of being contacted through email regarding sharing nondisclosed aspects of their publication.

False professional accreditations

Academic education through advanced degrees has become more ubiquitous (Statistics Canada 2019; United States Census Bureau 2019). The troubling presence of advanced degrees for purchase online

(Szeto and Vellani 2017) is a billion (US) dollar business. Professionals can use these fake degrees and advance to medical and academic positions without consequence (Gibson 2017) and sometimes verification of a publication record is questioned and not adequately addressed (Tat 2017). Other times false accreditations or publications can be imposed on researchers, such as instances where a researcher's name has been added as an author or as a journal board member without permission (Stern 2017). ECRs suspecting that a source (journal, board, conference) has added a researcher's name without permission to increase credibility, could contact that researcher directly to verify their involvement and the credibility of that resource.

The misrepresentation of professional accreditations (Sorokowski et al. 2017) can be concerning for ECRs when trusting sources for guidance or information, such as in assessing articles for citation. In addition, senior researchers and managers in higher positions often have a significant amount of influence over the work of ECRs. Tools or methods to verify the credentials of researchers are becoming more abundant, such as the inclusion of article DOIs (Digital Object Identifiers) in resumes and CVs (Paskin 2010) and unique identifiers (such as ORCID (Open Researcher and Contributor ID)) to differentiate researchers with similar names (Haak et al. 2012). These tools can be used at many steps along the research path including selecting mentors, co-authors, peer reviewers, and trusting sources of information.

Conclusion

While these six areas of caution and education are not exhaustive, we have touched on current aspects of research and publication that might be helpful for ECRs. There is a need to educate ECRs involved with scientific research about the complexities of the scientific process, scientific writing, maintaining integrity in science, and navigating the process of publishing. As good scientists we need to be aware of pressures and obstacles that may threaten to compromise our work. Integrity in science and publishing involves complex guidelines that ECRs may not be exposed to. ECRs may find it useful to have trusted peers with whom they can discuss aspects of publishing and share their experiences. Using resources and a critical lens, ECRs can promote scientific integrity in their own work and avoid promoting elements of compromised integrity.

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Author contributions

RGY and TFM conceived and designed the study. RGY and TFM performed the experiments/collected the data. RGY and TFM analyzed and interpreted the data. RGY and TFM contributed resources. RGY and TFM drafted or revised the manuscript.

Competing interests

The authors have declared that no competing interests exist.

Data availability statement

All relevant data are within the paper.

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