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Retraction Notices: Who Authored Them?

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Abstract: Unlike other academic publications whose authorship is eagerly claimed, the provenance of retraction notices (RNs) is often obscured presumably because the retraction of published research is associated with undesirable behavior and consequently carries negative consequences for the individuals involved. The ambiguity of authorship, however, has serious ethical ramifications and creates methodological problems for research on RNs that requires clear authorship attribution. This article reports a study conducted to identify RN textual features that can be used to disambiguate obscured authorship, ascertain the extent of authorship evasion in RNs from two disciplinary clusters, and determine if the disciplines varied in the distributions of different types of RN authorship. Drawing on a corpus of 370 RNs archived in the Web of Science for the hard discipline of Cell Biology and the soft disciplines of Business, Finance, and Management, this study has identified 25 types of textual markers that can be used to disambiguate authorship, and revealed that only 25.68% of the RNs could be unambiguously attributed to authors of the retracted articles alone or jointly and that authorship could not be determined for 28.92% of the RNs. Furthermore, the study has found marked disciplinary differences in the different categories of RN authorship. These results point to the need for more explicit editorial requirements about RN authorship and their strict enforcement.

Keywords: academic misconduct; authorship marker; disciplinary variation; evasion of authorship; retraction notice

1. Introduction

Authorship of academic publications is the lifeblood of academia. It dispenses tangible rewards for academics, for example, career advancement, reputation in one's academic community, enhanced chances to secure research grants, and winning of academic awards [1]. Because of the high stakes carried by academic authorship, many academics work hard to put their names in the bylines of as many academic publications as possible, and some even violate the ethics of academic authorship to take unmerited authorship credit (e.g., honorary authorship, gift authorship, and guest authorship) [2,3]. In a larger research project on which the present study is based, however, we observed the opposite phenomenon—the evasion of authorship for retraction notices (RNs) [4]. The provenance of RNs is often obscured presumably because retraction of published research is associated with undesirable behavior, be it genuine human error or academic misconduct, and consequently, carries negative consequences for the individuals involved. The ambiguity of authorship, however, has serious ethical ramifications and creates methodological problems for research on RNs that requires clear authorship attribution.

RNs are official documents published in print journals and/or electronically on journals' websites to retract problematic publications. Retracted articles are usually found so seriously flawed that their findings or conclusions are untenable or invalid [5]. Thus, the primary function of RNs is "to correct the literature and ensure its integrity" [5] (p. 2). When properly constituted, RNs may also play a role

in maintaining ethical integrity and deterring potential offenders because an appropriate demarcation of ethical responsibilities will expose the perpetrators of academic misconduct and bring tangible or intangible punishment upon them. According to the retraction guidelines proposed by the Committee on Publication Ethics (COPE), published research articles can be retracted solely by their authors, journal authorities (e.g., journal editors, publishers, or learned societies), or jointly by the authors and journal authorities [5]. Notably, retraction authorities (i.e., the entities requesting and/or performing retraction) may also include lawyers, offices of research integrity, institutions that authors of retracted articles are affiliated with, and other entities [6]. To complicate things, these entities may or may not be the actual authors of RNs for the retracted research.

Extant research on retraction has revealed a disturbingly increasing trend of retractions [6–9], many high-profile cases of retraction [10,11], overdue retraction of problematic publications [7,12], and other thorny issues, such as continual post-retraction citations of retracted articles [6,13–16]. A diversity of reasons for retraction have also been uncovered. Chief among these are scientific misconduct and honest human errors [4,7,17,18], with the former accounting for the majority of retracted articles [7] and incurring an ever-increasing number of retractions [17]. These dismal findings and developing trends call for serious and continued research attention to the ethical and textual aspects of RNs, including authorship-related issues. Our review of the literature on RNs has located no empirical study that focuses squarely on the determination of RN authorship. The few studies that needed to ascertain RN authorship to address their research questions unproblematically treated retraction requestors and/or performers as RN authors [19,20]. This conflation of retraction authorities and RN authors is inaccurate in identifying authorship at best, and may obscure important ethical issues at worst. As this article aims to demonstrate, RN authorship is a complicated issue that involves multiple authorial considerations.

Indeed, previous research has suggested that RN authors who are also authors of the retracted articles have reasons to leave authorship deliberately ambiguous [21]. Studies of research retraction have revealed grave negative consequences for authors of retracted articles, such as citation penalty [8,22–24], publishing bans [25], decreased opportunities for funding [26], dismissals from positions held [27], and, in serious cases, even termination of academic careers [28,29]. Even when such severe external penalties are not imposed, because of the increasingly frequent association of research retraction with academic misconduct [7], RN authorship inevitably tarnishes the image of authors of retracted articles, especially those who are held responsible for the retraction-engendering acts. Thus, it would be in the interest of authors of retracted articles to leave their RN authorship obscured as a means of dodging severe punishment or damage of their image as academics. However, due to a paucity of research on RN authorship, it remains unknown how serious the issue of authorship evasion is in academic disciplines. Nor are data-driven textual criteria available to help disambiguate obscured RN authorship. Such criteria are of great value to researchers who are interested in examining RN authorship in relation to various ethical issues in scientific research. They are also useful to journal authorities and ethical oversight bodies in their formulation of effective guidelines on the publishing of RNs in academic journals. Furthermore, they may facilitate the composing of RNs by authors who try in earnest to fulfill the ethical and substantive functions of retractions.

As a genre of academic writing, RNs are likely to be subject to the same influences that have been found to shape other academic genres of discourse. One of such well-established influences is disciplinary difference. Although academic genres in general are highly structured and stabilized, there is very good reason to expect them to vary across disciplines because they "package information in ways that conform to a discipline's norms, values, and ideology" [30] (p. 1). Drawing on a well-known distinction that is made by Becher between hard disciplines (i.e., natural sciences) and soft ones (i.e., the social sciences and the humanities) [31], an extensive body of research has found cross-disciplinary generic variations in a number of widely used academic genres [32–37]. By contrast, although RNs have been found in 82% of the disciplinary categories covered by the Web of Science (WoS) [6], a great majority of extant studies of RNs have focused only on hard disciplines, and there

has been little research examining cross-disciplinary differences in RNs. The only cross-disciplinary difference that has received some research attention is the varying incidence of retractions between hard and soft disciplines. Two studies have found that there are far more RNs in hard disciplines than in soft ones [6,8]. For instance, retraction rates in social sciences (i.e., soft disciplines) have been found to be lower than those of medicine, chemistry, life sciences, and multidisciplinary sciences (i.e., hard disciplines) [6]. However, there is reason to expect disciplinary variation in other aspects of RNs, for example, in issues of RN authorship since different disciplines do not necessarily subscribe to the same authorship conventions and ethical understandings.

In response to the research gaps identified above, the following research questions have been formulated to guide the present study:

1. What textual features can be used as criteria for disambiguating obscured authorship?
2. To what extent does ambiguous RN authorship occur in the disciplines sampled for this study?
3. Do the focal disciplines vary in the types of RN authorship observed as well as their distributions?

2. Materials and Methods

2.1. Data Collection

To address the research questions presented above, a corpus of RNs from the hard discipline of Cell Biology and the soft disciplines of Business, Finance, and Management were collected from the WoS (Core Collection). We sampled these disciplines because in the larger project from which the present study branched out we aimed to determine whether there were differences in textual features of RNs between hard and soft disciplines. These disciplinary areas were selected to operationalize the broad distinction between hard and soft disciplines for two reasons. First, they have featured prominently as representatives of hard and soft disciplines in previous research on academic discourse [38,39]. Second, according to the RNs archived by the Retraction Watch Blog (http://retractionwatch.com/), these disciplines are among the hard and soft disciplinary fields with the largest numbers of RNs, respectively. Given that a sizeable corpus of RNs is crucial to the present study, more than one soft discipline have been sampled because none of them alone would have yielded a sufficiently large number of RNs.

All the RNs were collected in March, 2017. The data collection comprised four steps: (1) conducting queries in the WoS by using *retract* * or *withdraw* * as title search words and selecting the four focal disciplines as WoS search categories; (2) locating the DOIs/URLs and other bibliographic information of the RNs and corresponding retracted articles returned by the queries; (3) retrieving the RNs from journal websites by following the recorded bibliographic information; and (4) screening the retrieved RNs according to the following inclusion criteria.

1. Only RNs published in English were included in our corpus.
2. An RN fully or partially retracted at least one research article but not any other type of publication (e.g., correction, erratum, corrigendum, expression of concern, editorial, letter to the editor, etc.).
3. An RN was sampled only once even when it retracted multiple publications and was indexed multiple times in the WoS.
4. Texts not explicitly labelled as RNs, but actually meant to retract published research were selected, whereas those labelled as RNs but in effect not intended to retract any published research article were excluded.
5. RNs indexed by the WoS but inaccessible through our institutional library databases were excluded.

As a result, a total of 370 RNs were included in the corpus constructed for the present study: 301 for Cell Biology and 69 for Business, Finance and Management.[1] Together with 17 RNs excluded according to the above inclusion criteria, these were all the RNs indexed in the WoS for the sampled disciplines.[2] The RNs included in the corpus were published from 1966 to March, 2017, when the data collection was completed.

2.2. Data Coding

In the larger project from which the present study has branched off, we made several efforts to identify criteria for ascertaining RN authorship. First, we attempted to identify RN authorship using bibliographic information that was provided by the WoS and journal websites where the RNs were published. The reliability of such information, however, turned out to be questionable in many cases. For instance, the RN [40] issued to retract Haribalaganesh et al. [41] was indexed by the WoS and the website of the journal concerned as being authored by all of the authors of the retracted article, but was signed off by the journal editors. Second, we turned to published studies on RNs for criteria that could be used to determine authorship, and we were able to locate only two research articles that reported classifications of RN authorship. A close scrutiny of the two articles, however, yielded no information on the criteria used to determine RN authorship. We then contacted the corresponding authors of the two articles for their criteria, and their replies revealed that in their studies, retraction authorities had been indiscriminatingly identified as RN authors, confirming the lack of well-developed criteria for disambiguating RN authorship. Third, we attempted to contact the authors of retracted articles to ascertain the authorship of the corresponding RNs. We emailed the corresponding authors of 20 retracted articles in our corpus and received replies from only four of them. Such a low response rate was understandable given the sensitivity and negative consequences of the topic but made it unfeasible to find out from the authors of retracted articles who had authored the RNs in our corpus. We did not contact more authors of retracted articles because the very low response rate would mean that this data source would not yield the information we needed to determine the authorship of the great majority of the RNs in our corpus.

Given the failed attempts that are described above, we decided to take a bottom-up data-driven approach to identifying authorship markers by conducting microscopic textual analyses of RNs. Specifically, the first author scrutinized each RN in our corpus for textual evidence indicative of authorship. All information that was potentially indicative of authorship was marked on printed copies of the 370 RNs. These textual features were then classified, grouped, and abstracted into distinct criteria. All of the textual features that were marked out, together with the preliminary classifications and the generalized criteria, were reviewed carefully by the second author, who indicated his agreements and disagreements in detail. We then resolved the identified disagreements through discussion and re-examination of the RNs concerned, which led to modifications of some criteria and the addition of a few new criteria. To make our authorship criteria as comprehensive as possible, the same process of analysis and generalization was applied to a subset of RNs archived by the Retraction Watch Blog for the focal disciplines to identify authorship markers absent from our corpus. A coding scheme was then developed to include all of the formulated criteria and prototypical examples and was used in a pilot coding exercise to test its applicability and adequacy. Issues arising in the pilot coding were discussed until a consensus between us was reached, and the coding scheme was modified accordingly.

The finalized coding scheme was used to establish coding reliability. A graduate student of applied linguistics who was familiar with textual analysis was trained by the first author to use the coding

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[1] A pilot study briefly reported in [4] drew on 376 RNs archived by the Retraction Watch Blog and the WoS. Subsequently, RNs from the former source were dropped, and RNs from the latter source were expanded into the present corpus.

[2] Although the aforementioned pilot study collected RNs from the soft disciplines of Business and Management as classified by the Retraction Watch Blog, it should be noted that these disciplinary groupings are actually represented by the three disciplinary fields of Business, Finance, and Management in the WoS.

scheme, which contained the full set of authorship markers illustrated by carefully selected examples. The two then used the coding scheme independently to code 20% of the RNs that were randomly selected from the corpus and achieved good inter-coder agreement (κ = 0.756). The two coders discussed cases of disagreement to standardize their interpretation of the criteria. Another 20% of the RNs that were randomly sampled from the corpus was then coded independently by the two raters, and there was excellent inter-coder reliability (κ = 0.915). The few inter-coder disagreements were again resolved through discussion. Based on the results of the two rounds of coding, minor adjustments were made to the wording of the authorship criteria. The first author then used the adjusted scheme to code the remaining RNs in the corpus.

3. Results

3.1. Criteria for Ascertaining RN Authorship

The finalized criteria, which draw on a range of textual and contextual resources termed as authorship markers, are presented below separately for RNs by authors of the retracted articles and those by journal authorities, with illustrative examples from the present corpus and, where no instances were found in the corpus, from the data set collected for the aforementioned pilot study. The frequencies presented in the parentheses following each criterion indicate the number of RNs in the corpus that contained the type of authorship markers in question. The numbers do not add up to 370 because 93 RNs did not meet any of the criteria.

3.1.1. Criteria for Identifying RNs by Authors of Retracted Articles

1. The RN begins with a salutation to the journal authorities and/or is signed off by any or all authors of the retracted article. (*n* = 10)

    - To the Editor [42]
    - Jie Tao, Yuan Sun, Qiu-gen Wang, Cheng-wen Liu [names of the signatories] [42]

2. A first person pronoun (e.g., *we* or *I*) is followed by the phrase *the authors* or the name of any author of the retracted article as its appositive or in parenthesis. (*n* = 5)

    - We, the authors, are retracting this article because of inappropriate manipulation of the data in... [43].
    - . . . , we (the authors) discovered differences from those presented in the original article . . . [44].

3. With *we* or *I* as its logical subject, a phrase or sentence in the RN describes and/or clarifies some of the findings presented in the retracted article. (*n* = 25)

    - We now show that the fusion defect instead apparently arises from the TM3 balancer chromosome [45].

4. With *we* or *I* as its logical subject, a phrase or sentence in the RN claims to uphold and/or justify some or all findings that are presented in the retracted article. (*n* = 13)

    - Despite these errors, we stand by the reproducibility of the experimental data and the conclusion, which has been reached by numerous subsequent studies, that IKK and NF-κB are required for activation of innate immunity [46].

5. With *we* or *I* as its logical subject, a phrase or sentence in the RN expresses apologies to the journal authorities. (*n* = 0)

    - We deeply regret this situation and apologize for any inconvenience to the editors and readers of *Journal of Bacteriology, Microbial Pathogenesis, and Microbiology* [47].

6. With *we* or *I* as its logical subject, a phrase or sentence in the RN offers remedies (e.g., to republish corrected data or findings in the same or another journal) or reveals some uncertainty about the reported findings. (n = 5)

    - We will continue to examine whether the central findings of the paper still stand; if they do, we will communicate them again in the future [48].

7. With *we* or *I* as its logical subject, a phrase or sentence in the RN admits having made mistakes, co-authored or published the retracted article, requests a retraction due to the detected problems with the article, or announces action on behalf of all other authors or co-authors. (n = 8)

    - Because of the data handling issues, we wish to retract this paper and to sincerely apologize to the scientific community for any potential harm we may have caused [49].
    - On behalf of all of the other authors, we wish to state that we have collectively confirmed the reproducibility of the findings reported in these articles [50].

8. With *we* or *I* as its logical subject, a phrase or sentence in the RN reveals an undesirable situation of the data source or a failed attempt to extend the work reported by the retracted article. (n = 0)

    - We were not able to find the source data files for the majority of the microscopy images shown in Figures 7–9 [51].

9. A first person pronoun *our* or *my* is used to indicate affiliation with an institution, ownership of the retracted article, its findings or conclusions, or confidence in the validity of them. (n = 45)

    - Our study investigated the mechanisms by which miR-31 regulates different aspects of breast cancer metastasis [52].
    - This could call into question some of our conclusions on how the presence of misfolded proteins might affect assembly and function of the ERAD machinery [53].

10. The agents of the retraction are the authors of the retracted article, and their retraction is presented in the present progressive tense and/or contains the word *hereby*. (n = 5)

    - Because the published paper contains a number of erroneous panels, the authors are retracting the full paper in the interests of accuracy in the published scientific literature [54].
    - The authors hereby retract the article entitled . . . [55].

11. The authorship can be ascertained with information found in sources (e.g., a previous notice of partial retraction) other than the RN itself. (n = 2)

    - Since our original partial retractions, questions have arisen concerning the validity of other figures in these articles that were provided by one of the authors (K.T.) [56]. (This is an excerpt from a collective full-retraction notice issued to two articles to which two partial RNs had been issued before.)

3.1.2. Criteria for Identifying RNs by Journal Authorities

1. The RN begins with the phrase *From the Editor*, lists the journal authorities in its byline, and/or is signed off by the journal authorities. (n = 10)

    - Hans Eklund, Handling Editor; Felix Wieland, Managing Editor [57].
    - From the Editor: . . . [58].

2. The journal authorities act as an independent agent to retract the article, detect problems with the retracted article, request the authors' institution to conduct an internal investigation, assume

responsibility, accept or approve a request for retraction, and/or express apologies/regrets for the retraction. (n = 96)

- Blackwell Publishing Ltd. accepts responsibility for this error [59].
- The Editors of Inflammation retracted this article due to a finding of plagiarism and possible scientific fraud on the part of Dr. Lundeberg following an investigation at the Karolinska Institutet which was completed in 2007 [60].

3. The RN includes apologies/regrets for having failed to detect the retraction-engendering problems in the retracted article during its submission and/or review process. (n = 6)

- The scientific community takes a very strong view on this matter and apologies are offered to readers of the journal that this was not detected during the submission process [61].
- We apologize to readers of the journals that this was not detected during the submission and review process [62].

4. The RN indicates that effort has been made to contact all of the authors of the retracted article and/or their affiliations. (n = 17)

- The Senior Editor then contacted the authors to inform them of the problems identified in the paper [63].
- G. Xi, E Hayes, R. Lewis, S. Ichi, B. Mania-Farnell, T. Takao and C.S. Mayanil agreed to this retraction. K. Shim, E. Allender and T. Tomita could not be reached to comment on the retraction [64].

5. The RN reveals why the journal authorities have initiated an investigation into the retracted article, and/or how it has been conducted. (n = 19)

- The journal has recently been notified by a reader who expressed concerns about some of the figures in this paper [65].
- Formal investigations by the Academy of Management Journal and an affiliated university of Professor Ulrich Lichtenthaler have revealed ethical violations in research practices [66].
- A team of CAR editors reviewed that report, responses from co-authors, and evidence from a supplemental investigation by Bentley University that relates to the above paper [67].

6. The RN highlights the upholding of strict scientific standards and the journal authorities' intolerance of violation of them in any form. (n = 1)

- DNA and Cell Biology is dedicated to upholding the strictest standards of scientific publishing, and will not tolerate any improprieties [68].

7. The RN makes clear that the retraction is agreed to by none of the authors of the retracted article. (n = 2)

- The authors of the paper stand by the original data and do not endorse the Retraction [69].

8. The RN announces follow-up actions that can be taken only by the journal authorities, such as announcing whether or not the retracted article is available on the journal website. (n = 11)

- All versions of this article have been removed from the Web site [70].
- The online version of this article contains the full text of the retracted article as electronic supplementary material [71].

9. The RN indicates that the published article is retracted for suspected but hard-to-verify problems. (n = 3)

- As a result, it was not possible to assess the novelty of the work [72].
- Data presented in Figure 1 appear to have been manipulated [73].

10. The RN contains explicit unhedged negative comments on confirmed problems with the retracted article. (n = 2)

    - It has come to our attention that the article ... was found to involve blameworthy inaccuracies in the way the research was carried out by Dirk Smeesters but not by the co-authors of the work [74].

11. The RN indicates that the authors of the retracted article have failed to comply with the journal authorities' requirements. (n = 1)

    - The authors confirmed a misstatement in the article and were unable to provide supporting information requested by the editor and publisher. Accordingly the article has been retracted [75].

12. The RN includes direct quotations from the authors of the retracted article and/or their affiliations. (n = 21)

    - The editors of The Journal of Cell Biology have been notified by Dr. Gerard C. Grosveld of St. Jude Children's Research. Hospital, Memphis, TN, that he and the other authors of the above article wish to retract the paper.

      The authors state:

      "Figure 1 of this paper was described as reflecting an experiment that showed . . . ". [76]

13. First person pronouns (e.g., *our*) are used to indicate affiliation to the journal and/or adherence to its policy on publication.[3] (n = 6)

    - These investigations held that Dr. Wataru Matsuyama was the only offender among the authors of this paper in our journal [77].
    - One of the conditions of submission of a paper for publication is that authors declare explicitly that their work is original and has not been submitted for or appeared in a publication elsewhere [78].

14. With the first person pronoun *we* as its logical subject, a phrase or sentence in the RN talks about the receipt or approval of a request for retraction. (n = 0)

    - We therefore accept Dr. Libby's, Dr. Tan's, and Dr. Seybert's request that this paper be retracted and acknowledge Dr. Hunton's objection, through his counsel, to the retraction [79].

3.2. Extent of Obscured RN Authorship

Our authorship analysis, aided by the criteria presented in the preceding sections, revealed four broad categories of RN authorship: by authors of the retracted articles, by journal authorities, jointly by the two parties, and ambiguous authorship. The frequencies of RNs in each authorship category are summarized by discipline and in aggregate in Table 1. Less than one-fourth of the RNs in our corpus could be unambiguously attributed to authors of the retracted articles. Notably, all of these RNs came from Cell Biology, the hard discipline. For both the hard and soft disciplines, the largest

[3] Some journal authorities may use a preformatted template (created by journal editors or publishers) in their RNs, for example, to refer to journal policy on publication. Because such a template reflects the journal authorities' stance rather than that of the authors of retracted articles, it is justifiable to classify the RNs as authored by journal authorities.

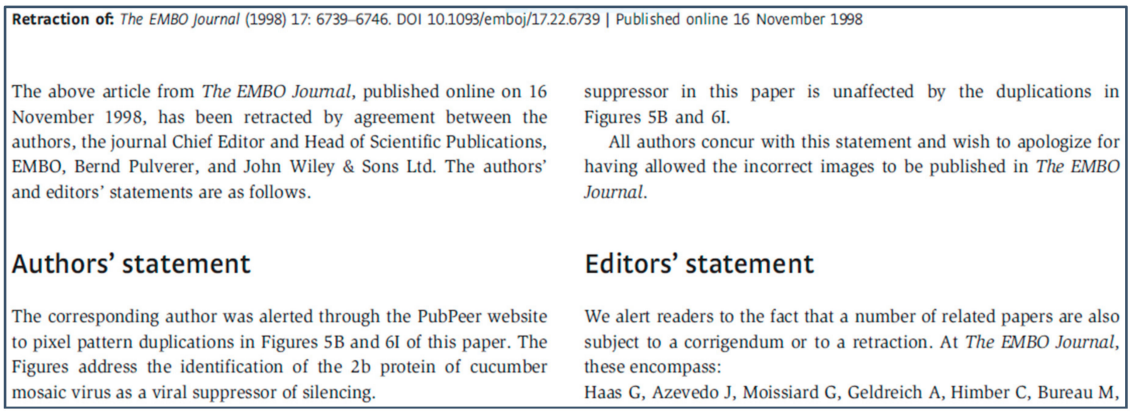
proportions of RNs fell in the category of authorship by journal authorities. The proportion was particularly striking in the soft disciplines, where more than three quarters of the RNs were penned by the journal authorities.

Table 1. Descriptive statistics for types of authorship of retraction notices.

Type of Authorship	HD (n = 301)		SD (n = 69)		Corpus (N = 370)	
	n	%	n	%	n	%
Authors of retracted articles	87	28.90	0	0	87	23.51
Journal authorities	114	37.87	54	78.26	168	45.41
Joint authorship	7	2.32	1	1.45	8	2.16
Ambiguous authorship	93	30.90	14	20.29	107	28.92

Note. HD = hard discipline (Cell Biology); SD = soft disciplines (Business, Finance, and Management)

A very small minority of RNs were ascertained to be jointly authored by journal authorities and authors of the retracted articles. An RN of joint authorship could take the form of juxtaposed statements by the authors of the retracted article and the journal authorities, as illustrated in Figure 1 [80]. It might also record correspondence between the authors of retracted articles and the journal authorities, detailing the process of handling the retraction, as exemplified by the six-page RN in [81]. It should be noted that jointly authored RNs were differentiable from those that were penned by journal authorities but included direct quotations from authors of the retracted articles and/or their affiliations, as illustrated in [76].



Retraction of: *The EMBO Journal* (1998) 17: 6739–6746. DOI 10.1093/emboj/17.22.6739 | Published online 16 November 1998

The above article from *The EMBO Journal*, published online on 16 November 1998, has been retracted by agreement between the authors, the journal Chief Editor and Head of Scientific Publications, EMBO, Bernd Pulverer, and John Wiley & Sons Ltd. The authors' and editors' statements are as follows.

Authors' statement

The corresponding author was alerted through the PubPeer website to pixel pattern duplications in Figures 5B and 6I of this paper. The Figures address the identification of the 2b protein of cucumber mosaic virus as a viral suppressor of silencing. suppressor in this paper is unaffected by the duplications in Figures 5B and 6I.

All authors concur with this statement and wish to apologize for having allowed the incorrect images to be published in *The EMBO Journal*.

Editors' statement

We alert readers to the fact that a number of related papers are also subject to a corrigendum or to a retraction. At *The EMBO Journal*, these encompass:
Haas G, Azevedo J, Moissiard G, Geldreich A, Himber C, Bureau M,

Figure 1. An example of joint authorship.

Although a rather comprehensive set of authorship criteria was employed in this study, the authorship of close to one-third of the RNs from the hard discipline and more than one-fifth of those from the soft disciplines remained ambiguous. Explicit authorship markers, for example, "salutation, sign-off, unmistakable use of first-person/third-person pronouns, references to actions by the authors of retracted articles, etc." [4] (p. 1), were absent from all of these RNs, and a number of RNs provided minimum information. Below are three examples of obscured authorship:

- This paper has been retracted [82].
- This article has been retracted at the request of the authors and/or the Editor-in-Chief. Reason: This article has been retracted at the request of the editors and authors due to unreliable data resulting from instrument error [83].
- This article has been retracted: please see Elsevier Policy on Article Withdrawal (http://www.elsevier.com/locate/withdrawalpolicy)... [84].

The one-sentence RN [82] provided no clues of any kind about its provenance. Similarly, there was no salutation/sign-off or other disambiguating information that could help to determine whether the second RN [83] was authored by the journal authorities alone or jointly by the authors of the retracted article and the journal authorities. Although journal authorities are likely to reference the publishers' policy on retraction to justify their decisions to retract published articles, authors of retracted articles do occasionally refer to such policy, as illustrated by the example below. Consequently, the authorship of the third RN [84] remained ambiguous.

- This article has been retracted: please see Elsevier Policy on Article Withdrawal (http://www.elsevier.com/locate/withdrawalpolicy). Soon after online publication of our paper we became aware of several manipulations of our Western blot data. In light of this, we are retracting the paper. We will continue to examine whether the central findings of the paper still stand; if they do, we will communicate them again in the future. We deeply apologize for any inconvenience that we may have caused [48].

3.3. Disciplinary Variation in RN Authorship

As reported above, the present study established four broad categories of RN authorship. Several two-way chi-square tests for independence were run to determine whether there was a systematic and significant association between discipline (i.e., hard vs. soft disciplines) and the incidence of each type of authorship. In the case of joint authorship, Fisher's exact test was conducted as a follow-up with the chi-square because the expected frequency count was smaller than 5 in one cell of the contingency table. The results of the statistical tests are summarized in Table 2. Two different types of measure—phi coefficients (Φ) and odds ratios—were used to gauge the effect sizes.

Table 2. Results of two-way chi-square tests by RN authorship.

Type of Authorship	*N*	*df*	χ^2	*p*	Φ	Odds Ratio
Authors of retracted articles	370	1	26.08	<0.001	−0.27	HD: SD = 56.70 [a]
Journal authorities	370	1	36.94	<0.001	0.32	SD: HD = 5.91
Joint authorship	370	1	-	1.000 [b]	−0.02	HD: SD = 1.62
Ambiguous authorship	370	1	2.58	0.108	−0.09	HD: SD = 1.74

Note. HD = hard discipline (Cell Biology); SD = soft disciplines (Business, Finance, and Management). [a] 0.5 was added to each of the four cell values in line with the recommended practice of calculating odds ratios when 0 is the value of one cell in the contingency table [85]. [b] As the expected frequencies in one cell are smaller than 5, Fisher's exact test was run to obtain the *p* value.

As can be seen from Table 2, a statistically significant association was found between discipline and incidence of RNs by authors of retracted articles. The related phi coefficient represented a medium effect size for the magnitude of the association [86]. The corresponding odds ratio indicated that RNs from the hard discipline of Cell Biology were at least 56.70 times more likely to come from authors of the retracted articles than those from the soft disciplines of Business, Finance, and Management were. A significant discipline/authorship association was also found for the incidence of RNs authored by journal authorities. The strength of the association, as indicated by the phi coefficient, was again of a medium effect size. This time, RNs from the soft disciplines were almost six times more likely to be authored by journal authorities than those from the hard discipline were. No significant relationships, however, were detected for the categories of joint authorship and ambiguous authorship, indicating that jointly authored RNs were equally infrequent across the disciplines and that the rather high frequencies of RNs with obscured authorship did not differ between the hard and soft disciplines.

4. Discussion

A total of 25 distinct criteria have been identified in this study that can be used to ascertain authorship of RNs. Each of them is a sufficient criterion in the sense that the authorship of an RN can be unambiguously attributed if it clearly meets the criterion in question (e.g., a first person pronoun

followed by the phrase *the authors* or the name of any author of the retracted article as its appositive or in parenthesis). The sufficiency of these criteria, however, does not preclude multiple authorship markers from occurring in a single RN, as demonstrated by the following RN [44]:

- In the course of carrying out experiments that were a direct extension of the above paper, we (the authors) discovered differences from those presented in the original article such that the primary conclusions of the paper are in question. Because of this, we are retracting the entire paper on the interaction of HIV-1 Vpr and the B55 subunit of protein phosphatase 2A (PP2A), and its implications on Vpr-mediated G_2 cell cycle arrest. We are deeply regretful for any scientific misconceptions that have resulted from this study and apologize for any delay that readers may have incurred in their research.

A close examination of the RN against the 11 criteria for attributing authorship to authors of retracted articles will show that it meets six of the criteria: #2, #3, #7, #8, #9, and #10. The co-occurrence of multiple authorship markers in an RN communicates a strong authorial presence, points to unmistakable authorship, and thus should be encouraged.

Clear, comprehensive, and easy-to-use criteria for ascertaining RN authorship, such as those identified in the present study, are invaluable to researchers who need to determine RN authorship to study ethical issues in research retraction, for example, the relationship between authorship of RNs and different reasons for retraction, discoursal presentation in RNs of retraction-engendering acts by different RN authors [21], and historical trends in various aspects of RNs based on types of authorship. Such criteria are also very useful to regulatory bodies for scientific integrity, such as COPE and ICMJE (International Committee of Medical Journal Editors), and publishers in their efforts to formulate guidelines on research ethics, retraction of published research, and publications of RNs. Furthermore, they can also assist the gatekeepers of scientific publishing—that is, editors, editorial boards and other editorial staff—in deciding whether RNs submitted for publication clearly indicate authorship, adequately attribute ethical responsibilities, and deservedly express mortification [4]. Finally, the criteria can help academics who are in need of retracting their publications produce RNs that not only correct the literature but also mark out their authorial responsibilities.

Despite the reasonable comprehensiveness of the criteria of sufficiency formulated for this study, authorship could not be ascertained for 20.29% of the RNs in the soft disciplines and 30.90% of those in the hard discipline. Most of these RNs (i.e., 75.70%) with obscured authorship involved serious academic misconduct such as data fabrication, data falsification, data manipulation, and plagiarism. Although no independent evidence is available for verification, it is reasonable to suggest that the majority of these RNs came from authors of the retracted articles for the reasons discussed below. This points to deliberate evasion of authorship. Authorship evasion was also reflected in another way. Of the 370 RNs examined in this study, only two involved retractions for which journal authorities were responsible, three dealt with retractions for which neither journal authorities nor authors of retracted articles were responsible, and three did not identify who had committed the retraction-engendering acts. The remaining 362 RNs retracted articles due to acts by the authors of the retracted articles. In other words, although authors of retracted articles in our corpus were held responsible for the retractions reported in 97.83% of the RNs, only 25.68% of the RNs could be unambiguously attributed to them alone or jointly. In the overwhelming remaining cases where they were responsible for the retraction-engendering acts, the authors of the retracted articles were able either to avoid issuing an RN themselves or to leave their authorship of RNs obscured. These findings are consistent with the observation that in cases of allegations of misconduct "the authors who were so glad to receive credit when the paper was published deny any responsibility and vanish, leaving the paper an orphan and making the authorship byline meaningless" [87] (p. 1275). Consequently, journal authorities would be forced to face up "a disconnect between credit and responsibility" [87] (p. 1275). This can partially explain why the journal authorities produced 45.41% of the RNs in our corpus, although they were responsible for the retractions reported in only 0.54% of the RNs.

There are reasons why the authors of retracted articles may avoid issuing RNs or deliberately leave their RN authorship ambiguous. RNs by authors of retracted articles are public admissions of serious problems with their publications. To publicize their retraction-engendering acts, be they instances of misconduct or honest human errors, can be interpreted by authors of articles warranting retraction as a grave threat to their image as reputable academics whose research is scientifically sound and ethically unflawed. To make things even worse, there are various grave consequences in the wake of retractions, including but not limited to publishing bans [25], denial of funding opportunities [26], job loss [27], and exile from academia [28,29]. Consequently, authors of retractable articles may choose to remain silent, leaving journal authorities with the unpleasant but necessary task of issuing RNs. However, silence is neither a responsible reaction nor a good strategy for savaging one's academic career. On the contrary, a public admission of one's fault can make the process of retraction less complicated and clean up the literature more effectively. It also evidences a willingness to atone for one's fault and amend scientific integrity, which, in return, may create more positive feelings towards one as a responsible academic and offset to some extent negative opinions of his/her work. As an example, in a retraction due to self-plagiarism [81], the two authors of the retracted article were commended by the journal editors for "their professionalism, humility, and courage" and for setting a good example of "living up to a commitment of ethical research and publishing practices" (p. 162). Journal authorities may also avoid issuing RNs or evade their authorship of RNs, but for considerations that are different from those entered by authors of articles warranting retraction. Given the unpleasant implications of retractions, journal authorities may wish to distance themselves and their journals from RNs. Frequent publication of RNs can damage the reputation of an academic journal and suggest serious lapses in the editorial process. More importantly, to identify themselves explicitly as RN authors puts journal authorities at a risk of potential litigation from the authors of retracted articles. Thus, the COPE retraction guidelines recommend that journal authorities negotiate with authors of retracted articles to agree on the wording of an RN as a form of defense against libel claims [5]. Although it is unknown to what extent this recommendation has been followed in practice, it would be safe to suggest that some of the ambiguous RNs in our corpus were authored by journal authorities.

There were notable cross-disciplinary differences in the likelihood of journal authorities issuing RNs. The present study has found that journal authorities in the soft disciplines were significantly more likely to issue RNs than their counterparts in the hard discipline, and, conversely, that authors of retracted articles in the hard discipline were drastically more likely to issue RNs than their counterparts in the soft disciplines. Several factors might have contributed to these patterns. First, because soft disciplines in general retract much fewer publications than hard disciplines do [6], to publish an RN tends to be much more ignominious to academics in soft disciplines than their counterparts in hard disciplines. This greater ignominy may have deterred academics in the soft disciplines of Business, Finance, and Management from issuing RNs in their own names. Second, more repeat offenders (i.e., with more than one retraction) were found in the soft disciplines, accounting for 72.46% of their RNs, than in the hard discipline, accounting for 52.16% of its RNs. Notably, the worst repeat offender in the soft disciplines was responsible for 19 retractions (27.54% of all the soft-discipline RNs). It would have been much safer for journal authorities to issue RNs to repeat offenders' publications. Third, a much larger proportion (i.e., 37.68%) of the retractions in the soft disciplines followed from institutional investigations that were carried out by third-party governing bodies for scientific integrity (e.g., home institutions of the authors of retracted articles and learned committees), as compared with the proportion (i.e., 18.27%) of such retractions in the hard discipline. Journal authorities in the soft disciplines were at a much lower risk of litigation to retract articles in response to the results of such institutional investigations into scientific misconduct. Last but not least, the nature and object of disciplinary inquiry could also explain why academics in Cell Biology were more likely to retract their own articles than their counterparts from the soft disciplines. The object of study in Cell Biology is the world of cells, that is, natural entities that are governed by invariant laws, and research on such entities is replicable and encouraged to be replicated [88]. If a published study cannot be replicated in multiple

attempts[4], there is cause for suspecting serious research flaws or misconduct, and the author of the study is under much pressure to retract the article. By contrast, the object of study in a soft discipline is usually the world of human behavior, and given human beings' volition and the caprices of their behavior, research on human behavior is hardly replicable [89]. Consequently, there is no real or hard evidence of a study having gone awry or foul play that can compel soft-discipline authors who lack the research integrity to retract their publications.

5. Conclusions

This study has identified a comprehensive set of criteria that can be used to disambiguate RN authorship. These criteria are of value to researchers interested in ascertaining RN authorship for their projects; regulatory bodies, learned societies, and publishers that are entrusted with the task of formulating policies and guidelines regarding research retraction; and journal editors and other journal authorities handling RNs in the front line. This study has also revealed a disconcerting extent of evasion of RN authorship, reflected in the large number of RNs with obscured authorship and the low proportion of RNs that could be unambiguously attributed to authors of retracted articles. This problem plagued both the hard and soft disciplines examined, indicative of its gravity. Furthermore, the study has uncovered systematic disciplinary variations in the incidence of RNs authored by journal authorities and authors of retracted articles, respectively. The disciplinary differences can be explained in terms of varying ignominy resulting from public admissions of problems with published research, the relative risk of litigation against journal authorities, the extent of third-party involvement, and characteristics of disciplinary inquiry. These findings point to the importance of giving continued research attention to RNs, the need to require and enforce unambiguous RN authorship, and the usefulness of providing guidance on how to mark authorship unmistakably.

Further research can extend the authorship criteria to RNs that are collected from other disciplines to verify their applicability and refine them for effective use. Interested researchers can also validate the accuracy of authorship classifications based on these criteria by collecting confirmatory information from journal editors and authors of retracted articles. Although our earlier unsuccessful attempt to contact authors of retracted articles evidenced the challenges of securing a reasonable response rate, the usefulness of information collected from these sources make it worthwhile to try every legitimate means to collect the data. Admittedly, the size of our corpus was relatively small, but these were all the RNs indexed by the WoS for the disciplines of interest. Consequently, our generalizations are restricted to RN authorship in only these sampled disciplines. Future research should involve more disciplines to increase the sample size of RNs and the generalizability of the findings. While this study has investigated the issue of RN authorship solely from an etic perspective and purely based on an analysis of textual features, further research needs to take the insider perspectives of journal editors and authors of retracted articles as well to understand their motivations and considerations concerning RN authorship. In particular, reaching out to journal editors to elucidate the retraction publication process and related policies could help to provide a more comprehensive picture of RN authorship and the behind-the-scenes factors influencing such authorship. Finally, future research could also examine RN authorship in relation to the demarcation of ethical responsibilities and the linguistic rendering of agency and visibility of retraction-engendering acts. This line of inquiry could draw on well-established conceptual frameworks, such as William Benoit's Image Repair Theory [90], to gain deeper insights into the psychology of research retraction.

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[4] One reviewer of our paper has noted that several cases of misconduct in the hard sciences were uncovered by merely comparing images within published studies, and such comparisons clearly showed manipulation or duplication of the images. Notably, the use of images is also a discipline-specific feature, with hard sciences such as Cell Biology more likely to use images than soft disciplines such as Business, Finance, and Management.

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