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## Poor visibility of retracted articles: a problem that should no longer be ignored

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1 **Unidentified retracted articles in publisher's websites, bibliographic**  
2 **databases, social academic networks, and Sci-Hub black open**  
3 **access website: a problem that should no longer be ignored**

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**KEY MESSAGES**

- **Publishers' websites and sites hosting references and/or full-text academic articles insufficiently identify retracted articles**
- **Retracted articles that are not identified as such may continue to be cited, propagating scientific error**
- **Solutions such as maintain up to date databases for sites hosting articles or better adhesion to COPE retraction guidelines exist, but these solutions have been unevenly applied to highlight when an article has been retracted**
- **All stakeholders must be aware of the importance of dealing appropriately with retracted articles and must urgently act in this direction**



22  
23  
24 **Contributors and sources**

25 CB and FM have published articles related to bibliometrics in the past several years,  
26 especially in ophthalmology. They have also studied the difficulty involved in accessing  
27 scientific literature around the world with KH, a specialist in information science. The idea for  
28 this article came from FM who had used a retracted article in his bibliography. Short  
29 interviews with colleagues showed that this topic was relatively unknown.

30 CB and FM drafted the manuscript; CB and FM extracted data. CB analyzed data; and CB,  
31 KH and FM revised the manuscript critically for important intellectual content. All authors  
32 approved the final version of the manuscript. CB is the guarantor of the article.

33

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37 discussions related to this article.

38

### 39 **Patient involvement**

40 No patients were involved in this work.

41

### 42 **Conflicts of Interest**

43 We have read and understood [BMJ policy on declaration of interests](#) and we have no  
44 conflicts of interest to declare.

45

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54 ***Christophe Boudry and colleagues** call for better identification of retracted articles on*  
55 *publishers' websites and sites hosting references and/or full-text articles, to stop retracted*  
56 *articles being cited without reference to the retraction and thus avoiding scientific error*  
57 *propagation.*

58

59 Again, in December 2022, a high profile paper was retracted [1]. Article retraction is defined  
60 as the withdrawal of a previously published article in an academic journal [2], and is  
61 understood to be “a mechanism for correcting the literature and alerting readers to articles  
62 that contain such seriously flawed or erroneous content or data that their findings and  
63 conclusions cannot be relied upon” [3]. Although retractions are still rare, with around 5  
64 retractions per 10,000 articles published [4–6], numerous papers have highlighted an  
65 increasing rate of retractions over time [4,5,7–9] (see Box 1). The COVID-19 crisis has been  
66 the source of a significant number of article retractions [10–12], with high retraction rates in  
67 the earlier and acute phase of COVID-19 compared to some related research fields, for  
68 example up to four times higher compared to other infectious diseases such as HIV, H1N1  
69 or Ebola [13]. Three years after the outbreak of the pandemic, however, it is now estimated  
70 that the retraction rate of COVID-19 articles is “consistent with the expected overall rate of  
71 retraction” [14].

72 Academic article retraction mainly results from inadvertent errors or mistakes, non-replicable  
73 findings, research misconduct, and redundant or duplicate publication [15]. In 2020, the most  
74 common reason for retraction of biological and medical research articles was scientific  
75 misconduct (62.2%), followed by error(s) in the manuscript (37.4%) and issues with the  
76 journal or publisher such as accidental duplicate publication, publication in wrong journal or  
77 preliminary version accidentally published without final author correction (19.4%) [6]. Nearly  
78 70% of retracted articles had more than 1 reason for retraction [6]. Retractions “represent  
79 wasted resources incurring significant financial costs” [16]: in a research article, Stern et al.  
80 found that retracted articles due to research misconduct accounted for approximately \$58  
81 million in direct funding from the NIH between 1992 and 2012 [16]. These authors also note  
82 the cost of unproductive research by researchers whose articles are retracted or based their  
83 work on retracted articles and, those related to publishing process of retracted articles (e.g.  
84 time spent for reviewing and managing the articles). Moreover, article retractions may put  
85 patients at risk [10,17,18]. Stern et al. also pointed out that “some studies indicate that  
86 hundreds of thousands of patients have been placed at risk of improper medical care due to  
87 enrolment in fraudulent studies or the administration of treatment based on fraudulent  
88 studies” that were retracted [16]. Article retractions also participate in scientific error  
89 propagation when retracted articles continue to be cited without reference to the retraction  
90 [19–24], also in clinical trials reports [25] and meta analyses [26].

91  
92 Theoretically, citations should stop as soon as articles are retracted. In fact, retractions have  
93 little or no impact on the total number of citations, showing that researchers continue to cite  
94 retracted articles without reference to the retraction [19–25]. For example, a research article  
95 paper published in Plos One analysed 54 retracted papers related to reporting a radiology-

96 imaging diagnostic method: for 30 of 54 articles (55.6%), the number of post-retraction  
97 citations was higher than the number of citations before retraction [15]. Moreover, of 559  
98 total post retraction citations of these 54 articles, 546 (97.7%) did not reference the  
99 retraction, suggesting that the majority of citing articles were either not aware of the  
100 retraction, or they were aware of the retraction and cited it anyway. This problem extends to  
101 high-profile journals: a paper published in Cell in 2010 [27] was retracted in 2014 but  
102 continued to be widely cited by 2016 without mentioning the retraction in 94% of post-  
103 retraction citations [24].

104

105 The Committee on Publication Ethics (COPE) [3] has published specific recommendations to  
106 help publishers facilitate and standardize their management of the retraction process.  
107 Several studies have shown that these recommendations are inconstantly applied: e.g.  
108 publishers may not correctly identify retracted articles as such on their website [21,28–30],  
109 although this is clearly stated in COPE guidelines. This could reflect “an inadequate  
110 awareness of the existence of the COPE guidelines” [10] which could explain why they are  
111 not well respected [28]. Copies of retracted articles can be hosted on a range of different  
112 websites (preprint servers, bibliographic databases, academic social networks or illegal  
113 black open access websites and may not be identified as retractions [19,20,25,31,32]. These  
114 unidentified retracted articles continue to be cited by authors without reference to the  
115 retraction and then may survive online [19–25]. We argue that a multi-pronged approach  
116 including actions by sites hosting articles, journals and authors is needed to solve this  
117 worrying problem. We also support that the persistence of this problem is as much  
118 incomprehensible that some simple-to-implement solutions exist to overcome it.

119

### **Box 1: Retractions of biological and medical science research articles**

The retraction rate per 10,000 publications was 0.38 in 1985, 2.03 in 2000 and rose to 5.95 in 2014. The majority of retractions occurred within 1 year of publication, with lower retraction rates over time since publication. On average, articles are retracted 3.8 years after their publication [5].

It is difficult to know if the increase in article retractions results from a rise in fraud and error [33], or if the scientific community is improving its ability to detect and report them, reflecting a more self-monitoring community [4,7,8,10,34]. Pressure to ‘publish or perish’, and the ensuing increased competition to publish and find funding may contribute to an atmosphere in which some individuals could be tempted to selectively report results, or worse, commit outright fraud, both of which may lead to article retraction [35]. For journals’ part, accelerated publication of research, as it was the case during the acute phase of the COVID-19 crisis [12,36,37] may be associated with less rigorous peer-review [38], further increasing the risk of retraction.

### **Online survival of unidentified retracted articles**

Since the late 1990s, there has been a large proliferation of article servers that have grown around publishers’ websites. The number of different places where an article citation or full-text could be accessed online is approximately 200, [39], including preprint servers, bibliographic databases (e.g. Scopus, Wos, Google Scholar), academic social networks (e.g. ResearchGate or Academia.edu), or illegal black open access websites (e.g. Sci-Hub). Information on the retraction of articles should in principle appear first on the publishers’ websites and flow to other research websites and servers. Nevertheless, some publishers are still not identifying retractions correctly on their websites [21,28–30]. In a research article from 2013, of 233 retracted articles studied, 52 (22.3%) were not flagged as being retracted [28]. If articles are not corrected on publishers’ websites, other sites hosting references and/or full-text articles online may fail to identify them as retracted. For example, a research article from May 2022 has shown that among the 30 preprints linked to retracted journal publications present on Research Square, bioRxiv, and medRxiv, only 16 (53.3%) included an indication of the retraction on the preprint [32]. Multidisciplinary databases such as Scopus and the WoS do not always clearly and consistently display retractions [29], and while Google Scholar is widely considered to be the most comprehensive source of scientific information [40], it is well known to lack quality control and clear indexing guidelines [41]. For example, two high-profile articles related to COVID-19 published in *NEJM* [42] and in *The Lancet* [43], survived as non-retracted articles in Google Scholar five months after their retraction [38]: 19 versions for the NEJM article, and 59 versions for The Lancet article.

156

157 The bibliographic database specialized in biology and medicine PubMed best adheres to  
158 procedures for documenting and updating retracted publications and is considered “the  
159 authoritative source for information about retractions” [44]. In contrast, there is currently no  
160 data available on the extent to which sites like Google Scholar, ResearchGate and Sci-Hub  
161 mark retracted articles as retracted on their websites. We checked 500 randomly selected  
162 retracted articles (from a total of 8559 retracted articles listed in PubMed in April 2021) for  
163 the presence of any information allowing identification of retraction in references and full-text  
164 articles (Table 1). Roughly 66.3% of references hosted by Google Scholar were not  
165 identified as retracted, and 22.9% of references and 81.8% of the full texts of retracted  
166 articles hosted by ResearchGate made no mention of retraction. In Scopus and the WoS,  
167 54.6% and 41.9% of references were not identified as retracted, respectively. A 2021  
168 research letter study corroborates our results with the poor identification of retracted articles  
169 we observed in Scopus (50%) and the WoS (40.6%) [45]. Sci-Hub is widely used by  
170 researchers and allows clinicians, especially in low income countries, to obtain essential  
171 information and respond appropriately to patient care needs [46,47]. In our sample, more  
172 than 71% of full texts downloadable on Sci-Hub were not marked as retracted. Researchers  
173 using Sci-Hub thus have the double burden of not having good access to full text articles,  
174 and also using a potentially biased subset of articles that does not account for retractions.  
175 For comparison, publishers did a somewhat better job of identifying when an article was  
176 retracted, but still did not flag 20.8% of references and 18.1% of full texts of retracted articles  
177 as retracted (Table 1).

178

179 **Table 1: Publishers’ websites and sites hosting references and/or full-text articles**  
180 **insufficiently identify retracted articles**

181 A search for retracted articles was done on PubMed on April 8th 2021. A total of 8559 journal articles were  
182 retrieved from which 500 were randomly selected. For this, a random sequence of integers between 1 and 8559  
183 was generated using Random.org and attributed to the 8559 articles. An ascending classification was performed  
184 based on these random integers, and only the first 500 articles were considered for analysis. A check for the  
185 presence of any information allowing identification of retraction in references and full-text articles was performed  
186 for each of these 500 articles and on each of the sites or services studied. Digital Object Identifiers (DOI) or titles  
187 of articles were used as queries. All searches were conducted between April and July 2021. Full-text paywalled  
188 articles on publishers’ websites were searched using the institutional access of our university. Searches using  
189 Sci-Hub were performed in France using non-university internet access. No university or institution affiliated with  
190 the authors of this article were therefore involved in downloading articles via Sci-Hub.

191 “-“ : unavailable

		Number of references available (%)	Number of references unidentified as retracted (%)	Of referenced articles, number of full text articles available (%)	Number of full text articles unidentified as retracted (%)
<b>Publisher</b>	<b>Publishers' websites</b>	476 (95.2)	99 (20.8)	403 (84.7)	73 (18.1)
<b>Subscription-based bibliographic databases</b>	<b>Scopus</b>	403 (80.6)	220 (54.6)	N/A	N/A
	<b>WoS</b>	420 (84)	176 (41.9)	N/A	N/A
<b>Free bibliographic database</b>	<b>Google Scholar</b>	499 (99.8)	331 (66.3)	N/A	N/A
<b>Academic social network</b>	<b>ResearchGate</b>	497 (99.4)	114 (22.9)	176 (35.4)	144 (81.8)
<b>Black open access (illegal)</b>	<b>Sci-Hub</b>	437 (87.4)	330 (75.5)	435 (99.5)	310 (71.3)

192



193 **Reducing citations of retracted articles needs action by publishers, sites**  
194 **hosting references and/or full-text articles, and authors**

195

196 A number of solutions have been proposed to better recognize when articles have been  
197 retracted online and to decrease their being cited. Most obviously, retracted articles should  
198 be unmistakably identified as such by publishers: Suelzer et al. and Frampton et al., have  
199 suggested that these ones should systematically add the prefix of ‘retracted’ to the title of  
200 retracted articles [45] and diagonally watermark each page of the full text article stating  
201 “retracted” or “withdrawn” [10]. As pointed out by Frampton et al., publishers fail to alert  
202 readers to retractions because some are not sufficiently “aware of the problem” [10]. It is  
203 important therefore that the limitations in the retraction process are widely communicated  
204 and that publishers share their best practices [10]. Improvement in adherence to COPE  
205 guidelines could improve this situation [3,28], but this step alone would of course not solve  
206 all problems. Indeed, there are potential limits to interoperability and the workflows that  
207 update articles because international standards regarding the transmission and display of  
208 metadata for retracted publications are still under development [29]. These difficulties alone  
209 do not explain the poor performance of Google Scholar or Sci-Hub in correctly identifying  
210 retracted articles. The fact that PubMed can and does update its references to reflect article  
211 retractions suggests that article retractions have not been recognized or considered a priority  
212 by these other sites. Retraction Watch DataBase (RWDB) has been specifically developed to  
213 report retracted articles [48]. It has identified more than 40000 retracted articles in all  
214 disciplines. It is the most comprehensive and largest database of retracted articles, and its  
215 content is regularly updated [4]. Considering partnership with the RWDB and/or referring to  
216 PubMed to identify retracted articles could be a solution for these sites.

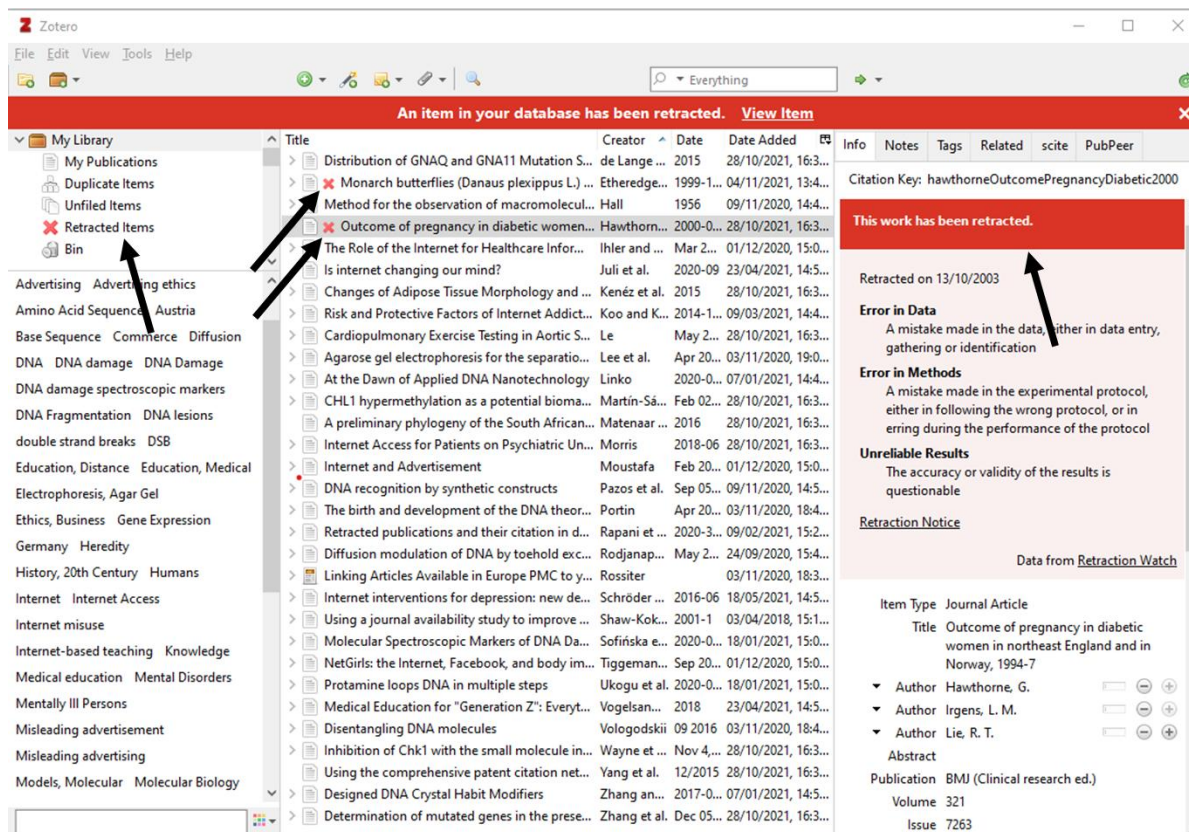
217

218 For their part, authors can identify retracted articles by searching PubMed for “Retracted  
219 publication [pt]”, where the term “pt” in square brackets stands for publication type, or by  
220 going directly to the PubMed list of retracted publications  
221 (<https://pubmed.ncbi.nlm.nih.gov/?term=retracted+publication+%5Bpt%5D>) [44]. As a result  
222 of partnering with the RWDB, reference management software such as Zotero and EndNote  
223 are another efficient way to avoid citing retracted articles [20]. Unlike other reference  
224 management software services (e.g., Mendeley), Zotero and EndNote have built-in  
225 capabilities for monitoring retractions by checking the RWDB for retracted documents. This  
226 feature was developed in partnership with the RWDB in 2019 for Zotero and in 2021 for  
227 EndNote. As an example, retracted publications stored in Zotero and also present in the  
228 RWDB are flagged in the Zotero article list, warning users that the stored article is retracted

229 (Figure 1). In addition, each time the software is run, all articles are checked for retractions in  
230 the RWDB, allowing automatic updates over time. In our sample, Zotero or EndNote (and  
231 therefore the RWDB), would have identified 477 of the 500 retracted articles as being  
232 retracted (95.4%). Nowadays "inappropriate citations of retracted articles are difficult to  
233 excuse" [49] according the partnership of Zotero and EndNote with RWDB, and the absence  
234 of drawbacks to use these tools (except for EndNote which is a commercial software).

235  
236 Publishers can also do more to avoid publishing articles citing retracted articles without  
237 reference to the retraction. In 2006 the members of the International Committee of Medical  
238 Journal Editors (ICMJE) changed the Uniform Requirements for Manuscripts to specify that it  
239 is the author's responsibility to check their manuscripts for and remove references to  
240 retracted articles [44]. To this end, publishers could require authors to attest that they have  
241 checked their submitted manuscripts' references and that no retracted articles are included  
242 unwittingly [45]. Unfortunately, few publishers have included such statements in their  
243 submission guidelines (for example Plos One or Visualized Cancer Medicine), and these  
244 recommendations do not address the issue (for authors and peer reviewers who depend on  
245 the same information sources [20]) because retracted articles are not systematically  
246 identified as retracted across online databases. Manuscript submission platforms could also  
247 help authors identify retracted articles in their reference list. Some platforms, such as  
248 Editorial Manager, in partnership with scite\_ [50], have developed reference check tools to  
249 track retracted article during manuscript submissions. Needless to say, not all journals (and  
250 not even all journals hosted by Editorial Manager) use this tool.

251



252  
253 Fig 1 | Display of a retracted article in Zotero

254  
255 In conclusion, despite COPE and ICMJE guidelines and the existence of reference  
256 management software services such as Zotero or EndNote, amidst a growing number of  
257 journals and a rising rate of retracted articles in the past two decades, retracted articles are  
258 not universally marked as retracted across multiple websites hosting references and/or full-  
259 text articles. Retracted articles continue to be cited long after their retraction, propagating  
260 errors and possibly affecting the accuracy of subsequent analyses [19–25] and, may have  
261 potential consequences in medicine for patient health [10,17,18]. Guidelines regarding  
262 retracted articles have existed for almost 25 years but have failed to improve the situation.  
263 This may be, in part, because the COPE guidelines do not provide any specific  
264 recommendations for tracking and deleting unlabelled retracted articles present on a  
265 multiplicity of websites and sites hosting references and/or full-text articles once a decision  
266 has been made to retract an article. It is also possible that the resolution of this problem,  
267 being dependent on multiple actors, has experienced an effect of dilution of their individual  
268 responsibility. We also assume that given that retractions are relatively uncommon, most  
269 researchers do not feel concerned by this problem. Nevertheless, the scientific community is  
270 increasingly aware of scientific integrity issues over time due to the rising of open science  
271 practices [51]. In the long run, this could put pressure on the journals or sites hosting articles  
272 to improve their practice regarding article retractions, which could indeed see in it an

273 opportunity to stand out from the other actors in an increasingly competitive field. In any  
274 case, solving the worrying problem of the citation of retracted articles is a collective  
275 responsibility that requires a real commitment on the part of all actors involved in scientific  
276 publication.

277

278

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