

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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5 Christophe Boudry (0000-0002-8730-8731) ^{1,2}

6 Katherine Howard (0000-0002-9327-8989) ³

7 Frederic Mouriaux (0000-0001-9183-4235) ⁴

8
9 ¹ Normandie Univ, UNICAEN, Média Normandie. 14032 Caen cedex, France

10 ² URFIST, Ecole Nationale des Chartes, PSL Research University. 75005 Paris, France

11 ³ University of South Australia, Adelaide, Australia

12 ⁴ INSERM, Univ Rennes, CHU Rennes, Department of Ophthalmology, CLCC Eugène
13 Marquis, COSS [(Chemistry Oncogenesis Stress Signaling)] – UMR_S 1242, 35000 Rennes,
14 France

15
16 **Correspondence to:**

17 Christophe Boudry

18 Email: christophe.boudry@chartes.psl.eu

19 Phone: (+33) 1.88.12.03.17

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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to COPE retraction guidelines exist, but these solutions have been unevenly applied to highlight when an article has been retracted**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**

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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28 this article came from FM who had used a retracted article in his bibliography.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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38

39 **Patient involvement**

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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.

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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.

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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 (%)
Publisher	Publishers' websites	476 (95.2)	99 (20.8)	403 (84.7)	73 (18.1)
Subscription-based bibliographic databases	Scopus	403 (80.6)	220 (54.6)	N/A	N/A
	WoS	420 (84)	176 (41.9)	N/A	N/A
Free bibliographic database	Google Scholar	499 (99.8)	331 (66.3)	N/A	N/A
Academic social network	ResearchGate	497 (99.4)	114 (22.9)	176 (35.4)	144 (81.8)
Black open access (illegal)	Sci-Hub	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

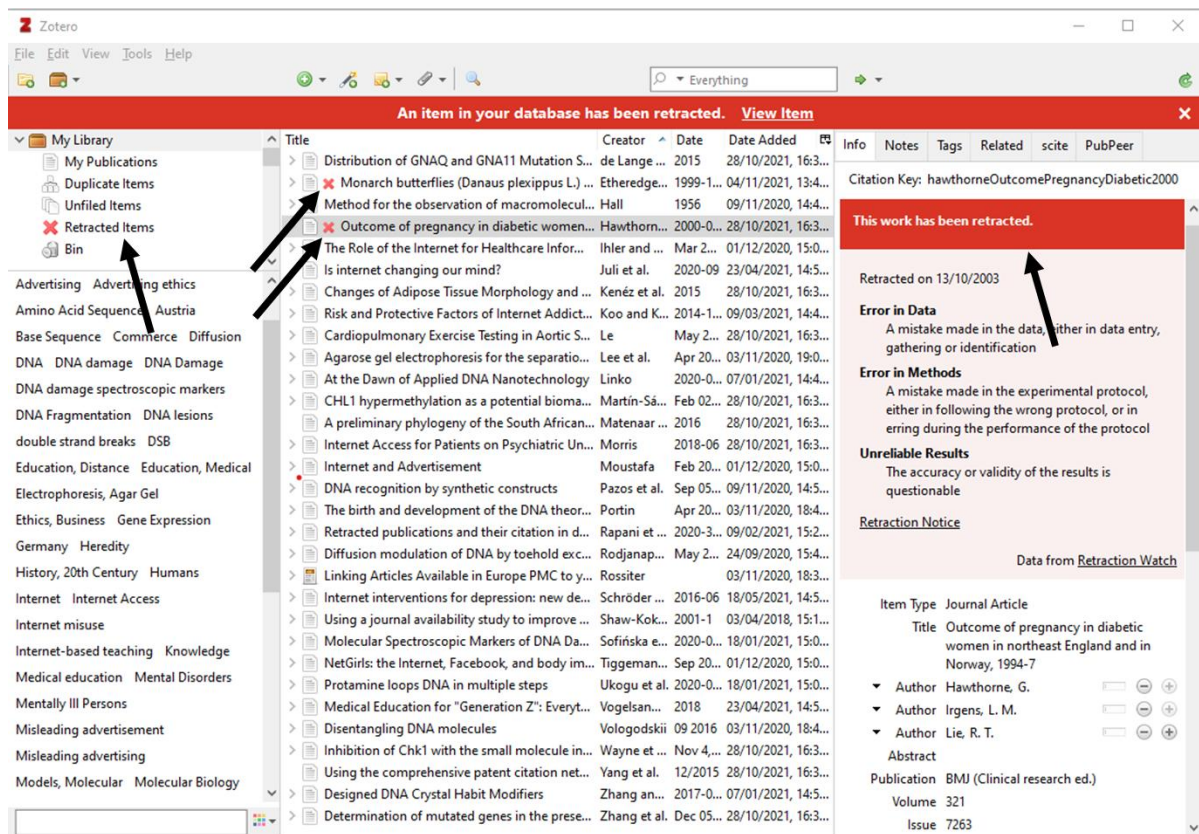
218 For their part, authors can identify retracted articles by searching PubMed for “Retracted
219 publication [pt]”, where the term “pt” in square brackets stands for publication type, or by
220 going directly to the PubMed list of retracted publications
221 (<https://pubmed.ncbi.nlm.nih.gov/?term=retracted+publication+%5Bpt%5D>) [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.

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