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DISPUTE RESOLUTION IN THE CONTEXT OF SCIENTIFIC RETRACTION

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Abstract

The scientific retraction process is essential for maintaining the integrity of academic research and the scientific record, addressing issues like data fabrication, plagiarism, and significant errors. Retractions have increased annually, with over 10,000 papers retracted in 2023 alone, reflecting more than 0.2% of published scientific papers. This rise is partly due to lower peer-review quality and increased awareness of correcting scientific records. Despite the importance of retractions, the process faces challenges, including lack of transparency and consistency in decision-making, prolonged disputes, and the impact on researchers' reputations. Authors are particularly vulnerable during the retraction process, often facing limited explanations for the retraction of their work. This lack of transparency and consistency in the decision-making process leaves authors with little recourse to understand or contest the retraction. When disagreements arise, the only avenue for authors to challenge the journal's decision is through the legal system, which is notoriously slow, inefficient, and costly, not only imposing substantial financial burdens on the authors but also prolonging the uncertainty to their professional standing. Consequently, many authors feel helpless and unprotected, exacerbating the stigma and professional risks associated with retractions. Plagiarism is a prevalent reason for retractions, being the second most common cause, and it is relatively straightforward to investigate since it can be adjudicated based on textual evidence. By employing Kleros Courts, this manuscript aims to introduce a transparent, immutable, and decentralized system for resolving such disputes. Implementing such technology could set a new standard for scientific publishing, ensuring consistent and fair resolution of disputes.

Retraction – State of the art

Scientific retractions are formal statements issued by academic journals indicating that a published paper has been withdrawn from the scientific record. Retractions are typically issued when significant errors or misconduct, such as data fabrication, plagiarism, or honest mistakes, are discovered post-publication [1]. The scientific retraction process is pivotal in preserving the integrity and reliability of academic research [2]. Studies across various fields indicate a yearly increase in retractions, both in absolute terms and relative to the number of published papers [3–6], with Nature reporting over 10,000 papers retracted in 2023, doubling from approximately 5,500 the year before, as well as Retraction Watch's database reporting more than 8,000 retractions in 2023 (Fig. 1a). This represents over 0.2% of the yearly published scientific papers, a rate that has been on the rise [6]. Concurrently, the volume of yearly publications has surged by about 200% over the last two decades, reaching more than 6.5 million in 2023 [7]. Although the reasons for this sharp increase in retracted articles is far from being understood, some have suggested there is a dual cause as to lower peer-review quality and increased awareness of correcting the published scientific record [8].

While retracting flawed articles is essential for the accuracy of the scientific record, the current retraction process faces several challenges, such as lack of transparency, [8]. The decision-making process often lacks transparency and consistency [9], evidenced by the fact that, before the publication of the Retraction Database by Retraction Watch, only 26% of retractions indexed in the Web of Science database included information about the investigation [10]. Currently, more than 20% of all retractions contain limited or no information about the reason for the retraction (Fig. 1b). The criteria for retraction are generally understood but not uniformly applied across journals and disciplines [11,12], leading to prolonged disputes and delaying the retraction of flawed articles [13]. Prolonged retraction times also have an impact on citations, which continue accruing until the retraction notice is issued [14–16]. The potential damage to a scientist's reputation upon retraction can often dissuade researchers from retracting their work voluntarily, even from collaborating during investigations when errors are discovered [17–20]. Reporting scientific errors publicly is not free from professional backlash either [21]. For this reason, anonymous reports have become increasingly popular, and the online platform PubPeer has gathered strong popularity for anonymous comments to scientific articles [13].
However, not all retractions result from deliberate misconduct, with honest errors in data collection, analysis, or interpretation also playing a significant role. Overall, plagiarism has been identified as the predominant cause, accounting for up to 50% of all retractions [19,22]. Analysis of Retraction Watch's database places plagiarism as the second leading cause for retraction with 29% of the cases (Fig. 1c). Direct costs of scientific misconduct have been estimated to be of more than $500.000, formed mainly by salaries of employees designated in the investigation [23].

The role of publishers in the retraction process is complex, with a growing number of

journals and publishers taking proactive steps against scientific misconduct [24]. However, the potential impact on journal reputation and citation metrics may make some publishers hesitant to retract articles, especially those of high profile [22]. The phenomenon of "open-access predatory publishers", first noticed by Jeffrey Beall when he described "publishers that are ready to publish any article for payment" [25], has created unrest in the scientific community. The exploitation of publishing fees as a profitable business model has created an incentive for scientific publishers to lower the quality standards of peer-review, this has been stated as one of the reasons for the recent increase in scientific retraction [7,25,26]. Prior to 2020, most retraction notices lacked detailed reporting of any underlying investigation, a trend that changed with the latest guidelines from the Committee of Publication Ethics [10,27]. These notices are predominantly issued by journal authorities and/or authors of the retracted publications [28]. The emphasis on transparent reporting of scientific integrity violations by international organizations underscores the importance of accountability in the scientific community [29–32]. Governments particularly affected by frequent cases of misconduct, e.g., China, and international universities have produced clear guidelines to assess the retraction process in cases of scientific misconduct [33–35]. A comprehensive compilation of journal policies on scientific integrity has been gathered by [36].

When authors and scientific journals do not agree on an article's retraction, the only form of mediation is the legal system. Because the retraction decision and its responsibility lie on the journal, it is the author who has to issue a lawsuit to the publisher in order to claim for either a retraction of the retraction, or a modification on the retraction notice's wording. The cost of taking a scientific problem to the tribunals is extraordinarily high [37], paid by the losing party, and the process can be lengthy. Nevertheless, it is not infrequent to find cases where a scientific dispute turned into a legal dispute. We analyzed all the cases (15) of scientific litigation reported by Retraction Watch [37,38]. In 7 cases, representing 47 % of the studied cases, the legal threats did not crystallize into a lawsuit [39–45], in 5 cases (33 %), the dispute reached the courts and the journal was found legitimate to retract the paper [46–50], was deemed appropriate. In 3 cases (20 %), however, the trial failed in favor of the authors, forcing the journal to retract the article's retraction notice, retract an expression of concern [51,52] or modify the wording of a retraction notice [53]. This situation is not beneficial for either party: on the one hand, upon a legitimate retraction, journals typically omit key information of the investigation from retraction notices to prevent malicious lawsuits from misbehaving authors (Fig. 1c) [18,20,54], who threaten legal actions against the journal [12]. On the other hand, authors that have suffered an arbitrary retraction are left unprotected against the journal's decision and their only way to prevent the retraction is to sue the journal.

Plagiarism – A case study

Given the prominence of plagiarism as one of the most frequent causes of retraction in the scientific community (Fig. 1c), there is a considerable body of literature dedicated to addressing this issue [55]. Plagiarism in academic research has been defined by the Committee of Publication Ethics (COPE) as "Theft or misappropriation of intellectual property and the substantial unattributed textual copying of another's work" [56]. For editors, recognizing and handling suspicions of plagiarism in published articles is critical; guidelines are well-established, offering step-by-step processes for investigation and confirmation of alleged misconduct [57]. These protocols emphasize the importance of maintaining a fair and transparent process, ensuring that accusations are handled with the necessary sensitivity and rigor to preserve the integrity of the academic record and uphold ethical standards in scholarly publishing.

Scientific journals typically follow a structured process when investigating plagiarism claims to ensure fairness and accuracy. The process often begins with the use of plagiarism detection software, such as Turnitin or iThenticate [58–60], which scans manuscripts for textual similarities with published work. These tools help identify potential cases of plagiarism by comparing the manuscript against a vast database of academic papers, web content, and other sources.

Once potential plagiarism is detected, editors must manually review the flagged sections to determine if they constitute actual plagiarism or acceptable similarities, such as common phrases or properly cited previous work. This step requires significant effort as it involves checking the context of the similarities and assessing whether proper attribution has been given. As per COPE guidelines, editors must differentiate between intentional plagiarism, inadvertent citation errors, and permissible overlap with previous work.

If plagiarism is suspected, the journal may conduct a formal investigation, which involves gathering evidence and possibly consulting with experts in the field. The authors of the manuscript are typically given an opportunity to respond to the allegations. The investigation may extend to contacting the institutions of the involved researchers for additional scrutiny and support [61]. Plagiarism can take several forms. Direct plagiarism involves copying text word-for-word without quotation marks or proper attribution, while self-plagiarism occurs when an author reuses significant portions of their own previously published work without citation. Mosaic plagiarism involves piecing together phrases, ideas, or text from various sources without proper attribution, and accidental plagiarism arises from an unintended failure to cite sources correctly due to ignorance or oversight.

In cases where plagiarism is confirmed, the consequences can be severe, including retraction of the paper, bans on future submissions to the journal, and notification of the authors' institutions. Journals aim to maintain transparency throughout this process, although the level of detail provided in retraction notices can vary. The entire process is

designed to uphold the integrity of the scientific record while ensuring due process for the accused authors.

Although investigations into plagiarism are conducted meticulously to uphold the integrity of the scientific record, the resulting retraction notices frequently provide limited information about the investigation's findings or rationale, causing frustration among authors who feel that the claims of plagiarism are unfounded or misrepresented. This lack of transparency not only affects the authors' reputations but also leads to disputes over the validity of the retraction itself, highlighting the need for more detailed and transparent communication in retraction notices. Additionally, there is a critical need for mechanisms allowing authors to seek independent verification of the plagiarism claims, ensuring a fair and unbiased review of the allegations and fostering trust in the retraction process.

In this context, blockchain technology, known for underpinning cryptocurrencies [62], offers a novel solution [63]. By providing a decentralized and transparent ledger system, blockchain could introduce unprecedented transparency and immutability to the resolution of disputes in the scientific retraction process. Its application could lead to a standardized, unbiased, and transparent dispute resolution mechanism, which would deem journal decisions fairer and bring the necessary protection to authors, often left helpless to the journal's internal processes. Nonetheless, integrating blockchain into the retraction process presents challenges, including scalability, accessibility, and governance, alongside concerns about its compatibility with traditional scientific publishing norms [64].

Framework for a Kleros court for plagiarism dispute resolution

Kleros is a decentralized arbitration protocol that leverages blockchain technology to resolve disputes in a transparent and efficient manner [65,66]. By using smart contracts, Kleros creates a decentralized and impartial court system where cases are adjudicated by randomly selected jurors. These jurors are incentivized to remain unbiased and deliver fair verdicts through a system of token staking and rewards. Kleros courts are divided into different categories, each specializing in specific types of disputes, such as e-commerce disagreements, freelance contract disputes, and intellectual property conflicts.

The main mechanism of Kleros involves the submission of a dispute to the appropriate court, where a group of jurors is selected to review the case. Jurors are required to stake tokens to participate, ensuring they have a vested interest in delivering a fair and accurate judgment. After reviewing the evidence and arguments presented by both parties, jurors vote on a resolution. The majority decision determines the outcome, and jurors who voted in the minority can lose their staked tokens, while those in the majority are rewarded, promoting honest and diligent participation.

Kleros has been applied to various types of cases, including disputes over digital services, content moderation, and cryptocurrency transactions. Its application to plagiarism cases is particularly promising due to the clear and objective nature of textual evidence. By using Kleros, disputes over alleged plagiarism can be resolved transparently and efficiently. Jurors can review the submitted manuscripts and the claimed original sources, using plagiarism detection tools and their judgment to determine if plagiarism has occurred. This decentralized approach can enhance the fairness and consistency of plagiarism adjudications, reducing the burden on traditional legal systems and improving the integrity of academic publishing.

To address the complexities of plagiarism in scientific papers, Kleros jurors can follow a structured framework that ensures thorough and unbiased assessment. This framework should be designed to balance transparency, fairness, and consistency in decision-making.

Suggestion for a Step-by-Step Framework for resolving retraction disputes through a Kleros Court

1. **Submission of dispute:**

   After a scientific paper has been retracted for plagiarism, the journal offers authors the possibility to send the case to a Kleros Court. If the author disagrees with the overall or parts of the retraction decision, they will submit their case to be assessed by a Kleros Court. To prevent constant groundless disputes of retraction decisions, the author must stake a certain amount of $PNK (for a better user-experience, on- and off-ramps can provide support for dollar payments that get converted into $PNK in the backend). The journal will then stake an equal amount of $PNK as the author. In this framework, it is always the author who decides how much $PNK token to stake, preventing economical discrimination from an outsized stake coming from the journal and impossible to match by the author. Both author and journal submit all relevant documentation and evidence for the evaluation by the jurors.

2. **Juror selection:**

   Depending on the author's initial stake, an appropriate Court will be formed. The higher the Stake, the more jurors can be drafted, Given the current Kleros infrastructure, jurors will be selected randomly. Ideally, a reputation system will classify jurors and the higher the reward for them can be, the more experienced jurors you can attract.

3. **Detailed Investigation:**

   Selected Kleros jurors are tasked with reviewing the evidence in retraction disputes involving plagiarism claims. They employ specific software for plagiarism detection to ensure a thorough and unbiased examination of the case. This comprehensive analysis involves several critical steps:

   a. Plagiarism Detection Report: Use advanced plagiarism detection tools (as mentioned above) to generate a detailed report highlighting similarities.
   b. Contextual Analysis: Examine the context in which the similarities occur. Distinguish between common phrases in the field and significant text replication.
   c. Authorship and Attribution Review: Verify whether appropriate credit has been given and whether self-plagiarism is involved.
   d. Intent and Impact Assessment: Assess the intent behind the plagiarism (e.g., deliberate theft vs. inadvertent omission) and its impact on the original authors and the scientific community.

4. **Voting and Verdict:**
   To incentivize honesty and impartiality, Kleros Courts employ mechanism design based on token rewards. Jurors who vote in line with the majority decision are rewarded with tokens, while those who vote differently may lose a portion of their staked tokens. This mechanism ensures that jurors are motivated to deliver fair and accurate judgments, aligning their interests with the integrity of the arbitration process. In scientific retraction disputes, Kleros jurors can either confirm the retraction of the article, when evidence corroborates the document contains uncredited plagiarized text; or rule in favor of the author, when the plagiarism claims cannot be proved or are inconclusive. In this case, a new note would correct the retraction, informing the scientific article maintains its integrity within the scientific record.

5. **Appealing:**
   In the Kleros jury system, the appeal process allows for disputes to be re-evaluated by a new set of jurors if one of the parties is dissatisfied with the initial ruling. This mechanism is designed to enhance the fairness and reliability of the arbitration process. Upon appealing, a larger set of jurors is selected, that will re-evaluate the dispute from the beginning. To prevent groundless appealing after initial ruling and provide appropriate incentives to the jurors, the appealing party must stake an increased amount of $PNK to start the appealing case. Only one appeal is possible. Therefore, the decision of the Appealing court is definitive and both parties must abide by the ruling.

6. **Mechanism design:**
   After a final verdict has been reached, the stakes and rewards are distributed according to the outcome of the case. The tokens from the losing party's stake are redistributed to the winning party and the jurors in the majority, promoting a fair and balanced incentive system. Jurors who voted in the minority lose a portion of their staked tokens, which serves as a disincentive for biased or careless voting. This redistribution mechanism ensures that only those jurors who make accurate and honest decisions based on the evidence are rewarded, reinforcing the integrity and reliability of the Kleros arbitration process. This system not only compensates jurors for their time and effort but also maintains a high standard of diligence and impartiality within the Kleros ecosystem.

Conclusion

The scientific retraction process plays a crucial role in maintaining the integrity of academic research, addressing issues such as data fabrication, plagiarism, and significant errors. However, this process faces challenges, including lack of transparency, inconsistent decision-making, and prolonged disputes that negatively impact researchers' reputations. Authors are particularly vulnerable, often receiving limited explanations for retractions and having to resort to costly and inefficient legal systems to challenge decisions.

Plagiarism, a leading cause of retractions, is relatively straightforward to investigate due to the availability of textual evidence. This manuscript proposes leveraging the Kleros decentralized arbitration protocol to enhance the fairness and transparency of plagiarism dispute resolutions. By employing blockchain technology, Kleros can create an immutable and decentralized system where randomly selected jurors review evidence, use advanced plagiarism detection tools, and make unbiased decisions based on a structured framework.

The Kleros system incentivizes honest and diligent participation through a token-based reward mechanism, ensuring that only accurate and fair judgments are rewarded. This approach not only addresses the current shortcomings in the retraction process but also sets a new standard for scientific publishing, providing authors with a reliable and transparent method for independent verification of plagiarism claims. Integrating blockchain technology into the retraction process presents challenges, such as scalability and compatibility with traditional norms, but offers significant potential for improving the integrity and consistency of academic research.

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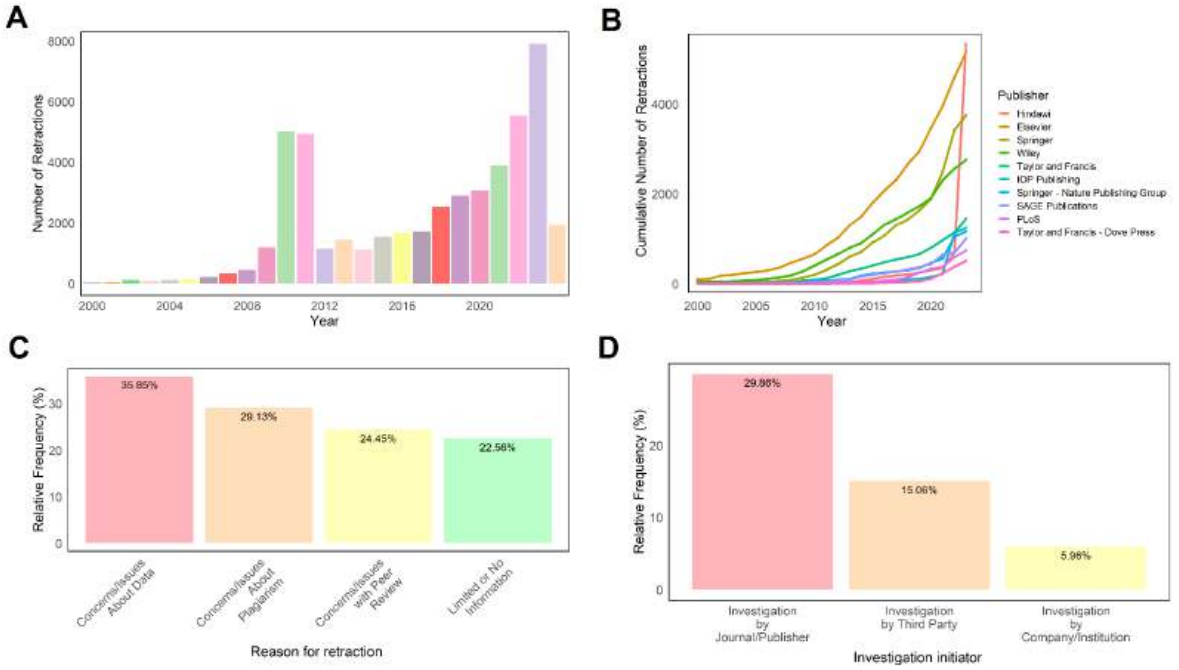

Figure 1. Analysis of scientific retractions. We analyzed the academic retractions included in the Retraction Watch Database (file available upon request) as of July 2024. Data for 2024 is incomplete compared to the rest of the years. We used RStudio for analysis. (A) Number of retractions per year. (B) Yearly cumulative retraction per publisher. (C) Frequency of reasons for retraction (each category is the result of combining multiple reasons with similar wording). (D) Frequency of reported retraction investigation initiator.