FORENSIC SCIENTOMETRICS

FoSci Report 2026

Understanding, Detecting, and Documenting Manipulation in the Research Ecosystem

Contents

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OVERVIEW

A Shared Concern

A few years ago, working independently and often in parallel, the authors of this report began to recognise a shared concern. What they were observing were not isolated incidents, but signals of something more systemic. Individual acts of research manipulation, left unchecked, can coalesce into something far more damaging: the gradual undermining of science itself. When enough small things erode trust, the system becomes fragile. The self-correcting nature of science cannot compete with the speed at which that erosion spreads.

Those working in this space come from different disciplines, use different methods, and are motivated by different concerns. Some are driven by technical curiosity, others by institutional responsibility, others still by broader societal implications. We should note that we, the authors, are not claiming to be either the originators or the definitive voice of those who work on tackling problematic research. Data sleuths and research investigators are typically unusual people who share a passion for getting at the truth and a willingness to put in many hours of thankless work to get to the bottom of problems. Many of them are fiercely independent and not attracted to the idea of joining any kind of group. This includes those who have a long track record in sleuthing, and whose tireless work has led to important discoveries of data manipulation, in some cases by senior figures in a field. Those of us who have banded together in FoSci recognise those achievements and aim to build on them, without diminishing their contribution.

What unifies us is not a uniformity of approach, but a shared commitment to hold science accountable to the integrity and trust on which the pursuit of knowledge depends.That shared recognition led to conversations, coordination, and ultimately to action.

The Forensic Scientometrics (FoSci Paris) Declaration marked an important step in that progression. It articulated, with clarity and intent, the need for a more systematic, data-driven approach to understanding and investigating the research ecosystem. The Declaration was both a statement of principles and a commitment: to move beyond fragmented efforts toward a more coherent field of inquiry.

The subsequent convening in London in 2025 advanced that work. There, the focus shifted to scoping the contours of this emerging field: what falls within Forensic Scientometrics and what does not, where its boundaries lie, and where it intersects with adjacent domains. These are essential questions for establishing the intellectual, methodological, and ethical foundations of the field, in both academic and applied terms.

The authors of this report believe in the pursuit of knowledge — open, rigorous, and as free as possible from undue influence. At the same time, we recognise that no system is pure. Science is shaped by the same forces that shape the societies in which it exists. The aim, therefore, is not to idealise the research and knowledge system, but to understand it, protect it, and strengthen its integrity.

OVERVIEW

Executive Summary

Because Forensic Scientometrics is still an emerging field, practitioners often rely on familiar frameworks to explain its scope. One useful way to understand this work is through three levels of investigation.

At the **micro level**, the focus is on individual cases: papers, authors, specific anomalies. Like a crime scene investigation, this involves careful, detailed analysis of specific events, typically within published papers or journals, evaluating evidence to determine whether something is amiss and reporting on findings. This is the most mature aspect of Forensic Scientometrics, with more defined subdomains and an emerging set of norms. Practitioners working at this level are sometimes referred to as "sleuths."

At the **meso level**, the lens widens to networks and patterns. The focus shifts to coordinated behaviour: clusters of activity across journals, institutions, or groups of actors. This is where the dynamics point toward organised systems (e.g., paper mills, hijacked journal operations) rather than isolated events.

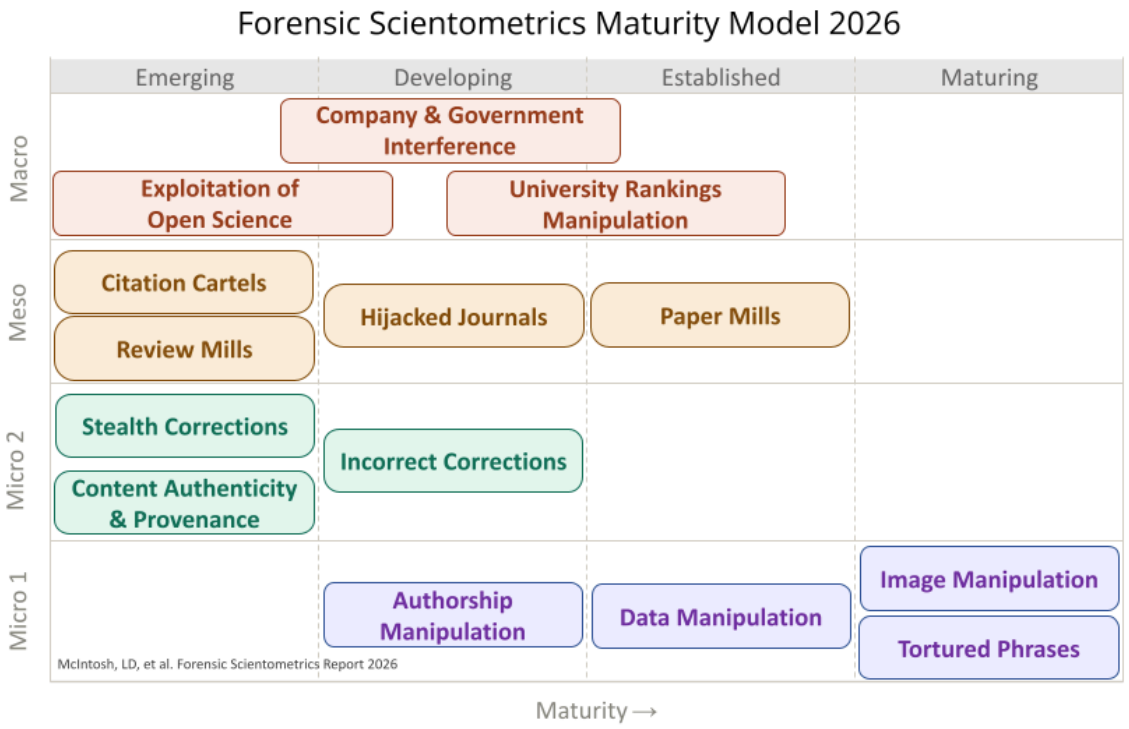
At the **macro level**, the perspective becomes systemic. Questions shift toward structure and incentive: how the global research ecosystem enables, amplifies, or fails to detect these behaviours. It is here that Forensic Scientometrics must engage most directly with policy, infrastructure, and the future of science itself. This remains the least developed area, and it is part of the impetus for FoSci — to examine the systemic implications of what can appear, at first, to be isolated infractions.

These levels are not discrete but interdependent, with insight at one level informing understanding at the others. Together, they form the backbone of what practitioners in the field do, and they also help frame this report.

What follows in this report are contributions from experts across different topics in Forensic Scientometrics, each providing background, methodology, examples, and references. While the editors have made some changes to ensure consistency, each contribution is written in the original voice of its author or authors. These topics are not exhaustive, but they offer readers a lens into areas that are developed or developing.

The report opens with three more established areas: tortured phrases, manipulation of images and data, and manipulation related to authorship and credentials. As seen in the image, they are more developed, with broad knowledge of the problems and available solutions.

The report then journeys to the correction of problematic papers and metadata some of which are problematic in their own right. The pieces on incorrect corrections and stealth corrections examine troubling practices at the publication level. The piece on content authenticity and provenance takes a more proactive stance, exploring how improved metadata standards can build trust into the scholarly record.



The FoSci Maturity Model 2026 represents the estimated maturity of FoSci specialty topics covered in this report. 'Maturity' is based on the breadth of knowledge of the topic, the number of people working on detection, and the availability of methods to detect and prevent activities. The Levels (micro, meso, and macro) represent the magnification of our work with micro generally looking within publications and macro levels evaluating systemic problems affecting the research ecosystem

Paper mills, review mills, hijacked journals, and citation cartels move the discussion into organised and coordinated misconduct entities acting across scientific outputs and corrupting the integrity of the research infrastructure.

The next group examines the exploitation of science itself. The first piece focuses specifically on the exploitation of open science. The second addresses how university ranking systems have created incentives for manipulation. A piece on company and government interference broadens and darkens that conversation, surfacing a more complex corruption narrative.

Three final topics close this year's report. The first addresses legal threats and other insidious actions against those working in this space. The second considers content authenticity and provenance, and the third the implications of artificial intelligence for the integrity of science.

Rather than a conclusion, each section offers recommendations for improvement. Some suggestions are seen as easier than others – what they offer are a means for discussion and action.

PART ONE · MICRO LEVEL

Individual Papers & Anomalies

The micro level is the crime scene of forensic scientometrics. The goal of a crime scene is to gather as many facts about what has happened as possible. This is not the time to remedy anything, but to gather as many clues as possible. Deciding if a crime even occurred, rather than an accident, happens after the collation of information. Applied to FoSci, we are looking at events that appear anomalous within scholarship, then deciding if they are perhaps intentional or arose through honest error. Unlike a true crime scene, most of what we find is not actually a crime, though. Awful, but lawful.

This is the most mature area of forensic scientometrics, largely attributed to the work of sleuths. For now, this work sits specifically within the context of published research.

Both the investigations into problematic publications and the community knowledge surrounding them are generally well established. There are a range of tools to detect and counter these problematic practices. That does not mean detection and remediation have been solved or fully integrated into workflows. Image manipulation, for example, has broad coverage and dedicated tools, yet the workflow to prevent manipulated images from entering the literature remains insufficient, as daily reminders on social media of newly discovered problematic publications make clear. Moreover, whether detection drives decline or simply displaces the problem remains an open question.

In this section, we offer an overview of four distinct but related problem areas:

- Tortured Phrases
- Data manipulation
- Image manipulation
- Authorship manipulation

Each of these areas operates at the paper level. They originate within a single publication and are detectable from within it or across others, but not necessarily outside the publication space. Yet, each undermines the research record differently, and their reach is uneven. Image manipulation has been documented primarily in the biomedical space, while authorship manipulation respects no disciplinary boundaries. All are consequential.

CHAPTER 1.1

Tortured Phrases

Tortured phrases are the result of authors using paraphrasing software (e.g., SpinBot) to copy-paraphrase-paste content from already published articles, in order to produce a seemingly new article [1, 2]. This can lead to deformed scientific vocabulary, with phrases such as “bosom peril” instead of “breast cancer”, “sulphuric corrosive” instead of “sulphuric acid”, or “shrewd matrix” instead of “smart grid”. Tortured Phrases are mainly spotted in paper-mill products that bypass peer-review and editorial decisions by hiding plagiarism [3].

METHODS FOR DETECTION

Since their discovery in 2021, Tortured Phrases are regularly spotted by highly qualified domain experts through PubPeer comments. Following a snowball effect approach, newly identified Tortured Phrases (i.e., fingerprints) are referenced in the Problematic Paper Screener (PPS) “Tortured” detector to spot additional unreliable articles, by querying the Dimensions search engine [4, 5].

A similar approach relies on Tortured Abbreviations: Tortured Phrases that do not match their abbreviations, providing obvious evidence of hidden plagiarism (e.g., “man-made consciousness (AI)” instead of “artificial intelligence” in computer science) [6].

Maturity: ● **Maturing** *Tortured Phrases are now a well-known red flag for scientific misconduct. Some organizations use the PPS fingerprints to flag Tortured Phrases in scientific articles. At the publisher level: EDP Sciences, Elsevier, IEEE, IOP, PLOS, SAGE, Springer Nature, Wiley (mainly for retraction notices). In research integrity products: Cactus, Clarivate Analytics, Clear Skies, Compilatio, Dimensions Author Check, Imagetwin, Morressier, River Valley, Springer Nature, Signals, STM Integrity Hub.*

SOLUTION WISH LIST

Pre-publication: At the publisher level, such detectors could be implemented as a filtering brick in editorial workflows.

Estimated difficulty: ★★★★ Integration required in internal infrastructures

Post-publication: At the reader level, such detectors are used to flag problematic articles through PubPeer comments.

Estimated difficulty: ★☆☆☆ Dashboards such as the PPS provide evidence to help staff take action

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CHAPTER 1.2

Data Manipulation

Data manipulation generally refers to cases where a study has been conducted but the reported data has been falsified in some way to make the result more impressive. We will also include here data fabrication, where an entire dataset may be invented. Both these ways of manipulating data correspond to research fraud.

METHODS FOR DETECTION

A brief summary of numerical methods for assessing data integrity is provided by Brown and Carlisle (2025). None of these is diagnostic of data manipulation; some errors may just be errors of computing or transcription. But they can be used to confirm suspicions. Methods include:

Confidence interval analysis. For most statistics, the reported test value should lie in the middle of the confidence interval. As Brown and Carlisle noted, you need to know enough about statistics to be aware of exceptions to this rule, but cases where, for instance, the mean lies outside the confidence interval are always erroneous.

Digit pattern analysis: For certain data types, if a value is reported to a given number of decimal places, then all integers 0 to 9 should be equally likely.

GRIM (Granularity-Related Inconsistency of Means) analysis. Brown and Carlisle give an example of 7 individuals who are asked to report how many children they have. Regardless of the numbers given, the mean value will always end in specific values: to two decimal places this will be 0, .14, .29, .43, .57, .71, or .86. If the reported mean is 2.67, this is incompatible with N of 7.

Weighted mean analysis. You should be able to reconstruct the mean of a total sample by multiplying the values given for subsamples by the subsample size and dividing by total sample size. For instance, if I have a subgroup of 5 people with mean of 2.6 and a subgroup of 10 people with mean of 3.1, then the mean for the total sample should be (5 x 2.6)+(10 * 3.1)/15 = 2.93.

Carlisle's method for analysis of baseline data. Baseline data are collected at the start of a clinical trial, before any intervention, and if randomisation is done properly, there should be no systematic difference between groups. Those fabricating data often make the mistake of assuming that their groups should not differ and they report identical or closely-similar results for all groups. However, in so doing they are likely to produce results that are too good to be true and are statistically highly improbable. Carlisle described an analysis by Kranke of an anaesthesia study with six groups, where it was reported that at baseline exactly 3/45 women reported headache in each group; this was highly unlikely to have occurred by chance. The researcher who authored this study was shown to have numerous articles with similarly unlikely patterns of data.

Simulation to evaluate other kinds of improbable data. A number of studies in clinical child neuropsychology samples reported remarkably narrow standard deviations on an IQ measure. To demonstrate just how implausible these were, Bishop showed simulated data on PubPeer.

Domain-specific knowledge. Sometimes data that look unremarkable to someone unfamiliar with a field of study seem highly improbable to anyone who has worked in that area. For instance, a clinical group may have values on a blood test that are outside the range one would usually see. The simulation example above is another such example.

Unusual patterns in datasets. If raw data is available, it may be possible to see evidence of data fabrication in unusual patterns of repeating data, with blocks of values being repeated in a way that suggests they were generated by copy and pasting on a spreadsheet. An example can be found here: https://pubpeer.com/publications/BAA5B7CE67CBB1A70822C1D84FA5FE.

Other evidence in Excel spreadsheets. Some incompetent fraudsters have left formulae in spreadsheets, showing how data in one column were generated from those in another. Where Excel spreadsheets (validly) use formulae for computation, it is possible to reconstruct the order of operations and see if blocks of data have been moved from their original position. This may be legitimate, but combined with other evidence may be concerning.

EXAMPLES

1. Suspicions about the research of Francesco Gino were raised by the Data Colada group of forensic data analysts, who found unusual patterns in raw data files suggesting values had been moved around or modified to generate significant effects.
2. In a landmark study, Carlisle analysed 168 randomised controlled trials by anaesthesiologist Yoshitaka Fujii and showed that the published distributions were massively improbable and suggestive of data manipulation. Fujii was subsequently found to be one of the most prolific known fraudsters in science.
3. A remarkable range of data issues were found in a trial of a stem cell treatment for heart disease published in the BMJ, including repeating patterns in the dataset indicative of cutting and pasting of blocks of values.

Maturity: ● **Established** *A range of methods have been developed and used to identify data manipulation in some high-profile cases. There are some methods to detect data manipulation, however, the overall adoption and implementation within pre- and post-publications still warrants growth.*

SOLUTION WISH LIST

Journals should require authors to submit individual participant level data and analysis code to a repository at the point of submission. Some journals already have policies about this, though they are not always enforced.

Neither the cost nor the difficulty of doing this seem particularly high. However, it is likely to meet with strong resistance from some authors, which may make journals reluctant to implement it.

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CHAPTER 1.3

Image Manipulation

Inappropriate image duplication and image manipulation is one of the most common research integrity issues detected in published articles. Usually, images that should depict different elements show (partial) overlap or contain traces of (digital) editing.

These integrity issues can be detected either by eye, or by digital tools such as Imagetwin or Proofig. Many of these cases have been reported on PubPeer, for example, Elisabeth Bik highlighted hundreds to thousands of cases showing overlap in an image and René Aquarius also reported a case of unexpected overlap in an image.

These types of issues have been well documented by science sleuths and well accepted by journals and publishers as signs of potential breaches of scientific integrity. Finding these issues is straightforward, but interpreting what they mean remains difficult. Elisabeth Bik defined a typology in 2016; however this typology is difficult to use and needs to be revised (work in progress). Moreover, intent cannot be gauged from these analyses or categorisation.

METHODS FOR DETECTION

These integrity issues can be detected either by eye or by digital tools such as Imagetwin or Proofig. Many cases have been reported on PubPeer.

Work through the training program via the STM Image Alterations and Duplications Resource Center presented by image manipulation expert Jana Christopher.

Maturity: • Maturing *Mature at the level of detection and awareness of the problem. Workflow integration for prevention remains insufficient.*

SOLUTION WISH LIST

Retroactive screening of all published articles by all publishers using the same standardised methodology.

Estimated difficulty: ★★☆☆ Software is expensive; all flagged articles need human verification

Active screening of all manuscripts before publication.

Estimated difficulty: ★★★☆ Time consuming; risk that publishers remove proof of integrity issues

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CHAPTER 1.4

Authorship

Authorship sits at the core of scholarly communication. A person's name on a paper, as an editor, or a peer reviewer, is not merely a formal attribution; it is a signal of accountability, provenance, expertise, and intellectual contribution. Authorship functions as both credit and responsibility. It shapes reputational capital, informs evaluation systems, and accumulates over a career as part of a researcher's scholarly record. Because of this, authorship is foundational to trust in science.

Authorship analysis must be embedded within a broader evidentiary framework. Identity signals, affiliation checks, metadata consistency, citation patterns, peer review irregularities, and network analyses all contribute to a more reliable assessment.

The core principle is proportionality: anomalies in authorship should trigger further inquiry, not automatic dismissal. Overcorrection risks excluding legitimate contributors, particularly early-career researchers and scholars from under-resourced institutions. Under-correction, however, enables systematic manipulation of the research record.

At its most basic level, breaches of authorship norms undermine confidence in the integrity of the research record. One long-standing problem is the failure to credit those who materially contributed to the work. Historically, single-author publications often obscured collaborative contributions. A frequently cited example in Western scientific history is the 1953 DNA paper by Watson and Crick, which did not adequately recognize Rosalind Franklin's critical experimental contributions.

More broadly, scientific discovery is rarely the achievement of a single individual. Even Nobel Prize–winning work typically builds upon decades of prior inquiry. Some laureates have attempted to correct this narrative by documenting the intellectual lineage and collaborative foundations behind their discoveries. These examples highlight the structural limitations of credit systems that elevate a small number of individuals to represent distributed and cumulative knowledge production.

While exclusion and misattribution are enduring concerns, contemporary challenges increasingly involve fabricated or manipulated identities.

> **EXAMPLES**
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> Two related but distinct risks have emerged in the modern scholarly ecosystem: imposters and impersonators.
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> **Imposters** are individuals who are not who they claim to be and may not exist at all. These fictitious identities can be inserted into the scholarly record as authors, reviewers, or editors.

The case of "Dragan Rodriguez," for example, illustrates how a fabricated persona can be embedded within the literature, complicating attribution and accountability.

Impersonators, by contrast, typically appropriate the identity of a real person. This may involve adopting the name and credentials of a retired or deceased academic, or creating a modified identity that closely resembles a legitimate scholar. In other cases, individuals fabricate credentials altogether, listing affiliations or degrees that cannot be substantiated (e.g., fictitious institutions or domains such as "uok.gr.edu").

These practices exploit weaknesses in identity verification systems and editorial workflows. However, it is critical to emphasise that anomalies in authorship alone rarely constitute sufficient evidence that an entire article is unreliable. The central challenge is distinguishing legitimate variation in academic trajectories from deliberate deception, such as authorship-for-sale schemes or paper mill activity.

METHODS FOR DETECTION

A range of techniques can be used to assess potential authorship irregularities. Each provides partial signals rather than definitive proof.

1. Persistent Identifiers and Identity Triangulation

Persistent identifiers (e.g., ORCID) are increasingly important in identity verification. A well-populated ORCID record—with institutional affiliations, prior publications, and linked grants—can strengthen confidence in a researcher's identity.

However, ORCID profiles can be sparse, newly created, or inadequately maintained for legitimate reasons. They can also be fabricated or minimally populated to create a veneer of credibility. ORCID, like other scholarly identifiers (e.g., Google Scholar, Dimensions, Scopus) is therefore a signal but not a guarantee of authenticity.

Institutional verification provides another triangulation point. Confirming that an author is at an official institution can strengthen confidence in claimed affiliations. Yet, institutional records may lag behind appointments, and not all legitimate contributors hold academic posts.

2. Email Address Verification

Examining whether an author's email domain aligns with their claimed affiliation is another common step. An institutional email address associated with a recognized domain may support identity verification.

However, many legitimate researchers use generic email services (e.g., Gmail, 123.com) for continuity across institutional moves or for privacy reasons. Conversely, fraudulent actors

may create domain names that mimic legitimate institutions. Email analysis must therefore be contextualized rather than treated as determinative.

3. Publication History Analysis

Reviewing a researcher's publication record can provide additional signals. Patterns that may warrant scrutiny include:

- An unusually high volume of publications relative to career stage, which may indicate authorship-for-sale arrangements or paper mill involvement.
- Abrupt thematic shifts or inconsistent subject-matter expertise, which may indicate hidden conflicts of interest.
- Sparse or nonexistent publication histories in cases where credentials are claimed.

Publication history alone is rarely sufficient to draw conclusions. New researchers may legitimately have limited records. Interdisciplinary contributors may publish outside traditional disciplinary boundaries. Conversely, prolific publication does not automatically imply misconduct.

Maturity: ◐ **Developing** *Mature at the level of individual identity checks. Systematic automation is still developing as is the community awareness of the problem of authorship manipulation schemes.*

SOLUTION WISH LIST

Journals: Screen paper authors, editors, and peer reviewers at submission and before publication.

Estimated difficulty: ★★☆☆

Institutions: Know who is associated with your institution. Make policies to prevent abuse of authorship.

Estimated difficulty: ★☆☆☆

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PART TWO · MICRO LEVEL

Micro Level: Contextualised Corrections

One of the traditional ways to address problematic papers has been to correct or retract them. This mechanism occurs from within publishers, guided by journal-level practices. In the old days of research correction, it was fairly common to see small, innocuous corrections: typos that changed meanings, added or corrected chemical compounds, and other such items. The corrections and retraction guidelines were based on the premise that science was being conducted by trained researchers in a bona fide research institution. However, times have changed.

Between open science, the internet, and general technological advancement, we now have a marketplace to optimise or game science, and at scale. A look at retraction reasons (here and here) shows just how many variations of problems are now seen, with over 100 reasons for retractions or corrections that can be broadly classified as manipulative, honest error, or administrative.

If we stick with the crime scene analogy, after the collection of information, samples, data, and photos, evidence returns to be processed at certified laboratories. In our case, the lab is the journal and publisher. But just like crime scene analyses, things can go wrong across a spectrum from innocent errors, to poor correction practices, to intent to cover up either poor or fraudulent publishing practices.

This look at publisher practices is a less mature area than those described in the previous section. Sleuths and members within the FoSci community are still learning about the processes governing corrections to the scientific literature. The broader community may be completely unaware of the granularity and nuances of journal processes, much less their potential impact on broader trust in science.

We begin with examples grouped into two categories: incorrect corrections and stealth corrections. Both operate at the journal or publisher level but affect the validity and trust in science as a whole. We conclude with content authenticity, which addresses the embedding of provenance directly into electronic scholarly artifacts. Making provenance a default feature of digital scholarship offers a potential solution that begins at the level of individual publications and their metadata, but if implemented at scale, would affect prevention and detection methods across networks and may help explain global efforts to support or undermine science.

CHAPTER 2.1

Incorrect Corrections

Corrections to scientific articles are vital for maintaining the integrity of the scholarly record. For this reason, poorly handled corrections can lead to lasting and often irreversible damage to science in general, and to academic publishing in specific.

TYPES OF CORRECTION MALPRACTICE

We identified several types of correction (mal)practices that must be recognized, scrutinized, and rectified:

Cavalier corrections

This is when the journal and/or the integrity office fail to conduct proper investigations, after receiving correction requests from authors or credible reports from sleuths, and issue corrections to non-error (that is, fabricated or falsified) data or images. We gave an example (https://pubpeer.com/publications/B034A59B90754B382DE2C3A7E19CC6) of four papers with highly similar figures being reported to all journals at the same time, with two ended up being "corrected" (https://pubpeer.com/publications/F2B1E0EEF01903BA9B46180CCB73C9). This is https://pubpeer.com/publications/3AE9C4C9A8C63B29FFF93E0759934C negligence and can be rectified with proper training, more empowered research integrity teams, and a more transparent and streamlined mechanisms that link reporting, investigation, and editorial action.

Fraud laundering

This is an insidious act, when the journal or the integrity office issue a correction despite being presented with clearcut strong evidence of data/image manipulation. This is usually the result of authors claiming that the evidence is attributable to "honest mistakes" and the journal siding with the authors (for whatever reason). Effectively, this type of correction cements fraud into the scientific record. Moreover, this practice exposes sleuths to reputational and legal risks. We gave an example (https://pubpeer.com/publications/DC4D1B3BF8C2E7CB262211939ED905) of a stealth correction that turned to a retraction due to sleuths' persistent protest. See the "Stealth Corrections" section of this report for related content.

Paper-gutting

This is when the journal allows the authors to swap out a large amount of data/images, and publish an essentially "cleaned-up" paper in the form of a correction. This is also known as the Ship of Theseus. We gave an example of a paper (DOI: https://doi.org/10.1016/j.jmrt.2020.12.064) that had 11 out of 14 figures swapped out in a corrigendum. This paper was eventually retracted due to sleuths' persistent protest.

Uninformative corrections

This is when the correction note fails to explain the issue or the changes being made to the article. We gave an example (https://doi.org/10.1016/j.colsurfa.2025.136955) where the correction note simply reads "*The authors regret to issue a correction regarding Fig. 1 to replace the previously published one*". Sleuths identified non-error issues in the original figure. https://pubpeer.com/publications/3AE9C4C9A8C63B29FFF93E0759934C

These practices identify flaws in the correction process as a whole, which to date has no clear guidelines from relevant organizations, while internal journal guidance is not implemented consistently. When corrections mask or minimize errors, journals risk losing credibility and becoming complicit in the distortion of the scientific record.

EXAMPLES

Example 1: Original Article: https://pmc.ncbi.nlm.nih.gov/articles/PMC3561766/

- Correction (now nearly invisible): Cancer Cell, Volume 30, Issue 2, 8 August 2016, Pages 349-351
- Retraction
  https://www.cell.com/cancer-cell/fulltext/S1535-6108(22)00497-4

Example 2: Original Article:
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0004070

- Expression of Concern and Correction
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0213701
- Retraction
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0267621

Example 3: Original Article:
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0067581

- First Correction
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131729
- Second Correction
  https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0267628

Maturity: ◐ **Developing** *Less mature than detection-level FoSci. Sleuths and the FoSci community are still learning about the processes governing corrections.*

SOLUTION WISH LIST

- Editor training.
- Each correction process must be clearly documented and ready to be shared with stakeholders or the public at any time.
- Increase visibility of ethics investigations, e.g., by temporary notes or Expressions of Concern.
- Guidelines for threshold for the amount of data that can be addressed by a correction.

For Publishers: Develop clearer guidelines for determining the boundary between corrections and retractions. If there is clear evidence of fabrication/falsification, the article should be retracted.

Estimated difficulty: ★★☆☆

CHAPTER 2.2

Stealth Corrections

A stealth correction is a post-publication change made to a scientific article, without providing a correction note or any other indicator that the publication was temporarily or permanently altered.

Because stealth corrections are made without any official notification, they are very difficult to detect and are often only found by chance by sleuths. So far, stealth corrections are categorized into 4 specific groups:

- Changes in author information (addition or removal of authors, changes in author affiliation, etc.).
- Changes in content (figures, data or text, etc.).
- Changes in the record of the editorial process (editor name, date of submission, acceptance or publication, etc.).
- Changes in additional information (ethics statements, conflicts of interest statements, funding information, etc.).

The reasons for stealth corrections are often unclear, but sometimes they 'solve' problems like endogeny (i.e. editors publishing excessively in their own special issue).[Crosetto et al., 2026]. For instance, an article co-authored by the special issue editor may be removed from the special issue, thereby lowering endogeny.

It is up for debate whether in some specific cases, a stealth correction is the best option; for example, when identifiable patient data is accidentally mentioned in a clinical article, or when the name of a whistleblower is accidentally mentioned in a retraction notice. In these cases, a regular correction could lead to personal damage, even after the scientific record has been repaired.

At the moment, it is unknown how common stealth corrections are; so far, 131 have been identified. While a small number, it is a signal that a pattern could be emerging.

Maturity: ◐ **Emerging** *The broader community is largely unaware of the granularity and nuances of journal processes.*

SOLUTION WISH LIST

Tracking of all changes to the published record by all publishers in an open, uniform and transparent manner, preferably by online submission systems that log every change publicly, making stealth corrections impossible.

Estimated difficulty: Unclear if current submission systems have this capability.

Clear definitions and guidelines on all types of corrections, supported by the entire publishing industry.

Estimated difficulty: ★★★☆

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CHAPTER 2.3

Content Authenticity & Provenance

Ensuring Research Integrity is generally a “cat and mouse” game, with the publishing community and interested parties having to keep up with the tricks of individuals and groups trying to game the system. The increase in AI usage is a good example of the changing landscape.

It turns out that scholarly publishing is not alone in the concern over content authenticity. Newspapers, broadcasters and content creators in general have also been keen to ensure that their content is not digitally altered. In 2019, a group including Adobe and New York Times founded the Content Authenticity Initiative (CAI). Interest in the group increased after the mainstream use of Generative AI. The community now has over 5000 members. An associated technical group with fewer members, Coalition for Content Provenance and Authenticity (C2PA), consists of several Technical Working Groups to establish a standard to ensure content authenticity. The movement is primarily driven by major news organizations and content providers, but the technology can be implemented in scholarly publishing by embedding provenance in each asset individually.

EXAMPLES

Let us take the example of microscopic images. The idea is that the microscope taking the images should be C2PA compliant. If it is, then it will automatically embed relevant *Content Credentials* via a *tamper-evident C2PA manifest* into the file that it creates. This is machine readable metadata with details of the time and date of image capture, model of microscope used, who did the capture, etc. If this embedded metadata is tampered with, then it will leave a digital trace. Suppose now the image is modified in an editing program like Photoshop, for instance to enhance the contrast. When the image is saved, Photoshop embeds a second manifest, including high-level details, e.g. who made the edit, what kind of changes were made – crop, resize, generative AI usage, etc. In this way, a full audit trail or history of the image is securely embedded in the image. The same idea can be applied to all other assets, e.g. video, audio, and even text. It is worth noting that several major camera manufacturers, including Canon, Nikon, Leica and Fuji, are already members of the CAI and supportive of the C2PA standard.

Maturity: ◐ **Emerging** *The idea of a standard for Content Authenticity started in 2019, with the technical standards body following in 2021. There is already software and hardware supporting the standard. We believe that within the next 2 years electronic documents can have provenance in the majority of the assets in their content. Documents need not have all assets containing provenance. For instance a document could have provenance in the bitmap images embedded, but not in the text.*

SOLUTION WISH LIST

Production vendors: Ensure that all provenance is maintained when creating content, and add relevant provenance at time of production.

Estimated difficulty: ★★☆☆

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PART THREE · MESO LEVEL

Coordinated & Organised Misconduct

The forensic scientometrics meso level is best understood as investigating the research equivalent of organised crime: structured, coordinated groups engaged in ongoing activity for profit or power. What we see is more accurately described as synthetic knowledge laundering, operating through the production of goods such as plagiarised papers, authorship slots, and peer reviews, to launder disinformation as legitimate knowledge. These systems produce artifacts that are consumed as truth, not just traded as goods.

The organized knowledge laundering, whether formal or informal, may have a financial incentive as evidenced through authorship sales, and some have enforcement mechanisms of their own. Unlike traditional organised crime, these systems depend on legitimacy rather than secrecy alone, exploit trust infrastructures instead of bypassing them, and often operate with partial institutional complicity. Crucially, most of what they do is not actually illegal. They are not breaking laws so much as breaking trust.

The maturity of the meso level investigative area varies. Paper mills are quite well known within the publishing ecosystem, but the other three areas are not. The methods used to connect and deceive have much still to be discovered: who, where, and how, but not necessarily why. There is an assumption that the motivation behind much of this activity is the publish or perish incentive structure within academia. But that seems incomplete. If there were no market to make money, would paper mills and review mills still exist? And there are other motivations to manipulate the scholarly record beyond that one perverse incentive, such as organisational or geopolitical gains, which are touched on in the next section.

For now, we explore four areas: paper mills, review mills, citation manipulation and cartels, and hijacked journals. The first three are closely related. It is not enough to create a paper; it generally must be reviewed. If you introduce synthetic knowledge into the system, you also need to compromise the review process to get it through. And if you want to promote an idea through publication, you need citations, which have long carried significant credibility in the scientific community. Of course, one way to bypass checks is to take over legitimate journal websites, which is explored in the final piece of this section.

CHAPTER 3.1

Paper Mills

Paper mills are organisations that sell authorship for fraudulent or low-value articles, guaranteeing to place them in journals. They may also sell citations. The price the "author" pays is typically dependent on the prestige of the journal, and the author position. Paper mills exist purely to make money, and successful ones can make millions. They adopt various methods for bypassing the usual barriers to publication, either by producing templated articles that look plausible, or by working with fake peer-reviewers and/or corrupt editors. The easiest option is for a paper mill to place their own person as a journal editor. There has been a massive growth in scientific journals, with some less-principled publishers recognising that there is an insatiable demand by authors for publication outlets. However, the boom in journals creates a demand for editors and peer reviewers to process articles, and it's clear that in many cases there has been little quality control of who does this valuable gatekeeping work.

Publishers first started to recognise paper mill activity around 2013, when Hvistendahl wrote about "China's publication bazaar" in a Science article describing paper-selling agencies that mimic legitimate services. The term "paper mill" was used in 2022 by Anna Abalkina when describing a Russian-based operation, by analogy with "essay mills" that produce written assignments for students.

In 2022, after some publishers had to conduct bulk retractions of paper-milled articles, COPE and STM (2022) wrote a report describing the phenomenon and recommending ways to deal with it.

METHODS FOR DETECTION

A relatively simple approach can be used when the paper mill uses fake email domains that ensure correspondence with journal editors is channelled to them. An example is the tanu.pro East European paper mill, named after the fake domain. Once this was recognised, all articles with an author whose email came from that domain could easily be found. It has also been suggested that paper mills can be foiled by requiring authors to have a legitimate academic email address, but this may disadvantage scholars without a current affiliation, or from universities that don't have their own domain.

The Problematic Paper Screener (PPS) can help identify certain types of paper-mill output that use synonyms in an attempt to avoid plagiarism checks, creating "tortured phrases". The PPS also checks for "feet of clay" - citation of retracted papers. When an article has a high proportion of these, it suggests citations have been planted to increase citation counts.

Some paper mills can be detected by distinctive signatures suggestive of templates. Recently, Scancar et al (2026) used machine-learning based screening of titles and abstracts to identify paper-milled articles in cancer research, based on formulaic language.

In the social sciences, paper mill articles may be characterised by inappropriate use of the IMRAD (Introduction, Method, Results, Discussion) structure; affected articles may have these headings appearing with unrelated content, so that, for instance, the Methods did not describe methods.

Paper mills may be unmasked when their articles are linked with advertisements from paper mills. They may also attempt to bribe editors to place articles in a journal in return for money. Examples were highlighted by journal editor Csaba Szabo, who described on the ForBetterScience blog and Bishopblog how he was approached by a shadowy organisation who offered payment for his assistance in publishing. He decided to string them along to try and find out more about how they operated, and it was clear that he could have made thousands of dollars had he been willing to comply.

Because of the seriousness of the large-scale pollution of the literature by paper mills, publishers have invested in developing AI approaches to distinguishing genuine from paper-milled content. The details of these are commercially sensitive, but they appear to use analysis of author networks, as well as unusual similarities between article text and figures.

EXAMPLES

1. Jennifer Byrne was working as a cancer biologist when she noticed a flurry of articles relating to a rare gene that she was studying. They were all similar and she noticed that the nucleotide sequence that they specified did not match the gene they purported to study. These articles looked like sound research, but seemed to be generated from a template. There are so many genes that have never been studied that it is easy to just substitute the gene details from a genuine study with another gene to produce what looks like a plausible new article - often with the same figures and tables. Byrne linked up with Cyril Labbé to perform an automated search of 12,000 human gene papers and found 700 of them had wrong nucleotide sequences, suggesting they had been generated by a template.

2. Abalkina and Bishop (2022) noticed a set of articles with illegitimate email domains in the Journal of Community Psychology. Close reading of the content revealed it was vague and failed to report key details. Because the journal offered open peer review, it was easy to determine that the peer review was compromised, with unqualified (and probably non-existent) reviewers writing brief, superficial, positive reports. The publisher retracted the articles after an investigation.

Maturity: ◐ **Established** *Big publishers were initially slow to act but have now banded together in United2Act. Paper mills adapt like a virus and detection methods still need to develop, be implemented, and adapt.*

SOLUTION WISH LIST

A) Publishers: Much greater investment in research integrity staff with skills to tackle already-published paper mill articles.

Estimated difficulty: ★★☆☆ Impact of not acting can be high

Elaboration: The sense is that publishers are focusing mainly on prevention rather than cure. As noted above, they are already investing heavily in methods to identify paper mill products at the point of submission, so that these articles do not get into the literature. Although some publishers been active in retrospectively cleaning up the literature, (e.g. mass retractions at IEEE and Hindawi) a large backlog remains, and there is a sense among forensic data experts that this is not a priority (e.g. Aquarius et al, 2025a). This may be because episodes of mass retraction can be damaging to the reputation of the journal and publisher. We recommend that publishers nevertheless need to bite the bullet and take a proactive stance to cleaning up the literature.

Quite apart from the basic ethical rationale for doing the right thing, there are three reasons to have a strong push to retract paper mill products from the existing literature.

- First, in these days of big data, the scientific literature is automatically scanned to create databases that are used for tasks such as drug development or diagnostics. If these contain fabricated data, then the databases will be inaccurate.
- Second, researchers who aim to synthesise studies using systematic reviews and meta-analyses are finding a high proportion of untrustworthy studies (Aquarius et al, 2025b) - evaluating these and justifying their exclusion can double or treble the workload of doing a review.
- Third, if potential consumers see that papers from a paper mill may get retracted, this can create a disincentive for them to use such services - especially when they realise they are not going to get a refund.

Publishers: Make study preregistration, open peer review, open data, open code, and openly identifiable editors the norm.

Estimated difficulty: ★★☆☆ (some journals already do this to some extent: e.g. PLOS, The BMJ, MDPI journals)

Note: None of these would rule out paper mills but it would make their life much harder. Byrne has already noted how preregistration would require there be a realistic delay from registration to completion of study, which for some fields may be 2-3 years. Generating plausible data and scripts can be done with AI but adds to the work. Value of open peer review has already been demonstrated, e.g. in the Abalkina and Bishop article. These steps would also make it easier to identify Review Mills.

Institutions: Universities should be evaluated in terms of adherence to a culture of research integrity; rankings based on superficial publication-based metrics should be banned.

Estimated difficulty: ★★★★

Note: There can be a strong incentive for using paper mills if the research culture rewards quantity of publications, so that those with many papers are more likely to get hired, promoted and funded. In some cases a publication in a high-profile journal leads to a monetary reward. These practices are particularly widespread in countries with a flourishing paper mill industry. Institutions who wish to boast about their status will encourage their researchers to publish high volumes of articles if they think it will boost their rank ordering on indices such as the World University Rankings.

Several bodies focused on research integrity have produced principles or guidelines for promoting research integrity: these include the Hong Kong Principles, and the Leiden Principles.

The international nature of the problem is what makes it difficult to achieve this solution. Institutions would need to be persuaded that it is in their interests to be highly rated for research integrity, even if this meant lower numbers of publications/citations.

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CHAPTER 3.2

Review Mills

Review mills use reviewers with established credentials who write boilerplate reviews containing generic and vague recommendations that can be tracked across different peer review reports [REFS 1-3]]. Review mills generally serve only one purpose, which is to include coercive citation requests in their peer review reports to inflate citation counts for the reviewer's own publications or for those of collaborators within the review mill network.

METHODS FOR DETECTION

Detection of review mill activity is done manually, but initiatives to scale up through the use of more sophisticated methods are currently in development within the FoSci community.

Features such as substantial text similarity or coercive citation requests directed toward particular authors are common indicators of review mill activity.

EXAMPLES

- Examples of articles that have been peer reviewed by a review mill can be found here, here, and here. A more comprehensive overview of a peer review mill can be found in the pre-print by Oviedo-Garcia et al. 2025 [REF 4].
- Papers published on this topic [5-7]
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Maturity: ◐ **Emerging** *Less well known than paper mills. Systematic detection methods are in development.*

SOLUTION WISH LIST

Open peer review — easy to incorporate a 'peer-review tab' for each accepted scientific article.

Identifiable academic editor recorded openly for each article.

Incorporation of automatic peer review mill detection through the STM Integrity Hub.

- Peer review reports need to be automatically forwarded to STM integrity hub and automatically compared to a database of already existing peer review reports.
- This will require continuous upkeep of the software and the database.
- The detection software needs to be developed.

This will require a significant effort of all publishers. Detection will improve the more publishers will be involved.

- Peer review reports need to be automatically forwarded to STM integrity hub and automatically compared to a database of already existing peer review reports.
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- The detection software needs to be developed.

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CHAPTER 3.3

Citation Manipulation & Cartels

Citation manipulation occurs when references are used not to support research but to artificially inflate impact, mislead readers, or serve external agendas. It undermines trust in scholarly metrics and distorts academic influence.

The harms of citation manipulation extend well beyond academic metrics. Skewed citation counts affect hiring, tenure, and funding decisions, displacing researchers whose work has genuine impact in favour of those who have gamed the system. They distort systematic reviews and clinical guidelines, which depend on accurate assessments of the literature to guide real-world decisions. They create policy-relevant noise: research that appears influential because it has been cited frequently, not because it is sound.

Many forms exist of citation manipulation – from self-citations, from a more individual level to coordinated citation cartels. This is an example area that spans the micro and meso level. Zaidi and Taqi illustrate citation manipulation practices and motivations in their article where one sees excessive citation leading to citation cartel operations to indexing agencies imposing publication sanctions (e.g., banning authors, delisting journals) (Zaidi & Taqi, 2023).

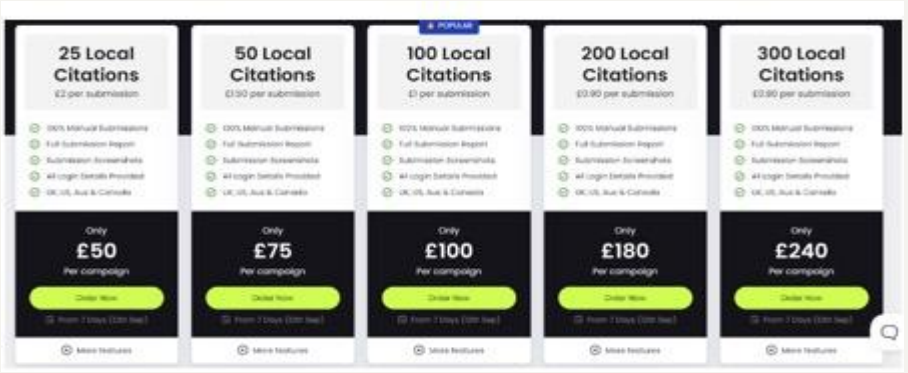
EXAMPLES

- **Self-citation** is the most familiar form, and the most ambiguous. It is entirely legitimate for researchers to reference their own prior work when it is genuinely relevant. Excessive self-citation, however, particularly when clustered at the author, journal, institution, or country level, can be a signal of impact inflation rather than scholarly continuity. Equally telling, is the complete absence of self-citation, which can indicate ghost authorship or paper mill activity, where the nominal authors have no genuine relationship to the work.
- **Forced citations** represent a more direct form of coercion. Here, editors or peer reviewers require authors to include citations that are unnecessary or tangential to the work, typically to serve the interests of the editor, a favoured journal, or an academic circle rather than the integrity of the manuscript. This practice exploits the structural power imbalance between gatekeepers and authors seeking publication.
- **Stealth citations** go a step further: references are added during the editing or production stage, after the authors have signed off, without their knowledge. This covert insertion may be used to boost a journal's impact factor or to quietly elevate the visibility of specific researchers. It is manipulation that leaves no obvious trace for the reader and can be difficult for the original authors to detect or contest.

- **Citation doping** occurs when institutions, journals, or informal networks disproportionately cite specific works to boost visibility and rankings. It is often observed in house journals, publications controlled by a narrow editorial circle, or in government and think-tank reports that habitually cite affiliated research. The effect is to create a false impression of influence, one that can feed into hiring decisions, funding allocations, and policy recommendations.

- **Citation cartels** represent the organised extension of these individual behaviours. Groups of researchers, journals, or institutions systematically cite each other in coordinated patterns designed to game citation metrics. Unlike isolated self-citation or a single instance of coercion, cartels operate as a network, and their effects compound over time. They are typically detected through anomalous citation patterns and network analysis rather than through any single paper reviewed in isolation.

- **Citations for sale** take the logic of the cartel into an explicit marketplace. In some documented cases, citations have been offered for purchase through undisclosed channels, sometimes connected to paper mills, sometimes operating independently.



Maturity: ◐ **Emerging** *Spans levels and maturity. Self-citation patterns are well studied; coordinated citation manipulation is just being realised.*

SOLUTION WISH LIST

Addressing citation manipulation requires action at multiple levels. At the individual level, researchers and reviewers should scrutinize citation patterns when assessing manuscripts, not just whether references exist, but whether they are appropriate to the claims being made. Journals should implement and enforce clear policies against coerced citations, and should audit production workflows for unauthorized reference insertions.

- **Publisher**: routine monitoring of citation networks using bibliometric tools capable of detecting anomalous clustering, disproportionate self-citation, and cartel-like patterns. These analyses should be integrated into editorial quality assurance processes, not treated as post-hoc investigations triggered only by complaint.
- **Policymakers and research assessment bodies** should be alert to the ways in which citation-based metrics, however well-intentioned, create the incentive structures that make manipulation rational.

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CHAPTER 3.4

Hijacked Journals

Hijacked journals represent clone websites of legitimate journals. They copy the title, ISSN, and other metadata of the original journal in order to create an alternative website of the journal and collect APCs from authors for publication. This model represents a scam and is mostly successful in countries that use journal titles and ISSN for journal identification in research evaluation, for example, India and Pakistan.

Since 2011–2012, when hijacked journals were first documented, hundreds of fraudulent websites have been identified. The Retraction Watch Hijacked Journal Checker, a regularly updated list of hijacked journals created in May 2022, includes more than 400 entries as of December 2025. Some journals are hijacked several times by different hijackers because they target the same types of journals, such as print-only journals, niche or trade journals, and journals published in local languages, for example, Chinese. For example, the Seybold Journal has been hijacked five times.

In 2024 and 2025, there has been an increasing trend of hijacking journals belonging to major publishers. Despite the efforts of corporate lawyers, not all cloned web domains have been closed, and such activity continues. We estimate that each year around 70–80 journals are hijacked, creating a significant burden for editors of legitimate journals.

Unlike other types of problematic journals, which can have different shades of gray and are difficult to categorise, hijacked journals are a definite category with clear criteria.

METHODS FOR DETECTION

Hijacked journals have a negative impact on science. There is evidence that hijacked journals publish low-quality papers with signs of scientific misconduct, which are cited in the literature and thus legitimised. Such papers are indexed in Google Scholar, and there is evidence of such papers being indexed in Web of Science (several cases) and in Scopus. The study showed that 67 hijacked journals compromised the data of legitimate journals in Scopus by compromising the link of a legitimate journal and/or by indexing non-authorised content.

EXAMPLES

Some journals are hijacked several times by different hijackers because they target the same types of journals, such as print-only journals, niche or trade journals, and journals published in local languages, for example, Chinese. For example, the Seybold Journal has been hijacked five times.

Maturity: ◐ **Developing** *The Retraction Watch Hijacked Journal Checker includes more than 400 entries as of December 2025. Around 70–80 journals are hijacked each year. Yet, options to detect, prevent, and address hijacked journals still need attention.*
Though many hijacked journals are documented, there is still a gap in understanding who is behind hijacked journals, how such networks are organised, and what the impact of publication in hijacked journals is for authors.

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PART FOUR · MACRO LEVEL

Systemic & Structural Issues

Science and research are more than papers or even networks; they are ostensibly the flow of information and knowledge to benefit humanity. But as with any system, there are natural tendencies to leverage it for gains, intentionally or not.

University rankings exemplify how a consolidation of information can ultimately reshape operations. They were not initially designed to alter how knowledge is generated, disseminated, or incentivised, but they have. Rankings have become an industry unto themselves, with mature companies solely focused on measuring, publishing, and selling them.

Along this spectrum sits the exploitation of open science. There has been an opportunistic move to take an ideal state of opening up research findings to the global community and game it. Yet as with an open lake, science can be passively polluted through neglect, or actively exploited through the intentional dumping of toxins.

Further along the spectrum lies something more deliberate: the interference of companies and governments into the scientific record to advance ideological, commercial, or geopolitical agendas. If the meso level is organised crime, this is closer to state-sponsored or corporate-sponsored fraud. This category does not exploit science for profit. It exploits science for power.

These three topics sit at different points of maturity. University rankings are the most established, with significant research, debate, and commercial infrastructure already built around them. The exploitation of open science is only now coming to light, with many advocates still holding firmly to the belief that openness is an unqualified good. Socio-geopolitical interference into the knowledge economy is the least understood of the three, only just beginning to be named and investigated.

The closest operational analogy is Bellingcat: open source, distributed, and transparent, using open intelligence to address global challenges through independent investigators, open data, and public findings. FoSci at the macro level works in a similar way. Yet Bellingcat operates in a world of clear adversaries. The macro level of FoSci sits somewhere between that clarity and systemic structural failure. Some of what happens here is deliberate interference. Some is negligent. Some is simply a perverse incentive structure everyone feeds.

CHAPTER 4.1

University Rankings

There is no doubt that International University Rankings are a root cause of the explosion in misconduct and publications that we see all around us. These rankings have fundamental flaws and value quantity over quality. As an example, one of the rankings insists on including self citations while evaluating Research Quality. [1][2]. They also have very opaque business models. CWTS, Leiden has Leiden Rankings, but it is too rudimentary in nature (with only 3 basic metrics).

While many people would like to see rankings eliminated, others see this as a wish and not a reality. Moving with the idea that rankings *will* exist in the foreseeable future, then the question remains of how we can address the gamification and manipulation of them – actions that are parasitic to the knowledge community.

As Forensic Scientometricans, we are privy to newer kinds of techniques being used to game these very rankings. Thus, we are in the best position to attempt to create such rankings. While creating a perfect ranking is impossible, some of the gaming can easily be mitigated with some scientometric techniques and graph analysis.

An example of such an approach is Research Integrity Risk [3] Index by Prof. Lokman Meho. Using some important parameters like retraction rate, self citation rate and percentage of articles in delisted journals, one can identify the institutes who might be gaming the rankings. Indeed one can also try and implement existing suggestions by scientometricians for better measuring impact than raw citation and publication counts.

METHODS FOR DETECTION

- Consider only quality venues: Only consider quality venues (Journals and Conferences). These venues will start being gamed if the rankings become popular, and one will have to be vigilant to constantly monitor them to see any signs of gaming.
- Normalise based on size of Universities: A lot of rankings do not normalise based on size, leading to bigger universities doing well. This is to ensure that universities do not increase their size just to game the rankings. A striking example of this is University Paris Saclay, where the French government spent 9 billion Euros to combine smaller universities into one mega university. The result was, they were ranked 14th by Shanghai Rankings, giving them boasting rights.
- Only field-wise rankings: One cannot compare two universities working in different fields with each other.

EXAMPLES

CSRankings are a good example and a starting point for developing rankings. Their methodology considers the number of publications in a curated list of Top Conferences as the only indicator.

Salient Features

- *Encouraging/enabling and promoting quality research instead of quantity*
- *Constantly evolving better scientometrics measures instead of static rankings popular currently and misleading science.*

Maturity: ◐ Developing - Established *University rankings are not new with significant research and commercial infrastructure already exists around rankings.Yet, the detection and transparency of how university rankings are manipulated and addressed still warrants significant attention.*

SOLUTION WISH LIST

Audience : Everyone interested in measuring research. Potential Solution : Rankings by teams of Forensic Scientometricians

Estimated difficulty: ★★★☆

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CHAPTER 4.2

Exploitation of Open Science

The Open Science movement, founded on principles of data transparency and equitable access, was designed to democratise science, aid reproducibility and act as a bulwark against unethical research, including the transparent sharing of data. This has, however, provided an opportunity for unethical producers of low-quality publications. Using fake data or experiments to construct manuscripts increases the chance of detection through forensic analysis, but dredging large and often noisy Open Science datasets for associations avoids this problem. This is contributing to 'fast churn science', where open-access data is processed through automated workflows to produce a flood of low-quality, formulaic, or misleading manuscripts. These papers typically use statistically appropriate methods, such as machine learning or Mendelian randomization. In the worst case, multiple versions of the same core analysis (with slight variations, such as switching cohorts or adjusting age ranges) can be submitted simultaneously, leading to large-scale redundant publication. This proliferation of low value papers offers little genuine insight, and instead introduces false discoveries, distorts assessment metrics, misallocates funding, and erodes public trust in scientific literature.

METHODS FOR DETECTION

- Detecting these outputs is difficult as GenAI (LLMs) can bypass traditional editorial and plagiarism checks by producing syntactically unique text. Current detection methods include:
- Topic and dataset matching: Identifying "formulaic titles" that report simple associations, e.g., "Exposure X and Outcome Y for Cohort Z", can often be accomplished through editorial screening or peer review, particularly when such studies repeat well-established analyses in the literature.
- Auditing Application IDs: For controlled-access datasets like the UK Biobank, checking for valid application numbers and "hypothesis drift", where the published study significantly deviates from the pre-registered research goals, may help identify patterns consistent with large-scale manuscript production.
- Cross-Check for Simultaneous Submissions: Detecting instances where conceptually identical manuscripts are submitted to multiple journals concurrently, although such identification is currently performed primarily on a post hoc basis.

EXAMPLES

The National Health and Nutrition Examination Survey (NHANES) is a prime target for exploitation because it is open access, "AI-ready", lacks registration requirements, and has large numbers of predictors, outcomes and cohorts, providing many researcher degrees of freedom. Between 2023 and 2025 the number of publications analysing NHANES more than doubled from 2805 to 7883 (source: Dimensions). Many of the publications centered on identifying simplistic associations between a predictor and outcome without correcting for

multiple testing or false discoveries, failing to use the full data range, and not accounting for the multifactorial nature of illness.

Maturity: ◐ **Emerging** *Until recently, the rate limiting step in 'click science' mass production of papers exploiting Open Science has been writing the manuscripts. Large language models have removed this limiting step, leading to an inflection point in 2023 and exponential growth in low value papers.*

SOLUTION WISH LIST

Publishers: More effective screening for mass-produced manuscripts, and greater emphasis by Editors and Peer Reviewers on why research is being done.

Estimated difficulty: ★★☆☆ Will require investment in systems

Data providers: Transition to soft restrictions, such as mandatory pre-registration of hypotheses and assignment of research IDs for all users.

Estimated difficulty: ★★☆☆ Data providers have the authority to impose access conditions if they choose to do so, but implementation may require sufficient institutional and political will. It would also require IT infrastructure to maintain records of data users and must be designed carefully to avoid discouraging legitimate research.

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CHAPTER 4.3

Company & Government Interference in Science

The deliberate interference of companies and governments into the scientific record to advance ideological, commercial, or geopolitical agendas.

The clearest historical examples come from industry. The tobacco industry's deliberate seeding of doubt into the scientific record is now well documented, most notably in Naomi Oreskes and Erik Conway's *Merchants of Doubt* and David Michaels' *Doubt is Their Product*. What those industries understood, and what remains true today, is that you do not need to win a scientific argument to delay policy. You simply need to create enough noise, confusion, and competing evidence to stall action.

What is less understood, and far less studied, is how this playbook has been updated and expanded. It now includes the manipulation of geographic labeling in publications, the use of fake or misleading institutional affiliations to launder credibility, and the weaponisation of science in legal proceedings. Because these activities frequently originate outside of institutions or legitimate governments, the burden of response falls disproportionately on publishers. That places publishers in an uncomfortable and largely unacknowledged position: as de facto guardians of democratic values, responsible for deciding whose science counts and whose agenda gets laundered as legitimate knowledge.

Governments and institutions are not without responsibility either. Funding agencies can screen grantees. Universities can establish clearer norms around what constitutes legitimate affiliation and acceptable science communication. The onus should not rest with publishers alone. But until those mechanisms mature, publishers remain the last line of defence in a system that was never designed to resist this kind of interference.

METHODS FOR DETECTION

Detection in this area is nascent and largely dependent on forensic investigation of anomalies rather than systematic screening tools. Three approaches have been documented so far:

- The first is network and conflict of interest analysis applied to legal proceedings. In the US mifepristone court case, an investigation examined eleven papers submitted as legal evidence and found that none of the top 25 researchers in the field were cited, that authors were tightly clustered around plaintiff-affiliated organisations, and that eight of the eleven papers had undeclared conflicts of interest. The key detection method here was comparing the expected landscape of expertise on a topic against what was actually presented in court.

- The second is rogue domain detection. A routine review of a paper flagged an email domain, uok.edu.gr, used by authors who listed Chinese institutional affiliations. Investigation revealed the domain had been purchased by a private individual, appeared to be hosted by Chinese individuals, and had no legitimate ties to Greece. Within twelve months of the domain's creation, 57 publications across five fields of research had used it to claim a veneer of Greek academic legitimacy. Detection relied on open source intelligence, whois records, and scientometric tools including Dimensions Author Check.
- The third is affiliation manipulation for ranking purposes. Researchers, including work by Yoran Beldengrün, have documented cases where highly cited researchers listed Saudi Arabian universities as their primary affiliation despite having only nominal ties to those institutions, artificially boosting those universities in global rankings and offers more credibility to the institutions.. Detection relied on cross-referencing publication records, affiliation histories, and ranking data.

Maturity: ◐ **Emerging** *This is one of the least developed areas within forensic scientometrics as systematic detection methods do not yet exist, and the field relies heavily on individual investigators noticing anomalies. Yet, there are well-known cases of knowledge manipulation within science and publications (e.g, tobacco industry). The research security community is beginning to pay greater attention to some of the dynamics, particularly around geopolitical interference, but the intersection of research integrity and security with scholarly publishing remains largely uncharted.*

SOLUTION WISH LIST

- External watchdog organisations: Support independent entities powered by the people and analytics used for forensic investigations.
- Journals: Require verification of institutional affiliations and conflicts of interest at submission, not just declaration.
- Institutions: Establish clear policies on what constitutes legitimate affiliation and monitor for misuse by affiliated researchers.
- Governments and Funders: Screen grantees for problematic publishing practices and withdraw funding where manipulation is evidenced.
- Publishers: Develop protocols for identifying when science submitted to journals or used in legal proceedings originates from advocacy organisations with undisclosed interests.

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PART FIVE · CROSS-CUTTING TOPICS

Cross-Cutting Topics

The topics in this final section do not fit neatly into the previous structure, but they matter to the FoSci community for distinct reasons.

First, we discuss the legal threats faced by people working in this community. Being sued, or even threatened with a lawsuit, is expensive, time-consuming, and stressful. Some sleuths are able to crowdsource legal fees or have them donated; most do not have the backing of institutional lawyers. That people continue this work regardless speaks to both their dedication and the very real personal risks they take. Including this section brings that reality to a broader readership.

The final section addresses artificial intelligence and how it is reshaping the scholarly research community and the work we do**.** AI enables faster publication but not necessarily more trustworthy knowledge. It is changing the game through speed and slop, and we need to look ahead to understand the new playing field.

CHAPTER 5.1

Legal Threats

The legal system is designed to punish defamation and other such forms of reputational damage. For instance, if an individual repeatedly claims that an author is a fraudster online without proof, and these claims appear in search results associated with that author's name, this may constitute defamation. In such cases, the affected individual may have grounds to pursue legal action to prevent further harm.

Unfortunately, like any reporting system, the legal system can be weaponized by bad actors to make the problem worse by filing false complaints. This is effective even if the complainant loses in court, because having to hire a lawyer, give testimony, and face trial requires a fair amount of money and time for the defendant. Depending on the country, the money can be gained back by winning the lawsuit, but it is still stressful.

Furthermore, the possibility of complaints can be weaponized by lazy actors to justify or encourage inaction. Even if this possibility is entirely hypothetical, it is not uncommon for sleuths to be stonewalled with the excuse that actions such as retracting a paper are a legal risk. On the other hand, lawsuits can be used to silence or threaten sleuths such that they would stop their investigation or reporting.

METHODS FOR DETECTION

Frivolous lawsuits are fairly easy to detect. They typically make grandiose claims about defamation, unfair competition, or other such broad categories, without concrete evidence to back these claims. They are likely to be filed by lawyers without much experience in such lawsuits, since those with experience are too expensive for the average frivolous complainant.

Regarding inaction due to hypothetical legal threats, it is important to recognize that this is the cost of doing business. Just as catering an event requires preparation for possible allergic reactions, addressing problematic papers requires preparation for possible lawsuits. No one would accept " someone may have an allergic reaction" as a reason to not provide food at an event. Publishers have more than sufficient resources to afford legal insurance.

Retaliations could also go beyond legal frameworks to include revenge-flagging of sleuths' papers in addition to lawsuits.

EXAMPLES

Many sleuths have been the target of lawsuits designed to silence them or provide a form of retributions for the person that was criticised. Carlo Croce is one of the early examples of a scientist taking scientific concerns to courts. Early during the pandemic, Dr. Elisabeth Bik was sued by IHU Méditerranée Infection for pointing multiple problems in Didier Raoult's papers [https://www.nature.com/articles/d41586-021-01430-z]. The lawsuit was dismissed in 2024 after three years following the release of an open letter co-signed by more than 1000 scientists to support post-publication peer review.

- https://retractionwatch.com/2021/07/01/a-scientist-critic-was-sued-and-won-but-did-not-emerge-unscathed-this-is-his-story/
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Maturity: ◐ **Emerging** *Only a few lawsuits have been filed, but sleuths receive threatening letters frequently.*

Considerations

It's important to take into account the legal framework for defamation lawsuits and defenses in the particular countries that have potential jurisdiction for a case.

Discovery, the legal requirement to exchange all information, is a very powerful tool for uncovering untoward conduct within and between laboratories, research institutions, journals and their editors, and corporations. Be sure to exploit it to the maximum extent possible as this allows more transparency in the legal process.

SOLUTION WISH LIST

For Publishers: Publishers should act on private reports within reasonable timeframes so that sleuths are not placed in a position where they feel compelled to go public.

Estimated difficulty: ★☆☆☆ Very easy to implement

For Institutions: Institutions should not accept "possibility of legal threats" as a sufficient justification for inaction.Publishers that rely on such reasoning should reasonably be viewed as lacking seriousness in addressing research integrity concerns and could be reconsidered for inclusion in indexing services.

Estimated difficulty: ★★★★ Challenging; requires substantial institutional buy-in.

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CHAPTER 5.2

Artificial Intelligence

Artificial Intelligence is a transformational field of Computer Science dedicated to developing systems capable of performing tasks that typically require human cognition, such as reasoning, learning, and autonomous decision-making, to solve complex, real-world problems. By exploring the Computer Science Ontology (CSO), one can see how the field acts as an expansive umbrella, encompassing specialised domains such as Knowledge Representation, Machine Learning, Natural Language Processing, Computer Vision, and Robotics. The recent breakthroughs in these areas, combined with the increasing overlap between these subdisciplines, have accelerated AI's evolution. This progress has ultimately culminated in the rise of Generative AI (GenAI) and its foundational technology, Large Language Models (LLMs). These large models are trained on vast datasets, trillions of words from books, articles, and websites, and use complex probability and pattern recognition to predict and generate coherent sequences of text. However, as these tools grow increasingly powerful, their integration into the research ecosystem has facilitated a troubling delegation of core intellectual responsibilities to automated systems. This shift undermines academic integrity through the use of undisclosed machine-generated text in place of original authorship, often resulting in the propagation of fabricated citations and synthetic data points. Moreover, the employment of LLMs to automate peer review breaches participant confidentiality and erodes the expert oversight fundamental to scientific validation.

METHODS FOR DETECTION

AI can be seen as an enabler for all other issues identified in this report. One can use GPTZero, tools for detecting duplicated images, or tortured phrases, but there is no one-size-fits-all tool that can be applied to consistently and accurately identify AI-generated content.

EXAMPLES

The revelation by GPTZero in early 2026 regarding the NeurIPS 2025 conference provides an illustration of how AI-driven fabrication is compromising the rigour of the scientific discourse. Despite a highly selective 24.5% acceptance rate and scrutiny from multiple expert reviewers, over fifty papers were found to contain hallucinated citations and entirely fictitious authors, such as the usual placeholder "John Doe".

These errors, ranging from incomplete arXiv identifiers to the attribution of imaginary titles to established economists like Claudia Goldin, demonstrate a profound lapse in human oversight. The NeurIPS board prioritised the preservation of research volume over academic accountability, requesting corrections rather than issuing formal retractions. This lenient approach effectively signals a problematic tolerance for the delegation of intellectual integrity to automated systems, ultimately risking the normalisation of synthetic misinformation within the foundational literature of the machine learning field.

Maturity: ◐ **Emerging** *The advent of GenAI has solidified AI-mediated misconduct as an established practice rather than a peripheral threat. By significantly streamlining the manuscript preparation process, GenAI's efficiency has cultivated a level of trust that is increasingly normalising the use of automated content in research.*

SOLUTION WISH LIST

Institutions: Education about Misconduct and Research Integrity; Digital literacy (expanded to AI); Institutional Policy or Guidelines on AI.

Estimated difficulty: ★★★★ In general AI written papers are difficult to spot. Unless they have very silly identifiable mistakes (e.g., AI generated images, fake references), otherwise you really need to be an expert of the field to identify traces of hallucinations.

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Glossary

A

Authorship manipulation

The misrepresentation of who contributed to a piece of research. Includes ghost authorship (omitting real contributors), gift or honorary authorship (listing people who made no genuine contribution), and authorship for sale (purchasing a named position on a paper).

C

C2PA (Coalition for Content Provenance and Authenticity)

A technical standard that embeds tamper-evident provenance metadata directly into digital assets such as images, video, audio, and text. A C2PA-compliant file carries a manifest recording its origin, any edits made, and the tools or systems involved.

Citation cartel

A coordinated network of researchers, journals, or institutions that systematically cite one another to artificially inflate citation counts and perceived influence. Typically identified through anomalous patterns in citation network analysis.

Citation doping

The practice of disproportionately citing specific works within a narrow institutional, editorial, or national network in order to boost rankings or impact metrics.

Citation manipulation

The use of references not to support research findings but to artificially influence citation metrics, mislead readers, or advance external agendas. Encompasses self-citation abuse, forced citations, stealth citations, citation doping, citation cartels, and citations for sale.

Content authenticity

The verifiable record of the origin and editing history of a digital asset. Content authenticity initiatives aim to embed this provenance information directly into files so that downstream users can assess whether and how content has been altered.

D

Data fabrication

The invention of an entire dataset without conducting the underlying research. A form of research fraud distinct from data manipulation in that no genuine study was performed.

Data manipulation

The falsification of data collected in a genuine study, altering results to appear more significant, consistent, or favourable than the actual findings warrant. Detection methods include GRIM analysis, digit pattern analysis, weighted mean checks, and domain-specific plausibility assessment.

F

Fast churn science

The mass production of low-quality, formulaic manuscripts generated by processing open-access datasets through automated or AI-assisted workflows.

Forensic bibliometrics

A sub-domain of forensic scientometrics focused on the quantitative analysis of publication and citation records to detect anomalies, manipulated metrics, or patterns indicative of misconduct.

Forensic scientometrics (FoSci)

A forensic, data-driven discipline concerned with understanding, detecting, and documenting manipulation within the research ecosystem. It operates across three levels: micro (individual papers), meso (coordinated networks), and macro (systemic governance).

Forced citation

A form of citation coercion in which editors or peer reviewers require authors to include references that are unnecessary or tangential to the work.

Fraud laundering

An editorial malpractice in which a journal or integrity office issues a formal correction to a paper despite being presented with clear evidence of data or image manipulation.

G

GRIM analysis

A statistical method for detecting impossible or implausible reported means in studies with discrete integer data. Given a known sample size, only certain mean values are mathematically possible.

H

Hijacked journal

A fraudulent clone of a legitimate journal's website, replicating its title, ISSN, and metadata to deceive authors into paying article processing charges for publication in a non-existent or illegitimate outlet.

I

Image manipulation

The inappropriate alteration or duplication of figures, photographs, or other visual data in a published article. Detection tools include Imagetwin and Proofig.

Incorrect correction

A correction issued to a published paper that fails to address the actual problem, either because the investigation was inadequate (cavalier correction) or because clear evidence of manipulation was disregarded.

K

Knowledge fidelity

The degree to which a piece of knowledge accurately reflects its original provenance, context, and properties as it moves through citation, reuse, and dissemination.

M

Macro level (FoSci)

The systemic dimension of forensic scientometrics, concerned with how the global research ecosystem — its governance structures, incentive systems, ranking mechanisms, and geopolitical forces — enables or fails to detect misconduct.

Meso level (FoSci)

The network and pattern dimension of forensic scientometrics, focused on coordinated behaviour across journals, institutions, or groups of actors. Encompasses paper mills, review mills, hijacked journals, and citation cartels.

Micro level (FoSci)

The individual case dimension of forensic scientometrics, focused on specific papers, authors, and detectable anomalies within published works. The most mature area of the field.

O

Open science exploitation

The opportunistic misuse of publicly available research datasets and open-access infrastructure to generate large volumes of low-quality or misleading publications.

P

Paper mill

An organisation that sells authorship for fraudulent or low-quality articles and guarantees their placement in journals. Paper mills may also sell citations.

Predatory journal

A publication that charges article processing fees while providing little or no genuine peer review, editorial oversight, or quality assurance.

Problematic Paper Screener (PPS)

An automated tool that searches for tortured phrases and other red flags in scientific publications by querying the Dimensions database.

Provenance (research)

The documented history of a research output: its origin, authorship, methodology, data sources, editorial history, and any subsequent modifications.

PubPeer

An online platform that allows researchers to post comments on published papers, often flagging concerns about data integrity, image duplication, statistical anomalies, or other potential problems.

R

Research integrity

The adherence to ethical principles and professional standards in the conduct, reporting, and dissemination of research. It encompasses honesty, rigour, transparency, and accountability.

Research security

The protection of research from foreign interference, espionage, theft of intellectual property, and geopolitical exploitation.

Retraction

The formal withdrawal of a published paper from the scientific record, typically because of misconduct, significant error, or irreproducible results.

Review mill

A coordinated network of peer reviewers who write boilerplate, superficial reports for papers — typically to insert coercive citation requests that inflate citation counts for affiliated authors.

S

Scientometrics

The quantitative study of scientific literature and research activity, including the measurement of publication outputs, citation patterns, collaboration networks, and journal metrics.

Sleuth (science sleuth)

An informal term for individuals, often working independently and voluntarily, who investigate published research for signs of manipulation, misconduct, or error.

Stealth citation

A reference added to a paper during the editing or production stage, after the authors have signed off, without their knowledge or consent.

Stealth correction

A modification made to a published paper without issuing a formal correction notice or informing readers that the content has changed.

Synthetic knowledge laundering

The process by which fabricated, plagiarised, or manipulated research outputs are introduced into the scholarly literature in ways that make them appear legitimate.

T

Tortured abbreviation

A variant of a tortured phrase in which an acronym or abbreviation does not correspond to the mangled term used in the text.

Tortured phrase

A deformed scientific expression produced when paraphrasing software is used to disguise plagiarism by replacing standard terminology with nonsensical synonyms.

U

University rankings

Commercial or academic indices that rank higher education institutions, typically using metrics such as publication volume, citation counts, and research income.