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Shining Light on "Dark Science": Mapping the Field of Science Watchdog Journalism

Aljosha Karim Schapals [1], Michelle Riedlinger [1], Silvia Montaña-Niño [2], and Artem Rednikin [1]

[1] School of Communication, Queensland University of Technology, Australia
[2] School of Culture and Communication, University of Melbourne, Australia

Correspondence: Silvia Montaña-Niño (silvia.montanan@unimelb.edu.au)

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Abstract

The journalistic watchdog role has traditionally been theorised as a mechanism for scrutinising political power. Yet comparatively little scholarly attention has been paid to watchdog practices that target science itself, despite growing concerns about research misconduct, misinformation, and the misuse of scientific authority in digital media environments. This study addresses this gap by conceptualising and mapping the emerging ecosystem of science watchdog journalism. Building on literature in journalism studies, science communication, and research integrity, the study defines science watchdog journalism as forms of journalistic and journalism-related scrutiny that monitors the production, communication, and use of scientific knowledge. Empirically, the study adopts an inductive mapping approach to identify actors engaged in science watchdog practices across contemporary platformised media environments. Drawing on case-based analysis, media monitoring, and multi-platform searches, we identified that actors are operating in a diverse science watchdog ecosystem that extends far beyond traditional investigative journalism. Science watchdog functions are increasingly performed by a broad range of actors, including research-integrity specialists, fact-checking organisations, advocacy groups, and highly visible individual commentators. Five primary watchdog functions are identified: primary investigative watchdogs, infrastructural watchdog platforms, translational intermediaries, corrective verification organisations, and attention-based watchdogs. Importantly, the study expands beyond Western media systems, highlighting watchdog initiatives operating across multiple global regions. By conceptualising science watchdog journalism and systematically mapping its actors and functions, the study contributes to journalism theory by proposing a broader understanding of watchdog practices in an era of platformised media and contested scientific authority.

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Keywords
investigative journalism; misinformation detection; peripheral actors; research integrity; science communication; scientific misconduct; watchdog journalism

1. Introduction

In 1998, *The Lancet* published a paper led by British physician Andrew Wakefield claiming a link between the measles, mumps, and rubella (MMR) vaccine and autism, triggering widespread public alarm and fuelling vaccine hesitancy (Rodriguez, 2025). Over several years, investigative journalist Brian Deer conducted a meticulous inquiry for the UK's *Sunday Times*, uncovering undisclosed financial conflicts of interest, ethical breaches, and evidence of data misrepresentation. Deer's reporting ultimately contributed to formal investigations by the General Medical Council and the retraction of the article from *The Lancet* in 2010 (Goldenberg, 2021), illustrating how investigative journalism within mainstream media institutions can correct the scientific record and protect public health. Beyond mainstream investigative journalism, science watchdog practices have increasingly emerged through digital platforms and hybrid forms of scrutiny operating outside traditional journalistic institutions. For example, platforms such as PubPeer enable researchers and independent analysts to publicly scrutinise published science. Yet, these peripheral science watchdog practices often lack the institutional protections afforded to journalists. For example, the commenter known as "Clare Francis" (a well-known pseudonym used by anonymous PubPeer commenters) faced a legal effort to compel disclosure of their identity during a defamation dispute, after raising concerns about research published by Wayne State scientist Fazlul Sarkar on PubPeer (Oransky, 2015). While diverse forms of scrutiny in contemporary science "watchdogging" are growing, without the editorial oversight, legal teams, and institutional backing typically available within mainstream media and specialised science publishing organisations, these actors face new challenges.

Building on these examples, this study examines the emerging ecosystem of science watchdog journalism—made up of actors dedicated to exposing scientific misinformation, misconduct, and malpractice, especially where these actors speak back to problematic aspects of institutionalised science and abuses of scientific power. This ecosystem spans both institutionalised and peripheral forms of watchdog practice. Leading scientific publications, such as *Nature* and *Science*, have expanded their journalistic functions to include sustained investigative reporting on research integrity, including paper mills, image manipulation, large-scale retractions, and failures of peer review. For example, *Nature* has published a series of news features on fraudulent publication infrastructures (e.g., Porter & McIntosh, 2024) and the work of "science sleuths" (e.g., Kwon, 2025), as well as analyses of systemic misconduct trends (Kozlov, 2026). *Science* has reported on high-profile retractions and contested findings (e.g., Brainard, 2024; Normile, 2024; Thorp, 2022), reflecting a broader shift toward scrutinising the reliability and governance of scientific knowledge production. While the journalistic watchdog role has traditionally been theorised in relation to *political* power (Mellado, 2014), much less attention has been paid to watchdog practices that *target science itself*—and this is despite pressures on research integrity, the amplification of pseudo-scientific claims, or even problematic scientific outputs and evidence circulating on digital platforms.

Science watchdog journalism operating at the intersection of journalism and advocacy remains a severely understudied subset of science communication. This current lack of scholarly attention may be due to the

fact that science watchdog journalism practices are more visibly anchored at the periphery of journalism, where they have emerged in response to gaps left by traditional, mainstream forms of science journalism, particularly in contexts where newsroom resources are limited (Franks et al., 2023) or where institutional pressures constrain critical reporting or simply because journalists are not equipped to understand the processes involved in the production and distribution of scientific knowledge. As such, rather than focusing on legacy media, our study explicitly investigates peripheral actors such as non-profit investigative outlets, digital journalism start-ups, science collectives, and individual researchers and activists who operate at the margins of journalism and science but play central roles in exposing the "dark sides" of science.

We investigate who these actors performing science watchdog journalism roles are, what watchdog functions they fulfil, and what conditions they operate under. We use the term "actor" herein to refer collectively to individuals, news outlets, organisations, and initiatives. Following a review of relevant literature bringing together work on watchdog journalism and science communication, we describe our mapping approach which systematically maps and categorises a diverse range of actors engaged in science watchdog activities across different geographic locations. We show how science watchdog practices emerge from media industry and institutionalised science contexts to meet the needs of specific regional and cultural contexts. Finally, we advance an agenda for decentring Western and mainstream media-centric assumptions about science watchdog journalism and expanding the field's analytical horizons.

2. Literature Review

In this section, we first trace the concept of being a "watchdog" back to its origins and find that the role is commonly associated with being a watchdog over those in *political* power. Next, we highlight that the field of watchdogs over science, in particular, has greatly expanded over the past few years. This finding merits a standalone conceptualisation of science watchdog journalism as we understand it herein, offered at the end of this section.

2.1. Watchdogs in (Science) Journalism

The watchdog role is well established in journalism, first theorised in the early 20th century by American journalist Walter Lippmann in his seminal works, *Liberty and the News* (1920) and *Public Opinion* (1922). At the core of this role conception lies the understanding of journalism as a monitoring institution, acting as checks and balances on political power and providing the public with essential information for democratic decision-making. In terms of the role's enactment in practice, it is still most frequently tied to the Watergate scandal of the 1970s, when two *Washington Post* journalists uncovered abuses of power by US President Richard Nixon which, ever since, has become a textbook example in journalism education and its linkages to democratic theory. Later, in her seminal work on journalistic role performance, Chilean scholar Claudia Mellado stratified the most observed journalistic roles in a global context across six dimensions: interventionists, watchdogs, supporters, service providers, infotainment, and civic roles (Mellado, 2014). Importantly, in the literature, the watchdog role is most frequently tied to cases of *political* wrongdoing: For example, Standaert et al. (2021) offer an elaborate framework of journalistic roles in political life, in which they highlight, among others, journalists' critical/monitorial role as a fourth estate over those in political power, a role most pronounced in Western contexts.

Scholars Declan Fahy and Matthew Nisbet have conceptualised the roles of science journalists as curators, conveners, public intellectuals, and civic educators, and have also found that science journalists occupy traditional journalistic roles including reporters, conduits, agenda setters, and, most importantly, watchdogs—a role which specifically "holds scientists, scientific institutions, industry, and policy-orientated organisations to scrutiny" (Fahy & Nisbet, 2011, p. 780). In their study of US and UK science journalists, they find that "journalists…strongly identified with the watchdog role, stressing that this meant they covered critically the scientific community itself, new scientific findings, challenges to scientific knowledge, science policy claims, and, indeed, science journalism itself" (p. 790). Similarly, in their study on journalists as brokers of scientific knowledge, Gesualdo et al. (2020) identified awareness, accessibility, engagement, linkage, and mobilisation as central roles, with the latter being a call to the public to act based on scientific knowledge, which, of course, harks back to the public service function of journalism (Deuze, 2005). These findings also somewhat align with both Hanitzsch's (2007) and Mellado's (2014) conception of journalists as interventionists and as assertive and motivated actors in the public sphere, which stands in contrast to the detached, objective, and neutral conception of traditional journalists (Deuze, 2005).

That said, the watchdog ideal is occasionally contested within science journalism itself, and some science journalists neither identify with, nor aspire to, a watchdog role. As noted, the watchdog role is one of many, and the explainer and educator role is frequently favoured over its adversarial counterpart (Fahy & Nisbet, 2011). This shows that, in practice, the actualisation and enactment of the journalistic watchdog role is not quite as straightforward, particularly during times of heightened political uncertainty or during significant public health or environmental crises. The reasons for this are primarily systemic: For example, in heavily under-resourced newsrooms, science journalists were found to practice "copy-and-paste journalism," including from press releases from big pharma companies, thereby acting as cheerleaders for for-profit conglomerates (Franks et al., 2023). Other such systemic issues became particularly evident during the global Covid-19 pandemic, where many journalists in general, and science journalists in particular, demonstrated a lack of familiarity with the scholarly peer-review process and were shown to unskeptically report preprints, i.e., published scholarly work which had not (yet) undergone peer-review (Fleerackers et al., 2022). This is problematic insofar as the "uncritical reliance on scientific experts risks compromising their [journalists'] ability to serve the public interest and retain independence and autonomy from their sources" (Fleerackers, Moorhead, et al., 2025). Other research has gone as far as to describe US journalists during the pandemic as "glorified minute takers" (Mesmer et al., 2024), citing as reasons a lack of training in specialised science beats, a need to publish quickly, and an overt reliance on official sources (see also Klemm et al., 2019), as well as a feeling of being overwhelmed at the onset of the crisis, leading to uncritical reporting of science news about Covid-19. Like investigative journalism in general, science watchdog journalism can be labour and time-intensive: Relevant sources and evidence can be challenging to acquire, and media outlets may not recognise the value of the story or risk libel suits (Fleerackers, Moorhead, et al., 2025).

Such systemic issues highlight the shortcomings that can arise when legacy media no longer operate specialised health or science beats and are structurally under-resourced. Simultaneously, this development opens the door for non-legacy watchdog actors to fill this scrutiny void, particularly during significant public health crises. Indeed, the terrain of peripheral (i.e., non-legacy) science journalism has increased over the years, comprising a multitude of actors who are holding science up to scrutiny and are acting as watchdogs.

2.2. Expanding the Field of Watchdog Actors

Public access to digital networks and communication infrastructures has meant that a range of new actors now complement the legacy, institutionalised fields of science and media. This new range of actors can actively participate in public debates around science. Indeed, "it has become an *inevitable condition* of digital public spheres: new actors have emerged as visible voices in science communication, regardless of whether or not they were invited to participate" (Brüggemann et al., 2020, p. 12, emphasis in original).

Drawing on the concept of boundary work as articulated by Thomas Gieryn in his influential 1983 article on the demarcation of science from non-science (Gieryn, 1983), and further incorporating the flourishing field of peripheral actors (Holton & Belair-Gagnon, 2018) working on the margins of journalism, the distinct term "peripheral science journalism" connotes "online channels dedicated to producing and disseminating online content" and "individuals…whose primary motivation is a social one: to share science news with the general public and enhance public engagement with science" (Ginosar et al., 2024, p. 933). This may include science news websites which share features with journalistic institutions but also include research amplifier platforms including *The Conversation* as a boundary-spanning organisation (Ginosar et al., 2024).

Indeed, the research amplifier platform *The Conversation* is a prime example of a peripheral science journalism actor having gained traction during significant public health emergencies, including the global Covid-19 pandemic (Schiffrin, 2020). By enabling academics to present their research findings to the general public in an accessible, journalistic style, the platform not only acts as a critical science communication intermediary but also as a response to the dissolution of many specialised health and science beats across increasingly financially strained legacy news organisations. Notably, and beyond providing expert advice and commentary on (predominantly) scientific matters, however, *The Conversation* also plays an active role in research integrity activism, including discussions surrounding scientific fraud and misconduct, paper mills, issues to do with peer review, scientific corrections, as well as wholesale retractions. As such, *The Conversation* transcends its core function in acting as a bridge between academia, journalism, and the public, but is also active in public accountability and advocacy; thus, we ascribe certain watchdog functions to research amplifier platforms, too.

The Conversation is one of several actors active in the emerging field of science watchdog journalism. As challenges surrounding research integrity activism become more frequent, including recent challenges to scholarly publishing practices due to the rise of GenAI technologies and tools, citation manipulation, predatory journals, paper mills, and science-for-profit tactics (Fleerackers, Nguyen, et al., 2025), so too do the number and diversity of actors operating as watchdogs over scientific malpractice increase. Research on these actors mostly centres on single case studies of more established actors recognised as occupying central roles in science watch journalism, such as *Retraction Watch* (see, e.g., Mede et al., 2025).

Founded in 2010, *Retraction Watch* has become a central institution in contemporary science watchdog journalism, conducting sustained investigative reporting on scientific retractions, paper mills, instances of image manipulation, and research misconduct. The watchdog outlet has built an influential archive of cases and a widely used retraction database, now referenced by journalists, publishers, and research integrity investigators. Rather than operating at the margins of the media ecosystem, *Retraction Watch* connects investigative reporting, post-publication peer review communities, and institutional accountability processes

(Kar, 2024; Xu et al., 2023). This central position of *Retraction Watch* complicates assumptions that science "watchdogging" practices outside of mainstream newsrooms or specialist science media occur primarily through peripheral actors or informal online networks. For researchers studying peripheral watchdog actors, including anonymous PubPeer commenters, independent analysts, or meta-research bloggers, the prominence of *Retraction Watch* emphasises how influence often depends on hybrid positioning: Actors may appear peripheral to mainstream media yet significantly shape agendas, circulate evidence, and translate technical scrutiny into widely recognised cases of scientific accountability. A diverse range of actors, peripheral to mainstream media, is expanding the field of science watchdog journalism, including those with particular corrective, verification functions, such as fact-checking organisations; those with public signalling or agenda-setting functions; and so-called "scienfluencers" (or science influencers) who rely on high levels of public visibility on their respective social media profiles. Cases such as these exemplify that watchdog roles can no longer exclusively be conceptualised in terms of actors being watchdogs over those in political power or actors operating in legacy settings.

Despite the increasing, but slow recognition of these science watchdog actors in public debates, to this date, no study has attempted to systematically classify *who* performs science watchdog journalism globally, and *what* respective functions these actors perform in these spaces. What's more, no study thus far has conceptualised science watchdog journalism as it pertains to *peripheral actors*. This study is the very first to do so, and as such offers a conceptual contribution beyond the mapping approach we present herein.

2.3. Conceptualising Science Watchdog Journalism

In this study, we conceptualise *science watchdog journalism* as forms of journalistic and journalism-related scrutiny that monitor the production, communication, and use of scientific knowledge. It focuses on exposing scientific misconduct, research malpractice, misinformation, and the misuse or misrepresentation of scientific authority.

Unlike traditional watchdog journalism, which scrutinises *political* power, science watchdog journalism directs accountability towards science itself. It operates within a distinct ecosystem that includes investigative journalists, research-integrity specialists, fact-checking organisations, digital platforms, advocacy groups, and influential science communicators. Importantly, this conceptualisation recognises that science watchdog functions are increasingly performed not only by institutional journalists, but also by peripheral and hybrid actors operating at the intersection of journalism, science, and advocacy.

In contemporary digital media environments, science watchdog journalism encompasses a range of practices, including investigative reporting on research misconduct, verification and debunking of scientific misinformation, infrastructural tools enabling post-publication scrutiny, translation of integrity investigations to broader publics, and public signalling that generates reputational accountability within scientific communities.

Taking this novel conceptualisation as a starting point, we chose a mapping approach to classify these actors by the *type* of watchdog role that best describes them and their primary watchdog *function*. While we do not claim completeness for this classification model, our study is the first of its kind to develop an exploratory typology that systematically categorises a diverse range of actors operating within the growing science watchdog journalism ecosystem.

3. Method

This study maps actors associated with science watchdog journalism operating within contemporary platformised and democratised media environments. We acknowledge that mapping activities impose order on complex phenomena rather than discovering pre-existing natural categories. In this study, we present one empirically grounded way of organising the landscape of science watchdog journalism actors. As such, it remains a provisional categorisation that invites further investigation as new actors emerge in response to changes in the science and media ecosystems. The aim of this mapping was not to produce an exhaustive list of all science watchdog actors globally, but rather to develop a functional classification framework capable of capturing key forms of watchdog practice across institutional, hybrid, and peripheral contexts. As such, the primary value of this mapping lies in its capacity to reveal patterns of variation in science watchdog function and alignment with professional norms, thereby identifying emerging science watchdog practices.

Rather than beginning with predetermined theoretical categories, this study adopted an inductive, ground-up approach where the classification dimensions emerged iteratively from the authors' discussion of the actors associated with the identified watchdog activity. Science and journalism fields are constantly being maintained as legitimate and delimited spaces of knowledge by insiders who adhere to normative values and ideals specific to the fields of scientific and journalistic production. Regarding debates over the delimitation of scientific and journalistic fields, Bourdieu's sociology is useful for identifying the practices that enable the delimitation and understanding of both scientific and journalistic authority. Aligning with Gieryn (1983) who finds it useful to consider *contrasting cases* of communities (e.g., religious, political, practical, or pseudoscientific), we consider that investigations of contrast may reveal important areas of demarcation in science watchdog journalism. While Gieryn's reflections speak of a moment in the history of science and its demarcation from non-science, we also observe how science watchdog journalism actors are considered central or peripheral to the norms and practices of institutionalised science and mainstream journalism. That said, both theoretical concepts were herein invoked for their general delimitation of scientific and journalistic fields, rather than practically operationalised in the study's methodological approach.

3.1. Data Collection

We began by identifying and collecting case studies of science watchdog activity and reporting drawn from the existing, but still extremely limited, academic literature focused on the reporting of scientific misconduct and research integrity breaches. We supplemented this list of cases with results from targeted web and platform searches that captured existing organisations, initiatives, and individuals engaged in science watchdog-related activities. Our searches were conducted between August 2025 and January 2026, using multiple keyword combinations designed to capture the breadth of activity in the area: scientific or research misconduct, scientific or research fraud, scientific or research integrity, scientific or research fabrication, retraction, predatory journals, post-publication peer review, scientific image manipulation, PubPeer, *Retraction Watch*, and science fact-checking. The searches were conducted on Google, Google News, Substack, Medium, X, Bluesky, Mastodon, and LinkedIn. Given the documented migration of science communities away from Twitter/X following platform changes in 2022–2023 (Valero, 2023), this multi-platform approach to data collection was essential.

We then used snowball sampling to expand the dataset with additional organisations, initiatives, and individuals. We first reviewed the identified actors' websites and platformised media presences to identify allied initiatives, and taking a metajournalistic discursive approach (Carlson, 2016), we considered these actors' (self-)presentation on their own platforms and media coverage about them (as science actors, journalism/media actors, or hybrid identifications). Secondly, we employed case-based tracking and examined media coverage of high-profile misconduct cases to identify actors who repeatedly appeared or engaged in investigative reporting. Finally, we employed citation tracking within relevant investigative reports and content identified from social media, newsletter-based, and social/blogging platforms to identify additional watchdog actors. We continued snowball sampling until no new novel actor types emerged. Our data collection approach was deliberately broad, adopting an expansive definition of science watchdog activity that includes all actors who appear to "speak back to science" in the public interest. While the study primarily foregrounds peripheral and hybrid watchdog actors, selected institutional and legacy media organisations were also included where they performed particularly visible or influential science watchdog functions within the broader ecosystem. After five passes through the emerging list, supplementary searches, and discussions about these and other cases, we identified a final sample of 60 distinct watchdog actors active up until the cut-off date in January 2026 for typological analysis.

3.2. Mapping Approach

Following Gieryn's (1983) pragmatic study of science and non-science boundary work and considering the primary function of these actors in relation to science watchdog journalism, we iteratively examined the identified actors to discern patterns of variation that might contribute to a better understanding of science watchdog activity within platformised media ecosystems. For each identified actor, we compiled detailed profiles documenting the organisational structure and legal status, the funding and sustainability models, the primary activities and intervention modes, the focus and scope of scrutiny, the platform deployment strategy, the positioning of actors to institutionalised authority (science, media, or hybrid), the stated or implied target audience/s, and the actors' pathway to impact.

Through iterative comparative analyses of these profiles, two researchers in the coding team identified the main institutional/field alignments and the functions of science watchdog activities. They then iteratively refined the dimensions as new cases were incorporated to ensure that we captured empirical variation. They collapsed categories where we identified that actors shared substantial but not complete similarity. For example, individual researcher actors classified as "platform-based science sleuths" formed a collapsed category of primary investigative functions with mainstream media and specialist science magazines, where actors initiate scrutiny, uncover misconduct, and generate original claims.

The two coders identified the key functions of science watchdog journalism, capturing empirically meaningful variation that overlapped with institutional alignments (science, media, and hybrid alignments). Each identified science watchdog actor was systematically coded for their function and provisionally assigned to categories through author consensus. However, individual actors varied in their platformised activities and the degree to which their activities received institutional recognition. Cofie et al. (2022) explicitly argue that a qualitative, descriptive characterisation of agreement through consensus coding of the kind employed in this project, emphasising coder dialogue, reflexivity, and consensus, can be more compatible with interpretivist qualitative paradigms than quantitative intercoder reliability. Researchers also argue that this consensus coding process

offers the same assurance of trustworthiness and consistency that intercoder reliability assessment is meant to signal, while better honouring the contextual, interpretive nature of qualitative data (Clarke et al., 2023; Hemmler et al., 2020).

The resulting mapping organises science watchdog actors according to science watchdog function, with secondary differentiation by proximity to science (scientific institutions) or the journalism field (media institutions).

4. Findings

Table 1 presents an exploratory mapping of science watchdog types and functions identified in this study. The findings show that accountability around scientific integrity is produced through several distinct but overlapping categories of actors. In several cases, allocating an actor to one category proved challenging because these actors performed multiple—as opposed to singular—functions. However, we were able to identify a *primary* function for all actors; these were allocated to the primary functions through author consensus (see Supplementary File for the allocation of actors).

In total, we identified five watchdog types: primary investigative watchdogs, infrastructural watchdog platforms, translational intermediaries, corrective verification organisations, and attention-based watchdogs. Each of their watchdog functions is discussed below, along with their self-perceptions of institutional alignment with either scientific institutions, media institutions, or a combination of these (i.e., hybrid).

Table 1. Classification of science watchdog journalism types and functions, including examples.

Group	Watchdog Type	Watchdog Function
1	Primary investigative watchdogs	Initiating scrutiny, uncovering misconduct, and generating original claims
2	Infrastructural watchdog platforms	Enabling, archiving, and legitimising scrutiny
3	Translational intermediaries	Translating watchdog findings into authoritative mainstream discourse
4	Corrective verification organisations	Rapid verification, debunking, and fact-checking
5	Attention-based watchdogs	Public signalling, agenda-setting, and reputational pressure

Primary investigative watchdogs play a foundational role in science watchdog journalism by initiating scrutiny, uncovering misconduct, and generating original claims about failures within the scientific research and scholarly communication system. Traditionally, these functions have been performed by investigative journalists working in mainstream media institutions and specialised science outlets. Major newspapers and investigative newsrooms such as *The New York Times*, *The Guardian*, and *ProPublica* have produced landmark investigations into biomedical fraud, toxic exposure, and regulatory failures, often setting the agenda for broader public and policy debates about scientific credibility. Specialist science journalism platforms extend this work within the research ecosystem itself, routinely exposing issues such as paper mills, clinical-trial irregularities, and image manipulation.

For example, *The Guardian* and its science reporters have continued journalistic investigations into paper mills and data transparency for scientific reproducibility, often building on cases initially revealed by other

organisations such as *Retraction Watch* or *Nature* (McKie, 2024). Alongside these institutional actors, specialised watchdog outlets and hybrid journalism-science initiatives have emerged, most prominently *Retraction Watch*, which functions as a dedicated accountability hub tracking retractions and misconduct across global scholarly publishing. Similar initiatives have developed beyond Western research centres, including *Plagio SOS* in Latin America and *India Research Watch*, which rely on insider reports, collaborative investigation, and partnerships with mainstream media to expose malpractice. Finally, the field increasingly includes individual research-integrity sleuths working from within science itself, whose technical expertise enables them to identify issues such as image manipulation, paper-mill activity, and machine-generated text, demonstrating how investigative watchdog functions can also emerge from within scientific practice.

Infrastructural watchdog platforms enable accountability in science by building systems that make scrutiny visible and durable. Unlike investigative journalists or individual science sleuths, these platforms do not themselves interpret or publicise specific cases. Instead, they support scrutiny by providing robust infrastructures that enable distributed oversight, allowing researchers, editors, and integrity investigators to detect patterns of misconduct and maintain public records of concerns. These tools archive evidence, automate the detection of irregularities, and create shared spaces where researchers can evaluate problematic publications before or after formal peer review has ended.

Platforms such as PubPeer, Statcheck, and ImageTwin illustrate this infrastructural form of watchdogging. PubPeer operates as a global post-publication peer-review forum where scientists publicly comment on published papers, often identifying image manipulation, statistical anomalies, or methodological concerns that escaped traditional editorial review. Statcheck automates the verification of reported statistical tests by recomputing *p*-values from published statistics, revealing widespread inconsistencies across the literature. Finally, ImageTwin enables large-scale automated image comparison across scientific publications, helping journals and institutions detect duplicated or manipulated figures.

Translational intermediaries play a key role in science watchdog journalism by converting specialised watchdog findings into accessible and authoritative public discourse. While they do not typically initiate scrutiny or conduct original investigations, they act as crucial bridges between primary investigative watchdogs and broader audiences. By translating complex research-integrity issues into journalistic formats, these actors enable wider visibility, interpretation, and uptake of watchdog findings across media and public spheres.

Actors such as *The Conversation*, *Scientific American*, *Times Higher Education*, and *360Info* illustrate this translational function. These platforms provide spaces where metascience researchers, science sleuths, and investigative journalists can communicate their findings to wider audiences, often contextualising cases of misconduct or questionable research practices within broader scientific and societal debates. While many of these intermediaries are primarily known for amplifying academic knowledge and research, they also contribute to science watchdog journalism by extending the reach and public impact of integrity-related investigations. Their established audiences, often global and highly engaged, position them as key actors in raising awareness of scientific malpractice and embedding watchdog findings within mainstream discourse.

Corrective verification actors operate as a specialised subset of fact-checking and verification organisations by scrutinising misleading or contested scientific claims circulating in public and media domains. Their

primary function lies in the rapid verification, contextualisation, and correction of science-related misinformation, often by comparing claims against established scientific evidence and expert consensus. These actors became particularly visible during major misinformation events, such as the Covid-19 pandemic, where they addressed the decontextualisation and politicisation of scientific knowledge. While their practices align with journalistic verification norms, their work is typically highly specialised and focused on complex scientific issues.

Actors such as *SciCheck*, *Climate Fact Checks*, and *Science Feedback* illustrate this corrective verification function by systematically evaluating claims about vaccines, climate change, and other contested scientific topics. Their work typically involves consulting expert sources, analysing scientific literature, and assessing the accuracy of public statements made by politicians, media figures, or social media users. Beyond these hybrid verification initiatives, organisations embedded within scientific advocacy and policy infrastructures also perform corrective watchdog roles. For example, the Center for Science in the Public Interest scrutinises scientific claims in public health and food marketing, while the Union of Concerned Scientists monitors political and corporate interference in scientific processes. These actors demonstrate how corrective verification extends beyond traditional fact-checking into broader science governance contexts, relying on expert networks, policy engagement, and evidence-based analysis to challenge misinformation.

Attention-based watchdogs operate through public signalling and agenda-setting rather than formal investigation. High-visibility scientists and commentators use blogs, social media, public talks, and online essays to draw attention to misleading claims, questionable methods, and exaggerated research findings. By highlighting such issues, they generate reputational pressure on researchers, journals, and institutions, encouraging accountability through visibility rather than through formal journalistic intervention. Their work is typically independent of media institutions or formal verification organisations and relies on reach, credibility, and audience engagement.

Figures such as Katie Mack, Andrew Gelman, and Carl Bergstrom illustrate this form of watchdog activity. Katie Mack uses writing, public talks, and social media to challenge scientific hype and clarify misconceptions, particularly in areas such as cosmology and climate change. Andrew Gelman performs a similar function in the methodological sphere, using his widely read blog to critique flawed statistical models, *p*-hacking, and overinterpreted findings. Carl Bergstrom combines research expertise with public communication, notably through his work *Calling Bullshit*, which helps audiences identify misleading statistics and data-driven misinformation. Collectively, these actors function as distributed "scienfluencer" watchdogs who enforce norms of scientific credibility by directing public attention to problematic claims and practices.

5. Discussion

In this study, we identified the core functions of a broad and diverse set of actors in the science watchdog journalism landscape, capturing empirically meaningful variation that overlaps with two main institutional alignments, media and science. We also captured organisations and actors identifying with hybrid alignments, i.e., those aligning themselves with both institutions.

Our findings demonstrate that science watchdog journalism, as a specific subset of science communication devoted to investigations of "dark science," has now well and truly expanded beyond traditional,

investigative journalism. Indeed, the field now encompasses a broad ecosystem of actors operating across journalism, science, and hybrid spaces. This study is the first attempt to bring some order to what has become an increasingly messy, definitional space. Our mapping approach reveals five distinct categories of actors operating in the science watchdog journalism space: primary investigative watchdogs, infrastructural watchdog platforms, translational intermediaries, corrective verification organisations, and attention-based watchdogs. Upon closer inspection of each actor, we found that critical watchdog functions are increasingly being performed by those known in the literature as "peripheral actors" (Holton & Belair-Gagnon, 2018). Unlike legacy news organisations and their well-known work of uncovering malpractice in science, our contribution lies in highlighting marginal, para-journalistic actors, including research-integrity sleuths, fact-checking organisations, digital journalism start-ups, and advocacy groups. What's more, these actors do not necessarily exist in isolation but, in fact, form part of a growing ecosystem in which journalists, scientists, platforms, and advocacy actors collectively expose misconduct, misinformation, and research integrity issues, thereby highlighting the value of collaboration (Walters, 2024).

The implicit linkages we draw between journalism and (Western) ideals of democracy, whereby an enlightened citizenry can intelligently participate in decision-making, and journalists act as watchdogs and a Fourth Estate over those in *political* power, are well established in scholarly literature (Mellado, 2014). However, we argue that the current, platformised media environment we find ourselves in has enabled entirely new forms of watchdog activity over the *scientific* community, too, with examples ranging from post-publication peer review to automated plagiarism detection tools and social media-driven scrutiny of scientific claims. Above all—and most crucially—our findings prompt a wholesale rethinking of traditional journalism theory: Watchdog journalism, we argue, must be conceptualised much more broadly to include actors operating at the margins of *both* journalism and science. The sheer number of actors we have found operating in this space is testament to this—and our list is not exhaustive.

Collectively, these actors contribute to greater scrutiny of science, faster exposure of misconduct, and increased amplification of perhaps otherwise ignored issues. While such an emerging science watchdog journalism ecosystem undoubtedly has its benefits, it also has obvious downsides: given their limited resources, and their dependence on often precarious labour, their long-term survival is anything but guaranteed. It is also worth noting that the lack of formalised accountability procedures, such as highly visible corrections in case suspected misconduct turns out to be false, means that these actors are at heightened risk of defamation, and without strong institutional or union-backed support networks as they are commonplace in legacy media organisations, the ecosystem is particularly susceptible to legal challenges. To mitigate that risk, it is therefore recommended that peripheral science watchdog journalists more explicitly highlight their evidence-based approach and methodological robustness, as well as possible funding sources or other affiliations to increase transparency and, conversely, trust in the system.

On a more conceptual level, the significant journalistic capital (Örnebring et al., 2018) that peripheral actors have attained over the years, as well as the fact that these actors' motivations and practice often overlap with those of their legacy counterparts, makes it increasingly difficult to continue to place these actors on the discursive periphery of journalism (Schapals, 2025). Naturally, too, discussions on the periphery depend on where the core of journalism is located: perhaps the actors we categorised as inhabiting a hybrid institutional alignment—that is, those who align themselves both with the values of legacy media institutions as well as institutionalised science—are the new centre? As such, calls for a more careful reconsideration of

who and what ought to be classified as "peripheral" persist, also in the science watchdog journalism space. Relatedly, one may even go as far as to question whether journalism as a lens through which we have observed these actors is perhaps too narrow, given these actors' inherent hybridity. This is where their functions—used as an analytical dimension to classify them—come in again: many of these mapped actors perform core journalistic functions, including investigation and verification, regardless of institutional origin. Analogous to our classification—where we have clustered these actors based on *what they do* (their primary functions) rather than *who they are* (their professional identity)—we argue that their orientation towards public accountability and visibility justifies looking at them through a journalism lens.

Notwithstanding this argument, we recognise that some of the actors we identified are far removed from conventional journalistic practice—and yet are still performing traditional journalistic watchdog roles. In fact, we know that there is an ecosystem of non-governmental and advocacy organisations that now perform political watchdog functions traditionally associated with investigative journalism. These groups are often described as civil society watchdogs and accountability NGOs that monitor government behaviour, corporate power abuses, and institutional misconduct; this includes the Sunlight Foundation, Human Rights Watch, the Project on Government Oversight, and Citizens for Responsibility and Ethics in Washington, among others. Indeed, research suggests a hybridisation of watchdog functions where investigative reporting, data work, legal advocacy, and civil-society campaigning are increasingly entangled, with journalistic outlets collaborating with non-journalistic outlets, particularly where data journalism skills are needed and especially as newsrooms' investigative capacity declines (see, e.g., Carson, 2021; Walters, 2024).

Such practices, however, are not only evident across major organisations. For example, our study has found several instances of so-called "science sleuths" operating in a single capacity on highly visible accounts on various social media platforms. They, too, fulfil a watchdog function beyond traditional forms of journalism. Rather than investigative reporters, scrutiny often comes from research integrity specialists, meta-science researchers, independent analysts on post-publication platforms, or researchers using computational fraud detection tools. Their work often appears on PubPeer, or feeds into outlets like *Retraction Watch* or journals' respective editorial investigations. Conversely, however, there are actors who *claim* to expose bias, ideology, corruption, or other hidden interests, but do so from a populist, conspiratorial, anti-institutional, or anti-science position. This goes to show that "watchdogging" science is not normatively homogenous but can itself challenge or even reject scientific authority in problematic—and arguably "dark"—ways.

Beyond the study's contribution in highlighting who is active in the science watchdog journalism space, and what functions these actors inhabit, crucially, this study also moves beyond the known, and overly dominant, Western-centric analyses of journalism by deliberately mapping watchdog actors operating across multiple global regions. In doing so, we demonstrate that science watchdog journalism is a global phenomenon, not confined to Western legacy media systems. Importantly, this broader geography is not only visible at the level of abstract regional spread, but also in the presence of concrete initiatives outside of dominant Anglo-American journalistic and scientific centres. For instance, we identify important investigative watchdog initiatives in the Global South, including actors monitoring research integrity in Latin America and South Asia. In Latin America, initiatives such as *Plagio SOS* point to locally grounded forms of scrutiny around plagiarism, authorship, and research misconduct; in South Asia, *India Research Watch* has emerged as a notable actor drawing attention to retractions, plagiarism, and systemic weaknesses in research governance. *India Research Watch* in particular positions itself as a non-profit, watchdog-style initiative focused on

exposing malpractice and improving research quality, illustrating how science accountability work can be undertaken outside traditional journalistic institutions. Such initiatives have profound implications on local scientific communities, as exemplified by the Romanian *Pandora Project*. Despite being located in Europe, it has largely flown under the radar in mainstream discussions of science watchdog journalism, notwithstanding its role in exposing suspected plagiarism and contributing to retractions in Romanian biomedical publishing. These examples point to a critical finding: Our study shows that institutional contexts with weaker formal research integrity infrastructures can *still* stimulate grassroots or civil society watchdog initiatives. As such, this study openly challenges assumptions that investigative scrutiny of science is exclusively driven by Western legacy media—instead revealing a much broader geographical ecosystem of watchdog actors. Beyond the subject matter itself, our study contributes to an increasing number of efforts to de-westernise journalism studies by acknowledging the diverse institutional arrangements through which watchdog functions are contemporarily performed.

6. Conclusion

In this study, our starting point was to fill both a theoretical and empirical gap left in previous scholarly work on science journalism: first, to offer a new conceptualisation and definition of science watchdog journalism; and second, to map the emerging ecosystem of science watchdog journalism, particularly as it unfolds on the periphery of journalism. Doing so has allowed us, for the first time, to identify a total of five primary watchdog types and functions within the science watchdog journalism ecosystem: primary investigative watchdogs, infrastructural watchdog platforms, translational intermediaries, corrective verification organisations, and attention-based watchdogs.

The study makes a core conceptual contribution to research investigations of the journalistic watchdog role, which in the literature is tied to instances of "watchdogging" over those in *political* power, and which frequently references major, investigative scoops such as the Watergate scandal as examples of uncovering political wrongdoing. Our work, however, proposes a much broader understanding of watchdog journalism: namely, one that includes journalism-related scrutiny of scientific knowledge systems. This finding has significant implications for journalism theory, both in terms of how the watchdog role is being theorised, but also how it is being taught in journalism curricula at educational institutions. In approaching our work with an explicit de-westernising lens, we argue that it is increasingly important to recognise the global dimension of science watchdog journalism, including actors operating outside Western media systems.

That said, this study is not without its limitations. First, it is important to stress once again that the classification of actors (Table 1 and Supplementary Material) is not exhaustive but provisional. On the former, the rapidly evolving nature of platformised media and science accountability practices means that the list can expand at short notice; vice versa, some actors may not be able to sustain their venture due to lacking funding or outright threats to their work, as the case of *India Research Watch*, with its cross-over to whistleblowing practices, demonstrates (Chakrabarty, 2025). On the latter, the classification of some actors is provisional and partially contestable: Not all translation or amplification of research-integrity issues is necessarily equivalent to watchdog work in the closest sense of the word. Nevertheless, this study is the first of its kind to systematically map the emerging ecosystem of science watchdog journalism types, stratified across the various functions they fulfil. Second, although this study identifies actors across multiple global regions, the available material may still unevenly privilege initiatives with a stronger digital

footprint, greater visibility in international networks, or the capacity to publish in English. If, as was the case here, the study relied on English-language materials, this should be recognised as an important limitation, as it may have constrained the visibility of watchdog actors operating in other linguistic contexts and thereby underrepresented non-Anglophone forms of science accountability.

Overall, from what we can observe, the rapid proliferation of digital technologies has allowed scientific misinformation to flourish at-scale; has led to instances of scientific misconduct, e.g., in the form of so-called paper mills producing fake scientific papers on an almost industrial scale; and has further enabled AI-driven scientific manipulation, as evidenced by the rise of so-called "tortured phrases" describing nonsensical phrases acting as substitutes to established academic terminology. In line with this increase, we have identified several research avenues for future scholarly work. First, our classification model has emphasised these actors' *primary* watchdog functions, but many also fulfil several roles concurrently. As such, a more exhaustive mapping that considers their numerous watchdog functions would be a worthwhile undertaking in future research. Following Bailey's (1994) guidance on empirical taxonomy construction, future research could develop a typology of actors associated with science watchdog journalism, investigating organisational forms, the specific methodologies used by each of the actors, the degree of institutional recognition, and their funding models. Second, it would be especially interesting to analyse these actors' closeness or distance to the journalistic core. For example, primary investigative watchdogs are the actors most critical of institutionalised science and scientists in our study. Does this mean they are closest to the traditional conception of the journalistic watchdog role? Situating these actors on an axis, demonstrating their positioning vis-à-vis the journalistic core, would also be especially interesting as it would help resolve conceptual and definitional ambiguities whenever we talk about peripheral actors, especially in light of previous research having found that these actors' practice and self-presentation is not actually that peripheral, after all (Schapals, 2022). Third and final, our study clarifies the *who* (watchdog type) and *what* (watchdog function) of science watchdog journalism actors—but what's thus far missing is the *why*: Why do these actors engage in science watchdog journalism, often in a voluntary capacity, and at times coming at a great personal cost, as those engaging in whistleblowing activities would testify? In-depth interviews with these actors would help shed further light on their motivations, and the broader, underlying ethos and ideology they carry.

With this in mind, we urge that journalism studies and science communication as disciplines take the emerging field of science watchdog journalism seriously as a distinct research domain—not least because maintaining public trust in science increasingly *depends* on these watchdog practices. As scientific authority becomes more contested in the digital age, the importance of science watchdog journalism will only continue to grow.

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Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary material for this article is available online in the format provided by the authors (unedited).

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About the Authors



Aljosha Karim Schapals is a senior lecturer in the School of Communication at Queensland University of Technology. His work sits at the intersection of digital journalism, political communication, and emerging media systems, with a particular focus on alternative media, peripheral actors, and the reconfiguration of journalistic authority in the platform age.



Michelle Riedlinger is an associate professor in the School of Communication at Queensland University of Technology. Her research interests include emerging environmental, agricultural, and health research communication practices, roles for "alternative" science communicators, online fact checking, and public engagement with science.



Silvia Montaña-Niño is a lecturer in journalism at the Centre for Advancing Journalism, School of Communication and Culture, University of Melbourne. Her research interests include the automation, datafication, and platformisation of news outlets and fact-checking operations and how these processes transform professional journalism practices, values, and occupational ideology.



Artem Rednikin is a postgraduate student in the School of Communication at Queensland University of Technology, completing a master's in digital communication.