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Systemic territoriality in academia: The Gollum effect's impact on scientific research and careers

Graphical abstract

Highlights

- The Gollum Effect impacts 44% of researchers in ecology and conservation
- Marginalized groups and early-career researchers face the most severe impacts
- Territorial behaviors disrupt scientific research and career progression
- Solutions include institutional reforms, open science policies, and accountability measures

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In brief

Scientific progress depends on open collaboration and thus resource sharing, but possessive and territorial behaviors, which we call the Gollum Effect, threaten this ideal. This study reveals widespread resource hoarding and gatekeeping in ecology and conservation, particularly affecting early-career and marginalized researchers. Our findings highlight these systemic issues in academia and propose solutions to foster more collaborative, inclusive scientific environments essential for addressing global environmental challenges.

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Systemic territoriality in academia: The Gollum effect's impact on scientific research and careers

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SCIENCE FOR SOCIETY Scientific progress thrives on collaboration and knowledge sharing, yet territorial behaviors in academia, which we call the Gollum Effect, threaten this foundation. This global study reveals how such behaviors, particularly in ecology and conservation, disproportionately affect early-career and marginalized researchers, potentially driving talented and motivated scientists away from addressing crucial environmental challenges. By identifying the systemic nature and impacts of these practices, we highlight the urgent need for cultural and institutional reforms that promote more inclusive, equitable, and cooperative research environments. The goal is to achieve a cultural shift in academia and improve institutional frameworks by actively addressing ingrained territorial behaviors, power dynamics, and resource inequities. These systemic changes can enable a more open and innovative scientific community, empowering researchers to focus on collaborative solutions to pressing global issues.

SUMMARY

Addressing environmental challenges requires scientific collaboration, access to resources, and open knowledge exchange. However, possessive behaviors, referred to by these authors as the Gollum effect, undermine these principles by restricting resource access, obstructing research, and monopolizing opportunities. Despite widespread anecdotal evidence, the prevalence and impacts of these territorial behaviors remain unquantified. Here, we present a global study of this phenomenon, surveying 563 researchers from 64 countries in the fields of ecology, biodiversity conservation, and environmental science. We find that 44% of respondents have experienced the Gollum effect, particularly marginalized groups and early-career researchers. High-profile researchers, group members, supervisors, and competing groups were common perpetrators, frequently obstructing research planning, manuscript preparation, and fieldwork. Over two-thirds reported career disruptions, including abandoning research topics, changing institutions, or leaving academia/science. One-fifth acknowledged engaging in similar behaviors, driven by the hypercompetitive culture, fear, and limited resources that define modern academia. Systemic reforms like open science policies, increased awareness, and accountability are needed to mitigate impacts on researchers and scientific progress.

INTRODUCTION

The foundation of scientific progress lies in the collective effort of researchers who build upon shared knowledge, openly exchange data and research methodologies, and integrate expertise through direct collaboration. This cooperative framework is essential for the development of science, as it not only allows researchers to learn and advance one another's work but also accelerates discoveries by allowing breakthroughs that transcend what a single individual or lab group could achieve working in isolation.[1–4] Modern research increasingly transcends traditional boundaries, with collaborations spanning disciplines, institutions, and geographic regions, enabling diverse expertise and perspectives to converge for improved research outcomes.[3,5] The necessity for sharing and collaboration is particularly critical in the fields of ecology, biodiversity conservation, and environmental science, where scientific progress often hinges on long-term studies, unrestricted research sites, and collaborative

efforts in both field and laboratory settings. However, evidence suggests that this collaborative and open ideal is often at risk of being undermined by the prevalence of possessive and territorial behaviors within the scientific community, a phenomenon termed by the authors of this work as the Gollum effect, a reference to the eponymous, secretive, and possessive *Lord of the Rings* character.[6,7] These behaviors manifest in the reluctance of researchers and groups to share data, methodologies, materials, study sites, research topics, or even entire fields of study, effectively hoarding resources and impeding the free flow of information.[6] Recognizing and mitigating the Gollum effect is crucial for maintaining the culture of open collaboration and knowledge sharing that underpins scientific progress.

A key driver of the Gollum effect is likely the hypercompetitive culture that has come to define modern academia. Limited research funding and career opportunities have created a "publish or perish" environment, where there is constant pressure for individuals to secure resources, produce papers, and carve out their own space within the confines of traditional academic settings.[8–10] To gain a competitive edge, some researchers may resort to selfish and toxic territorial behaviors, rather than collaborating or freely sharing resources they do not have ownership over. These practices can manifest as hoarding datasets and refusing reasonable data requests, deliberately obscuring or omitting descriptions of methods to hinder research reproducibility, or aggressively blocking research opportunities, resources, samples, or authorships.[6,7,10] This allows researchers to establish their monopoly, particularly those with established careers on a particular species, site, or topic to prevent competition and dictate the direction of future research, especially against early-career researchers.[6] Such self-serving actions and possessiveness ultimately undermine the ideals of collaborative and open science by stifling diverse perspectives and knowledge generation, wasting effort through unnecessary replication, slowing the pace of scientific progress, and potentially delaying critical breakthroughs that have the potential to provide both environmental and societal benefits.

While anecdotal evidence strongly suggests that the Gollum effect is pervasive within the sciences,[6,10] it remains largely unreported in the scientific literature. A lack of systematic data on its occurrence is likely exacerbated by the reluctance of victims to openly report such toxic and potentially harmful behaviors for fear of career repercussions,[11–16] preventing open discussions of their effect and thus allowing such behaviors to persist as an open secret within the scientific community.[6,7,13,14,17] Furthermore, the absence of public awareness, institutional guidelines, and support services to protect individuals, along with a lack of measures to penalize perpetrators, may further enable these behaviors to continue unabated.[12,18,19] As a result, the prevalence and impacts of the Gollum effect on both individual researchers and the broader community remain unquantified, with the lack of empirical evidence representing a critical gap hindering the development of effective solutions to the problem. Without a clear understanding of the extent, underlying drivers, patterns, and outcomes of these behaviors, the true nature of the Gollum effect in academia remains unknown and unregulated. Thus, it is crucial to systematically investigate and quantify this phenomenon to shine a light on this issue and inform the development of evidence-based policies, guidelines, and support mechanisms to foster a more productive and fairer research landscape.

Here, we investigate the prevalence, patterns, and impacts of the Gollum effect within the international scientific community. This study involved a comprehensive survey of researchers spanning diverse disciplines, geographic regions, institutions, and career levels, with a specific focus on the fields of ecology, biodiversity conservation, and environmental science. Our key objectives were to (1) assess the frequency and manifestations of the Gollum effect experienced by researchers across various disciplines, career stages, and regions; (2) identify the underlying drivers and causes of these possessive behaviors, including any disciplinary, demographic, or career-related trends; (3) examine the consequences and impacts of the Gollum effect on researchers' work processes, career trajectories, and overall well-being; and (4) gather firsthand accounts and proposed solutions from researchers who have encountered the Gollum effect. Our findings reveal that the Gollum effect is a widespread and systemic issue in academia, marked by possessive and obstructive behaviors that significantly disrupt scientific research and careers. These behaviors disproportionately impact marginalized and early-career researchers, highlighting the urgent need for greater awareness, institutional reform, and a cultural shift toward greater cooperation, accountability, and open science.

RESULTS

Demographics

We received responses from 563 respondents representing 64 nationalities and currently working or studying in 58 countries (Figure S1A; Table S1). Respondents ranged in age from 21 to 87 years (mean = 36.4, median = 34). The gender distribution included 46.2% identifying as female, 49.9% as male, and 1.8% as gender non-comforming. Most respondents identified as heterosexual (70.5%), followed by bisexual (8.7%), homosexual (5.0%), and asexual (1.4%). Additionally, 22.2% of respondents identified as belonging to a marginalized group, most commonly related to ethnic/racial minorities (34.4%), LGBTQ+ (lesbian, gay, bisexual, transgender, queer or questioning, and more) identities (24%), disabilities or chronic health conditions (17.6%), gender (11.2%), religious minority status (5.6%), and socioeconomic background (5.6%). Geographically, the United States represented the largest proportion of respondents, with 23.4% identifying it as their nationality and 24.2% reporting it as their current work or study location. This was followed by Europe, with 21.1% of respondents identifying it as their nationality, and it was also the most common location of work/study (30.2%). Latin America contributed one-fifth of the nationalities (20.4%) and 16.7% of locations, while South Asia, primarily represented by India, accounted for 15.6% of nationalities and 12.9% of locations. Africa and Australia had smaller but notable representations as well (Figure S1A).

The survey captured a diverse range of career stages, with Ph. D. students and postdoctoral researchers each accounting for one-fifth of respondents (42% combined; Figure S1B). Professors made up 14.6% of respondents, followed by independent researchers (11.2%), senior researchers (10.8%), and master's degree students (10.8%). The most common research area was ecology (39.1%), followed by biodiversity and conservation

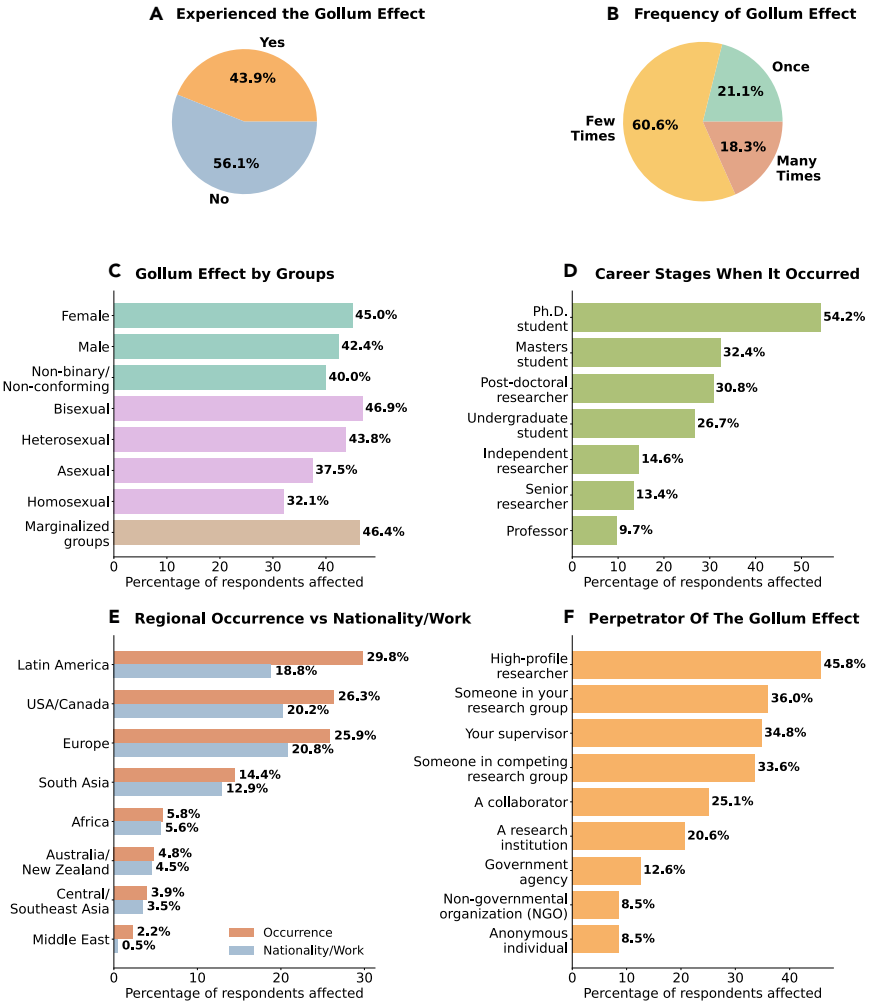

Figure 1. Overview of survey findings on the prevalence of the Gollum effect

(A) Proportion of respondents who experienced the Gollum effect, (B) frequency of occurrence of the Gollum effect among those who experienced it, (C) prevalence of the Gollum effect across demographic and marginalized groups, (D) career stages during which the Gollum effect was reported compared with the percentage of respondents currently working in or from those regions, (E) geographic regions where the Gollum effect occurred, and (F) individuals who were identified as the source of the Gollum effect. Respondents were allowed to select multiple answers for categories (D)–(F).

biology (18.1%), and other areas less represented (Figure S1C). The taxonomic focus of respondents was diverse, with nearly one-third (32.5%) of respondents studying plants and around one-fourth focusing on mammals (26.5%). Birds and insects were the focus of approximately one-sixth of respondents each, while smaller proportions worked on amphibians, reptiles, and fish (Figure S1D). Most respondents reported engaging in desk-based work (70.9%) or fieldwork (68.0%), while laboratory work was less common, reported by 34.8% of respondents.

Prevalence of the Gollum effect

Over two-fifths (43.9%) of respondents reported experiencing the Gollum effect during their academic careers (Figure 1A). Among those affected, the majority (60.6%) encountered it a few times, while 21.1% experienced it once and 18.3% reported many occurrences (Figure 1B). The effect showed slight variations across gender identities, with females reporting the highest prevalence (45.0%), followed by males (42.4%) and non-binary/gender non-conforming individuals (40.0%) (Figure 1C). Across sexual orientations, bisexual respondents reported the highest occurrence (46.9%), followed by heterosexual respondents (43.8%), with asexual (37.5%) and homosexual (32.1%) respondents reporting the lowest prevalence. Notably, respondents from marginalized groups reported a higher incidence of the Gollum effect, with 46.4% affected (Figure 1C). Over half (54.2%) of those affected reported experiencing the Gollum effect during the Ph.D. stage of their careers, while about one-third experienced it during their master's degree (32.4%) and postdoctoral (30.8%) stages, and over one-quarter (26.7%) during their undergraduate studies (Figure 1D).

Geographically, the Gollum effect showed notable regional variations in its prevalence. Latin America reported the highest occurrence, accounting for 29.8% of cases despite representing only 18.8% of respondents' nationality and work locations. Similar overrepresentation was observed in the US/Canada (26.3% of cases vs. 20.2% of respondents) and Europe (25.9% vs. 20.8%). Other regions showed more proportional distributions, with South Asia (14.4%), Africa (5.8%), Australia/New Zealand (4.8%), and Central/Southeast Asia (3.9%) reporting cases that closely matched their representation. While the Middle East reported a slightly higher occurrence (2.2%) than expected (0.5%), the absolute numbers were minimal.

High-profile researchers were the most frequently identified perpetrators of the Gollum effect, cited by 45.8% of those affected (Figure 1F). Research group members (36.0%), supervisors (34.8%), and members of competing research groups (33.6%) were also commonly mentioned. Collaborators (25.1%) and research institutions (20.6%) were noted by approximately one-quarter and one-fifth of affected respondents, respectively. Although less commonly reported, government agencies (12.6%), non-governmental organizations (NGOs) (8.5%), and anonymous individuals (8.5%) were also cited as perpetrators of the Gollum effect (Figure 1F).

Impacts

The Gollum effect had a significant impact on various stages of the research process among those who experienced it. Nearly three-quarters (72.5%) reported interference during research planning, followed by nearly two-thirds (62.7%) during

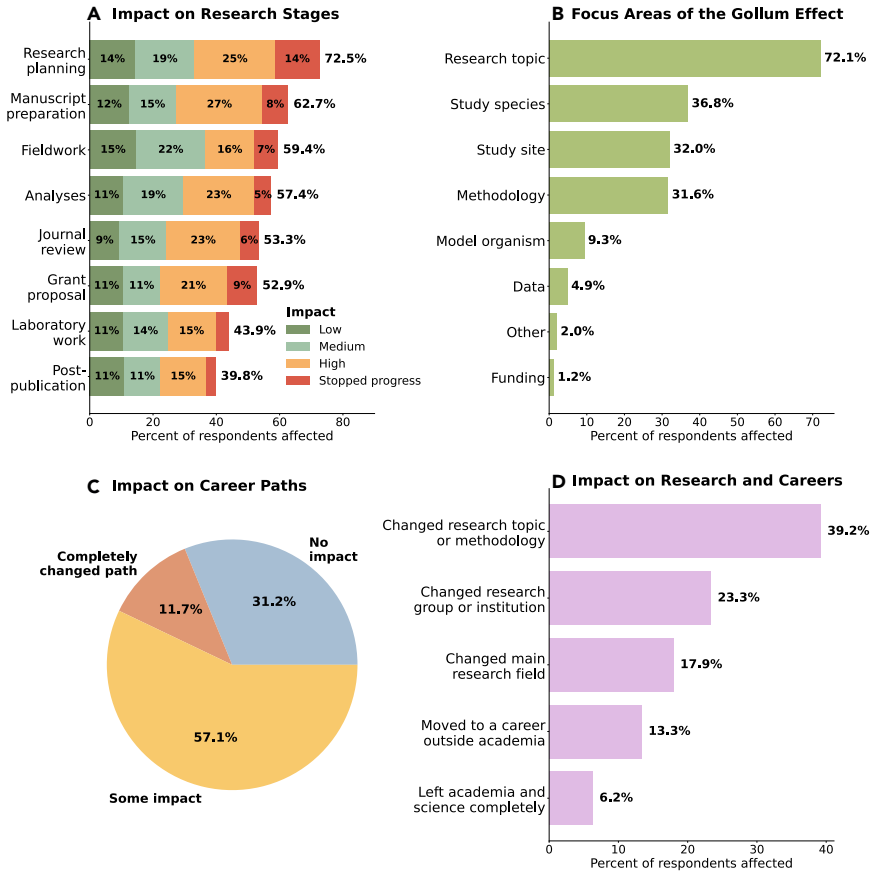

Figure 2. Impacts of the Gollum effect based on affected survey respondents

(A) Impact severity based on research stage, (B) focus area where the Gollum effect was experienced, (C) effect on career paths, and (D) specific impacts on respondent's research and careers. Respondents were allowed to select multiple answers for (A), (B), and (D).

manuscript preparation and fieldwork (59.4%) (Figure 2A). More than half also reported disruptions during analyses (57.4%), journal review (53.3%), and grant proposals (52.9%). While less frequently affected, 43.9% of respondents reported the Gollum effect in laboratory work and 39.8% in post-publication stages. Manuscript preparation (27%) and research planning (25.4%) were the most impacted, with over 25% of respondents reporting high impacts (Figure 2A). Journal review (23.4%), data analyses (22.5%), and grant proposals (21.3%) also showed significant disruption. Complete halts in work progress were most frequently reported during research planning (13.9%), followed by grant proposals (9.4%), manuscript preparation (8.2%), and fieldwork (7.4%) (Figure 2A). The Gollum effect primarily targeted research topics (72.1%), followed by study species (36.8%), study sites (32.0%), and methodologies (31.6%) (Figure 2B).

There was also a notable impact on career paths among affected respondents. While 31.2% reported no change to their career trajectory, over half (57.1%) stated it somewhat influenced their careers, and 11.7% indicated it completely altered their career path (Figure 2C). The most common result was a shift in research focus, with 39.2% indicating they changed their research topic or methodology, 23.3% moved to a different research group or institution, and 17.9% transitioned to a new research field (Figure 2D). Notably, 13.3% left academia but continued in research-based careers such as consulting or industry, while 6.2% left science entirely (Figure 2D). Those who left academia or science did so mostly after experiencing the Gollum effect during their Ph.D. work (28.2%), followed by independent research (20.5%), master's degree studies (17.9%), postdoctoral positions (15.4%), senior researcher roles (12.8%), and professorships (5.1%).

Actions taken

Just over one-third (36.4%) of respondents who experienced the Gollum effect reported taking action, while 63.6% did not (Figure 3A). Open-ended responses revealed that the most common approach, used by 39.6%, was adaptation and resilience. Many described adjusting their methodologies, research focus, or study sites to navigate obstacles without direct confrontation. Some continued their work despite challenges, while others modified projects to bypass obstructive individuals (Figure 3B).

Direct communication, reported by 22.0%, was the second most mentioned response. This involved direct discussions, negotiations, or confrontations with those involved. While some successfully resolved conflicts, others found their concerns dismissed. Collaboration and mediation, cited by 17.6%, included seeking support from colleagues, mentors, or institutional mediators. Respondents described consulting peers for advice, involving department heads, or collectively addressing conflicts within research teams. Reporting, taken by 14.3%, involved escalating concerns through formal complaints, institutional channels, or legal means. Some sought investigations into research misconduct or unethical peer review, but many noted that these processes were slow or ineffective. Similarly, 13.2% chose to change their environment, which included switching labs, institutions, or even leaving academia altogether. While this helped some escape toxic situations, others expressed frustration over disrupted research and career uncertainty. The least commonly reported response, mentioned by 7.7%, was advocacy and ethical action. This involved pushing for systemic change by promoting transparency, advocating for policy reforms, raising awareness, forming committees to improve accountability, or publicly exposing misconduct.

Self-reported Gollum behaviors

While 78% of respondents stated that they have never acted like Gollum, 3.3% admitted they have, and 18.3% said they might have exhibited Gollum-like behaviors in the past. The motivations behind Gollum-like behavior were influenced by a combination of personal and systemic factors, grouped into five major

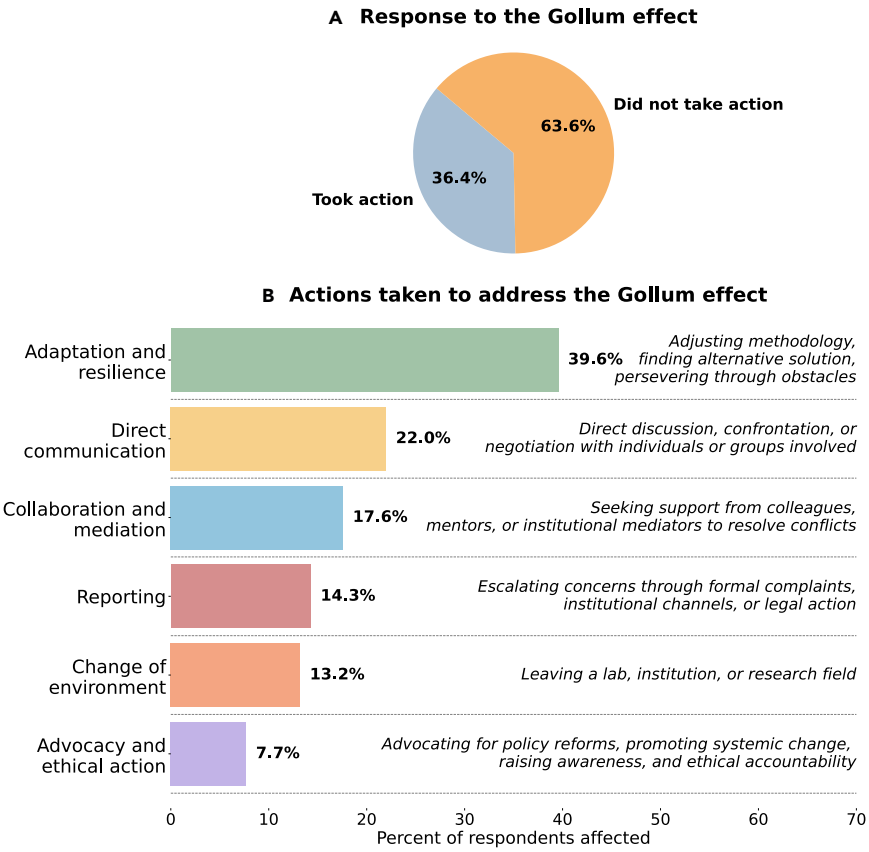

Figure 3. The response of affected individuals to the Gollum effect

(A) Percentage of affected individuals who took action to address the effect.

(B) Percentage of strategies employed, categorized from open-ended responses.

categories. First, learned behavior and academic culture played a significant role, with many individuals adopting territorial behaviors modeled by supervisors or shaped by competitive environments that valued secrecy over openness and collaboration. In such environments, peers working on similar topics were often viewed as threats. Fear of losing credit or work also emerged as a key factor, as many individuals withheld research ideas or delayed access to resources to protect their authorship and prevent others from claiming or publishing similar work first. Resource scarcity and institutional constraints contributed to gatekeeping behaviors, particularly in situations where there was limited access to lab space, funding, or equipment, which led individuals to restrict access to data or resources to protect their career opportunities. Retaliation and power struggles also drove Gollum-like behavior, with some researchers withholding information or controlling resources out of frustration, especially after experiencing exclusion or having their work undermined. Finally, concerns over research integrity led individuals to restrict access to study systems or data, fearing misuse by inexperienced researchers or harm to the research ecosystem.

Personal experiences

Survey respondents provided deeply personal accounts illustrating the profound impact of the Gollum effect on their academic careers, professional opportunities, and mental well-being. Many described forced or manipulated authorship, where they were pressured into including undeserving co-authors or were outright prevented from publishing their own work. One respondent recalled, "After the final edit of the manuscript went around, one of the government employees pressured us into including the other government employee as a coauthor … We would not be allowed to work on the species anymore if we didn't include them." Another recounted an experience of authorship being used as a tool for control: "I submitted an abstract … The collaborator approached me outside of the conference center to talk about authorship … I was told I wouldn't be able to publish anything until the collaborator published their study, which has been in prep for over six years now."

Beyond publications, data withholding and territorial behavior were common, with senior researchers blocking access to essential datasets, specimens, and lab equipment. One respondent described, "Collaborator has 'reserved' important research avenues … and is actively withholding data from our entire research group in order to block any of us from pursuing these questions." Another explained, "Some researchers won't give you access to the museum to examine specimens … In the end, no one describes the species." Others were pushed out of their own research areas by senior academics monopolizing study sites, species, or topics. One respondent noted, "Many researchers think certain sampling locations are their territories … you cannot publish or study those organisms." Another shared, "I had planned to continue my career studying this organism … but recently I believe she 'staked her claim' on the species and does not want me to continue working on it."

Idea theft and sabotage were also widespread. Many reported that supervisors or colleagues stole their ideas, secured funding, or published without credit. One researcher revealed, "My supervisor stole the entire idea and sought funding for it … while the partner was seeking funding for identical work." Another explained, "A researcher claimed we would start a collaboration … then published with the collaborator without my name." For some, these forms of academic misconduct escalated into exclusion, bullying, and professional sabotage, including public defamation at conferences or backchannel efforts to blacklist them with potential partners. One respondent described, "He did all he could to disrupt my role … undermining me whenever possible." Another explained how the damage extended beyond the workplace, stating, "Defamation also occurred at conferences, talks, and on social research networks." In some cases, this escalated into academic mobbing, where individuals were systematically pushed out of research opportunities.

Table 1. In-depth strategies identified from open-ended responses on proposed solutions to mitigate the Gollum effect

Strategy	Proposed solutions and implementation	Examples/quotes	Explanation and impact
Awareness and education	organize workshops, seminars, and training on the Gollum effect, research ethics, and collaboration share educational resources and openly discuss unethical territorial behavior develop guidelines for ethical research conduct and foster a culture that discourages territoriality	"Making more people aware of this effect … I have shared it with friends …" "Better training and raising of awareness of what the Gollum effect is …" "Changing the culture of research so people don't feel a sense of ownership but are open to collaboration …"	increases understanding and helps researchers recognize and avoid harmful behaviors, promoting a collaborative culture where territoriality is discouraged
Institutional and policy reforms	provide stable, long-term positions and baseline funding for early-career researchers to reduce competition shift evaluation criteria from publication counts to teamwork, teaching, and mentorship establish clear policies regarding data ownership, authorship, and conflict of interest to prevent unfair exclusions	"More permanent positions in science with basic funding …" "Get rid of publications as 'most important' measure … reward creativity and cooperation …" "Academia should be restructured … new Ph.D.s should get a few years' funding …"	reduces cutthroat competition by creating secure environments and fair evaluation practices, which discourages resource-hoarding and territorial gatekeeping
Collaboration and open science	mandate open data, code sharing, and pre-registration for research projects encourage and fund multi-institutional and interdisciplinary collaborations recognize contributions from all members, including technicians, field assistants, and statisticians	"Openness! Open science, pre-registrations, code and data sharing." "Mandatory open data in papers is great … forces sharing after publication" "Less pressure … better research is done with collaboration; if grants benefit collaboration rather than hoarding, Gollums disappear as well"	promotes openness and teamwork, allowing researchers to benefit from shared resources and collective expertise while reducing secrecy, information hoarding, and exclusion
Accountability and oversight	establish independent reporting and grievance systems (e.g., an ombudsperson or human resources office) for unethical behavior implement team-based decision-making (multiple reviewers for funding, authorship disputes, and peer review) to prevent unilateral power abuse use transparent, double-blind review processes for grants, hiring, and publications to prevent bias	"Naming and shaming Gollum behavior … disciplinary action should be taken" "Supervisors need to be made accountable for healthy mentoring … Department heads need to ask students for confidential reviews." "We need double-blind reviewing of papers and monitoring how often reviewers reject papers due to conflicts of interest."	ensures that unethical behaviors are addressed fairly and systematically, preventing individuals from monopolizing fields or blocking others' progress; team-based decision-making reduces individual control over key academic opportunities

(*Continued on next page*)

Table 1. *Continued*

Strategy	Proposed solutions and implementation	Examples/quotes	Explanation and impact
Mentorship and support	require training for supervisors and mentors to ensure fair and supportive guidance create peer-support groups or safe spaces for early-career researchers to report issues and seek guidance implement external committees to oversee thesis progress, ensuring students are not unfairly blocked or isolated	"Have open and transparent communication with my peers and interns" "Ask direct and detailed questions about mentoring … to gain insights" "Supervisors need to be made accountable for mentoring … Department heads should ask students for confidential reviews while ensuring no retaliation."	strengthens support networks and ensures junior researchers receive fair and balanced guidance; prevents isolation, fosters professional growth, and reduces power imbalances between senior and junior academics
Incentives and recognition	design funding and grant applications that prioritize collaborative proposals and shared credit recognize and reward contributions beyond first-author publications (e.g., data management, technical support, methodology contributions) offer awards for outstanding teamwork and ethical research practices	"Either give these behaviors consequences … or reward altruism (grants earmarked for less-established groups/academics)" "Give credits to interdisciplinarity in research." "Prize collaborative research"	aligns rewards with cooperative behavior and shared success, encouraging researchers to work together rather than compete aggressively; helps prevent unethical authorship disputes and credit hoarding

"I experienced a weaponized form of the Gollum effect … I was excluded from opportunities. When I did get an opportunity … the mobbing followed me," recounted a researcher who felt unable to escape the harassment.

The career consequences were severe, with respondents reporting missed opportunities, professional blacklisting, and being assigned menial tasks. One respondent recalled, "I enjoy doing science … but I was given photocopy duties. Then, they spread word that I wasn't even capable of that … My contract wasn't renewed." Another reflected, "Looking back, my early-mid career productivity was suppressed and impacted, with repercussions on publication history and recognition." Finally, others revealed mental health struggles so severe that they led to hospitalization or complete withdrawal from their fields or academia entirely. One researcher shared, "It was one of the most painful experiences of my life. I became completely disenchanted with science … ." Another provided a particularly distressing account, stating, "It's triggering … I ended up in a hospital thrice due to the passive mental harassment." These testimonies reveal a systemic cycle of coercion, exclusion, and sabotage, where coercion, gatekeeping, idea theft, and career sabotage stifle scientific progress, damage mental well-being, and drive researchers out of academia (full responses in Table S1, with all identifying details removed for confidentiality).

Solutions

Survey respondents identified six key strategies to mitigate the Gollum effect in academia, addressing both cultural and structural challenges (Table 1). Awareness and education emerged as a critical approach, with respondents emphasizing the need for workshops, training sessions, and institutional discussions to increase understanding and deter exclusionary behaviors. Institutional and policy reforms were widely suggested, including stable funding for early-career researchers, shifting hiring and grant evaluation criteria to prioritize mentorship and collaboration over publication record, and establishing clear policies on data ownership and authorship to prevent territorial gatekeeping. Many respondents highlighted collaboration and open science as key solutions, advocating for mandatory open data sharing, interdisciplinary teamwork, and recognizing non-traditional research contributions such as technical support and data management. Strengthening accountability and oversight was also emphasized, with recommendations for independent reporting mechanisms, double-blind peer review, and team-based decision-making to reduce biases in funding and hiring. The role of mentorship and support was another major theme, with calls for better mentorship training, external oversight of student progress, and peer-support networks to help early-career researchers navigate exclusionary environments. Lastly, respondents stressed the importance of incentives and recognition, advocating for grants and awards that prioritize teamwork, ethical research practices, and contributions beyond first-author publications to shift the academic culture away from hypercompetition. More detailed descriptions, including direct quotes and implementation examples, are provided in Table S1.

DISCUSSION

Academic research is often shaped by complex power dynamics, competition for limited resources, and structural inequalities that

can undermine collaboration and individual well-being. Despite widespread anecdotal evidence of territorial behaviors in academia, there has been no systematic investigation of how these dynamics manifest in academic research settings. This study provides a large-scale empirical investigation of the Gollum effect, shedding light on how these territorial behaviors manifest within the scientific community and their profound impacts on both individual researchers and the broader academic environment. Our findings reveal that the Gollum effect is a pervasive issue in academia, with over 40% of surveyed researchers in the field of ecology, conservation, and environmental science having experienced these territorial behaviors at some point in their careers. These behaviors affected researchers across all demographics, disciplines, regions, and career stages, reflecting the systemic nature of the Gollum effect within academia that is spurred by a hypercompetitive framework. However, early-career researchers, particularly Ph.D. students and marginalized groups, were found to face disproportionate impacts, highlighting existing and often negative power imbalances for these individuals. The consequences of experiencing the Gollum effect were often found to be severe, forcing researchers to abandon topics, alter methodologies, switch institutions, change fields, or leave academia altogether, aligning with previous studies that identify academic culture as a key factor driving researchers out of science.[20–22] These findings highlight that the Gollum effect is a systemic issue within academia, particularly in the field of ecology and environmental science, emphasizing the urgent need for institutional reforms and cultural shifts to mitigate its long-term impact on the research community.

The results from this study highlight the heightened vulnerability of early-career researchers to the Gollum effect, particularly during critical phases of Ph.D. research, which can have long-lasting consequences on professional development and career success. Over half of those who experienced the Gollum effect reported encountering it during their Ph.D. work, while about one-third experienced it during their master's degree work and a similar percentage during the postdoctoral stage. This aligns with previous studies showing that up to one-fourth of early-career researchers experience other harmful behaviors such as discrimination or harassment, with bullying being the most commonly reported in over half of cases.[16,21,23] Notably, those who left academia did so mostly after experiencing the Gollum effect during their Ph.D. Early-career researchers, often lacking institutional power and support networks, are especially exposed to exploitation and exclusion, which leaves them vulnerable to the long-term impacts and often career-damaging consequences of the negative behaviors that can stem from the Gollum effect.[19,22,24–27] Compounding this issue, we found a disproportionate impact of the Gollum effect on marginalized groups, such as ethnic and religious minorities, LGBTQ+ individuals, people with disabilities, and those from lower socioeconomic backgrounds. This is alarming, as these groups already face not only typical early-career challenges but also discrimination, harassment, lack of mentorship, and insufficient institutional support, all of which hinder their career progress.[20,28–30]

High-profile researchers, often recognized as experts or specialists in their fields, were frequently cited as perpetrators of the Gollum effect. Their authority and status can inadvertently contribute to territorial behaviors that maintain their dominance over specific research areas, limiting resource access and collaboration opportunities for others. These findings align with studies showing that senior academics and established researchers are also the most common perpetrators of bullying and exploitative behaviors, using their power and status as a means of control.[16,20,23,28,31] This form of academic gatekeeping not only hinders the career progression of early-career researchers but it also stifles scientific innovation by limiting diverse perspectives that are facilitated by collaboration and resource sharing.[20,29,32–34] However, research group members were also frequently cited perpetrators of the Gollum effect, suggesting that exclusionary behaviors can be deeply embedded within team dynamics. Competition for recognition, funding, and authorship may drive individuals within the same group to obstruct one another's work, creating a culture of exclusion.[9,10,35] This internalized competition may be further shaped by supervisors, who were also among the most commonly identified perpetrators of the Gollum effect. Supervisors exert direct control over lab resources, data, and career opportunities, making it easy to block research progress, withhold information, or manipulate authorship decisions to maintain power over early-career researchers under their authority. Studies have shown that supervisors play a key role in fostering toxic academic cultures, where abusive supervision, including knowledge hoarding and psychological manipulation, discourages transparency, reduces psychological safety, and reinforces hierarchical power structures.[28,36] This aligns with findings that Ph.D. researchers experiencing unethical supervision are more likely to consider leaving academia,[20] which may explain why most individuals who left in our study as a result of experiencing the Gollum effect did so after their Ph.D. These patterns of behaviors within a research group, and especially when expressed by researchers in positions of power, can create a self-perpetuating cycle, where past victims may unconsciously replicate these behaviors or early-career researchers are taught or mimic these behaviors, further entrenching territorial norms.[37]

While territorial behaviors were often observed within research teams, they also manifested at broader levels, extending to competing research groups, collaborators, institutions, government organizations, and NGOs. Competing groups and collaborators, instead of fostering cooperation, often engage in strategic obstruction, withholding data, restricting access to study sites, or blocking publications to secure a competitive edge. This behavior reflects broader academic pressures where limited funding, publication expectations, and institutional policies incentivize territorial behaviors over open collaboration.[8,10] Institutions and NGOs, although designed to support research, can also inadvertently contribute to exclusionary practices by favoring established researchers, reinforcing gatekeeping, or failing to implement effective accountability measures.[38–41] The geographic distribution of the Gollum effect offers further insights into the interplay between institutional factors and cultural context. The relatively higher prevalence reported in regions like Latin America, Europe, and North America suggests that differences in academic culture, resource availability, and institutional practices may influence the severity and frequency of these behaviors. Factors such as varying levels of competition, access to funding, cultural differences, and structural inequalities may exacerbate territoriality, creating environments where

exclusionary practices thrive. For instance, institutions in certain regions may emphasize research output and grant acquisition more heavily in promotion criteria, intensifying competition and potentially fostering territorial behaviors.[42] Conversely, regions with more collaborative academic cultures and robust institutional safeguards may experience a lower prevalence of the Gollum effect.[43]

The Gollum effect was found to significantly disrupt all stages of the research process, with the most severe impacts concentrated in the early stages of research planning and preparation. Nearly three-fourths of respondents reported interference during research planning, while almost two-thirds faced obstacles during manuscript preparation. These disruptions manifested in various forms, including data withholding, denial of access to study sites, blocked publications, coerced authorship, and even sabotage of research projects. While the Gollum effect affected all research stages, it most frequently led to a complete stop in further progress during research planning, grant proposals, manuscript preparation, and fieldwork, jeopardizing the integrity and continuity of entire research projects. The most common form of the Gollum effect was the guarding of research topics, affecting nearly three-fourths of respondents. Besides research topics, study species, site access, and methodological choices were frequently restricted, reflecting territoriality in dictating future research directions.[10,44] Additionally, exclusionary behaviors extended beyond direct research activities by affecting journal peer review and grant proposal submissions, key determinants of research output, funding, and career advancement.

Responses to the Gollum effect varied widely, reflecting both the challenges of confronting territorial behaviors and the structural barriers that discourage direct action. The most common approach was adaptation and resilience, with many researchers modifying their research focus, methodologies, or study sites to bypass obstructive individuals rather than engaging in direct confrontation. While this allowed them to continue their work, it often required compromises that altered research trajectories. Some attempted direct communication, including negotiations or confrontations with perpetrators of the Gollum effect, but many found their concerns dismissed, highlighting the difficulty of challenging entrenched power dynamics. In some cases, respondents faced retaliation and career repercussions. This echoes cases of individuals speaking out against systemic issues often being disbelieved, labeled as problematic or difficult, and blacklisted from the close-knit scientific community.[14,17,45–47] Others sought support from colleagues, mentors, or collaborators, to provide advice, act as mediators, and assist in finding solutions. Some also relied on informal gossip within their social group, which has been shown as a common strategy to address misconduct when formal action was unfeasible.[17] However, formal reporting through institutional channels was rare, as many found these processes slow, ineffective, or favoring those in power. This aligns with research showing that victims feel the potential risks of reporting problematic behaviors, including retaliation and reputational damage, often outweigh any potential benefits,[16,17,28] particularly when institutions enable or protect perpetrators in positions of authority.[46,47] While some respondents pursued legal or formal complaints regarding misconduct, unethical peer review, or authorship disputes, these efforts frequently led to frustration rather than meaningful accountability, which may explain why reporting was rarely pursued.

For many researchers, the only viable solution was leaving toxic environments by switching labs or institutions. Some ultimately decided to exit academia entirely, driven by the psychological toll manifested as high levels of stress, resentment, and disillusionment, patterns consistent with research indicating that toxic academic cultures contribute to attrition.[41,48] Alarmingly, several respondents reported severe mental health struggles, with some experiencing anxiety, depression, and burnout severe enough to require medical intervention or hospitalization. Nevertheless, the fact that many affected researchers chose to remain in academia highlights the resilience within the scientific community and suggests that the severity of the Gollum effect varies, with some perpetrators inflicting more harm than others.

Lastly, a small number of researchers advocated for systemic change by promoting transparency, pushing for policy reforms, raising awareness, and forming committees to improve accountability. In some cases, individuals publicly exposed misconduct, although this carried significant professional risks, particularly in hierarchical academic settings where whistleblowers often face retaliation.[28,49] Additionally, nearly two-thirds of affected researchers in our study took no action at all, perpetuating cycles of exclusion and reinforcing the structural barriers that allow the Gollum effect to persist.

The perpetuation of the Gollum effect appears to be driven by the hypercompetitive culture that dominates modern science, fueled by limited resources, research funding, and career opportunities.[10,30,44] Indeed, we found that even well-intentioned researchers can sometimes exhibit Gollum-like behaviors, with some respondents acknowledging having been perpetrators themselves. While some actions were centered around legitimate concerns, such as safeguarding study systems or sensitive data (especially from newcomers or inexperienced researchers), many admitted that their actions were motivated by fear and anxiety surrounding their careers and projects. This territoriality manifested as a desire to protect resources, research investment, and acquired knowledge that was often coupled with a drive to monopolize research and prevent competition. Retaliation and power struggles also played a role, with some respondents restricting access after experiencing exclusion themselves, further continuing the cycle. Additionally, the institutional normalization of these practices prevents many from recognizing their participation in this dynamic, as nearly one-fifth of victims were unsure whether they had engaged in Gollum-like behaviors. Some respondents stated that learned behavior and academic culture played a role, with territoriality often modeled by their supervisors and reinforced by competitive environments that prioritize secrecy over openness, a pattern consistent with previous research.[37] Peers working on similar topics often were viewed as threats, leading some researchers to withhold research ideas or delay sharing data out of fear of losing credit or having their work claimed by others. This is not surprising, as academic systems often incentivize unethical practices to maximize performance, output, and advancement.[9,10,38,50] A lack of accountability, ineffective reporting mechanisms, and weak institutional support allow the Gollum effect to persist,[20,30,50] while victims' reluctance to report

further normalizes these behaviors.[12–15] Despite this, some respondents expressed remorse, highlighting a capacity for self-reflection and empathy, an essential step toward breaking the cycle of territoriality and exclusion.

Addressing the Gollum effect requires a multi-faceted approach that integrates institutional reforms, cultural shifts, and individual actions to mitigate its harmful impacts and prevent its recurrence. At the institutional level, respondents emphasized the need for policy reforms and structural changes to reduce hypercompetition and territorial behaviors. Providing stable career paths, securing baseline funding for early-career researchers, and shifting evaluation criteria from publication counts to mentorship, teamwork, and creativity could help reduce the pressure that fosters exclusionary practices.[30,50,51] Implementing clear policies on codes of conduct, transparent reporting, data ownership, authorship, and conflict resolution can prevent unethical behaviors and promote a more collaborative environment.[14] Additionally, enhancing accountability through independent reporting mechanisms and promoting team-based decision-making in funding allocations and hiring processes can prevent unilateral control over academic opportunities. Incentives and recognition should be restructured to reward ethical research practices, interdisciplinary teamwork, and contributions beyond first-author publications, thus reducing the motivation for researchers to engage in gatekeeping behaviors. Furthermore, strengthening mentorship and support systems by providing training for supervisors, establishing peer-support networks, and forming external committees to oversee graduate student progress can protect early-career researchers from exclusionary practices and power imbalances. Respondents also suggested efforts to raise awareness and educate researchers about the Gollum effect and its impacts. Initiatives such as workshops, ethical training, and open discussions can effectively address misconduct and support early-career researchers by fostering a supportive research culture.[16,17] Informal strategies such as peer support and networking were also highlighted as effective ways for researchers to navigate exclusionary environments, as close professional relationships can provide guidance, mediation, and advocacy in cases of conflict. Some respondents also emphasized the importance of collective action, such as refusing to cite or collaborate with known perpetrators of academic exclusion, a tactic that has been shown to reduce the influence of researchers engaged in unethical practices.[14,17] Ultimately, addressing the Gollum effect requires a cultural shift in academia, supported by both top-down institutional policies and bottom-up individual actions.

While this study provides a comprehensive investigation into the Gollum effect, several limitations should be acknowledged. First, the reliance on self-reported experiences introduces the possibility of recall bias and underreporting. For example, while nearly one-fifth of respondents reported leaving academia or science due to the Gollum effect, this is likely underreported, as those who have already left academic institutions would have been much less likely to have seen or responded to the survey. Second, the cross-sectional nature of the survey prevents the ability to determine causal relationships or long-term trends, limiting insights into how experiences with the Gollum effect evolve over time. A third limitation is that the demographic composition of the sample closely aligns with the nationalities and work locations of the authors, potentially restricting the representation of researchers from other regions. Given that academic cultures, institutional structures, and levels of competition vary globally, future research should explore how these factors influence the prevalence and manifestations of the Gollum effect. Fourth, while this study identifies key patterns and behaviors, it does not fully examine the institutional mechanisms that enable or mitigate the Gollum effect, underscoring the need for further investigation into the role of university policies, funding structures, and mentorship models. Lastly, the sample was predominantly drawn from the fields of ecology, conservation, and environmental science, which may limit the generalizability of the findings to other disciplines. Expanding the disciplinary scope in future studies could determine whether similar trends emerge in fields such as the humanities, social sciences, and other natural sciences. Despite these limitations, this study provides critical empirical insights into the Gollum effect and its impacts, emphasizing the urgent need for targeted solutions and institutional reforms to foster a more inclusive and collaborative academic environment.

Conclusion

This study provides the first empirical evidence and sheds light on the pervasive and detrimental nature of the Gollum effect within academia. From disproportionately impacting early-career researchers and marginalized groups to disrupting the research process and hindering career progression, this phenomenon has serious consequences ranging from psychological distress to talented individuals being driven out of academia altogether. These findings underscore the urgent need for systemic changes to create more equitable and inclusive academic environments. Addressing the Gollum effect requires a multi-level approach, including institutional reforms, interpersonal interventions, and individual awareness. By promoting open science practices and accountability and providing support for early-career researchers, academia can mitigate the harmful consequences of the Gollum effect and cultivate a culture of resource sharing, collaboration, respect, and innovation. Ultimately, by working together to confront the Gollum effect and dismantle systems that promote its presence, we can foster a more supportive and conducive environment for scientific advancement and academic success.

METHODS

An anonymous online survey was conducted between November 2022 and December 2024 to investigate the prevalence, patterns, and impacts of the Gollum effect in academic research. The survey primarily targeted researchers in ecology, conservation, and environmental science and was distributed through multiple channels, including professional and ecological societies (e.g., Ecological Society of America Listserv, Society for Conservation Biology chapters, Young Ecologists Talk and Interact [YETI]), social media platforms (e.g., Twitter/X, ResearchGate, Reddit), and academic and professional networks. To avoid pre-selection bias and ensure a reliable measure of prevalence of the Gollum effect, the survey was framed as a general study on academic experiences across career stages, with the concept of the Gollum effect introduced only after respondents had begun the survey.

The survey gathered demographic information, including age, gender, sexual orientation, nationality, current country of work or study, and whether respondents identified as part of a marginalized group. Respondents also provided details about their professional backgrounds, such as career stage, research area, taxonomic focus, and primary research activities. To assess the prevalence and nature of the Gollum effect, respondents were asked if they had experienced it, how often, and during which career stages. Additional questions explored the perpetrators, the research stages most impacted, the effects on research progress and career trajectories, and whether any actions were taken to address these incidents. The survey also included two open-ended questions for respondents who wished to provide additional details about their experiences and suggest potential solutions to mitigate the Gollum effect in academia (full survey in Methods S1). The open-ended responses were systematically reviewed to identify recurring patterns and themes, which were then manually categorized by frequency and relevance to create a framework of experiences and proposed solutions.

Ethics approval

This study was exempt from ethics approval by the ethics committee at Martin-Luther-Universität Halle-Wittenberg and the German Center for Integrative Biodiversity Research (iDiv) due to its minimal risk to participants and the absence of sensitive personal data collection. Data collection adhered strictly to the EU General Data Protection Regulation (GDPR) to ensure participant privacy. No personal identifiers (such as IP [Internet Protocol] addresses, e-mail addresses, or names) were collected. Only data essential to the research objectives were gathered, in line with GDPR's data minimization principle. Participants were informed that the survey was part of a research study focused on experiences in academic research. Participants were required to provide informed consent before participation, with the consent form clearly outlining the study's purpose, the voluntary nature of participation, data usage protocols, anonymity guarantees, and the right to withdraw at any time. The survey was designed to be fully anonymous, and no personal information was linked to any responses. Open-ended responses were reviewed and redacted to remove any indirect identifiers or sensitive information. These redacted responses were then stored separately from the structured survey data, ensuring a layer of additional privacy protection. All data were securely stored in compliance with GDPR guidelines and accessible only to authors of this study.

RESOURCE AVAILABILITY

Lead contact

Further information and requests for resources and materials should be directed to and will be fulfilled by the lead contact, Dr. Jose Valdez (jose.valdez@idiv.de).

Materials availability

This study did not generate new unique reagents.

Data and code availability

The anonymized dataset analyzed in this study is provided in the supplemental information. All responses were reviewed and redacted to remove any potential indirect identifiers. No original code was used in this study. Any additional information required to reanalyze the data is available from the lead contact upon request.

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AUTHOR CONTRIBUTIONS

J.W.V.: conceptualization, methodology, survey design, survey dissemination, data analysis, writing – original draft, writing – review & editing, visualizations, supervision, and project administration. S.S.: conceptualization, methodology, survey design, survey dissemination, data analysis, writing – original draft, and writing – review & editing. J.G.: methodology, survey dissemination, writing – original draft, and writing – review & editing.

DECLARATION OF INTERESTS

The authors declare no competing interests.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the authors used ChatGPT and Gemini to improve clarity, coherence, and organization of the text. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

SUPPLEMENTAL INFORMATION

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