Iurii Volk
Artem Artyukhov
Olga Yeremenko
Tetiana Holovach

Research Integrity: a Path to the Open Science European Community

Monograph

IZDEVNIECĪBA
BALTIJA
PUBLISHING
2026

UDC [174+179.9]:378(477):(4EU)
R45

Reviewers:
Professor Serhiy Lyeonov,
Silesian University of Technology, Poland;
Professor Tetiana Vasylieva,
TU Bergakademie Freiberg, Germany;
Professor Tomasz Wołowiec,
WSEI University in Lublin, Poland

Approved
by Quality Council
of the Centre of Doctoral and Postdoctoral Studies
at the Sumy State University
as methodical material
for the "Research Integrity" and "Open Scientific Practices" courses
(protocol No. 07, 26.07.2025)

Funded by the European Union

Research Integrity: a Path to the Open Science European Community :
R45 collective monograph / Iurii Volk, Artem Artyukhov, Olga Yeremenko, Tetiana Holovach. Riga, Latvia : Baltija Publishing, 2026. 188 p.

ISBN 978-9934-26-616-4

The following monograph is prepared in the frame of the project "OSEE – Open Science and Education in Europe: success stories for Ukrainian academia" (project number ERASMUS-JMO-2022-HEI-TCH-RSCH-101085198). Funded by the European Union. Views and opinions expressed are however those of the authors only and do not necessarily reflect those of the European Union or EACEA. Neither the European Union nor the granting authority can be held responsible for them.

UDC [174+179.9]:378(477):(4EU)

ISBN 978-9934-26-616-4

Contens

Introduction

The idea for this book emerged from a recurring sense of frustration and curiosity that accompanied our work with real research cases, discussions with colleagues, and everyday encounters with academic practice. We kept returning to the same feeling: many important questions are discussed either in a highly abstract, formal way or reduced to simplified advice that ignores the messy reality of decision-making. Between official guidelines and lived experience, there is often a gap, and it was exactly this gap that pushed us to start writing. We wanted to create a space where reflection, doubt, and concrete examples could coexist without pretending that science is cleaner, calmer, or more linear than it really is.

The book's purpose is therefore both practical and reflective. It does not aim to provide another manual of rules or a catalogue of familiar slogans. Instead, it provides a means to consider real-life situations, tensions, and trade-offs that researchers encounter in their daily work. The book invites readers to slow down, question automatic choices, and develop their own informed positions rather than copy ready-made answers. It is meant to be read with a pen nearby, used, argued with, and occasionally challenged.

The book exists because another purely academic text or another collection of standard recommendations would not solve this problem. Its purpose is not to repeat what is already available elsewhere, but to help readers navigate situations where rules alone are insufficient. It is meant to support reflection rather than obedience, judgement rather than compliance, and awareness rather than certainty. The book invites readers to think along with the authors, rather than accepting finished conclusions.

Chapter 1 explains how research integrity in Europe has evolved from a narrow concern with misconduct into a broader conversation about research culture, openness, and responsibility. It shows how policies, public trust, technological change, and major scandals have reshaped expectations toward researchers and institutions. The chapter helps readers understand why integrity today cannot be reduced to a set of rules alone.

Chapter 2 challenges widespread assumptions about research misconduct and integrity. It examines popular but misleading beliefs, such as the notion that misconduct is rare, always intentional, or confined to specific countries or disciplines. By unpacking these myths, the chapter encourages a more realistic and nuanced understanding of why problems arise in research practice.

Chapter 3, which focuses on the full research cycle, applies SWOT analysis to key stages of the research work. It examines the strengths, weaknesses, opportunities, and threats that emerge during the idea generation, design, data collection, analysis, and dissemination phases. The chapter illustrates how integrity risks often emerge early and how awareness at each stage can prevent larger problems from developing later.

Chapter 4 examines the tangible outcomes of research, including publications, authorship, peer review, data, scientific consulting, and intellectual property. It explains how ethical tensions become embedded in these products through everyday decisions and institutional pressures. The chapter highlights how integrity is reflected not only in intentions but also in the research that ultimately produces results.

Chapter 5 explores the close connection between research integrity and open research practices. It discusses open access, open data, transparency, reproducibility, and citizen science as tools that can strengthen trust in research. At the same time, it shows how openness introduces new ethical challenges that require careful and responsible handling.

Chapter 6 explores artificial intelligence as a growing component of research practice. The chapter examines how AI affects authorship, data analysis, reproducibility, bias, and accountability. Rather than promoting fear or enthusiasm, it encourages thoughtful and transparent use of AI in line with integrity principles.

Chapter 7 focuses on institutions and governance. It introduces SMART modelling as a practical approach to designing research integrity policies that are specific, realistic, and effective. The chapter demonstrates how policies can foster an ethical research culture when grounded in practical applications rather than abstract declarations.

Several features distinguish this book from many others on similar topics. It is written in a deliberately accessible language, free from heavy jargon and excessive formalism. Theory and practice appear side by side, with neither dominating the other. Familiar template topics that are already well-covered elsewhere are intentionally avoided, leaving room for questions that rarely receive attention, despite being central to everyday work. The book also functions as a personal notebook, inviting readers to record their own interpretations, doubts, and alternative solutions directly alongside the cases discussed.

One more aspect deserves to be stated clearly from the beginning. The book was written with the active support of artificial intelligence, and we chose not to hide this fact. On the contrary, the role of AI is openly acknowledged and discussed as part of the creative and analytical process behind the text. AI helped us generate drafts, explore alternative formulations, and test the clarity of arguments, while all final decisions, interpretations, and examples remain the responsibility of the authors. By making this collaboration visible, we treat AI not as a silent tool but as another element of the contemporary research environment that deserves transparency and reflection. In that sense, the way this book was written already mirrors one of its central ideas: responsible practice begins with openness about how work is actually done.

Before you turn the page and move into the chapters that follow, we would like to offer a brief piece of guidance rather than a promise. This book is not meant to be read quickly or passively, and it is not designed to confirm what you already believe. Some examples may feel uncomfortably familiar; others may challenge habits that seem harmless or even necessary. We encourage you to read with curiosity rather than defensiveness, to pause, take notes, engage with the text, and test its ideas against your own experiences. Use these pages as a space for thinking, not for memorising. Research integrity does not live in rules or documents, but in everyday choices made under real constraints. If this book helps you notice those moments more clearly and approach them with greater awareness and responsibility, then it has achieved its purpose.

AI Usage Disclosure

In line with principles of transparency and responsible AI use in academic work, we disclose the following:

AI models used:

Claude 3.5 Sonnet (Anthropic, released June 2024) – primary content generation and editing

Claude 3 Opus (Anthropic, released March 2024) – complex analysis and structural development

ChatGPT-4 (OpenAI, released March 2023) – supplementary text refinement

Grammarly – grammar and style checking

Additional AI-powered tools for formatting and visual layout

These AI tools were employed for grammar checking and language editing, formatting and layout optimization, visual element design and illustration layout, and reference formatting consistency.

The substantive prompts listed below were used to generate the initial draft of this document. All AI-generated content was subsequently reviewed, verified, fact-checked, and edited by human experts to ensure accuracy, academic rigor, and alignment with research integrity principles. The final document represents human oversight and scholarly judgment applied to AI-assisted content generation.

This disclosure reflects our commitment to the very principles discussed in this document: transparency, accountability, and responsible use of emerging technologies in research.

Prompts Used for Initial Draft Generation

The following prompts (and/or their variations) were used sequentially to develop the substantive content of this document:

Introduction and Evolution

"Write about the transformation of Research Integrity in Europe over 15 years: from FFP triad to comprehensive approach including research culture, diversity, and open science. Reference ALLEA Code revisions (2011, 2017, 2023) and GDPR impact."

“Create text descriptions for two Europe maps showing: (a) expansion of national RI frameworks 2012-2020, (b) divergence from European Code. Include stats: 24/32 countries by 2020, special cases (Bulgaria, Luxembourg, Liechtenstein).”

“Analyze Google Trends data for ’research integrity’ across UK, Netherlands, Sweden, Italy, Germany (2010-2025). Link peaks to specific scandals and policy changes. Explain different patterns per country.”

“Describe evolution table of RI frameworks (2010-2025) with four periods: Fraud Prevention (2010-13), Responsible Conduct (2014-17), Systemic Integrity (2018-21), Integrated Responsibility (2022-25). Show shift from compliance to culture.”

“Explain ’research integrity climate’ concept. Create table with 5 dimensions: Communication, Support, Accountability, Leadership, Recognition. For each: strong vs weak climate indicators.”

Open Science Ecosystem

“Write about Open Science as expanding ecosystem: philosophical foundations, historical milestones (Budapest 2002, Bethesda 2003, Berlin 2003), difference from open access, EU’s leadership role.”

“Describe Venn diagram showing interconnection of Open Science, Responsible Research Practices, and Transparency. Central goal: research verifiability. Based on Haven et al., 2022.”

“Overview of key European OS initiatives: EOSC (FAIR principles), Horizon 2020/Europe (mandates, €2.6B funding), OpenAIRE, NI4OS-Europe, OSCARS. Format: paragraphs + table.”

“Explain FAIR Data Principles (Findable, Accessible, Interoperable, Reusable): origin 2016, philosophy, machine-readability, EOSC implementation, challenges. Create table: Principle, Requirements, Challenges, Initiatives.”

“Analyze global Google Trends for ’open science’ vs ’open access’ (2020-2025). Include world map showing regional preferences (blue=OS, red=OA). Explain geographical patterns and policy implications.”

“Write about citizen science in Europe: philosophical basis, examples (eBird, Galaxy Zoo), COVID-19 cases (COVID Symptom Study, Folding@home), challenges (data quality, ethics, training).”

Misconduct Scandals and Consequences

"Detail three major misconduct scandals: Diederik Stapel (Netherlands, 2011-12, social psychology), Paolo Macchiarini (Sweden, Karolinska, 2010-16, trachea transplants), Carlo Croce (Italy/Ohio, 2017-23, cancer research). Each: context, scale, detection, consequences, systemic lessons."

"Explain 'institutional afterlife' concept (Horbach 2024): long-term impact on policies, training, culture. Link to Google Trends peaks. Create table: Impact Level, Affected Groups, Manifestations, Duration, Interventions."

"Describe 'Yin Yang Battle of Fraud' diagram (Turakhiya 2017): triangle of causes (Motive/Pressure, Opportunity, Rationalisation), four misconduct types (Fabrication, Falsification, Plagiarism, QRPs)."

"Write about predatory publishing: definition, European vulnerability (esp. Eastern Europe), Hungarian case study (15% researchers, €2M annually), Beall's list, Think.Check.Submit, gaps in solutions."

"Explain replication crisis: Psychology project (36% success), causes (p-hacking, publication bias, HARKing), OS solutions (preregistration, open data, registered reports), Many Labs projects, innovation tension."

"Use Climategate (2009) as case study: email leak, context manipulation, investigation outcomes (no misconduct found), lessons about transparency as weapon, dual-use nature of openness."

Scientific Products and Practices

"Create chapter on scientific publications: role/functions, ICMJE authorship criteria (all 4 points detailed), violation types (gift/ghost/guest authorship), order disputes, CRediT taxonomy. Include decision tree logic."

"Describe peer review systems: four models (Single-blind, Double-blind, Open, Post-publication) with process, advantages, disadvantages. Add publication ethics issues: image manipulation, plagiarism, data sharing, COI."

"Write about scientific consulting dilemmas: dual loyalty (client vs objectivity), COI types, decision framework (accept/decline projects), best practices (transparency, control, peer review), case studies."

"Create SWOT analysis for research cycle stages: methodology design, idea generation, funding applications (elevator pitch), execution (70% rule, checkpoints), analysis/interpretation. For each: S/W/O/T + practical tips."

"Explain IP in Open Science context: openness vs protection paradox, situation types (fully open, strategic protection, hybrid), case study (water purification device: patent vs OS vs hybrid), CRISPR vs COVID genome examples."

Artificial Intelligence Challenges

"Balanced overview of AI in research: Strengths (speed, pattern recognition, democratization), Weaknesses (black box, bias, reproducibility), Opportunities (breakthroughs, collaboration), Threats (integrity erosion, digital divide). Visualize as four-quadrant diagram."

"Develop four detailed AI integrity scenarios: (A) Reproducibility – Maria & DataGenius Pro version changes, (B) Authorship – James & ChatGPT 35% text, (C) Data integrity – Dr Chen & automated outlier removal, (D) Bias – Aisha & admissions AI. Each: setup, dilemma, detection, solution, lessons."

"Technical section on AI-generated text detection: linguistic patterns (overly formal, repetitive), vocabulary (unusual choices, consistent sophistication), tone (no personal voice), red flags (transition phrases, hedging). Include James original vs AI comparison, why 'humanizing' fails."

SMART Policy Framework

"Explain SMART framework for institutional RI policies: Specific, Measurable, Achievable, Relevant, Time-bound. Application to research integrity with examples transforming vague→SMART goals. Include interactive exercises."

"Three institutional implementation models: (A) Centralized (dedicated office), (B) Distributed (champion network), (C) Hybrid (hub-and-spoke). Each: structure, advantages, disadvantages, visual scheme, selection criteria + matrix."

"European integration of RI policies: multilevel governance, European Code as framework, harmonization vs homogenization, international collaboration challenges, researcher mobility, integrity passports, OS mandate alignment, COVID-19 lessons."

Interactive Elements and Exercises

"Create interactive exercise series: (1) SMART Goal Transformation with model solution, (2) Stakeholder Perspective Analysis (4 roles), (3) Model Selection Matrix (scoring), (4) European Alignment Checklist (4 principles), (5) Open Science Audit (18-point checklist). Each: goal, instructions, template, reflection."

"Develop detailed case studies: María's biology app (dorm to discovery), Funding Application A vs B (coffee farmers comparison), Research execution challenges (survey/experiments/hypothesis issues), 7 researcher dialogues with barriers. Format: narrative + analysis + recommendations."

"Write 7 realistic dialogues between researchers: (1) Pure Science Myth (senior vs junior), (2) Reputation Protection (department meeting), (3) Power Dynamics (postdoc vs senior), (4) Disciplinary Exceptionalism (interdisciplinary), (5) Bystander Effect (faculty lounge), (6) Cognitive Dissonance (unexpected results), (7) International Misunderstandings (authorship cultures). Each: setting, conversation, barrier analysis, recommendations."

Myths and Conclusions

"Create 'Debunking Myths' section with 7 misconceptions about research integrity: (1) only bad environments, (2) rare scandals only, (3) regulation prevents all, (4) developing country problem, (5) technology solves all, (6) young researchers more likely, (7) always intentional. Each: statement + reality + explanation + data/ examples."

"Comprehensive resource lists organized by category: International organizations (COPE, WCRI, ENRIO), Training platforms (CITI, OnlineEthics), Publication integrity tools (Think.Check.Submit, DOAJ, Retraction Watch), OS infrastructure (FAIR, RDA, COS), Detection tools (iThenticate, ImageTwin, statcheck). For each: URL, description, key resources."

"Write academic conclusion synthesizing: 15-year RI transformation, RI-OS integration, scandal role in policy formation, AI challenges/opportunities, path to responsible science, call to action for young researchers. Style: inspiring, forward-looking, balanced."

"Ensure document consistency: academic but accessible style, British English, Harvard referencing, structured numbering, theory-practice balance, rhetorical questions, examples/case studies, visual elements described textually, interactive elements marked clearly."

Chapter 1
The Changing Landscape of Research Integrity in Europe

The current scientific scene is at a critical crossroads hitherto unheard of. The principles and standards of research integrity and the problems of open science have never before been so clear and complicated. Since the beginning of peer review as such, this convergence, at once harmonic and paradoxical, represents one of the most radical changes in intellectual culture. With its strong history of intellectual precision and bold vision of actually democratic knowledge, the worldwide scientific community is ideally suited to negotiate this change.

The cooperation of research integrity and open science presents fresh possibilities and exposes weaknesses never meant to be solved by conventional and sometimes cumbersome academic frameworks. How can we balance the requirement of transparency with the need for accountable data management? Opens new avenues for exploitation and abuse or does it really reinforce the basis of scientific trust?

These problems go to the core of the social interaction between science and society; they are not just intellectual. The combination of research integrity and open science is no longer a luxury but an urgent necessity as European (Boulton & Lucas, 2008; Meyer, 2021) and American (Gauchat, 2012) institutions fight diminishing public trust, funding demands, and the fast tempo of technological change. This chapter examines the current state of this vital connection, tracks its evolution, explores its inconsistencies, and charts the path toward a more ethical and transparent future.

In the last 15 years, the concept of Research Integrity in Europe has transformed (Sørensen & Dumay, 2024; Vendé et al., 2025) as a result of the transfer from merely focusing on halting scientific misconducts to a significant, comprehensive approach that aims to incorporate open data, inclusivity, and societal responsibility. The early 2000s RI focused heavily on addressing obvious breaches like fabrication, falsification, and plagiarism – so-called FFP triad (Steneck, 2006; Kornfeld, 2012). But as studies became more collaborative and interdisciplinary, RI expanded to encompass more ethical considerations such as research culture, equity, diversity, openness and the uptake of open science ideas (Peršak, 2025).

The shifting perspective is evident in the revision to the European Code of Conduct for Research Integrity (ALLEA, 2023). At first published by ALLEA (All European Academies) in 2011, the first edition of the code was further revised in 2017 and 2023 to reflect evolving challenges facing the research sector. “Particularly the 2023 version demonstrates the need for an enabling research environment that supports fairness, diversity, and inclusion” (Hastings et al., 2023). This paper expressed a concept that acknowledged research integrity as a multifaceted construct that encompasses not just individual behaviour but also institutional culture, structural influences, and society expectations. It was more than just a collection of recommendations. Especially because of regulations like GDPR, which work to protect personal information and privacy, it realizes that the practices associated with controlling data are essential.

Moreover, the integration of novel technologies in research, generative artificial intelligence included, has also called for a redefinition of how research integrity is upheld and defined (Chen et al., 2024). Unfortunately, the use of such powerful instruments expands the research capacity, but also trigger high ethical responsibilities that must be undertaken equally forcefully. The revised code clearly states ideals supporting honesty, respect, reliability, and accountability (Desmond & Dierickx, 2021), therefore offering a thorough framework acting as a pillar for selfregulation across all scientific fields (Mondragón Barrios et al., 2017).

Figure 1.1a illustrates the expansion of national-level regulatory documents governing research integrity (RI) across Europe between 2012 (left panel) and 2020 (right panel). In 2012, only a subset of European countries had established leading national RI codes, represented in dark blue, while substantial areas of Europe, shaded in grey, lacked such frameworks. By 2020, a marked increase in coverage is visible, with most European nations having developed or adopted a leading national-level RI code (Desmond & Dierickx, 2021).

According to them, by 2020, 24 out of 32 surveyed countries possessed an official regulatory document on research integrity. Notably, Bulgaria and Luxembourg, though lacking their own national code, have formally adopted the European Code of Conduct as their principal guideline. Additionally, Greece and Slovenia have declared their intention to develop national frameworks in the near future.

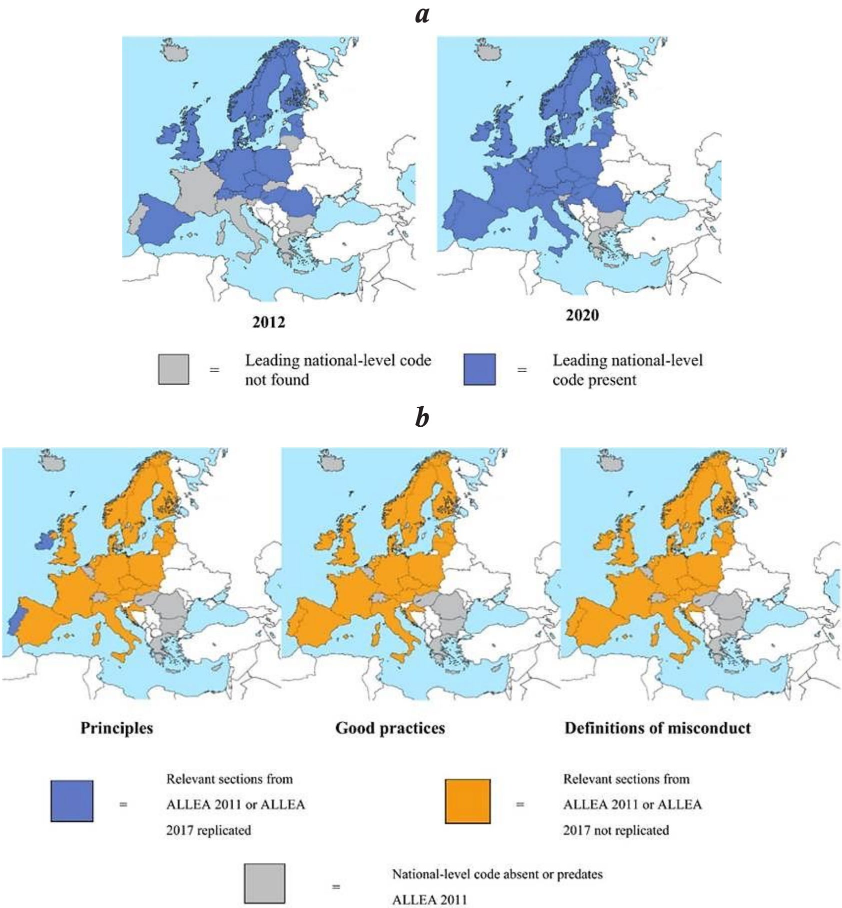

Figure 1.1. Expansion of National Research Integrity Frameworks in Europe between 2012 and 2020 (Desmond & Dierickx, 2021)

For four countries: Malta, Liechtenstein, Cyprus, and Iceland – no statement was identified concerning plans for a national-level RI framework. However, institutional codes exist in Malta, Iceland, and Cyprus, providing at least a localised structure of guidance. Liechtenstein, by contrast, does not appear to have institutional-level RI codes in place. This absence may be partially explained by the small size of its higher education sector: the University of Liechtenstein, its largest institution, enrols only approximately 1,200 students, potentially reducing perceived necessity for an explicit formal code.

Several interacting variables explain the rise in national-level RI codes between 2012 and 2020:

1. Improved European policy coordination, especially under the power of ALLEA's European Code of Conduct for Research Integrity (updated 2017 and 2023).
2. High profile incidents of research misconduct drew public and legislative focus on integrity concerns (Horbach et al., 2024).
3. Rising worldwide research cooperation generates demand for harmonised standards across borders (Perković Paloš et al., 2023).
4. Pressure from funding organizations, like the European Commission's Horizon programmes, which calls for RI policies as part of institutional eligibility requirements (Evans et al., 2021).

Although the seeming dissemination of national systems points to advances in harmonisation, the quality and execution of such codes remain inconsistent. Effective integration into research cultures is not guaranteed by only existence of a national code, Sørensen et al. (2021) point out. Furthermore, the reliance of some countries on the European Code of Conduct, rather than developing locally contextualised policies, raises questions about adaptability to specific disciplinary, cultural, and institutional settings.

Another noteworthy reflection concerns microstates and small higher education systems, such as Liechtenstein. A distinct examination emerges when considering microstates alongside compact higher education frameworks exemplified by Liechtenstein. The small scale of their research activities might decrease the perceived need for extensive RI frameworks yet the lack of these systems can prevent them from joining global partnerships and damage confidence in their research results.

The data demonstrates that Europe has taken significant steps towards adopting research integrity frameworks but achieving uniformity across the continent still demands ongoing policy development along with local adjustments and educational investments to foster genuine cultural transformation.

While Figure 1.1a demonstrates a clear expansion (by 2020, 24 out of 32 countries had national-level RI frameworks) Figure 1.1b reveals a striking divergence. Despite widespread adoption of national codes, almost none replicate the formulations of the ECoC, whether from the 2011 or 2017 versions. Of 60 total comparisons (three per country), exact replication occurred only twice: the Irish code mirrored ECoC 2011 values, and the Portuguese code mirrored ECoC 2017 values.

Early European policies on RI were dominated by a narrow focus on misconduct detection and punitive measures. Godecharle et al. (2014), in their seminal analysis of 19 national RI guidelines across the European Economic Area, uncovered striking heterogeneity in definitions of misconduct. Some countries favoured norm-based definitions, emphasising compliance with prescriptive rules, while others employed value-based frameworks that embedded ethical reasoning within broader societal and scientific contexts. This heterogeneity, while reflecting cultural and institutional diversity, has often been a barrier to harmonisation and cross-border collaboration (Godecharle et al., 2014).

Figure 1.2 shows how public interest in "research integrity" has changed over time in five European countries: Italy, the UK, Sweden, Germany, and the Netherlands, from January 2010 to July 2025, using data from Google Trends.

The United Kingdom (blue line) clearly shows a steady upward trend over these fifteen years. Before 2011, there wasn't much interest, but it started to grow gradually, with some ups and downs but generally going up. There were noticeable peaks around 2014–2015, which might be linked to policy changes and high-profile research misconduct cases in UK universities. Interest also picked up again from 2022 onwards, possibly because the UK Research and Innovation (UKRI) tightened its rules on research integrity. This steady growth in the UK could be due to strong national efforts like the Concordat to Support Research Integrity (set up in 2012 and updated in 2019) and the fact that major funding organizations require training on this topic.

On the other hand, the Netherlands (shown by the red line) shows a very different trend. Instead of steady interest, its search activity is marked by sudden, scattered bursts. These peaks pop up unpredictably between 2014 and 2025, pointing to specific times when attention spiked (maybe because of news about misconduct probes, Responsible Innovation conferences, or national policy updates) before things went back to normal. The Netherlands' bursts of activity fit with how RI fits into bigger talks about open science and research quality, leading to intense but short-lived focus.

For Sweden (the yellow line), there are only two major spikes, both extremely high (over 90) in 2014 and 2015, with almost no activity outside those months. This setup hints that isolated incidents or policy moments briefly brought research integrity into the national spotlight before the buzz died down. The brief Swedish spikes probably tie back to one-off events like media stories on misconduct or the introduction of RI policies without much carryover into ongoing public discussions.

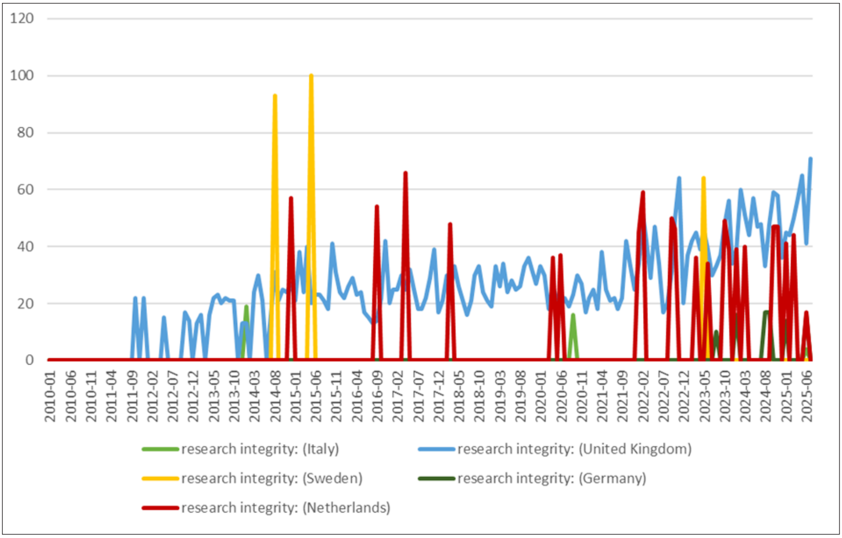

Figure 1.2. Comparative Google Trends Data on "Research Integrity" in Italy, UK, Sweden, Germany, and Netherlands (2010–2025)

Similarly, looking at Italy (the orange line), it's pretty clear that there wasn't much interest shown throughout the whole period. There were only a few small upticks now and then, like in 2014 and 2020. This really suggests that the idea of "research integrity" hasn't really caught on or become a regular topic in how people search online. And then there's Germany (the green line), which also shows very little and quite random activity. You can barely spot any small increases in 2023 and 2024. This points to limited public interest in the term overall, even though Germany has strong institutional frameworks in place for research integrity.

What Italy and Germany show us is that just because institutions and policies are developing doesn't mean the public will automatically start searching for these topics. It hints that there might be a gap between what policymakers are focused on and what the general public is actually interested in or engaged with.

Overall, Figure 1.2 really highlights how uneven public and researcher interest in research integrity is across Europe. Some countries are showing more and more attention that seems to be sticking around, while others only dip their toes in occasionally, or not at all. This difference presents both a challenge and a chance: if we put targeted communication and policy efforts into play, we could potentially close these gaps. The goal would be to build a stronger, more unified European research integrity culture – one that's based not just on official rules and codes, but also on public awareness and open discussion.

Table 1 outlines the evolution of research integrity (RI) frameworks in Europe from 2010 to 2025, highlighting a clear paradigmatic shift in both focus and approach over this fifteen-year period.

Table 1. Evolution of research integrity frameworks in Europe (2010–2025)

Period	Primary Focus	Key Characteristics	Dominant Approach
2010–2013	Fraud Prevention	Reactive, punitive, institutional	Compliance-based
2014–2017	Responsible Conduct	Proactive, educational, individual	Training-oriented
2018–2021	Systemic Integrity	Holistic, cultural, organizational	Culture-building
2022–2025	Integrated Responsibility	Collaborative, open, community-driven	Ecosystem-based

Between 2010 and 2013, RI efforts centred primarily on fraud prevention, characterised by reactive and punitive measures implemented at the institutional level. During this period, frameworks were largely compliance-based, aiming to detect and penalise cases of fabrication, falsification, and plagiarism.

From 2014 to 2017, there was a clear shift toward encouraging responsible research conduct (RCR). Emphasising the part individual scientists played in maintaining integrity, this phase employed a proactive and instructional approach. As a result, training-based initiatives developed to be the most important approach since they aimed to provide researchers with ethical decision-making abilities rather than just enforced regulations.

The years 2018 to 2021 witnessed a further expansion in perspective, embracing the notion of systemic integrity. Here, the focus shifted towards holistic, cultural, and organisational change, embedding integrity within research environments. This phase prioritised culture-building, recognising that fostering an integrity-supportive climate requires institutional leadership, policies, and shared norms rather than isolated training modules alone.

Finally, the period from 2022 to 2025 is characterised by an emerging emphasis on integrated responsibility. The latest phase showcases research integrity through collaborative, open, and community-driven initiatives which embody an ecosystem-based approach. RI has expanded beyond individual compliance and institutional policies to become an integral part of broad movements that promote open science, community involvement, and societal trust in research.

Over time, however, a conceptual shift became apparent. As Evans et al. (2021) argue, RI frameworks evolved to prioritise internalisation of ethical principles rather than mere rule-following. Their study of the VIRT^{2}UE programme – a blended learning, train-the-trainer initiative operational in ten EU Member States plus Switzerland, Norway, and Turkey – illustrates this approach. VIRT^{2}UE explicitly integrates virtue ethics into RI education, encouraging researchers to cultivate moral character traits such as honesty, care, and respect in navigating ethical dilemmas (Evans et al., 2022). In sum, the papers reviewed portray an evolving landscape in which scandal, policy innovation, and tailored educational strategies reshape the research integrity agenda in Europe.

Field et al. (2024) extend this critique further, highlighting that dominant frameworks of Responsible Conduct of Research (RCR) still tend to overlook dimensions such as reflexivity and anticipation. They argue that without fostering researchers' capacity to reflect critically on the assumptions, values, and possible consequences of their work, RI training remains incomplete.

Over the past decade, Europe's approach to research integrity has undergone a profound transformation. Where once the focus lay almost exclusively on damage control – intervening only when misconduct had already occurred – there is now a clear shift towards proactively building a culture of integrity. This change reflects a deeper realisation: true integrity cannot be enforced solely through punishment; it demands ongoing investment in education, supportive institutional environments, and systemic reforms that address the root causes of misconduct.

One of the most visible signs of this evolution has been the establishment of research integrity offices across European universities and research institutes. Initially, these offices were mostly set up to investigate misconduct, but many have expanded their roles quite a bit. Now, they do more than just handle complaints; they also educate, offer private advice, and give strategic guidance to help create ethical research environments. For example, the German Research Ombudsman started as a way to respond to complaints, but has evolved into a full-service advisory body that provides guidance on ethical issues, best practices, and developing institutional policies.

Training programmes have mirrored this shift. In their early forms, these initiatives were largely compliance-oriented, centred around telling researchers what they must not do. Modern programmes, however, adopt a far more holistic perspective. They emphasise ethical reasoning, cultural sensitivity, and collaborative problem-solving, fostering reflection rather than simply prescribing rules. The Research Integrity Thinking School in the Netherlands really shows what this approach looks like. They bring together researchers from all sorts of fields, encouraging them to learn through real-world cases and have conversations that cross disciplines, which helps everyone understand things better (NHL Stenden University of Applied Sciences, 2025).

It's also worth noting that how research is funded is starting to reflect this shift in attitude. For instance, the European Research Council (ERC) has made its rules about research integrity stricter (ERC, 2025). And many national funding organizations now require researchers to complete integrity training before they can even apply for grants.What was once optional is becoming embedded into the very fabric of research practice, substantially increasing engagement with integrity issues throughout the European research community.

Perhaps the most significant conceptual shift has been the growing recognition that research integrity is not just an individual responsibility. Today's frameworks understand integrity as a multidimensional construct, shaped by personal values, institutional cultures, systemic incentives, and societal expectations. This systems thinking perspective has given rise to more sophisticated analytical tools and policy approaches.

For example, the Integrity in Science project, funded by the European Commission, applies organisational psychology to explore how institutional cultures influence individual behaviour (Thierry, 2022). Their findings highlight that violations of integrity are rarely just personal moral failings; rather, they emerge from complex interactions between individual beliefs, institutional pressures, and structural incentives.

Also, there's this idea called "research integrity climate" that's really been getting attention as a useful way to think about things. It was developed by researchers at the University of Amsterdam, and it really highlights how much scientists' actions are influenced by the rules, support systems, and ways of holding people responsible within their organizations (Haven et al., 2019). Places that have a strong sense of integrity tend to have open communication, clear decision-making processes, and are supportive when issues come up (Boulton, 2024). On the flip side, organizations with weak integrity climates often encourage keeping things secret, have strict hierarchies, and deal harshly with ethical matters – these kinds of environments just aren't great for encouraging honest and thoughtful research.

Table 2 presents the key dimensions of a research integrity climate, outlining indicators that distinguish strong ethical environments from weaker ones within research institutions.

Table 2. Dimensions of Research Integrity Climate

Dimension	Strong Climate Indicators	Weak Climate Indicators
Communication	Open dialogue about integrity issues	Avoidance of integrity discussions
Support	Accessible guidance and resources	Limited support for integrity concerns
Accountability	Transparent investigation processes	Inconsistent or secretive responses
Leadership	Visible commitment from senior staff	Lack of leadership engagement
Recognition	Reward systems that value integrity	Incentives that prioritize productivity only

The first dimension, 'Communication', contrasts institutions where there is open dialogue about integrity issues with those where such topics are actively avoided. In strong climates, researchers feel free to discuss ethical dilemmas without fear of judgment, whereas in weak climates, conversations about integrity are often silenced or brushed aside.

'Support' forms the second dimension. Here, a strong climate is characterised by accessible guidance and resources, such as dedicated integrity officers, clear protocols, and training opportunities. Conversely, in weak climates, researchers find themselves without adequate support when navigating integrity concerns, leading to confusion or inaction.

The third key area is 'Accountability', which shows how organizations deal with breaches of integrity. In places with a strong ethical climate, you'll find clear and fair investigation processes that are always applied consistently and transparently. On the other hand, weaker climates tend to have inconsistent or even secretive ways of handling these issues, which damages trust in the system and makes people less likely to report misconduct.

The fourth dimension is ’Leadership’. Organizations that foster a strong integrity culture clearly show commitment from their senior leadership. They make sure integrity is woven into their core values and the way people work every day. However, in organizations with weak climates, leadership often isn’t visibly engaged, sending researchers the message that integrity isn’t really a top priority.

Finally, the ’Recognition’ factor. This highlights how reward systems really shape things. In environments with a strong integrity focus, the rewards clearly celebrate honesty and ethical behavior, right alongside things like productivity and new ideas. But in weaker environments, the incentives often only focus on output, which can unfortunately push people towards iffy research practices just to hit their targets.

All these factors together show us that research integrity isn’t just about individual choices; it’s deeply rooted in the overall feel and structure of the place we work. Building a genuinely strong culture of integrity means we need to actively work on things like open communication, providing good support, holding people accountable, having strong leadership, and having reward systems that truly value doing the right thing.

In conclusion, the trajectory of research integrity over the past decade and a half demonstrates a significant shift towards a more holistic understanding of ethical research practices. By embracing inclusivity, emphasizing the integration of open science principles, and recognizing the societal responsibility of researchers, the European research community is taking meaningful steps towards ensuring that scientific inquiry does not only focus on preventing misconduct but also actively promotes a culture of integrity that benefits all stakeholders involved. This evolution reflects a commitment to not only advancing knowledge but doing so in a manner that is ethical, responsible, and aligned with the values of an increasingly interconnected and diverse society.

Open Science as an Expanding Ecosystem

Open science is about much more than just technical tools or rules – it's really about rethinking how scientific knowledge is made, checked, and shared. At its heart, open science questions the old way of doing things in science, which often meant limiting who could access information, keeping data secret, and having private peer review processes. This push for openness comes from both practical thoughts about making research more efficient and strong beliefs in letting everyone participate in creating knowledge.

The ideas behind open science started with the bigger open access movement from the late 1900s. Key moments like the Budapest Open Access Initiative (2002), the Bethesda Statement (2003), and the Berlin Declaration (2003) set the ground rules. These ideas later grew into the full picture of what open science looks like today. These early documents imagined a way to share science where accessibility, being open, and working together were more important than the old ways that kept information scarce and exclusive.

However, the shift from open access to open science isn't just about doing more of the same: it's a fundamental change in how we approach research (Chakravorty et al., 2022). While open access was mainly about breaking down walls so that published studies could be freely accessed, open science is about opening up the whole process. That means everything from the very first idea or hypothesis right through to collecting data, analyzing it, and sharing the findings. This broader perspective really highlights that being transparent and collaborative can boost the quality of science at every single step along the way.

The European Union has really stepped up as a world leader in pushing for open science, and it's not just a whim, they have solid reasons, both economic and philosophical, for doing so. There's now widespread agreement across European politics that research funded by the public should be available to the public (Huang & Soete, 2025). Plus, the EU's strong belief in making policy decisions based on solid evidence means there's a big push for research to be transparent and easily accessible.

Figure 3 shows a Venn diagram that helps us understand the complex connections between three important ideas in research: open science, responsible research practices (often called RRPs), and transparency. This is all seen through the lens of research integrity (Haven et al., 2022).

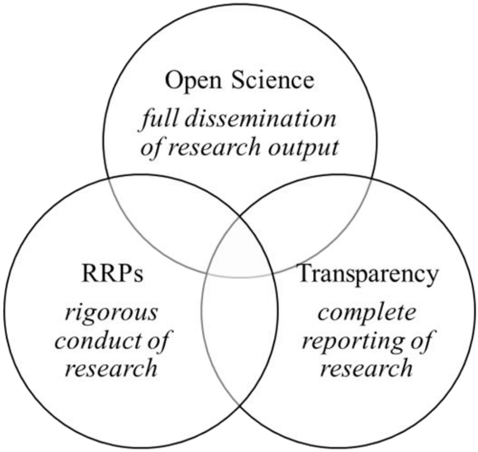

Figure 1.3. Interconnection of Open Science, Responsible Research Practices, and Transparency in Enhancing Research Verifiability (Haven et al., 2022)

Open science (OS) is really changing how research is done. It's all about being open, accessible, and collaborative. Think of it as including things like making publications freely available, sharing data openly, using open methods, having open peer reviews, and even involving the public in science through citizen science. The main goal is to get scientific knowledge out there for everyone – researchers, decision-makers, and the general public – which helps spark new ideas and builds trust (Abcam, 2022).

When it comes to research integrity (RI), open science really boosts transparency, which is a fundamental part of doing honest research. For example, open data lets others check and replicate studies, which helps cut down on potential misconduct. But, it's not without its hurdles; you need to make sure the data is good quality and figure out how to protect sensitive information. The European Code of Conduct for Research Integrity, put out by ALLEA, points out that open science practices need to stick to ethical guidelines to keep that trust intact.

The diagram (Figure 1.3) highlights three areas that overlap:

- Open Science is all about sharing research findings widely. This means making sure things like data, publications, and the methods used are freely available to everyone, helping knowledge spread as much as possible.
- Responsible Research Practices (RRPs) are about doing research the right way. This focuses on making sure the methods are sound, the research follows ethical rules, and that the results can be reproduced by others.
- Transparency means reporting research completely. This includes documenting every detail about the procedures used, how data was managed, and the analytical choices made, so others can check the work critically and potentially repeat it.

Where these three circles meet is the main goal: making research easy to follow and verify. This point shows us that building trust in science isn't just about doing one thing; it takes a combined effort that brings together openness, careful methods, and full reporting.

The European Union really puts Open Science at the heart of its research strategy. A key example of this is the European Open Science Cloud (EOSC), which is designed to be a shared online space where researchers can easily share and reuse their data, all following the FAIR guidelines – meaning data should be Findable, Accessible, Interoperable, and Reusable (Open Science Europe).

Furthermore, major funding programs like Horizon 2020 and Horizon Europe actually require research publications and data to be openly accessible. In fact, Horizon Europe specifically set aside €2.6 billion for artificial intelligence and data-heavy research projects between 2021 and 2022 (European Commission, 2021).

Beyond the EOSC, there are other important efforts underway (Table 3). OpenAIRE, for instance, helps build the infrastructure needed for open access (Rettberg & Schmidt, 2012). Meanwhile, NI4OS-Europe works to connect national Open Science initiatives with the wider EOSC (Lencsés, 2022). The OSCARS project also brings together large European Research Infrastructures to encourage Open Science practices across different fields (OPUS, 2024). And the European University Association (EUA) is also a strong supporter, even taking part in the UNESCO Global Open Science Partnership (EUA.eu, 2025).

Table 3. Key European open science initiatives

Initiative	Description	Key Features
EOSC	Virtual environment for data sharing	Supports FAIR principles, integrates national initiatives Facet joint initiatives
Horizon Europe	EU research funding program	Mandates open access and data sharing
OpenAIRE	Open access infrastructure	Provides repositories like Zenodo
OSCARS	Research infrastructure collaboration	Promotes OS across disciplines

Still, there's a core question behind all these efforts: how can research data be handled so that it stays open, and also useful, easy to get, and able to be used again by people in different fields and countries? This is where the FAIR Data Principles come in as a really important guide. They help make openness responsible by making sure data is easy to find, accessible, works with other systems, and can be reused. The next section will look at these principles more closely, explaining how they help create an open, ethical, and globally connected research world.

The rise of the FAIR data principles (table 4), meaning Findable, Accessible, Interoperable, and Reusable, marks a really big shift in the world of open science (Rothfritz, 2019). These ideas were first put forward by a group of European research organizations back in 2016. It's important to note that they weren't meant to be strict rules, but rather guiding ideas aimed at making research data more useful, transparent, and easy to reuse, no matter the field or location (Boulton, 2024).

Basically, the FAIR principles provide a framework that tries to balance the idea of open data with the real-world need for quality and usability. While open data policies had long encouraged scientists to share their work, the FAIR principles added a key point: data shouldn't just be accessible, it should also be organized and described clearly so others can easily find it, understand it, and use it, including by computer systems. So, being FAIR isn't just about making data available to people; it's just as much about making it usable by machines, which reflects how much science today relies on data.

The adoption of FAIR principles, ensuring data is Findable, Accessible, Interoperable, and Reusable, has happened quickly and widely across Europe. A key driver of this is the European Open Science Cloud (EOSC), which launched back in 2016. Think of EOSC as the main initiative designed to weave FAIR principles right into the fabric of European research. The idea behind EOSC is to create a network of connected data services that work together, making it easy for researchers to share data and collaborate computationally, regardless of their field or country (Publications Office of the European Union, 2025). This isn't just about fancy technology; it's also about fundamentally changing how knowledge is created, linked up, and used to tackle big global problems.

However, putting these FAIR principles into practice isn't without its hurdles, and many of these go well beyond just technical issues. For example, making data 'findable' means you need really solid, standardized metadata, think of it as detailed, consistent descriptions that help people discover datasets, both within specific research areas and more broadly. But agreeing on these metadata standards across all the different research communities is proving to be incredibly tricky. This difficulty reflects the diverse ways different fields use terminology, how they approach knowledge, and their unique data practices.

We also need to handle the principle of accessibility with care. While being open is a key ethical and knowledge-based goal, it has to be balanced against worries about privacy, especially when dealing with health and social data, as well as the need for strong data security and the fair interests of businesses, like protecting intellectual property in research tied to industry.

Table 4. FAIR Data Principles and Their Implementation

Principle	Core Requirements	Implementation Challenges	European Initiatives
Findable	Persistent identifiers, metadata	Standardization across disciplines	EOSC, OpenAIRE
Accessible	Clear access protocols	Balancing openness with privacy	GDPR compliance frameworks
Interoperable	Standard formats and vocabularies	Technical complexity	EOSC standards
Reusable	Clear licensing and provenance	Legal and ethical complexity	Creative Commons, RDA

Making sure different systems can talk to each other (interoperability) is still a major challenge. Real interoperability isn't just about having common data formats and rules; it also needs significant technical setups, coordination between different organizations, and ongoing maintenance to ensure data can be combined and analyzed across various platforms and software.

Finally, reusability, which is the ultimate aim of the FAIR principles, depends heavily on having clear rules and ethical guidelines for sharing data, along with systems that give proper credit to the people and expertise involved in preparing that data. Without the right licenses, clear information about where the data came from, and accepted ways of citing it, even datasets that are well-organized might not be used as much as they could be.

In sum, while the FAIR principles offer an elegant and powerful vision for responsible openness, their realisation depends on ongoing investments in infrastructure, standardisation, governance, and cultural change within research communities. They are not merely technical guidelines, but an invitation to reimagine data stewardship as a collaborative, ethical, and future-oriented endeavour.

Research funding initiatives from the European Union have been instrumental in pushing forward the adoption of open science principles across the continent. A prime example is Horizon 2020, the EU's major research program that ran from 2014 to 2020. During this period, it made open access to publications a non-negotiable requirement for all projects it financed (Karampekios et al., 2018). Although this rule was debated at first, it turned out to be incredibly effective in making European research much more available to everyone.

How did Horizon 2020 make this happen? They used a mix of rules and support. Researchers had to put their published work into open access databases, but the program also gave them money to help pay for publishing costs. There were two main ways to do this: the "Green" route, which let researchers put their manuscript versions online after a delay of up to a year, and the "Gold" route, which directly funded publishing in open access journals (Husiev et al., 2023).

The outcomes of this policy have been impressive. By the time Horizon 2020 ended in 2020, more than 90% of the publications from its projects were freely available online. This is a huge jump compared to the roughly 50% open access rate for European research in general(European Commission, 2023). This big leap in accessibility hasn't just been a number on a chart; it's made a real difference. Studies have found that papers from Horizon 2020 get cited and downloaded far more often than those locked behind paywalls.

Table 5. Evolution of EU Open Science Policies

Program	Time Period	Key Requirements	Innovation
FP7	2007–2013	Pilot open access program	Experimental approach
Horizon 2020	2014–2020	Mandatory open access to publications	Systematic implementation
Horizon Europe	2021–2027	Open access to data, comprehensive OS	Holistic open science

Horizon Europe, which kicked off in 2021, has really ramped up the requirements around open science. It now covers the whole range of open practices. The program demands that research data be made openly accessible, operating on the principle of keeping things as open as possible, but only closing access when it's absolutely necessary.

Researchers are now required to create data management plans detailing exactly how their data will be shared with the wider scientific community. Plus, the program actively encourages other open science methods like preregistering studies, using open peer review, and getting citizens involved in science.

Looking at the Google Trends data from June 2020 up to June 2025, it's clear that people around the world have consistently shown a strong interest in both "open science" and "open access," even though the level of interest has gone up and down over time.

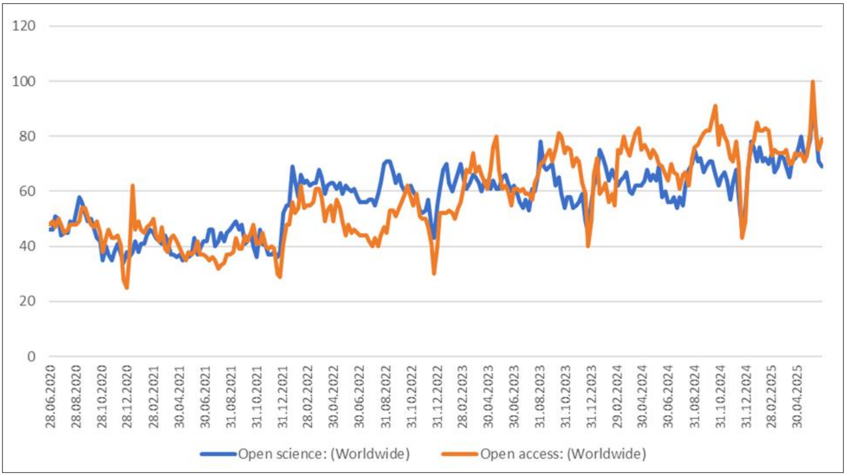

Figure 1.4. Comparative Google Trends data on "open science" and "open access" (2020–2025)

The data on Figure 1.4 highlights a few important patterns:

– Between mid-2020 and early 2022, interest in "open science" and "open access" stayed pretty much neck-and-neck. Both terms scored between 30 and 60 on Google's Trends scale during this period.
– Starting in early 2022, search interest for both topics began to climb. "Open science" often pulled slightly ahead, especially during noticeable surges in early 2023 and mid-2024, when it hit scores above 70 and even 80.

– The final data point, from June 2025, shows that global interest in both terms reached its highest point. “Open science” scored 92, and “open access” hit the top score of 100. This suggests that discussions and attention around these related concepts were increasing together right up to the end of the period.

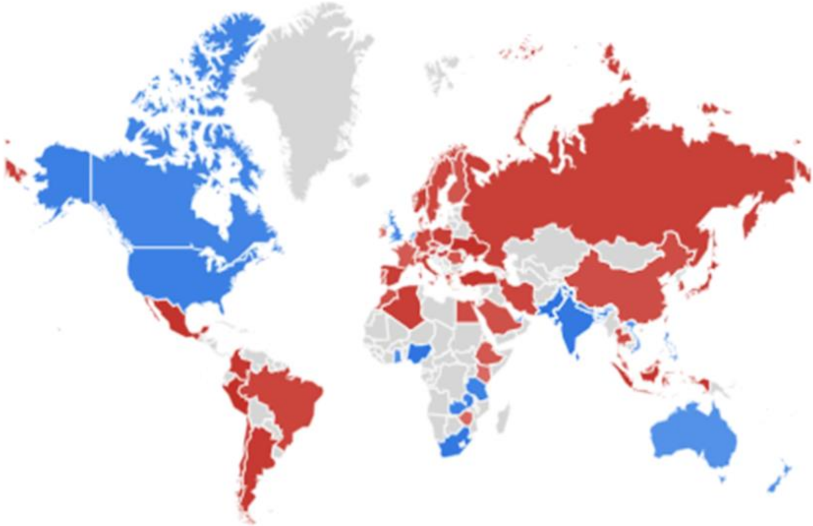

Figure 1.5. Mapping Global Engagement with Open Science (blue) and Open Access (red) (Google Trends)

Figure 1.5 shows a world map that contrasts where people are searching for “open science” (shown in blue) versus “open access” (shown in red), using information from Google Trends. The colors on the map highlight which term is more popular in each country during the time studied.

The data paints a clear picture of different trends across the globe in how both the public and academics talk about these topics. In places like North America and much of Western Europe, including the United States, Canada, the United Kingdom, and the Netherlands, people are more likely to search for “open science.” This suggests that in these areas, both the general public and researchers are increasingly seeing open science as the bigger picture, one that includes things like open access, open data, citizen science, and push for more transparency.

On the other hand, in many parts of Eastern Europe, Asia, Africa, and Latin America, "open access" is the term that comes up more often in searches. For instance, countries like Russia, China, India, and Brazil are shaded in red, which shows a stronger interest in open access publishing. This might reflect government policies focused on making research more visible, perhaps without yet fully embracing the wider range of practices that make up open science.

It's worth noting that some nations, particularly in Central Africa and parts of the Middle East, are shown in grey. This indicates there wasn't enough search data to clearly say which term is more popular. This could be due to lower overall search activity or maybe because local academic circles use different words to discuss these concepts.

The map and graph show us that while open access is still a fundamental part of open research worldwide, open science is becoming a bigger and more unifying idea, especially in Europe and North America. These regional differences might be due to different policies, available resources, and the unique ways scholars work in each area. What's really important is that both terms have become more popular over time. This suggests that people around the globe are increasingly interested in making knowledge transparent, accessible, and shared ethically. This growing interest highlights how crucial it is for countries and institutions to weave both open science and open access policies into their research plans.

The growing world of open science is increasingly recognizing citizen science as a vital part of creating knowledge in a democratic way. This shift comes from both practical needs, like expanding research capabilities, and a belief in involving everyone in the scientific process. Citizen science projects get everyday people involved in collecting, analyzing, and making sense of data. This not only broadens the scope and influence of scientific work but also helps boost scientific understanding and public involvement in science.

European citizen science efforts showcase amazing variety and creativity. The eBird project, which started in North America, has become very popular across Europe. Citizen scientists there have submitted millions of bird sightings, greatly improving our knowledge of bird ecology and how climate change affects them (Sullivan et al., 2009). Meanwhile, the Galaxy Zoo project has involved European volunteers in classifying galaxies, leading to significant discoveries in astronomy and cosmology (ZooUniverse, 2020).

The COVID-19 pandemic really showcased just how powerful citizen science can be. A great example is the COVID Symptom Study, set up by researchers at King's College London (Menni et al., 2020). This project managed to gather over four million people across Europe, asking them to track their COVID-19 symptoms and how the virus was spreading. The information they collected was incredibly useful for understanding how the disease developed and helped shape public health decisions.

Along similar lines, the Folding@home project also got Europeans involved, this time asking them to lend their computer power to help model protein folding for COVID-19 research (General – Folding@Home, 2020).

But, bringing citizen science into the day-to-day world of mainstream research hasn't been without its hurdles. It's clear that we need solid ways to check the quality of the data coming from citizens to make sure it meets proper scientific standards. We also need clear ethical guidelines to tackle tricky issues like making sure people understand what they're signing up for (informed consent), who actually owns the data collected, and how to fairly recognize the participants' contributions. Plus, we need to develop training programs that get both professional scientists and citizen scientists ready to work together effectively.

Today's open science isn't just about its individual parts anymore; it's about seeing everything as a connected ecosystem. We now understand that practices like open access, open data, open peer review, preregistration, and open educational resources all depend on and support each other. This bigger-picture approach shows that transparency, teamwork, and solid research methods work together to create a research culture we can trust and that works effectively.

We're already seeing progress towards this idea. European efforts, like F1000Research's open peer review model and the widespread use of preregistration through the Open Science Framework, are practical steps in this direction (Dezhina, 2023).

Keeping this ecosystem strong means focusing on building skills and knowledge. Initiatives like FOSTER and the EU's support for open educational resources aren't just about theory (Schulte-Buskase & Gruhn, 2024); they give researchers the practical abilities to actually use open science principles in their everyday work. Through these efforts, Europe is moving past small, separate changes and working to create a research community that's truly open, responsible, and collaborative – ready to tackle the challenges of our time.

The Afterlife of Misconduct Scandals

The way research integrity works across Europe has been deeply influenced by several major scandals. These incidents really brought to light some systemic weaknesses and pushed everyone to make changes. While these events were incredibly unsettling, they also acted as crucial wake-up calls, helping shape much stronger frameworks for ensuring integrity in research.

The Diederik Stapel case, which came to light between 2011 and 2012, was a turning point for research integrity in Europe. Stapel was a well-known Dutch social psychologist who turned out to have made up data for dozens of studies over more than ten years. The sheer scale and length of his deception stunned the academic world and revealed serious problems with how research is supervised, reviewed by peers, and overseen by institutions.

The comprehensive investigation into Stapel's misconduct, detailed in the report Flawed Science: The Fraudulent Research Practices of Social Psychologist Diederik Stapel (Levelt et al., 2012), not only revealed individual malfeasance but also exposed systemic deficiencies in the culture and practices of social psychology. This section examines the Stapel case as a lens to understand the broader challenges to RI, highlighting how a "sloppy" research culture, inadequate statistical literacy, and flawed peer review practices facilitated widespread misconduct, with implications for fostering a more robust framework for RI in Europe. In response, the Netherlands moved quickly and decisively: they set up new integrity committees, made training programs mandatory, and tightened up supervision rules.

Similarly, the Paolo Macchiarini scandal at the Karolinska Institute in Sweden (happening roughly from 2010 to 2016) showed how a big institution's reputation can sometimes protect wrongdoing from being properly examined (Nature, 2016). Macchiarini performed experimental windpipe transplants that lacked proper ethical approval and had terrible results for patients. This exposed how the intense drive for scientific breakthroughs can sometimes lead people to ignore basic ethical duties. This scandal led to significant changes in how research is governed in Sweden and really emphasized how important it is for institutions to foster a strong culture of integrity.

The COVID-19 pandemic really brought new challenges to the world of scientific integrity. Because the global health crisis was so urgent, researchers had to speed up their publication timelines, peer review standards sometimes loosened, and everyone was watching the scientific process more closely than ever. When some big-name papers got retracted from The Lancet and The New England Journal of Medicine in 2020, both about COVID-19 treatments, it really highlighted the tough balance between getting results out fast and making sure they're rock-solid (Rabin & Gabler, 2020).

Between 2017 and 2023, Carlo Croce, a well-known cancer researcher from Ohio State University who also had strong connections to research institutions in Italy, found himself in the middle of several big controversies (Glanz & Armendariz, 2017). Investigations were launched, and scientific journals retracted articles, all because of claims that images had been doctored, data had been made up, and that there had been misconduct in the research coming out of his lab.

Although Croce has always denied doing anything wrong on purpose, several papers from his lab were either withdrawn or had corrections added because of worries about duplicated or altered images. The scandal got a lot of attention in the media, especially after The New York Times published a thorough article in 2017 explaining the seriousness of the accusations and how the institutions involved were responding (Glanz & Armendariz, 2017). Back in Italy, where

Croce was highly respected for his scientific work, this controversy made the country take a closer look at how research ethics are managed. As a result, whistleblower protections were made stronger, and there were talks about finding better ways to deal with misconduct in top research labs.

These high-profile scandals share common characteristics that reveal systemic vulnerabilities in the contemporary research enterprise (table 6). First, they demonstrate that research misconduct is rarely the result of individual moral failure alone, but typically involves complex interactions between personal factors, institutional pressures, and systemic incentives. Second, they show that prestigious institutions and renowned researchers are not immune to integrity failures – indeed, their status may sometimes shield them from scrutiny. Third, they highlight the crucial role of institutional culture in either facilitating or preventing misconduct.

The concept of "research integrity climate" has emerged as a crucial framework for understanding these systemic factors. Research by Martinson and colleagues (2012) has shown that institutions with strong integrity climates are characterized by several key features: open communication about ethical issues, supportive responses to integrity concerns, fair and transparent investigation processes, and leadership that actively promotes integrity values. Conversely, institutions with weak integrity climates often exhibit cultures of secrecy, hierarchical decision-making that discourages questioning, and punitive responses to integrity concerns.

It seems that just as moral theory and changes in policy have played a significant role, scandals have too. Horbach and colleagues (2024) introduce the idea of the "institutional afterlife" that misconduct cases carry. By examining documents, making observations, and conducting interviews in Denmark, they show how major scandals keep influencing university policies, staff training programs, and the overall research atmosphere long after the public has stopped paying attention. Basically, every scandal leaves behind some kind of mark – sometimes it results in stronger training programs and a greater focus on ethical behavior, but other times it can lead to defensive, overly bureaucratic environments that discourage new ideas.

Table 6. Systemic Factors in Major Research Integrity Scandals

Case	Institutional Factors	Cultural Factors	Systemic Pressures
Stapel	Weak supervision, inadequate peer review	Tolerance for “sloppy” practices	Pressure for high-impact publications
Macchiarini	Prestige protection, conflict of interest	Star system mentality	Competition for breakthrough discoveries
Croce	Delayed institutional response	Hierarchical lab culture	International collaboration complexity
COVID-19 Retractions	Expedited review processes	Crisis mentality	Public health urgency

The Google Trends data presented in Figure 2 depict search interest in “research integrity” across five European countries between 2010 and 2025, revealing patterns that intersect meaningfully with major research misconduct scandals.

Notably, the Netherlands (red line) exhibits repeated sharp peaks from 2014 onwards, with particularly high spikes in 2015 and 2017. These peaks align temporally with the aftermath of the Diederik Stapel scandal (2011–2012), when public reporting intensified as universities implemented systemic reforms. The persistence of these peaks in later years suggests an ongoing public and academic discourse, consistent with Horbach et al.’s (2024) concept of the “institutional afterlife”, where scandals continue to influence policy, training, and awareness long after initial exposure.

In Sweden (yellow line), significant spikes appear between 2014 and 2016, coinciding with revelations about Paolo Macchiarini’s unethical trachea transplants at the Karolinska Institute. These data suggest that public attention to research integrity surged during investigations and institutional reckonings, further evidenced by Sweden’s subsequent governance reforms.

The United Kingdom (blue line) shows a gradual but steady rise in searches from 2012 onwards, with marked increases in 2020 and 2022–2025. Peaks in 2020 may partially reflect the COVID-19 publication retractions from The Lancet and NEJM, which fuelled widespread scrutiny of research standards under crisis pressures. The continued upward trend towards 2025 aligns with the UK's systematic integration of integrity training requirements into national funding policies.

On the other hand, Italy (the green line) and Germany (the dark green line) show much lower and more scattered interest in searching for this topic, with hardly any consistent engagement, even during major events like the Carlo Croce controversies from 2017 to 2023. This difference might be due to cultural or institutional factors that shape what the public pays attention to. Even though Croce's scandal got a lot of press in Italy, it perhaps didn't fuel the same kind of ongoing policy discussions that the Stapel or Macchiarini cases did in their home countries.

Overall, these findings back up the idea that public interest in research integrity often surges in reaction to scandals, acting both as a sign of and a trigger for institutional changes. However, the fact that we see more permanent increases in search activity in places like the UK and the Netherlands suggests that the conversation about research integrity is more deeply woven into the fabric of academic and public life there, going beyond just temporary attention sparked by specific scandals. This kind of analysis really highlights how individual cases of misconduct, the long-term effects on institutions, and public conversation all interact. It also strongly underscores how crucial transparency and proactive communication are for rebuilding trust after breaches of integrity occur.

Scientific misconduct, though often perceived as isolated incidents, reveals underlying vulnerabilities within research systems. Recent high-profile cases illustrate both individual breaches of integrity and institutional shortcomings in oversight and culture.

For example, the article by the Science Media Centre (Spain, 2023) highlights the case of Haruko Obokata in Japan, whose 2014 publications on STAP cells were retracted after it was revealed that images had been manipulated and results could not be replicated. The scandal led to significant damage to RIKEN's reputation and, tragically, to the suicide of Obokata's supervisor, underscoring the intense pressures and hierarchies within elite research institutions.

What's so intriguing about these scandals is that they never really just vanish. Instead, they change, they grow, and they end up woven into the very fabric of institutions. The consequences of this can be felt for years, sometimes even decades down the line. Think about the Stapel case, for example. It wasn't just about one researcher making up data; it ended up being the spark that led to a complete transformation in how the Netherlands handles research integrity training.

The response from the Dutch was quick and thorough. Within a few months of the scandal coming to light, universities all over the country started putting new rules into place. But what makes this really interesting is that these weren't just about following procedures to tick boxes. They represented fundamental changes in how the research community started thinking about their duties to each other and to society as a whole.

Sweden's handling of the Macchiarini affair was quite revealing. The Karolinska Institute, a globally respected medical research hub, found itself in an awkward spot, admitting that its own fame had actually become a problem. They did away with the "star system" that had let Macchiarini work with very little supervision, swapping it out for more teamwork and openness in how research is managed.

But what do these changes actually mean on a day-to-day basis? In Sweden, the fallout from the Macchiarini case led to the Swedish Research Council setting up new rules for clinical research. These rules now demand several levels of approval for any experimental procedures. It's not just about filling out forms; it's about building an environment where asking questions is seen as positive, where younger researchers feel comfortable speaking up about concerns, and where the push for big discoveries doesn't mean ignoring basic ethical guidelines.

There's something really human about how institutions deal with trauma (table 9). It's like how individuals carry the scars from tough times, research institutions develop what almost feels like "institutional PTSD." They become super sensitive, maybe even a bit paranoid, about potential wrongdoing (National Academies of Sciences Engineering et al., 2017).

These scandals really take a toll, way beyond just the people directly involved. Young researchers, seeing their mentors get investigated, start questioning everything they believed about being honest in academia. Even experienced researchers find themselves doubting practices they've used for ages (Stricker & Günther, 2019). Meanwhile, administrators are rushing to put new rules in place while trying hard to keep that tricky balance between watching closely and allowing academic freedom to flourish.

Table 7. Psychological Impact Levels of Research Integrity Scandals

Impact Level	Affected Groups	Manifestations	Duration	Interventions
Individual	Direct colleagues, mentees	Anxiety, self-doubt, hypervigilance	2–5 years	Counseling, peer support
Departmental	Faculty, staff, students	Changed communication patterns, increased documentation	3–7 years	Team building, transparency initiatives
Institutional	University-wide	Policy changes, cultural shifts	5–15 years	Leadership training, cultural assessment
Field-wide	Entire disciplines	Methodological changes, publication practices	10+ years	Professional society initiatives

"Let me tell you about Maria, a postdoctoral researcher I'll refer to by that name to protect her privacy. She worked at a large European university, and three years had passed since a major research misconduct scandal had shaken her department to its core. Although Maria herself had always conducted her research with the utmost integrity, she couldn't help but find herself constantly double-checking her data, asking for approval multiple times for even routine tasks, and feeling a persistent anxiety about whether her own work might be viewed with suspicion. This is what it looks like when an institution's trauma trickles down to the individual – it's how the wounds of an organization become personal anxieties.

The idea of “moral injury,” which was first used to describe the psychological harm healthcare workers suffer when they can’t act according to their moral principles, also fits perfectly with research integrity scandals” (Kalkman & Molendijk, 2019). Researchers who see misconduct but feel powerless to speak out, or who work in places where concerns about integrity are simply ignored, suffer a form of moral injury that can stick with them, affecting their job satisfaction and mental well-being long-term.

One really concerning outcome of how institutions react after a scandal is how it can sometimes accidentally put a damper on innovation. When organizations become overly cautious about potential misbehavior, they tend to introduce rules that encourage safe, small-step research over risky, truly groundbreaking projects. This sets up what experts refer to as the “innovation dilemma” – that tricky balance between keeping things ethical and pushing the envelope.

Think about the field of gene editing following the He Jiankui controversy back in 2018. Although He was based in China, his unauthorized work on human embryos caused a huge stir in the international science community. As a result, European institutions beefed up their monitoring of genetic research, added more ethics checks, and made approval processes stricter. While these steps were definitely needed, they also had the unintended effect of slowing down perfectly legitimate research in the area.

The growth of predatory publishing is proving to be one of the most concerning unintended side effects of the open access movement (Smart, 2017). These deceptive journals and publishers take advantage of the genuine demand for freely accessible scientific information, all while discarding the quality checks that set serious academic publishing apart from simple content sharing. The spread of these predatory operations has sparked a crisis of trust that could potentially damage the entire open access initiative.

Researchers in Europe seem especially vulnerable to exploitation by these predatory practices. The push to publish in open access formats, coupled with the availability of funding from institutions to cover publication fees, has made them a prime target for unscrupulous publishers. Research indicates that European scholars contribute a significant number of articles to these predatory journals, with particularly high numbers coming from Eastern European countries. In these regions, the systems used to evaluate research quality might not be effective enough to differentiate between legitimate and fake publications.

The Hungarian Academy of Sciences conducted a comprehensive study of predatory publishing among Hungarian researchers, revealing alarming patterns of exploitation. The study found that over 15% of Hungarian researchers had published in potentially predatory journals, often without realizing the fraudulent nature of these publications. Many researchers reported being deceived by sophisticated marketing campaigns that mimicked legitimate academic publishers. The financial cost to Hungarian institutions was estimated at over €2 million annually, while the reputational damage to Hungarian science was incalculable.

The response to predatory publishing has revealed both the strengths and limitations of European research integrity systems. National research integrity offices have developed guidelines for identifying and avoiding predatory publishers, but enforcement remains challenging. The subjective nature of predatory publishing definitions makes it difficult to establish clear criteria for distinguishing between legitimate and fraudulent publications. Moreover, the rapid evolution of predatory publishing tactics requires constant vigilance and adaptation of detection methods.

Jeffrey Beall's blacklist of predatory publishers, while controversial, provided a crucial service to the research community until its discontinuation in 2017 (Wikipedia Contributors, 2024). The absence of a comprehensive blacklist has left researchers and institutions struggling to identify potentially predatory venues. European initiatives such as the Think.Check.Submit campaign have attempted to fill this gap by providing researchers with tools for evaluating publisher legitimacy, but the effectiveness of these educational approaches remains limited.

Figure 1.6, titled "The Yin and Yang Battle of Fraud," gives us a comprehensive look at why scientific misconduct happens and how it shows up in research (Turakhiya, 2017). The top part of the figure uses a triangle that connects with the yin-yang symbol. It suggests that misconduct isn't just one thing, but rather comes from three things working together: Motive/Pressure (like the pressure to publish a lot or win grants and awards), Opportunity (how easy it is for a researcher to control or change data), and Rationalisation (finding ways to justify actions that bend the rules, like tweaking data to fit what they hope to prove). This way of looking at it makes it clear that misconduct isn't usually just about someone being dishonest on their own; it often comes from a mix of personal reasons, chances provided by the system, and ways people convince themselves it's okay.

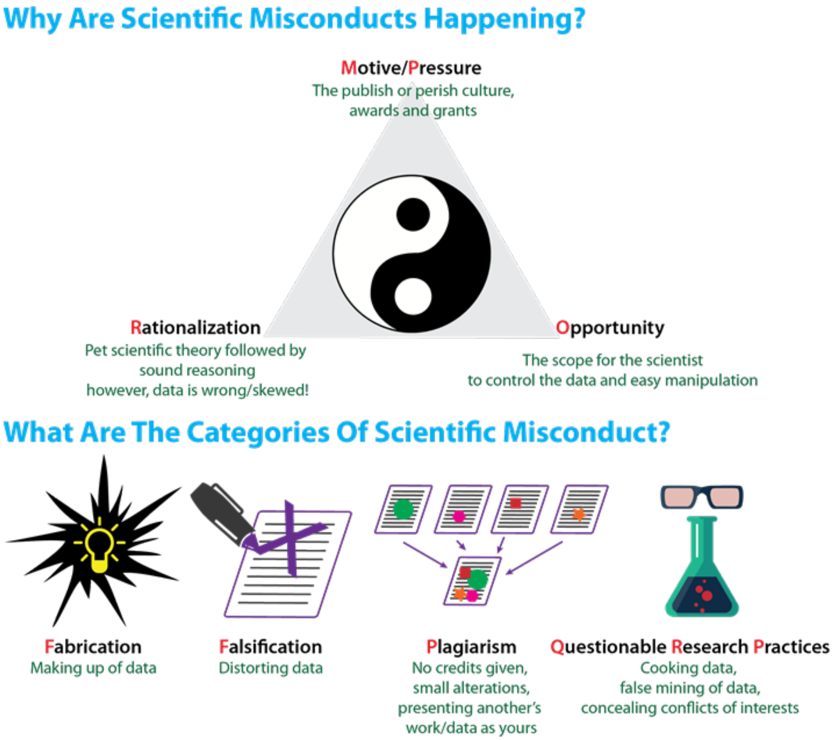

Figure 1.6. The Yin and Yang Battle of Fraud (Turakhiya, 2017)

The bottom part of the figure lists four main types of scientific misconduct. These are Fabrication (making up data that doesn't exist), Falsification (twisting real data to support a point), Plagiarism (using someone else's work without giving them credit, even if it's just slightly changed), and Questionable Research Practices (QRPs), like only reporting results that look good or hiding conflicts of interest. Each type is shown with a simple but clear icon, helping us see how misconduct can take many different forms, sometimes blending together, in the world of science.

It turns out that when serious research misconduct hits the headlines in Europe, it really shakes things up. While we often focus on the individual researchers involved, like the cases of Stapel, Macchiarini, or Croce – we learn something much bigger when we look closer. These situations don't just show us that a few people made unethical choices; more importantly, they uncover some deep-seated problems within the whole system, like how we supervise researchers, how peer reviews work, and even the kind of culture fostered by research institutions.

Each time one of these scandals comes to light, it forces universities, organizations that fund research, and national authorities to take a hard look at themselves (Riley, 2025). They have to confront the uncomfortable possibility that their own systems might have accidentally allowed misconduct to continue unchecked for years.

One key takeaway from these incidents is that research misconduct usually isn't just a lone individual acting out of line. There's often a broader context. Think of the idea of "institutional afterlife" – it's a way of saying the consequences of these scandals echo far and wide, affecting more people and systems than just the original culprits. For instance, the Stapel scandal in the Netherlands didn't just taint his reputation; it led to nationwide changes, including mandatory ethics training and special committees dedicated to research integrity. Similarly, Sweden's reaction to the Macchiarini affair pushed the Karolinska Institute to move away from a culture that idolized star researchers, instead implementing much stricter oversight and emphasizing shared responsibility.

Still, this process of fixing things within the institution comes with its own set of psychological and cultural side effects. Scandals can really poison the atmosphere, fostering a sense of distrust and constant suspicion. Just look at Maria's situation: a place that used to buzz with academic freedom turned into an environment heavy with anxiety and overly cautious bureaucracy. This "trauma trickling down" shows up as researchers constantly watching their own backs, being extra careful with approvals, and feeling less trusting in their relationships with colleagues.

Furthermore, scandals don't just change how institutions deal with wrongdoing; they also reshape the balance between sticking to ethical principles and encouraging new ideas. Although stricter ethical checks are essential, the He Jiankui gene-editing controversy highlighted how policies born from scandals can accidentally put the brakes on legitimate, high-risk research. So, institutions really have to walk a fine line – the "innovation dilemma" – making sure ethical standards are rock solid while still creating space for bold scientific adventures. The rise of predatory publishing highlights another unintended consequence of structural changes in research culture. As European institutions push for open access, they inadvertently expose researchers, particularly in regions with weaker quality assurance systems, to exploitation by unscrupulous publishers. The persistence of these predatory practices underscores gaps in institutional guidance and the limitations of current detection and prevention mechanisms. Ultimately, the afterlife of misconduct scandals teaches us that integrity reforms must go beyond punitive measures or compliance checklists. True change requires cultivating an embedded culture of openness, ethical reflexivity, and supportive supervision, coupled with systemic reforms that reduce perverse incentives and empower researchers to uphold the highest standards of their profession.

However, Open Science introduces challenges. Predatory journals, which exploit open access models by publishing low-quality or fraudulent research, undermine the scientific record. The pressure to share data quickly can lead to inadequate anonymization, risking privacy breaches, particularly under GDPR (ROSiE) (CORDIS, 2024). Misinterpretation of open data without proper context is another concern, potentially leading to erroneous conclusions.

The ROSiE project addresses these tensions by developing guidelines for responsible OS, complementing the *European Code of Conduct* (ROSiE). These guidelines cover ethical data sharing, publication standards, and the use of AI in research, ensuring OS aligns with RI principles.

The replication crisis, which has affected fields like psychology and medicine, has had a dual impact. On one hand, it has spurred the adoption of more open scientific methods. On the other, it has created some friction between the need for research integrity and the push for openness. This crisis came to light through systematic studies revealing that many research findings published in reputable journals couldn't be repeated by other scientists. It shone a spotlight on some deep-seated issues in how science is traditionally done, such as picking and choosing which results to report, manipulating data to get desired outcomes (p-hacking), and not having enough statistical power in studies.

Open science approaches are seen as a hopeful way to fix these issues. Things like preregistering study plans help stop researchers from changing their hypotheses after they already know the results (Gruebner, 2025). Making data openly available lets others check the analysis independently. Sharing methodologies openly means research practices can be examined, rather than staying hidden. Registered reports, where the research plan is reviewed by peers before any data is collected, can also cut down on selective reporting and bias in what gets published.

Researchers in Europe have been very active in finding solutions to the replication crisis. Although the Reproducibility Project: Psychology was coordinated by a center in the U. S., it relied heavily on European researchers. The project's discovery that only 36% of psychology studies could be successfully replicated was a major shock to the scientific world and really pushed the adoption of open science practices forward (Jarrett, 2015).

However, the focus on replication has also created new pressures that can conflict with research integrity principles. The emphasis on replicability may discourage researchers from pursuing innovative or high-risk research questions that are inherently difficult to replicate.

The demand for open data may prevent researchers from investigating sensitive topics or vulnerable populations where data sharing could cause harm.

The Many Labs projects, which involve coordinated replication efforts across multiple laboratories, have demonstrated both the potential and the limitations of open science approaches to addressing replication concerns. These projects have successfully replicated some classic findings while failing to replicate others, providing valuable insights into the robustness of psychological research. However, the resource requirements for such collaborative efforts are substantial, and the focus on replication may divert attention from original research.

The connection between research honesty and open science is a really interesting puzzle that gets right to the heart of how science works today (Labib et al., 2021). On one side, being open, like the core idea of open science, seems like a fantastic way to boost research integrity. Sharing data openly lets others check and repeat studies; open peer reviews can cut down on bias or dishonesty; and open methods mean how research is done can be looked at closely. However, this same openness can also create new problems, leaving researchers open to their work being misunderstood, used in the wrong way, or even deliberately misused.

For instance, take climate science as an example, where the idea of open data acts like both a shield and a sword. Climate researchers are increasingly sharing their data, methods, and code openly. This transparency has made the scientific agreement on climate change stronger by letting others check the results and encouraging groups to work together. At the same time, it has also given critics who doubt climate change something to use against it, as they can dig through the data looking for small issues or uncertainties that can be taken out of context to argue against the scientific findings.

The "Climategate" incident back in 2009 is a really interesting case, even though it happened before the "open science" movement really took off. In many ways, it kind of predicted how transparency could be turned into a weapon (McKie, 2019). You see, private emails between climate scientists were leaked without permission, and these were then used to imply there was some kind of misconduct or even a conspiracy going on. Ultimately, despite all that, several investigations couldn't find any proof of actual scientific wrongdoing. What really stood out was how this showed that even efforts meant to be open and honest can be twisted and used by people who have their own hidden agendas.

Meanwhile, university tech transfer offices have found it tough to keep up with the demands of open science. The usual way they turn research into commercial products relies on keeping research details secret until they can get patents or other protections. Open science, however, is all about sharing findings right away, which clashes with this approach. As a result, a few schools have come up with mixed strategies, like allowing temporary holds on sharing data while patents are being processed. But these fixes are often just stopgaps and might not fully embrace the spirit of open science.

Looking ahead, the future of European science lies not in choosing between research integrity and open science, but in their thoughtful integration into a unified framework of responsible research practice. This integration requires moving beyond the traditional binary thinking that has characterized much of the debate between transparency and protection, openness and quality, innovation and responsibility. Instead, it demands a more nuanced understanding that recognizes these apparent tensions as creative opportunities for developing more sophisticated and effective approaches to scientific practice.

The concept of "responsible open science" represents more than a mere compromise between competing values – it embodies a fundamental reimagining of what scientific responsibility means in the digital age. This framework recognizes that responsibility in science is not static but must evolve in response to changing technological capabilities, social expectations, and global challenges. Furthermore, it acknowledges that the traditional model of scientific communication, developed in an era of print publication and limited data sharing capabilities, may no longer be adequate for addressing contemporary scientific and social needs.

In this context, the European research community's unique position – combining strong traditions of scientific excellence with robust regulatory frameworks and democratic governance, provides an ideal foundation for developing this integrated approach. The continent's experience with both the benefits and challenges of open science implementation offers valuable lessons for creating more sustainable and effective models of responsible research practice.

To wrap things up, the way we view the connection between doing science ethically and sharing it openly illustrates the significant impact of modern scientific work. Research ethics used to mainly mean just avoiding cheating, but now it's seen as including wider duties like being open, inclusive, and making sure science matters to society. At the same time, open science has grown way beyond just making research papers easy to read; it now covers every step of the research process. This opens up new ways to be transparent, check each other's work, and collaborate, but it also brings up tricky ethical, legal, and practical questions that need careful thought.

Looking at big science scandals, like those involving Diederik Stapel, Paolo Macchiarini, and Cesare Croce, shows us that ethical breaches are rarely just personal mistakes. They often happen because of problems within the whole system, like how institutions are run or the culture in a lab, that influence how researchers act. These scandals leave a lasting mark on institutions, affecting policies, training, and the overall atmosphere for years, sometimes leading to good changes and other times just making things more bureaucratic and defensive. Plus, the ongoing push and pull between being open and protecting things, like the difficulties in using FAIR data rules or balancing sharing data with intellectual property rights, highlights how important it is to take careful, situation-specific approaches.

Basically, the future of science in Europe isn't about choosing between research integrity and open science as if they're rivals. Instead, it's about blending both into a single, sensible way of conducting responsible research. For this to work, we need to see that integrity and openness actually strengthen each other, especially when we have supportive environments, solid resources, and a real focus on ethics. This means shifting away from just ticking boxes for compliance, towards actually building a culture where integrity is the norm. We need to build trust by being transparent and empower researchers to feel like they're taking care of knowledge for society's good. Only by taking this combined and forward-thinking approach can the European research community tackle the tricky issues of the digital age while still maintaining the highest levels of scientific quality and responsibility.

References

Abcam. (2022). The future of open science: why and how to share your data. *Abcam.com.* https://www.abcam.com/en-us/stories/articles/the-future-of-open-science-why-and-how-to-share-your-data

ALLEA. (2023). The European Code of Conduct for Research Integrity. *Allea.org.* https://allea.org/code-of-conduct/

Allum, N., Reid, A., Bidoglia, M., Gaskell, G., Aubert-Bonn, N., Buljan, I., Fuglsang, S., Horbach, S., Kavouras, P., Marušić, A., Mejlgaard, N., Pizzolato, D., Roje, R., Tijdink, J., & Veltri, G. (2023). Researchers on research integrity: a survey of European and American researchers. F1000Research, 12, 187. https://doi.org/10.12688/f1000research.128733.1

Armond, A. C. V., & Kakuk, P. (2022). Perceptions of Research Integrity Climate in Hungarian Universities: Results from A Survey among Academic Researchers. *Science and Engineering Ethics, 28*(4). https://doi.org/10.1007/s11948-022-00382-5

Boeckhout, M., Zielhuis, G. A., & Bredenoord, A. L. (2018). The FAIR guiding principles for data stewardship: fair enough? *European Journal of Human Genetics, 26*(7), 931–936. https://doi.org/10.1038/s41431-018-0160-0

Boulton, G. (2024). Science as a global public good: A necessary responsibility for science (pp. 3–19). *Academic Press.* https://doi.org/10.1016/B978-0-443-23655-6.00001-0

Boulton, G., & Lucas, C. (2008). What are universities for? League of European Research Universities Report. https://www.leru.org/files/What-are-Universities-for-Full-paper.pdf

Brown, P. O., Cabell, D., Chakravarti, A., Cohen, B., Delamothe, T., Eisen, M., Grivell, L., Guédon, J.-C., Hawley, R. S., Johnson, R. K., Kirschner, M. W., Lipman, D., Lutzker, A. P., Marincola, E., Roberts, R. J., Rubin, G. M., Schloegl, R., Siegel, V., So, A. D., & Suber, P. (2003). Bethesda Statement on Open Access Publishing.

Budapest Open Access Initiative. (2002).

Bullinger, H. J. (2003). Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities.

Chakravorty, N., Sharma, C. S., Molla, K. A., & Pattanaik, J. K. (2022). Open Science: Challenges, Possible Solutions and the Way Forward. *Proceedings of the Indian National Science Academy, 88*(3), 456–471. https://doi.org/10.1007/s43538-022-00104-2

Chen, Z., Chen, C., Yang, G., He, X., Chi, X., Zeng, Z., & Chen, X. (2024). Research integrity in the era of artificial intelligence: Challenges and responses. *Medicine, 103*(27), e38811–e38811. https://doi.org/10.1097/md.0000000000038811

Cologna, V., Mede, N. G., Berger, S., Besley, J., Brick, C., Joubert, M., Maibach, E. W., Mihelj, S., Oreskes, N., Schäfer, M. S., van der Linden, S., Abdul Aziz, N. I., Abdulsalam, S., Shamsi, N. A., Aczel, B., Adinugroho, I., Alabrese, E., Aldoh, A., Alfano, M., & Ali, I. M. (2025). Trust in scientists and their role in society across 68 countries. Nature Human Behaviour, 9. https://doi.org/10.1038/s41562-024-02090-5

CORDIS. (2024, May 20). Tools to achieve responsible and ethical open science. *CORDIS | European Commission*. https://cordis.europa.eu/article/id/451296-tools-to-achieve-responsible-and-ethical-open-science

Desmond, H., & Dierickx, K. (2021). Research integrity codes of conduct in Europe: Understanding the divergences. *Bioethics*. https://doi.org/10.1111/bioe.12851

Dezhina, I. G. (2023). Advantages and challenges to open science practices. *Terra Economicus, 21*(3), 70–87. https://doi.org/10.18522/2073-6606-2023-21-3-70-87

Enserink, M. (2012, November 28). Final Report: Stapel Affair Points to Bigger Problems in Social Psychology. *Www.science.org.* https://www.science.org/content/article/final-report-stapel-affair-points-bigger-problems-social-psychology

EUA.eu. (2025). Open Science. *Www.eua.eu.* https://www.eua.eu/our-work/topics/open-science.html

European Commission. (2021). European research development and deployment of AI. *Shaping Europe's Digital Future*. https://digital-strategy.ec.europa.eu/en/policies/european-ai-research

European Commission. (2023). Open access. Research and Innovation. https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/our-digital-future/open-science/open-access_en

Evans, N., Schmolmueller, A., Stolper, M., Inguaggiato, G., Hooghiemstra, A., Tokalic, R., & Widdershoven, G. (2022). VIRT2UE: A European Train-the-Trainer Programme for Teaching Research Integrity. https://doi.org/10.31219/osf.io/mfx32

Evans, N., Marusic, A., Foeger, N., Lofstrom, E., van Hoof, M., Vrijhoef-Welten, S., Inguaggiato, G., Dierickx, K., Bouter, L., & Widdershoven, G. (2021). Virtue-based ethics and integrity of research: train-the-trainer programme for upholding the principles and practices of the European Code of Conduct for Research Integrity (VIRT2UE). *Research Ideas and Outcomes, 7*. https://doi.org/10.3897/rio.7.e68258

Field, S. M., Thompson, J., Sarah de Rijcke, Penders, B., & Munafò, M. R. (2024). Exploring the dimensions of responsible research systems and cultures: a scoping review. *Royal Society Open Science, 11*(1). https://doi.org/10.1098/rsos.230624

Gauchat, G. (2012). Politicization of Science in the Public Sphere. *American Sociological Review, 77*(2), 167–187. https://doi.org/10.1177/0003122412438225

General – Folding@home. (2020). *Foldingathome.org.* https://foldingathome.org/faq/project-details/

Glanz, J., & Armendariz, A. (2017, March 8). Years of Ethics Charges, but Star Cancer Researcher Gets a Pass. *The New York Times.* https://www.nytimes.com/2017/03/08/science/cancer-carlo-croce.html

Gruebner, C. (2025, June 16). "A preregistration plan is a plan, not a prison." *Open Science Future.* https://open-science-future.zbw.eu/en/a-preregistration-plan-is-a-plan-not-a-prison/

Hastings, R., Labib, K., Lechner, I., Bouter, L., Widdershoven, G., & Evans, N. (2023). Guidance on research integrity provided by pan-European discipline-specific learned societies: A scoping review. *Science and Public Policy, 50*(2), 318–335. https://doi.org/10.1093/scipol/scac067

Haven, T. L., Tijdink, J. K., Martinson, B. C., & Bouter, L. M. (2019). Perceptions of research integrity climate differ between academic ranks and disciplinary fields: Results from a survey among academic researchers in Amsterdam. *PLOS ONE, 14*(1), e0210599. https://doi.org/10.1371/journal.pone.0210599

Haven, T., Gopalakrishna, G., Tijdink, J., van der Schot, D., & Bouter, L. (2022). Promoting trust in research and researchers: How open science and research integrity are intertwined. *BMC Research Notes, 15*(1). https://doi.org/10.1186/s13104-022-06169-y

Horbach, S. P. J. M., Fishberg, R., Ulpts, S., & Degn, L. (2024). Thou Shalt Not! – How the institutional afterlife of research misconduct scandals shapes research integrity training. *Journal of Responsible Innovation, 11*(1). https://doi.org/10.1080/23299460.2024.2414500

Huang, C., & Soete, L. (2025). Reconciling open science with technological sovereignty. *Economics of Innovation and New Technology, 1–15*. https://doi.org/10.1080/10438599.2025.2459764

Husiev, O., Ukar Arrien, O., & Enciso-Santocildes, M. (2023). What does Horizon 2020 contribute to? Analysing and visualising the community practices of Europe's largest research and innovation programme. *Energy Research & Social Science, 95*, 102879. https://doi.org/10.1016/j.erss.2022.102879

Increased ERC funding for top global researchers moving to Europe now confirmed. (2025, June 17). *ERC.* https://erc.europa.eu/news-events/news/increased-erc-funding-top-global-researchers-moving-europe-now-confirmed

Jarrett, C. (2015, August 27). This is what happened when psychologists tried to replicate 100 previously published findings. BPS; *The British Psychological Society.* https://www.bps.org.uk/research-digest/what-happened-when-psychologists-tried-replicate-100-previously-published-findings

Kalkman, J. P., & Molendijk, T. (2019). The Role of Strategic Ambiguity in Moral Injury: A Case Study of Dutch Border Guards

Facing Moral Challenges. *Journal of Management Inquiry, 30*(2), 105649261989269. https://doi.org/10.1177/1056492619892693

Karampekios, N., Oikonomou, I., Carayannis, E. G., & Springerlink (Online Service). (2018). The Emergence of EU Defense Research Policy : From Innovation to Militarization. Springer International Publishing.

Kornfeld, D. S. (2012). Perspective: research misconduct: the search for a remedy. *Academic Medicine, 87*(7), 877–882. https://doi.org/10.1097/acm.0b013e318257ee6a

Labib, K., Evans, N., Roje, R., Kavouras, P., Reyes Elizondo, A., Kaltenbrunner, W., Buljan, I., Ravn, T., Widdershoven, G., Bouter, L., Charitidis, C., Sørensen, M. P., & Tijdink, J. (2021). Education and training policies for research integrity: Insights from a focus group study. *Science and Public Policy, 49*(2), 246–266. https://doi.org/10.1093/scipol/scab077

Lencsés, Á. (2022). Challenges of promoting open science within the NI4OS-Europe project in Hungary. *PUBMET, 30–31*. https://doi.org/10.15291/pubmet.3929

Lo, C. K. (2023). What Is the Impact of ChatGPT on Education? A Rapid Review of the Literature. *Education Sciences, 13*(4), 1–15. https://doi.org/10.3390/educsci13040410

Martinson, B. C., Thrush, C. R., & Lauren Crain, A. (2012). Development and Validation of the Survey of Organizational Research Climate (SORC). Science and Engineering Ethics, 19(3), 813–834. https://doi.org/10.1007/s11948-012-9410-7

McKie, R. (2019, November 9). Climategate 10 years on: what lessons have we learned? *The Guardian.* https://www.theguardian.com/theobserver/2019/nov/09/climategate-10-years-on-what-lessons-have-we-learned

Menni, C., Valdes, A. M., Freidin, M. B., Sudre, C. H., Nguyen, L. H., Drew, D. A., Ganesh, S., Varsavsky, T., Cardoso, M. J., El-Sayed Moustafa, J. S., Visconti, A., Hysi, P., Bowyer, R. C. E., Mangino, M., Falchi, M., Wolf, J., Ourselin, S., Chan, A. T., Steves, C. J., & Spector, T. D. (2020). Real-time tracking of self-reported symptoms to predict potential COVID-19. *Nature Medicine, 26*, 1037–1040. https://doi.org/10.1038/s41591-020-0916-2

Meyer, G. (2021). University PR and Efforts to Prevent Research Misconduct. Cambridge Scholars Publishing.

Mondragón Barrios, L., Jiménez Tapia, J. A., Meza Mercado, D. M., & Sosa Mora, L. (2017).

Regulation and self-regulation of ethical practices in scientific publication. *Salud Mental, 40*(5), 227–234. https://doi.org/10.17711/sm.0185-3325.2017.029

National Academies of Sciences Engineering, Affairs Policy and Global, Committee on Science Engineering, & Science Committee on Responsible. (2017). Incidence and Consequences. *Iwww.ncbi.nlm.nih.gov.* National Academies Press (US). https://www.ncbi.nlm.nih.gov/books/NBK475945/

Nature. (2016). Macchiarini scandal is a valuable lesson for the Karolinska Institute. *Nature, 537*(7619), 137–137. https://doi.org/10.1038/537137a

NHL Stenden University of Applied Sciences. (2025). Research Integrity | NHL Stenden university of applied sciences. Nhlstenden.com. https://www.nhlstenden.com/en/research/research-integrity

OPUS. (2024, December 13). OSCAR Project: Advancing Open Science and Research Assessment Reform in European Universities – Open and Universal Science (OPUS) Project. Open and Universal Science (OPUS) Project – OPUS Helps Reform the Assessment of #Research in All Research.

Organisations towards a System That Incentivise Researchers to Practice; Open and Universal Science (OPUS) Project. https://opusproject.eu/openscience-news/oscar-project-advancing-open-science-and-research-assessment-reform-in-european-universities/

Perković Paloš, A., Roje, R., Tomić, V., & Marušić, A. (2023). Creating research ethics and integrity country report cards: Case study from Europe. *Accountability in Research, 31*(6), 1–35. https://doi.org/10.1080/08989621.2022.2163632

Peršak, N. (2025). Research Integrity and Qualitative Research: Tackling and Researching UnethicalPractices at the Top. Advances in *Research Ethics and Integrity, 12*, 235–251. https://doi.org/10.1108/s2398-601820250000012014

Publications Office of the European Union. (2025, March 31). The European Open Science Cloud: How this initiative is advancing open data and collaboration | data.europa.eu. *Europa.eu*. https://data.europa.eu/en/news-events/news/european-open-science-cloud-how-initiative-advancing-open-data-and-collaboration

Rabin, R. C., & Gabler, E. (2020, June 4). Two Huge Covid-19 Studies Are Retracted After Scientists

Sound Alarms. The New York Times. https://www.nytimes.com/2020/06/04/health/coronavirus-hydroxychloroquine.html

Rettberg, N., & Schmidt, B. (2012). OpenAIRE – Building a collaborative Open Access infrastructure for European researchers. *LIBER Quarterly, 22*(3), 160. https://doi.org/10.18352/lq.8110

Riley, N. (2025, April 14). Harvard University rejects conditions for federal funding, Trump administration freezes $2.2B in grants. *Cbsnews.com*; CBS Boston. https://www.cbsnews.com/boston/news/harvard-university-trump-federal-funding/

Rothfritz, L. (2019). The FAIR data principles. https://doi.org/10.14293/s2199-1006.1.sor-compsci.clnbrup.v1

Schulte-Buskase, A., & Gruhn, A. (2024). Open Educational Practices mit, durch und trotz Open

Educational Resources. MedienPädagogik: *Zeitschrift Für Theorie Und Praxis Der Medienbildung, 62*, 117–131. https://doi.org/10.21240/mpaed/62/2024.11.06.x

Shen, C., & Björk, B.-C. (2015). “Predatory” open access: a longitudinal study of article volumes and market characteristics. *BMC Medicine, 13*(1). https://doi.org/10.1186/s12916-015-0469-2

Smart, P. (2017). Predatory journals and researcher needs. *Learned Publishing, 30*(2), 103–105. https://doi.org/10.1002/leap.1101

Sørensen, T. B., & Dumay, X. (2024). The European Union’s governance of teachers and the evolution of a bridging issue field since the mid-2000s. *European Educational Research Journal, 23*(2), 237–260. https://doi.org/10.1177/14749041241234695

Sørensen, T. B., Grimaldi , E., & Gajderowicz , T. (2021). Rhetoric or Game Changer: Social Dialogue and Industrial Relations in Education Midst EU Governance and Privatisation in Europe. Brussels: ETUCE.

Spain, S. (2023). What do we know about scientific misconduct? A guide to reporting about research integrity. SMC España. https://sciencemediacentre.es/en/what-do-we-know-about-scientific-misconduct-guide-reporting-about-research-integrity

Stankovic, B. (2004). Pulp fiction: reflections on scientific misconduct. Wis. L. Rev., 975.

Steinberg, N. A. (2000). Regulation of scientific misconduct in federally funded research. C. Cal. Interdisc. LJ, 10, 39.

Steneck, N. H. (2006). Fostering integrity in research: definitions, current knowledge, and future directions. *Science and Engineering Ethics, 12*(1), 53–74. https://doi.org/10.1007/pl00022268

Stricker, J., & Günther, A. (2019). Scientific Misconduct in Psychology. *Zeitschrift Für Psychologie, 227*(1), 53–63. https://doi.org/10.1027/2151-2604/a000356

Sullivan, B. L., Wood, C. L., Iliff, M. J., Bonney, R. E., Fink, D., & Kelling, S. (2009). eBird: A citizen-based bird observation network in the biological sciences. *Biological Conservation, 142*(10), 2282–2292. https://doi.org/10.1016/j.biocon.2009.05.006

Thierry, E. C. (2022). Scientific integrity: Handling knowledge as a public good.

Turakhiya, U. (2017, October 9). Research Integrity: Integral to Good Science. Club SciWri. https://sciwri.club/archives/4783

Vendé, B., Barberousse, A., & Ruphy, S. (2025). From 2015 to 2023, eight years of empirical research on research integrity: a scoping review. *Research Integrity and Peer Review, 10*(1). https://doi.org/10.1186/s41073-025-00163-1

Wikipedia Contributors. (2024, November 17). Beall's List. Wikipedia; Wikimedia Foundation. https://en.wikipedia.org/wiki/Beall%27s_List

ZooUniverse. (2020). GalaxyZoo Project. Zooniverse.org. https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/

Chapter 2
Debunking Myths about Research (Mis)conduct

Seven common misconceptions (MYTHS) about research integrity

Myth 1: Research misconduct only happens in "bad" research environments or with unethical researchers.

In reality, research integrity issues can occur in any environment. Good researchers can make poor decisions under pressure, and even well-intentioned labs or other research environments can develop problematic cultures or practices over time.

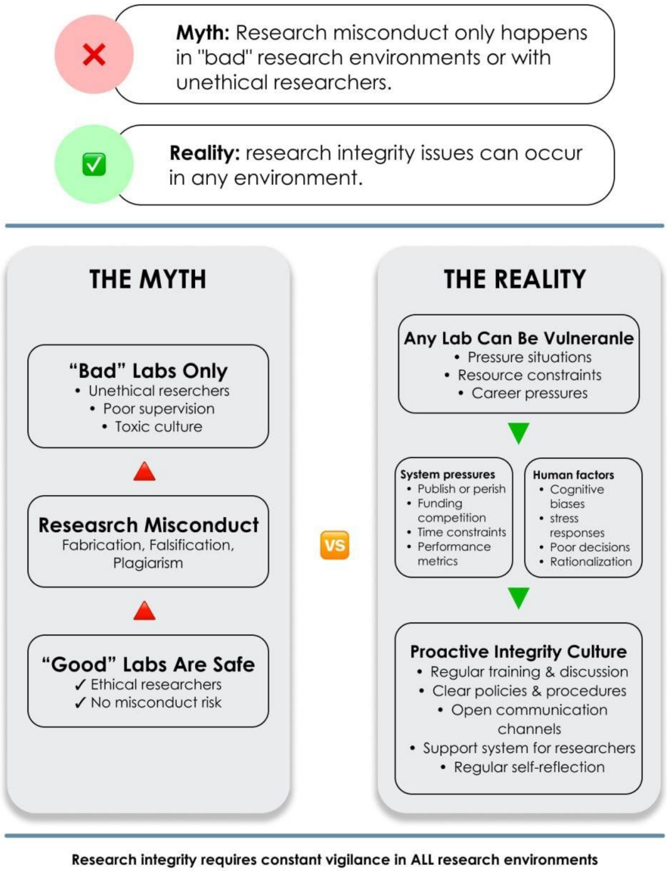

Figure 2.1. Research Misconduct only happens in "Bad" Labs

Myth 2: Research misconduct is rare and only involves major scandals that make headlines.

Reality: While serious cases of fabrication, falsification, and plagiarism grab media attention, questionable research practices (QRPs) are far more common and equally damaging to scientific integrity. Studies suggest that minor forms of misconduct occur frequently across disciplines

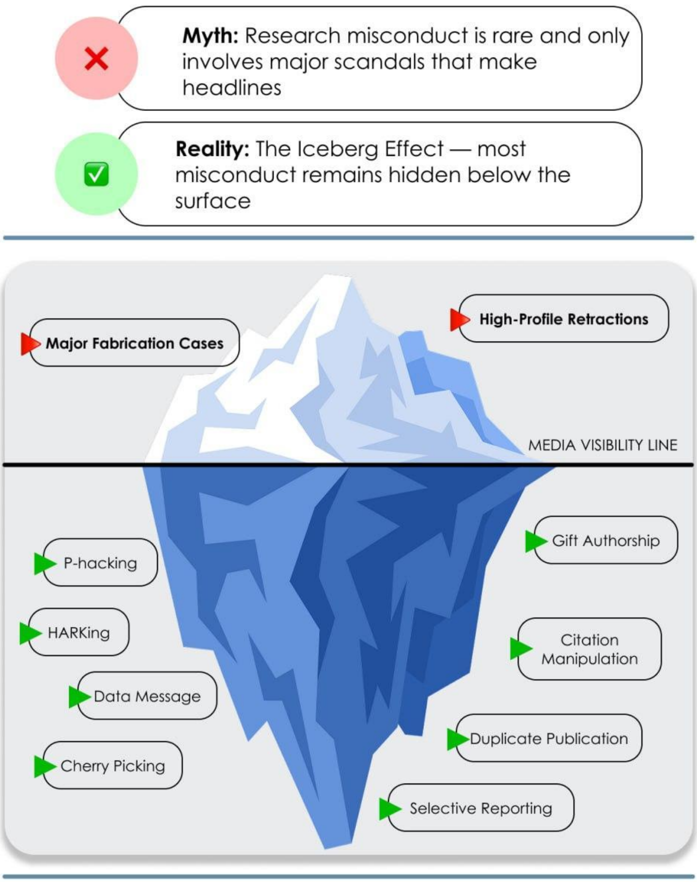

Figure 2.2. Misconception of research misconduct as rare

Myth 3: Strong oversight and regulation can completely prevent research misconduct.

Reality: While robust oversight systems are essential, they cannot eliminate all misconduct. Over-regulation can create compliance-focused cultures that miss the spirit of research integrity, and determined individuals can circumvent even sophisticated monitoring systems.

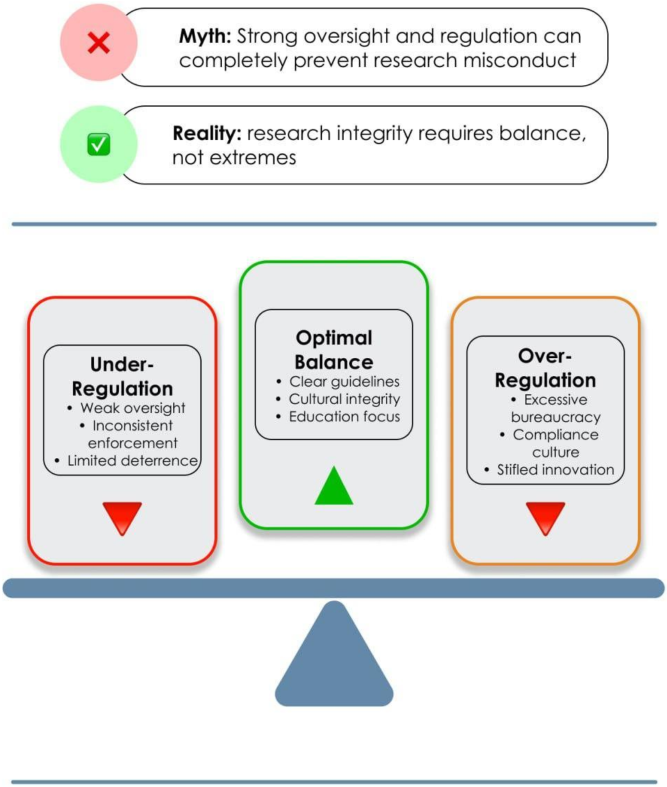

Figure 2.3. Limits of oversight in preventing misconduct

Myth 4: Research misconduct is primarily a problem in developing countries or non-Western research systems.

Reality: Research misconduct occurs globally across all research systems, regardless of economic development or cultural background. While different regions may face different challenges, integrity issues are universal and require internationally coordinated responses.

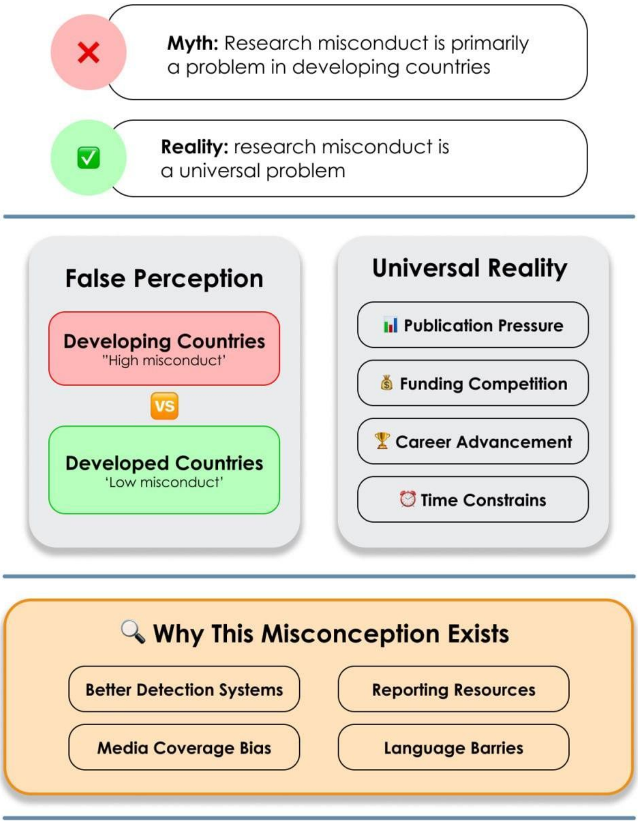

Figure 2.4. Misconception that misconduct is limited to non-Western systems

Myth 5: Technology and AI tools can solve research integrity problems by automatically detecting misconduct.

Reality: While technology offers powerful tools for detecting certain forms of misconduct (like plagiarism or image manipulation), it cannot address underlying causes or prevent all forms of problematic behavior. Technology solutions require human interpretation and can create new integrity challenges.

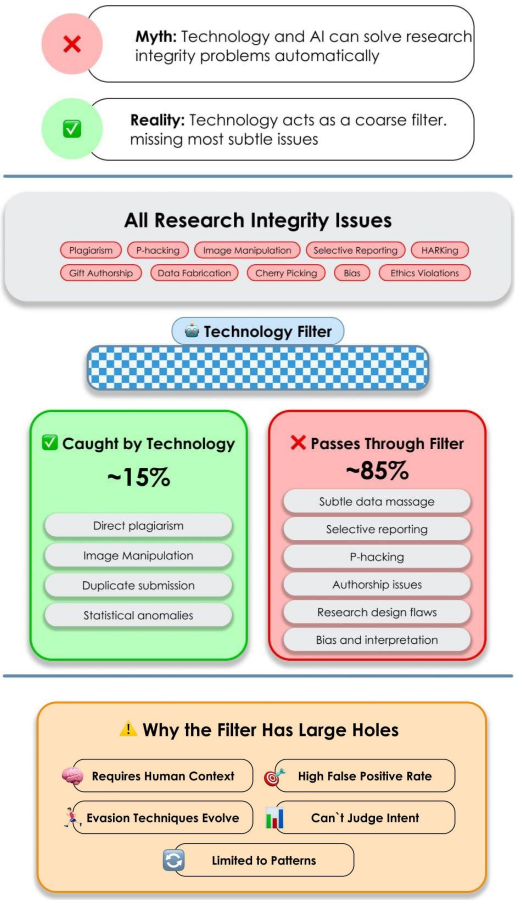

Figure 2.5. Limits of technology in ensuring research integrity

Myth 6: Young researchers and students are more likely to commit research misconduct due to inexperience.

Reality: Research misconduct occurs across all career stages and experience levels. While early-career researchers face unique pressures and may lack training, senior researchers also commit misconduct, sometimes at higher rates due to greater autonomy and less oversight.

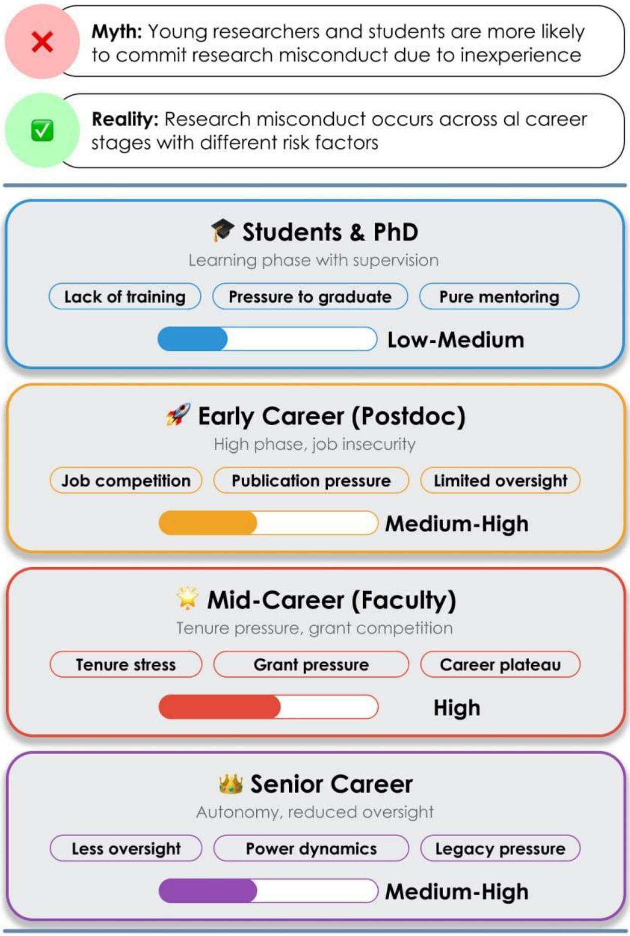

Figure 2.6. Misconduct Risk Across Career Stages

Myth 7: Research misconduct is always intentional and malicious.

Reality: Many research integrity violations result from negligence, inadequate training, systemic pressures, or honest mistakes rather than deliberate deception. Understanding the spectrum of intent is crucial for developing appropriate prevention and response strategies.

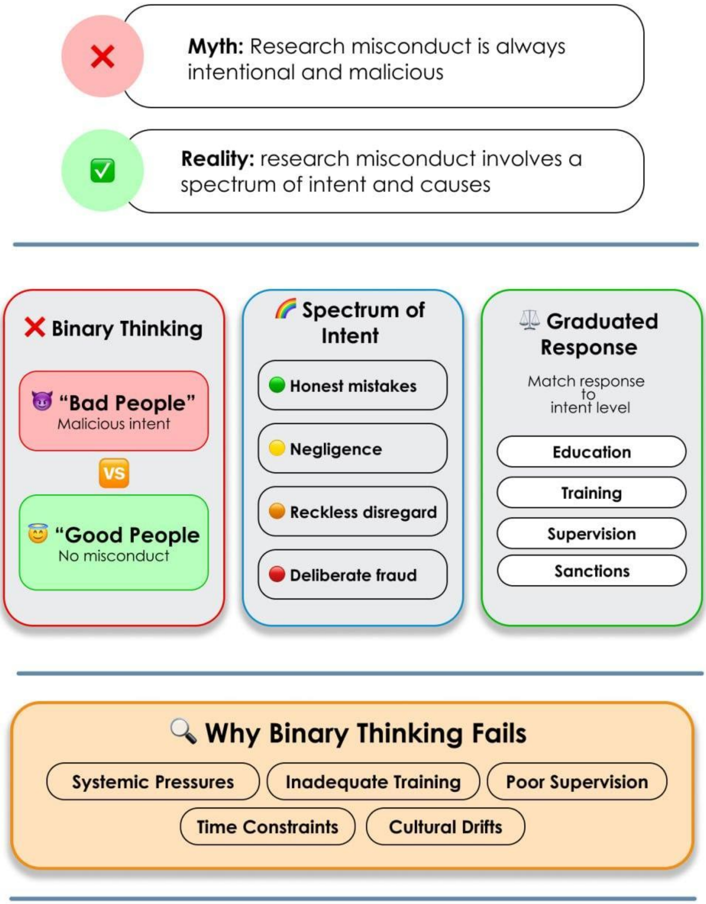

Figure 2.7. Misconception that misconduct is always intentional

Cultural and institutional barriers

Despite growing awareness of research integrity issues, significant cultural and institutional barriers continue to impede our understanding of research misconduct. These barriers operate at multiple levels: from individual cognitive biases to systemic institutional structures, creating blind spots that prevent effective recognition, discussion, and prevention of integrity violations. Understanding these barriers is crucial for developing more nuanced and effective approaches to research integrity.

The persistence of myths about research misconduct often stems from these deeply embedded cultural and institutional factors that shape how we perceive, discuss, and respond to integrity issues. By identifying and addressing these barriers, we can create more open and honest conversations about the realities of research misconduct.

The following dialogues present realistic (though made up) conversations between researchers that illustrate how cultural and institutional barriers manifest in everyday academic interactions. These scenarios demonstrate how well-intentioned individuals can perpetuate myths about research misconduct, avoid difficult conversations, and maintain systems that impede understanding of integrity issues. Each dialogue is followed by a brief analysis of the barriers at play.

Dialogue 1: The "Pure Science" Myth

Setting: Two faculty members discussing a recent misconduct case at a neighboring institution

Dr. Martinez (Senior Faculty): Did you hear about that fabrication case at State University? I just can't understand how something like that happens.

Dr. Kim (Junior Faculty): It's shocking. The researcher had such a good reputation too.

Dr. Martinez: Well, that's the thing: real scientists don't do things like that. Science is self-correcting. Peer review catches these problems before they become serious.

Dr. Kim: But the fabrication went on for years before anyone noticed...

Dr. Martinez: That just shows it wasn't real science to begin with. If you're doing good, honest research, following proper methodology, these issues don't arise. The system works when people work within it properly.

Dr. Kim: I suppose, but what about all the pressure to publish and get funding? Sometimes I feel like –

Dr. Martinez: *interrupting* Pressure is no excuse. If you can't handle the demands of academic research with complete integrity, maybe this isn't the right career. We can't lower our standards because some people can't cope.

Dr. Kim: *hesitates* Right, of course. I just meant...

Dr. Martinez: The beauty of science is that truth always emerges. Bad science gets exposed, good science prevails. That's why cases like this are so rare – the system naturally selects against fraud.

Analysis of Barriers:

- Idealization of science: Dr. Martinez treats science as inherently pure and self-correcting.
- Hero worship: Assumption that "real scientists" are incapable of misconduct.
- Denial of systemic issues: Dismissal of environmental pressures as irrelevant.
- Silencing effect: Dr. Kim's attempt to discuss pressures is shut down.

Your thoughts and recommendations for characters:

Dialogue 2: Institutional Reputation Protection

Setting: Department meeting discussing a PhD student's questionable research practices

Dr. Thompson (Department Head): We need to discuss the situation with Alex's research. There are some concerns about data handling.

Dr. Patel: What kind of concerns exactly?

Dr. Thompson: Well, let's just say there are irregularities that need to be addressed. But we need to be very careful about how we handle this.

Dr. Rodriguez: Are we talking about possible misconduct?

Dr. Thompson: Let's not use that word yet. We don't want to blow this out of proportion. The last thing we need is negative publicity for the department.

Dr. Chen: But if there are serious issues...

Dr. Thompson: Alex is a good student who's under a lot of pressure to finish. Sometimes people make mistakes when they're stressed. We should handle this internally, provide some additional mentoring.

Dr. Patel: What about our obligation to report potential misconduct?

Dr. Thompson: We're not there yet. Let's exhaust all other options first. Think about Alex's career, think about our department's reputation. We don't want to destroy a promising young scientist over what might be a misunderstanding.

Dr. Rodriguez: But what if other students see that questionable practices get overlooked?

Dr. Thompson: *firmly* We're not overlooking anything. We're being responsible and measured. This stays in this room until we decide how to proceed.

Analysis of barriers:

- Reputation protection: Priority on institutional image over integrity
- Euphemistic language: Avoiding direct discussion of misconduct
- Conflict of interest: Personal relationships affecting judgment
- Silencing mechanisms: Restricting communication about the issue

Your thoughts and recommendations for characters:

Dialogue 3: Hierarchical Power Dynamics

Setting: A postdoc raising concerns about their advisor's research practices

Dr. Sarah (Postdoc): I'm worried about some of the practices in Dr. Williams' lab. The data analysis seems... problematic.

Dr. James (Senior Postdoc): What do you mean?

Dr. Sarah: Well, there's a lot of cherry-picking of results, and when experiments don't work out, we just don't report them. Is that normal?

Dr. James: *looking around nervously* Sarah, you need to be careful about questions like that. Dr. Williams is highly respected in the field.

Dr. Sarah: I know, but I've been reading about research integrity, and some of these practices seem questionable.

Dr. James: Look, Dr. Williams has been doing this for twenty years. They have tenure, major grants, and serve on editorial boards. Don't you think they know what they're doing?

Dr. Sarah: But the guidelines say–

Dr. James: *interrupting* Guidelines are one thing, but real research is more complicated. You're new to this. Dr. Williams is training you in how things actually work in competitive science.

Dr. Sarah: So I should just go along with it?

Dr. James: I'm saying you should trust your mentor and focus on learning. Asking too many questions about established practices won't help your career. Word gets around.

Dr. Sarah: But what if someone asks me about these practices later?

Dr. James: Then you say you followed your advisor's guidance. That's what everyone does. Don't overthink it.

Analysis of Barriers:

- Authority deference: Equating seniority with ethical correctness
- Career threat implications: Using professional consequences to silence concerns.
- Normalization of questionable practices: Presenting problematic behavior as standard.
- Isolation: Making the questioner feel alone and naive.

Your thoughts and recommendations for characters:

Dialogue 4: Disciplinary Exceptionalism

Setting: Interdisciplinary research meeting where different field norms collide

Dr. Liu (Computer Science): In our field, we routinely share code and datasets. It's expected for reproducibility.

Dr. Anderson (Social Psychology): That's interesting, but our data involves human subjects. We can't just share everything openly.

Dr. Liu: Of course, but within the research team, surely transparency is important?

Dr. Foster (Business School): You have to understand, in business research, we often work with proprietary industry data. Sharing isn't always possible.

Dr. Anderson: Exactly. Every field has its own standards. What works in computer science doesn't necessarily apply to psychology or business.

Dr. Liu: But basic principles of transparency and reproducibility should be universal, right?

Dr. Foster: That's a very computer science way of thinking. In the real world of business research, we have to balance multiple considerations – ethics, confidentiality, commercial interests.

Dr. Anderson: And in psychology, we have decades of established practices that work for our field. We can't just import standards from other disciplines.

Dr. Liu: But what about cases where lack of transparency has led to problems? The replication crisis affects multiple fields.

Dr. Foster: Those are isolated incidents blown out of proportion. Most business research is perfectly valid using our established methods.

Dr. Anderson: Same with psychology. We have peer review, institutional oversight. Our field's standards have evolved for good reasons.

Dr. Liu: So there's no room for improvement or cross-disciplinary learning?

Dr. Foster: I'm not saying that, but we shouldn't assume that one size fits all when it comes to research practices.

Analysis of Barriers:

- Disciplinary silos: Resistance to cross-field standards and learning.

- Defensive exceptionalism: Claiming unique circumstances exempt fields from general principles.
- Minimization: Dismissing documented problems as "isolated incidents."
- False complexity: Using field-specific challenges to avoid addressing universal principles.

Your thoughts and recommendations for characters:

Dialogue 5: The Bystander Effect in Action

Setting: Faculty lounge conversation about a colleague's suspicious publication pattern

Dr. Green: Have you noticed Dr. Peterson's recent publications? The productivity seems... unusual.

Dr. Blue: What do you mean?

Dr. Green: Ten papers in six months, all with very similar methodology and almost identical figures. It's raising some eyebrows.

Dr. White: *overhearing* Are you talking about Peterson's work?

Dr. Blue: Green was just mentioning the high publication rate.

Dr. White: Yeah, I noticed that too. Some of the data looks recycled.

Dr. Red: *joining the conversation* Oh, Peterson's papers? Yeah, there's definitely something odd there.

Dr. Green: So... should someone say something?

Dr. Blue: Say something to whom?

Dr. White: Well, there's the research integrity office, but I don't really know how that works.

Dr. Red: Plus, it's just suspicious patterns. We don't have proof of anything.

Dr. Green: But if we all see it...

Dr. Blue: I mean, Peterson is in a different department. It's not really our business.

Dr. White: And the department head over there is Peterson's close collaborator. Awkward.

Dr. Red: Besides, if it's really problematic, surely someone closer to the situation will address it.

Dr. Green: I suppose the journal editors would catch major problems.

Dr. Blue: Exactly. There are systems in place. If there were real issues, they'd be detected.

Dr. White: And Peterson has been here for years. Hard to believe they'd suddenly start cutting corners.

Dr. Red: Probably just a coincidence. Maybe they had a lot of data ready to publish.

Dr. Green: *uncertainly* Yeah, you're probably right.

Analysis of Barriers:

- Diffusion of responsibility: Each person assumes someone else will act.
- Uncertainty about procedures: Lack of clear knowledge about how to report concerns.
- Boundary rationalization: Using departmental divisions to avoid responsibility.
- Benefit of the doubt: Finding excuses to avoid taking action.
- System faith: Assuming other mechanisms will catch problems.

Your thoughts and recommendations for characters:

Dialogue 6: Cognitive Dissonance and Rationalization

Setting: Two researchers discussing unexpected results that contradict their hypothesis

Dr. Taylor (Principal Investigator): These results don't make any sense. We've been working on this hypothesis for three years.

Dr. Morgan (Research Associate): The data seems pretty clear though. All three experiments show the opposite of what we predicted.

Dr. Taylor: There must be something wrong with the methodology. Check the equipment calibration again.

Dr. Morgan: I've checked everything twice. The protocols were followed exactly.

Dr. Taylor: *frustrated* This can't be right. Our preliminary data clearly supported the hypothesis. The theory is sound.

Dr. Morgan: Maybe the preliminary sample was too small? Or there were confounding variables we didn't account for?

Dr. Taylor: *pacing* You know what? I bet it's the new batch of reagents. The supplier probably changed something without telling us.

Dr. Morgan: We could run the experiments again with fresh reagents, but that will take months and we're already behind schedule.

Dr. Taylor: Look, we know the effect exists. We've seen it before. These results are probably just noise from some technical issue we haven't identified yet.

Dr. Morgan: But what if we report these results? Negative findings are important too...

Dr. Taylor: *sharply* Negative findings don't get published in high-impact journals. They don't get cited. They don't advance careers or secure funding.

Dr. Morgan: So what do we do?

Dr. Taylor: We troubleshoot until we get it right. The truth is out there – we just need to find the right conditions to reveal it.

Dr. Morgan: Should we at least mention these contradictory results in the paper?

Dr. Taylor: Why confuse reviewers with technical artifacts? Once we figure out what went wrong, these results will be irrelevant anyway.

Dr. Morgan: *hesitating* I guess... but it feels like we're only looking for evidence that supports what we want to find.

Dr. Taylor: That's not what we're doing. We're being thorough scientists who don't give up when faced with obvious experimental errors.

Analysis of Barriers:

- Confirmation bias: Rejecting data that doesn't fit preconceptions
- Sunk cost fallacy: Unwillingness to abandon invested effort and time.
- Rationalization: Creating elaborate explanations to avoid confronting unwelcome results
- Career pressure: Prioritizing publishability over scientific honesty
- Motivated reasoning: Using scientific-sounding justifications for questionable decisions

Your thoughts and recommendations for characters:

Dialogue 7: International and Cultural Misunderstandings

Setting: Zoom call between international collaborators discussing authorship and data sharing

Dr. Nakamura (Japan): Thank you all for joining. We need to discuss the authorship order for our joint publication.

Dr. Schmidt (Germany): Yes, I've prepared a draft based on contribution levels. I suggest alphabetical order within each contribution category.

Dr. Zhao (China): *politely* I appreciate Dr. Schmidt's work, but in our tradition, senior researchers should be listed according to their status and the honor of the collaboration.

Dr. Johnson (USA): Well, our institutional guidelines are pretty clear about basing authorship on actual contributions to the work.

Dr. Patel (India): I agree with Dr. Johnson, but we should also consider that Prof. Chen provided the initial funding and lab space. That deserves recognition.

Dr. Nakamura: In Japan, we often list the lab director last as a position of honor, regardless of direct contribution.

Dr. Schmidt: But that could be seen as gift authorship under current international standards...

Dr. Zhao: *carefully* I think there may be a misunderstanding. Prof. Chen has overseen every aspect of this project. To not include them would be... inappropriate in our context.

Dr. Johnson: I'm not saying Prof. Chen shouldn't be included, but we need to document their specific contributions.

Dr. Patel: Perhaps we're overthinking this. These guidelines are meant for preventing problems, not creating them between honest collaborators.

Dr. Nakamura: *diplomatically* Maybe we could find a way that respects everyone's institutional requirements?

Dr. Schmidt: The problem is, if we submit to a Western journal, they might question authorship that doesn't match international standards.

Dr. Zhao: Are you suggesting our practices are unethical?

Dr. Johnson: No, no, not at all. It's just that different systems have different expectations...

Dr. Patel: But whose standards should take precedence? We're all following our local guidelines.

Dr. Nakamura: Perhaps the real issue is that we didn't discuss these differences at the beginning of our collaboration.

Dr. Schmidt: True, but now we need to find a solution that won't cause problems for anyone.

Dr. Zhao: *quietly* I worry that adapting to Western standards might cause difficulties with my institution.

Dr. Johnson: And I worry that not following our standards might cause problems with mine.

Analysis of Barriers:

- Cultural relativism: Different cultural norms about hierarchy, honor, and recognition.
- Communication styles: Indirect versus direct approaches to conflict.
- Institutional pressures: Local requirements conflicting with international standards.
- Power dynamics: Western standards often seen as "international" standards.
- Fear of cultural imperialism: Resistance to adopting outside practices.
- Lack of early communication: Assumptions about shared understanding.

Your thoughts and recommendations for characters:

These dialogues illustrate how cultural and institutional barriers operate in everyday academic interactions. They show how well-meaning individuals can perpetuate systems that obscure rather than illuminate research integrity issues.

Recognizing these patterns is the first step toward creating more open, honest, and effective approaches to research integrity. The goal is not to blame individuals caught in these dynamics, but to understand how structural and cultural forces shape behavior, and to design interventions that make integrity-supporting conversations easier and more natural.

Evidence-based Perspective on Research Integrity Issues: Useful Links

International Organizations and Networks

Committee on Publication Ethics (COPE)

Website: https://publicationethics.org/

Description: Leading organization providing guidance on publication ethics, with flowcharts, guidelines, and case studies for editors, publishers, and researchers

Key Resources:

- COPE Flowcharts for ethical decision-making
- Publication ethics guidelines
- Annual conference and training materials

World Conference on Research Integrity (WCRI)

Website: https://wcrif.org/

Description: Global forum for research integrity discussion, held every 3-4 years with proceedings and declarations

Key Resources:

- Conference proceedings and presentations
- Research integrity declarations and statements

Global Research Council (GRC)

Website: https://globalresearchcouncil.org/

Description: Virtual organization of science funding agencies worldwide, promoting research integrity principles

Key Resources:

- Statement of Principles for Research Integrity
- Best practices for funding organizations

European Network of Research Integrity Offices (ENRIO)

Website: https://www.enrio.eu/

Description: Network of research integrity offices across Europe, sharing best practices and training materials

Key Resources:

- Training materials and courses
- Policy recommendations

Educational and Training Resources

Office of Research Integrity (ORI) – USA

Website: https://ori.hhs.gov/

Description: US government office providing leadership in research integrity education and policy

Key Resources:

- Research integrity training modules
- Case studies and newsletters
- Policy guidance and regulations

Research Integrity Training (Various Platforms)

Collaborative Institutional Training Initiative (CITI Program)

Website: https://about.citiprogram.org/

Description: Comprehensive online training in research ethics and integrity

Key Resources:

- Modular training courses
- Institutional subscriptions available

OnlineEthics Center for Engineering & Science

Website: https://onlineethics.org/

Description: Educational resources for engineering and science ethics

Key Resources:

- Case studies and teaching materials
- Disciplinary-specific content

Publication Integrity and Predatory Publishing

Think. Check. Submit.

Website: https://thinkchecksubmit.org/

Description: International campaign helping researchers identify trusted journals

Key Resources:

- Journal evaluation checklist
- Educational materials and infographics
- Multilingual resources

Directory of Open Access Journals (DOAJ)

Website: https://doaj.org/

Description: Community-curated directory of legitimate open access journals

Key Resources:

- Quality standards for journals
- Journal search and verification

Beall's List (Archived)

Website: https://beallslist.net/ (Current maintained version)

Description: List of potentially predatory publishers and journals

Key Resources:

- Publisher and journal lists
- Criteria for evaluation

Retraction Watch

Website: https://retractionwatch.com/

Description: Blog tracking retractions in scientific literature

Key Resources:

- Retraction database
- Analysis of retraction trends
- Daily updates on retractions

Research Data and Open Science

FAIR Data Principles

Website: https://www.go-fair.org/fair-principles/

Description: Guidelines for making data Findable, Accessible, Interoperable, and Reusable

Key Resources:

- Implementation guidelines
- Training materials

Research Data Alliance (RDA)

Website: https://rd-alliance.org/

Description: Community-driven organization building social and technical infrastructure for data sharing

Key Resources:

- Working group outputs
- Best practice recommendations

Center for Open Science (COS)

Website: https://cos.io/

Description: Organization dedicated to improving research practices through openness and reproducibility

Key Resources:

- Open Science Framework (OSF)
- Reproducibility guidelines
- Training materials

TOP Guidelines

Website: https://cos.io/top/

Description: Transparency and Openness Promotion Guidelines for journals

Key Resources:

- Implementation standards
- Journal adoption tracker

Detection and Analysis Tools

Crossref Similarity Check (iThenticate)

Website: https://www.crossref.org/services/similarity-check/

Description: Plagiarism detection service for scholarly content

Key Resources:

- Similarity checking tools
- Publisher integration

ImageTwin
Website: https://imagetwin.com/
Description: Tool for detecting image manipulation and duplication
Key Resources:

- Image forensics analysis
- Automated screening

statcheck
Website: http://statcheck.io/
Description: statcheck is a "spellchecker" for statistics. It checks whether your *p*-values match their accompanying test statistic and degrees of freedom.
Key Resources:

- Automated statistical checking
- Research on statistical errors

Quick Reference Cards and Checklists

COPE Flowcharts
Direct Link: https://publicationethics.org/guidance/flowcharts
Description: Decision trees for common publication ethics dilemmas
Think Check Submit Checklist
Direct Link: https://thinkchecksubmit.org/check/
Description: Quick checklist for evaluating journal quality
ICMJE Authorship Criteria
Direct Link: http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html
Description: Standard criteria for determining authorship

Chapter 3

Research Cycle – SWOT Analysis of Critical Stages

Misconduct in Research: Forms, Causes, and Consequences

https://sites.google.com/mss.sumdu.edu.ua/osee-chapter-2

Scan Me!

Think of research as an adventure – not the boring, dusty-library kind, but more like a treasure hunt where you're both the explorer and the cartographer. Every breakthrough, from discovering penicillin to creating TikTok's algorithm, started with someone asking "What if?" and then following a path remarkably similar to the one you're about to learn.

This chapter breaks down the research cycle into digestible pieces, analyzing each stage's Strengths, Weaknesses, Opportunities, and Threats (SWOT). Why SWOT? Because understanding what can go right (and wrong) at each stage helps you navigate like a pro, not a lost tourist with a torn map.

When writing about your research methodology, think of it as your scientific GPS – the system that tells you:

- Direction: Where are you heading? (Your research question)
- Methods: How will you get there? (Your tools and techniques)
- Subject: What are you studying? (The phenomenon or problem)
- Object: What specific aspects will you examine? (Your focus area)

For example, imagine you're trying to understand why students procrastinate. Your direction would be exploring procrastination patterns, your methods might include surveys or time-tracking apps, your subject would be student behavior, and your object of study could be the use of social media during study time.

Before finalizing your approach, it's worth running a little thought experiment I like to call the "Would I bet money on it?" test. If someone offered you a thousand euros to prove that your chosen methodology can truly answer your research question, would you take the bet? If your answer is "probably not," it's a sign that your plan might need some fine-tuning.

Your research methodology acts as your roadmap – it helps you stay oriented, organized, and purposeful throughout your study. But like any roadmap, it has its strong and weak points.

To visualize this balance between structure and flexibility, take a look at the diagram below. It summarizes the key strengths, weaknesses, opportunities, and threats that often come with designing and following a research methodology.

Search for Original Ideas: Catching "The Spark"

Where do new research ideas actually come from?

We often imagine someone suddenly shouting "Eureka!" in the middle of a brilliant discovery. But in reality, most ideas don't appear out of nowhere – they grow out of connections, curiosity, and a bit of frustration with how things are.

Sometimes an idea appears when you combine knowledge from different areas. Other times it's when something just doesn't make sense and you think, *"there must be a better way to do this."*

Some discoveries happen completely by accident, like penicillin or the microwave oven, but even those moments of luck only turn into something meaningful when curiosity is already there.

The good news is that you don't have to wait for inspiration to strike. You can actually create the right conditions for it. Think of it like growing plants: you can't force them to sprout, but you can prepare the soil, water it, and give it sunlight. In research, that "fertile soil" comes from active reading, questioning, and experimenting with ideas.

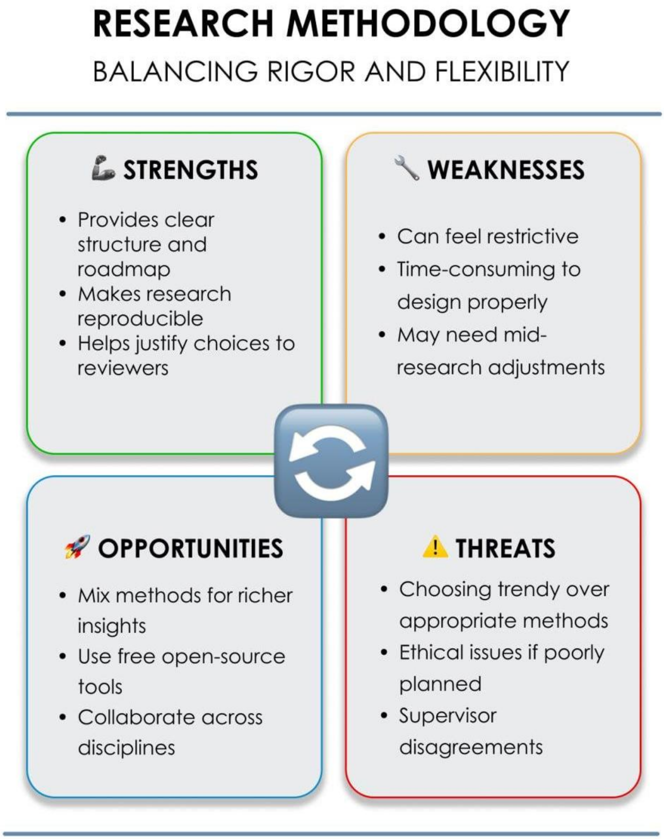

Figure 3.1. SWOT Research Methodology

Here are a few simple techniques that help turn vague thoughts into something real:

1. Keep a quick-note habit. Write down your thoughts as soon as they appear – on your phone, a sticky note, or a voice memo. Some of the best ideas appear when you're half-asleep or just walking somewhere.
2. Try the 30-second explanation. If you can explain your idea clearly and briefly to someone outside your field and they say, "That's interesting," you might be onto something.

3. Look for research gaps. When you read papers, pay attention to phrases like "future research should..." or "a limitation of this study is..." Those are invitations to explore.
4. Connect unrelated things. Pick two random ideas or topics and see if they could somehow work together. For example: *"What if we used game design principles to teach climate change?"*
5. Work backwards. Think about a real problem that needs solving, for instance, something that would make students' lives easier, and then ask, *"What research question would help me get there?"*

Often, one method leads to another. You might have a random thought at night, test it in conversation, find a research gap related to it, and suddenly you're developing a full research project. Ideas rarely come perfectly formed – they evolve as you keep thinking and refining them.

To see how this works in practice, here's a real example of how a small personal frustration turned into meaningful research.

Case Study: From Dorm Room to Discovery

María, a biology student, often helped her family with their greenhouse. She noticed how much time it took to identify plant diseases and wondered if there was a faster way. One day, while using a photo filter app on her phone, she thought: *"If my phone can recognize faces, could it also recognize diseased leaves?"*

It turned out to be a great research idea: realistic, useful, and easy to test. She realized it would require learning some coding and collecting many plant images, but those were challenges she could handle.

The Reality Check:

✓ Feasible with existing technology
✓ Clear practical application
✓ Scalable to help small farmers
✕ Requires coding skills (opportunity to learn!)
✕ Needs large image dataset (collaboration opportunity!)

By the end of her Bachelor's degree, María had built a prototype app that used machine learning to identify plant diseases from photos. What started as an everyday annoyance became a project that eventually helped thousands of local farmers.

Preparation of Funding Applications: The Art of Selling Your Science

Even brilliant ideas need resources. Funding applications are your pitch deck – convincing others that your research deserves time, money, and trust. But here's the reality: funding is highly competitive, with success rates often between 5–20%. That means your application needs to be exceptional, not just good.

Figure 3.2. Mini-SWOT Funding Applications

Test Yourself: Good vs. Bad Application

Read these two opening paragraphs from funding applications for the same project. Which one would you fund?

Application A:

"Climate change is a significant global challenge affecting multiple ecosystems and causing widespread environmental degradation across numerous geographical regions. The scientific community has extensively documented these changes through various methodological approaches. Our research project aims to investigate the multifaceted impacts of climate-related phenomena on agricultural productivity, with particular emphasis on crop cultivation patterns in temperate zones. We will utilize advanced statistical modeling techniques and comprehensive data collection protocols to examine these complex interrelationships."

Application B:

"By 2030, 50% of coffee-growing regions will be unsuitable for cultivation, threatening livelihoods for 25 million farmers and your morning espresso. Our project offers farmers a lifeline: a €50 smartphone app using AI to predict microclimatic changes three months ahead, allowing crop diversification before disaster strikes. In pilot tests with 500 Ethiopian farmers, early adopters increased income by 34% while reducing crop losses by 60%. We're seeking €150,000 to scale this to 50,000 farmers across East Africa within 18 months."

Which application grabbed your attention? Which would you fund? Take a moment to decide before reading on.

The Breakdown: Why Application B Wins

Application A problems:

× Generic opening – could apply to thousands of projects
× Jargon-heavy ("multifaceted impacts," "comprehensive data collection protocols")
× No clear problem statement or real-world impact
× No specific outcomes or timeline
× Doesn't answer "Why should anyone care?"
× No evidence this team can deliver

Application B strengths:

- ✓ Opens with a concrete, relatable problem (50% of coffee regions, your morning coffee)
- ✓ Immediately states the solution (€50 smartphone app)
- ✓ Provides evidence it works (pilot data: 34% income increase, 60% loss reduction)
- ✓ Clear beneficiaries (25 million farmers, specific example: Ethiopian farmers)
- ✓ Specific funding request and timeline (€150,000, 18 months, 50,000 farmers)
- ✓ Creates urgency (2030 deadline)

Key Lessons for Writing Winning Applications

1. The Hook Matters Your opening paragraph determines if reviewers read with enthusiasm or obligation. Start with impact, not background. Answer immediately: "What problem does this solve and why should I care?"

2. Be Concrete, Not Abstract

- Bad: "improve educational outcomes"
- Good: "increase exam pass rates from 60% to 80% for 5,000 students"

3. Show Evidence You Can Deliver Pilot data, preliminary results, team expertise, partnerships – anything proving you're not just dreaming but building on solid foundations.

4. Know Your Audience Research the funder's priorities. If they care about social impact, emphasize that. If they value innovation, highlight novelty. Tailor each application.

5. Budget Realistically Reviewers spot inflated or unrealistic budgets instantly. Every line item should be justified and necessary.

Exercise: The Elevator Pitch Challenge

Now it's your turn. Write a funding application opening for YOUR research idea (real or imagined) in exactly 50 words that your grandmother would understand. No jargon allowed. This is the core of any great funding application.

Your 50-word pitch:

____

____

____

____

____

____

____

____

Remember: Writing funding applications is a skill that improves with practice. Your first attempt won't be perfect, and that's okay. Each application makes you a better communicator, clearer thinker, and more competitive researcher. Start practicing now – your future funded research depends on it.

Research Execution: Where Plans Meet Reality

Let's get real for a moment. Remember those inspiring research stories where everything flows smoothly from hypothesis to breakthrough? Yeah, that's not how it actually works. Research execution is about 20% thrilling "aha!" moments and 80% troubleshooting equipment, waiting for results, redoing experiments, and questioning your life choices at 2 AM in the lab. The sooner you accept this reality, the better. This messy middle stage is where your carefully crafted plans collide with the real world – and the real world doesn't

Survival Strategies

1. The Lab Notebook Revolution

Digital or paper? Doesn't matter – use whatever you'll actually maintain. What matters: date everything, record failures alongside successes (failures teach more), note weird observations (today's anomaly = tomorrow's breakthrough), and document thoroughly enough for someone else to replicate your work. Future you will thank present you.

2. The 70% Rule

Start when you have 70% of what you need, then adapt. Waiting for perfect conditions means never starting. Perfectionism masquerades as diligence but kills progress. Launch that pilot study with the equipment you have. Iterate and improve along the way.

3. The Weekly Checkpoint

Every Friday, spend 30 minutes honestly asking: What worked this week? What failed and what did it teach me? Is my timeline still realistic? Do I need to pivot? Regular reality checks prevent months of drifting off course.

When Things Go Wrong (They Will)

Let's normalize research disasters with the three most common crises:

Common Crisis #1: "My survey has only 12 responses after 3 weeks."

Breathe. This happens to everyone. Quick fixes: check if you're reaching your actual target audience, offer ethical incentives (gift card raffles), ruthlessly shorten your survey, try snowball sampling, and adjust expectations to match reality.

Common Crisis #2: "My experiment keeps giving inconsistent results."

Systematically check hidden variables (temperature, timing, calibration, your own fatigue). Consult experienced researchers – they'll spot what you're missing. Sometimes pivoting is the answer. That's science working, not failing.

Common Crisis #3: "I'm 6 months in and my hypothesis was wrong."

This is completely normal. Science discovers truth, not confirmation. Disproving your hypothesis saves others from dead ends. Document why it failed, then pivot. Many breakthroughs start with "contrary to our hypothesis..."

Sound exhausting? It is. But it's also weirdly addictive when you're genuinely curious about what you're discovering. The key is building resilience, maintaining perspective, and remembering that every successful researcher has lived through countless weeks exactly like this one. You're not failing – you're participating in the gloriously messy reality of knowledge creation.

Figure 3.3. Research week

Analysis and Interpretation: Making Sense of the Chaos

"Data are not information. Information is not knowledge. Knowledge is not wisdom."

– Clifford Stoll

After weeks (or months) of experiments, surveys, or simulations, your screen (or lab notebook) is full of numbers, charts, and notes that look like pure chaos. Now comes the critical phase – turning that chaos into clarity.

This is where the magic happens – and where many researchers stumble. You've worked hard to collect data, but raw data is like uncut diamonds: valuable, but not yet useful. Analysis polishes those diamonds. Interpretation decides what jewelry to make from them. And integrity ensures you don't pass off glass as gems.

Think of this stage as detective work. Your data contains clues about how the world works, but those clues are hidden, mixed with noise, and sometimes pointing in contradictory directions. Your job is to find the real signal, understand what it means, and communicate it honestly – even when the truth isn't what you hoped to discover.

Figure 3.4. Mini-SWOT Analysis & Interpretation

Data Cleaning: The "Laundry Day" of Science

Before you can start analyzing your data, you have to make sure it's clean. That means checking for duplicates, missing values, or entries that clearly make no sense – like someone being 450 years old or having a negative body temperature. It's not the most exciting part of research, but it's absolutely necessary.

If the data isn't cleaned properly, it can easily lead you to false conclusions. One tiny mistake – a misplaced decimal, a repeated row, or a misclassified category – can distort the entire analysis. That's why many researchers say they spend more than half their analysis time just cleaning and organizing data. It's tedious, but it's the foundation of trustworthy results.

When cleaning data, transparency is everything. Every change you make should be recorded and justified. Don't quietly delete an "odd" data point just because it doesn't fit your expectations. Instead, explain why you removed it – or leave it in if you're not sure. The goal isn't to make your data look perfect; it's to make it honest.

Figure 3.5. Data cleaning from chat GPT

Data Analysis: Finding Patterns in the Noise

Now comes the detective work. You've collected all your clues – your data – and it's time to find out what story they're trying to tell.

Whether you're running statistical tests, coding interview transcripts, or building models, the real goal is the same: to uncover patterns that actually mean something.

As you dig in, keep asking yourself:

- Are there relationships between the variables?
- Do different groups behave differently?
- Are there new themes or unexpected trends emerging?

And don't fall for the trap of thinking that "complex" automatically means "better." The best method is always the one that truly fits your research question. Sometimes a simple t-test can tell you more than the most sophisticated machine-learning model – especially if it answers your question clearly and directly.

Interpretation: The Art of Seeing the Invisible

Analysis tells you what happened in your data. Interpretation goes a step further – it explains why it matters. This is the stage where you connect your findings to theories, real-world situations, and the bigger picture.

As you interpret your results, keep asking yourself:

- What story does this data tell?
- Does it confirm, challenge, or nuance existing knowledge?
- What are alternative explanations for these patterns?
- What can I confidently claim, and where should I be cautious?
- Who benefits from knowing this?

It's easy to fall into the trap of overinterpreting – claiming your results prove more than they really do. Remember: a correlation isn't causation, and a trend among 100 students doesn't automatically apply to everyone on the planet. Good research is honest about its limits.

Test Yourself: Can You Spot Overinterpretation?

Below are four statements from a fictional study on social media use and academic performance among 150 university students. Some show careful interpretation, while others stretch the truth a bit too far. Can you tell which is which?

Statement A: "Our results suggest that gamified learning may improve engagement in STEM courses, though further research is needed to determine if this translates to long-term retention."

Statement B: "Our study proves that gamification revolutionizes education and should be implemented immediately in all schools worldwide."

Statement C: "We observed a negative correlation ($r = -0.42$, $p < 0.05$) between daily social media use and GPA in our sample. This suggests that excessive social media use may be associated with lower academic performance among university students, though we cannot determine causation from this correlational data."

Statement D: "Social media destroys students' grades. Our research proves that universities must ban all social media platforms on campus to protect academic standards."

Answers & Explanations:

✓ *Statement A = GOOD interpretation*

It uses careful language ("may improve," "suggest") and acknowledges limitations ("further research is needed"). The claims stay within the boundaries of what was actually studied.

× *Statement B = OVERINTERPRETATION*

It declares absolute proof ("proves"), makes sweeping generalizations ("all schools worldwide"), and recommends major policy changes without adequate evidence.

✓ *Statement C = GOOD interpretation*

It reports specific statistical findings, uses appropriate caution ("suggests," "may be associated"), clearly distinguishes correlation from causation, and limits its claims to the sample studied.

× *Statement D = OVERINTERPRETATION*

It assumes causation, uses extreme language ("destroys," "must ban"), and draws conclusions far beyond what the data can justify.

The takeaway? Good interpretation is a lot like responsible journalism: it tells the truth about what the evidence actually shows, admits what it doesn't, and resists the urge to sensationalize. Overblown claims might sound impressive at first, but they undermine your credibility in the long run. When in doubt, err on the side of humility – your research will speak louder when it's honest.

Integrity in Analysis: Doing the Right Thing When No One's Watching

This is the moment where ethics and pressure collide. When results don't look as perfect as you hoped, it's incredibly tempting to adjust, polish, or quietly hide the rough edges. But here's the truth – integrity is your real superpower in research. It's what separates good scientists from merely clever ones.

Unfortunately, there are a few classic traps that every researcher faces sooner or later:

- Cherry-picking only the results that look good.
- P-hacking until that magical $p < 0.05$ finally appears.
- HARKing – claiming you predicted something after you've already seen the results.
- Deleting outliers just because they look odd or inconvenient.
- Confusing correlation with causation (remember, ice cream sales don't *cause* drowning).
- Overfitting models so tightly to your dataset that they collapse on new data.
- Hiding negative or null results, as if they don't matter.

Every one of these shortcuts might feel harmless in the moment, but together they erode trust – in your work and in science itself.

- The honest approach isn't glamorous, but it's the one that lasts:
- Plan your analysis in advance and stick to it.
- Report every test, even the ones that didn't "work."
- Be upfront about limitations – they make your conclusions stronger, not weaker.
- Share your data and code when you can.
- Ask for feedback before locking in your conclusions.
- And when something unexpected appears, don't hide it – investigate it. That's often where real discoveries begin.

At the end of the day, your reputation is your most valuable research asset. One dishonest decision can undo years of credibility. Each time you choose transparency over convenience, you're not just protecting your integrity – you're quietly shaping a scientific career built on trust and respect.

From Results to Meaningful Impact

Even the most brilliant analysis means little if it never leaves your laptop. The final step of research is sharing your findings in a way that actually reaches people and makes a difference.

Different audiences need different approaches:

- Academic papers: demand precision, detail, and technical depth.
- Conference presentations: should be visual and engaging, highlighting the big ideas rather than every number.
- Policy briefs: need to be concise, clear, and free of jargon – they're meant to be used, not admired.
- Public communication: works best through stories, metaphors, and connections to everyday life.
- Industry reports: focus on what can be applied – the return on investment, the "so what" factor.

Whatever the format, good visualization is your best ally. A single clear figure can say more in three seconds than a dense paragraph can in three minutes. Invest time in making graphs that are not only accurate but also accessible and easy to interpret – and don't forget that colorblind-friendly palettes are part of good scientific design.

Here's a simple test for clarity: could you explain your main finding in thirty seconds to someone outside your field – and actually hold their attention? If they respond with a genuine "Oh, that's interesting," you've done your job. If they just smile politely and nod, it's time to simplify.

In the end, analysis and interpretation only matter when they're transparent, rigorous, and shared honestly. Your data won't call you out for massaging it – but the scientific community eventually will. So, be open about your methods, acknowledge what your work can and can't claim, and don't hide negative results. Science advances not just through success stories, but through every honest attempt to understand a messy world a little better.

Intellectual Property: Your Research Has Value

"Ideas are free–until you make them real."

Whenever you create something new–a discovery, a design, an algorithm, a piece of software, or even a dataset–you are producing intellectual property (IP). In the research world, IP is like an invisible currency. It represents the value embedded in your ideas, methods, and outputs. Intellectual property isn't just about patents or legal paperwork; it's about making sure your work is recognized, respected, and, when appropriate, rewarded.

A lot of early-career researchers think that IP only matters for inventions or commercial products. That's not true. Every piece of research you produce has intellectual value. The paper you write, the code you develop, the survey you design, and the data you collect–all of these carry legal and ethical considerations that influence how they can be used, shared, and credited.

Students often struggle with a common question: how can I embrace Open Science while also protecting my intellectual property? It might seem like a contradiction, but it isn't

Open Science doesn't mean giving away your work for free – it means sharing responsibly and strategically. You can publish open-access articles, share datasets publicly, or post preprints while still maintaining appropriate control over your creations.

Think of it like this:

🔓 **Open Science** = transparency and accessibility for faster progress

🔒 **IP protection** = fairness, recognition, and sustainability for creators

It's not an either/or situation–you can, and should, do both. The important part is knowing when and how to balance sharing with protection.

Choosing the right approach to your work is a bit like picking what to wear for different occasions. You wouldn't wear the same outfit to a job interview, a beach party, and a formal wedding. Similarly, your research outputs may require different strategies depending on their purpose and where you plan to share them.

Some research benefits from being fully open, especially when wider access makes it more valuable, for example:

- Foundational research data → Enables reproducibility and builds on your work
- Educational materials → Teaching locked behind paywalls helps 50 students; openly shared helps 50,000
- Widespread adoption tools → Open-source software like R or Python gains power from massive communities

A real-world example of this is the COVID-19 genome sequences, which were shared openly around the world and helped accelerate vaccine development.

On the other hand, some innovations require strategic protection, particularly when significant investment is needed to bring them to life.

- Commercially viable inventions → Medical devices need funding for trials and manufacturing; investors won't fund what anyone can copy
- Innovations requiring scale → Lab prototype → 10,000 hospitals = €50 million investment
- Industry partnerships → Companies need assurance competitors can't immediately steal results

A well-known case is CRISPR gene-editing, which is heavily patented because developing safe medical applications costs billions.

Sometimes the best approach is a hybrid strategy, balancing openness with sustainability. For socially important innovations, it might make sense to patent in wealthy markets while offering open access in developing regions. Different regional needs can guide this balance–Kenyan farmers might benefit from free access, while European companies can pay licensing fees. This way, public good and financial reality meet: you can generate revenue while maximizing access. A practical example is how some universities license technologies commercially but include provisions that allow free use in developing countries.

Case Study: To Patent or Not to Patent?

Let's make this concrete with a real dilemma you might face.

Scenario: You've developed a low-cost water purification device for developing regions during your Master's thesis.

Patent Path:

✓ Attracts investment for mass production and distribution

✓ Prevents competitors from copying without meaningful improvement

✕ Delays publication by 18+ months (confidentiality requirements)
✕ Costs €5,000–50,000 depending on geographic coverage
Open Source Path:
✓ Immediate global access, allowing communities to build it now
✓ Builds your reputation, enables grant funding for further work
✕ No commercial control over who produces or profits from it
✕ Corporations may manufacture and sell your design without compensation

Hybrid Solution: Patent in wealthy markets (generating revenue to fund operations), while open-sourcing the design in developing regions where people need it most but can't afford commercial products. Many social enterprises successfully use this model, balancing impact with sustainability.

There's rarely one "right" answer. Your IP strategy should align with your values, your research goals, and the real-world impact you want to create.

Figure 3.6. Good practices for researchers

Knowledge and Technology Transfer: From Lab to Life

Imagine you've spent two years on groundbreaking research and published an excellent paper, only for it to sit behind a paywall, read by maybe fifty specialists. Meanwhile, the real-world problem you were studying remains unsolved.

This is where knowledge transfer comes in. Research doesn't stop once you hit "submit" on your manuscript–that's really just the beginning. True impact happens when your discoveries make it out of the ivory tower and start making a difference in the world, whether through partnerships with industry, influencing policy, educational initiatives, or public engagement.

There are several ways research can make a real-world impact, each with its own pathway.

1. Academic → Industry: When Research Becomes Business

This happens when companies scale up the technologies or products you've developed, through licensing agreements, collaborative projects, spin-offs, or contract research. For instance, a university lab might develop an AI algorithm to detect manufacturing defects. By licensing it to a tech company, that algorithm could be deployed in factories across three continents within two years, analyzing products on a million devices and preventing defective items worldwide.

2. Academic → Policy: When Science Shapes Laws

Scientists influence government decisions through policy briefs, expert testimony, advisory boards, or white papers. Environmental researchers studying air pollution, for example, might show that reducing city center traffic by a certain percentage could prevent dozens of premature deaths annually. Lawmakers use this evidence to draft new regulations, and within a year, air quality improves–literally saving lives.

3. Academic → Public: When Everyone Understands

Citizen science projects, podcasts, YouTube channels, blogs, and social media posts make research accessible to everyone. Imagine a climate scientist creating an Instagram series about glacial melting–suddenly, 50,000 people understand the issue who would never have read a journal article.

4. Academic → Education: When Research Becomes Teaching

Your work can change how subjects are taught through new curricula, open educational resources, textbooks, or online courses. Research on effective learning strategies might become teacher training materials, integrated into schools, and ultimately improve the learning experience for thousands of students.

Effectively sharing your research means tailoring your story for different audiences. You can think of it in three levels:

Level 1 – The Tweet (280 characters)

Your research distilled to its essence – instantly understandable and immediately interesting. No jargon, just the core idea.

Example: "Our AI detects crop diseases 95% accurately from smartphone photos, helping small farmers save harvests without expensive equipment. #AgTech #OpenScience"

Level 2 – The Abstract (150 words)

Your dinner party explanation – conversational but substantive. Explain the problem, your approach, key findings, and why anyone outside your field should care. You have two minutes of attention. Make it count.

Level 3 – The Deep Dive (Full paper/presentation)

Technical details for specialists, but with clear structure, compelling visuals, and welcoming introductions. Even experts appreciate clarity. Complexity should be in your ideas, not your communication.

The key takeaway is that research has untapped potential energy, waiting to be released. Knowledge transfer turns that potential into action–whether it becomes products, policies, public understanding, or improved education. Don't wait for impact to happen by chance. Plan for it, work for it, and make it happen.

References

Alley, M. (2018). *The craft of scientific presentations: Critical steps to succeed and critical errors to avoid* (3rd ed.). Springer.

Bernard, H. R. (2013). *Social research methods: Qualitative and quantitative approaches* (2nd ed.). SAGE Publications.

Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & FitzGerald, W. T. (2016). *The craft of research* (4th ed.). University of Chicago Press.

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE Publications.

Browning, B. A. (2016). *Grant writing for dummies* (6th ed.). John Wiley & Sons.

Day, R. A., & Gastel, B. (2016). *How to write and publish a scientific paper* (8th ed.). Cambridge University Press.

European Commission. (2021). *Horizon Europe programme guide*. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/programme-guide_horizon_en.pdf

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners* (5th ed.). SAGE Publications.

Ogden, T. E., & Goldberg, I. A. (2002). *Research proposals: A guide to success* (3rd ed.). Academic Press.

Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S., Kitson, M., Llerena, P., Lissoni, F., Salter, A., & Sobrero, M. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research Policy, 42*(2), 423–442. https://doi.org/10.1016/j.respol.2012.09.007

Reed, M. S. (2016). *The research impact handbook* (2nd ed.). Fast Track Impact.

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson Education.

Steneck, N. H. (2007). *ORI introduction to the responsible conduct of research*. U. S. Department of Health and Human Services, Office of Research Integrity.

Chapter 4
Scientific “Products” and Research Integrity

Science doesn't exist in a vacuum–it produces tangible outputs that shape our understanding of the world. These "products" of research, from journal articles to expert consultations, are the currency of scientific progress. But with this productivity comes responsibility. How we create, share, and validate scientific knowledge directly impacts the integrity of the entire research enterprise.

In this chapter, we'll explore three critical aspects of research outputs: how scientists communicate their findings through publications, how the scientific community validates this work through peer review, and how researchers navigate the complex terrain of providing expert advice. Each of these areas presents unique ethical challenges that every scientist must learn to navigate.

The Role of Scientific Publications

Scientific publications are the primary way researchers share their discoveries with the world. A published paper is more than just a document–it's a permanent contribution to humanity's collective knowledge. When you publish research, you're making a promise to the scientific community and society: *this work is trustworthy, reproducible, and represents an honest account of what we discovered.*

Publications serve multiple functions: knowledge dissemination (sharing findings so others can build upon them), validation (subjecting work to scrutiny by peers), career advancement (demonstrating productivity and expertise), and accountability (creating a permanent record of who discovered what, when, and how).

One of the most contentious issues in research integrity is authorship. Who deserves to be listed as an author on a scientific paper? This question generates heated disputes, damaged relationships, and even institutional investigations.

The fundamental principle is simple but profound: Authorship means both credit and accountability. If your name appears on a paper, you're claiming intellectual contribution *and* accepting responsibility for its content, accuracy, and integrity.

Most scientific communities follow the International Committee of Medical Journal Editors (ICMJE) guidelines, which state that authors must meet all four of these criteria:

1. Make substantial contributions to conception/design OR data acquisition/analysis/interpretation
2. Draft the work or revise it critically for important intellectual content
3. Approve the final version to be published
4. Agree to be accountable for all aspects of the work

Simply providing funding, collecting data without interpretation, or being the lab head doesn't automatically qualify someone for authorship. All four criteria must be met because when papers are retracted, every author bears responsibility.

To help you determine whether someone qualifies for authorship on your projects, we've provided an interactive decision tree tool that walks through each ICMJE criterion with examples and guidance. You can test your understanding and make fair authorship decisions using this online tool.

https://sites.google.com/mss.sumdu.edu.ua/authorshipcriteriadecisiontree/

Scan Me!

Common Authorship Problems

Despite clear guidelines, authorship disputes are remarkably common. Understanding typical problems helps you avoid them.

Gift authorship occurs when someone is added despite not meeting authorship criteria–often to please senior colleagues or reciprocate favors. A department head might be added to every lab paper regardless of actual contribution. This dilutes accountability; if problems arise, that person may not be able to defend the work.

Ghost authorship is the opposite: omitting someone who *did* meet all criteria. This sometimes happens when pharmaceutical companies employ medical writers who make substantial contributions but aren't listed, hiding potential conflicts of interest.

Guest authorship involves adding a famous name to increase acceptance chances, even though they contributed little. This exploits the community's trust in established researchers.

First and last author disputes arise because author order carries significant meaning. The first author typically did most work (often a student), while the last author supervised. Disagreements can be emotionally charged as these positions significantly impact careers.

https://sites.google.com/mss.sumdu.edu.ua/
authorship-problems-guide /

Scan Me!

Understanding these problems is essential, but recognizing them in real situations can be challenging. We've created a visual guide that illustrates these authorship problems with concrete examples to help you identify warning signs in your collaborative projects.

Preventing authorship problems requires proactive communication and clear documentation from the start of any research project. The most critical step is discussing authorship expectations openly before research begins–who will be authors, in what order, and what contributions qualify for authorship versus acknowledgment. As projects evolve and contributions change, these discussions should be revisited to ensure authorship plans reflect actual work done. Many journals now support detailed contribution statements using systems like CRediT (Contributor Roles Taxonomy), which provide transparency beyond simple author lists. To help you navigate these decisions systematically and avoid common pitfalls, we've created a comprehensive visual guide that illustrates authorship problems with real scenarios and practical solutions–review this interactive tool to learn how to recognize and prevent integrity violations in your own collaborative work.

https://sites.google.com/mss.sumdu.edu.ua/
osee-best-practices-for-author

Scan Me!

The academic world runs on a simple but problematic formula: “publish or perish.” Your career–jobs, promotions, grants–depends heavily on how many papers you publish. This pressure can push even well-intentioned researchers toward questionable practices.

You might be tempted to slice one study into several smaller papers just to boost your publication count. Or submit the same manuscript to multiple journals at once, hoping someone accepts it faster. Perhaps republish old findings dressed up as something new, or only report positive results while hiding the experiments that didn’t work out.

Here’s the uncomfortable truth: these practices happen because the system rewards quantity over quality. When hiring committees simply count your papers instead of reading them, the temptation to game the system becomes powerful.

But there’s a better path. Focus on doing thorough, honest research–even if it means fewer publications. Remember that important work like replications and null findings matter, even though they rarely make headlines. As you build your career, commit to integrity in your own work, support colleagues who do the same, and advocate for evaluation systems that value quality and honesty over raw numbers. Your scientific credibility is built on trust, not publication counts.

Peer Review and Publication Ethics

Peer review is the quality control mechanism of science. Before a manuscript is published, other experts in the field evaluate it for soundness, significance, and originality. This process helps ensure that published research meets professional standards and contributes meaningfully to knowledge.

Peer review typically involves:

Not all peer review works the same way. Different journals use different approaches to evaluating manuscripts, each with its own strengths and weaknesses. The main difference between these systems is who knows what about whom–does the reviewer know the author’s identity? Does the author know who reviewed their work? Are the reviews themselves made public? Understanding these variations helps you navigate the publication process and make informed choices about where to submit your work.

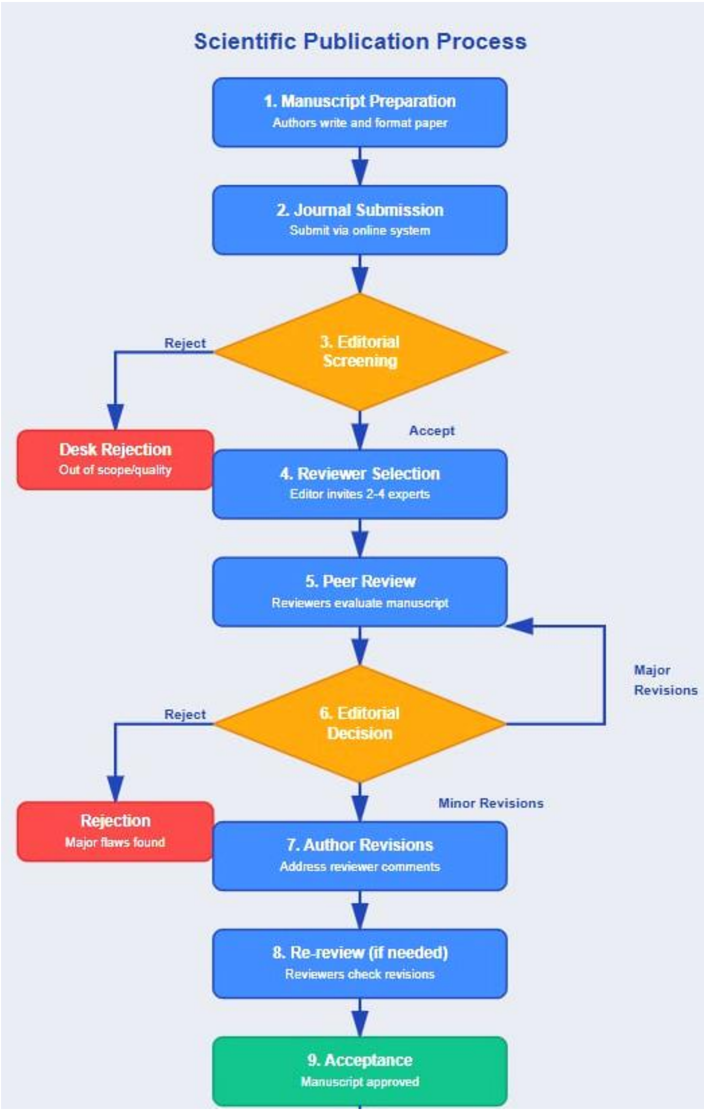

Figure 4.1. Peer Review Process

Each system tries to balance fairness, accountability, and efficiency, but none is perfect. We've created an interactive comparison tool that breaks down the four main peer review models, showing you the advantages and disadvantages of each approach so you can better understand what happens to your manuscript after submission.

https://sites.google.com/mss.sumdu.edu.ua/
osee-peerreviewtypescomparison

Scan Me!

Understanding the different types of peer review is essential, but equally important is knowing what each participant in this process is expected to do. Peer review works effectively only when both reviewers and authors fulfill their ethical obligations. Reviewers must assess manuscripts fairly and constructively, while authors must present their work honestly and respond to feedback appropriately. The visual below outlines the key responsibilities that ensure peer review remains a cornerstone of research integrity.

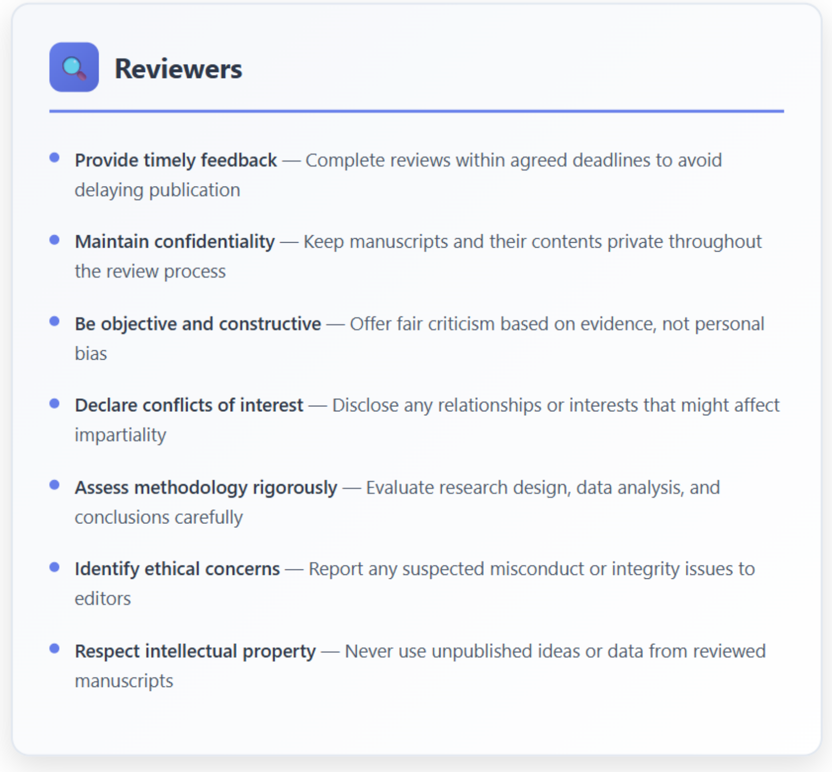

Figure 4.2. Key responsibilities in peer review: Reviewers

Authors

- **Report research honestly** — Present data accurately without fabrication, falsification, or selective reporting
- **Acknowledge all contributors** — Properly credit everyone who made substantial contributions
- **Disclose conflicts of interest** — Reveal any financial or personal interests that could influence the work
- **Respond to reviewers professionally** — Address feedback constructively and revise manuscripts accordingly
- **Avoid duplicate publication** — Submit original work to one journal at a time and disclose any overlapping content
- **Provide data access** — Make underlying data available when requested for verification purposes
- **Correct errors promptly** — Issue corrections or retractions if significant mistakes are discovered

Figure 4.3. Key responsibilities in peer review: Authors

Scientific publishing operates on trust. When we read a paper in a respected journal, we assume the authors conducted their research honestly, the data are genuine, and the conclusions follow logically from the evidence presented. But what happens when this trust is broken? Publication ethics issues represent some of the most challenging problems facing modern science, and understanding them is crucial for anyone entering the research community.

Consider these five scenarios that researchers might encounter. Some represent clear ethical violations, others fall into gray areas, and one might actually be acceptable practice. As you read through each one, think about whether it crosses an ethical line and why.

Scenario 1: A research team submits the same study to three different journals simultaneously because they need to publish quickly for an upcoming tenure review.

Scenario 2: A scientist uses the same dataset to write three different papers, each focusing on a slightly different aspect of the data and submitted to different specialized journals.

Scenario 3: An image in a biology paper is enhanced using Photoshop to make the protein bands clearer and more visible, with no mention of this enhancement in the figure legend.

Scenario 4: During peer review, a scientist recognizes that an anonymous manuscript is from a competing lab. They provide a thorough review but take detailed notes on the methodology for their own future experiments.

Scenario 5: A research group publishes their findings in a highly respected journal, but when other scientists request access to the raw data for replication purposes, the authors claim the data were lost due to a computer failure.

Which of these scenarios represent ethical violations? Scenarios 1, 3, 4, and 5 are clearly problematic, while scenario 2 falls into a gray area that could be acceptable or unacceptable depending on the details.

Scenario 1 – represents simultaneous submission, which violates the policies of virtually every scientific journal. Journals invest significant resources in peer review, and submitting to multiple venues simultaneously wastes these resources and can lead to duplicate publication. Scenario 3 involves image manipulation. While some enhancement is acceptable to improve clarity, any changes that alter the data itself or hide important information constitute falsification. The lack of disclosure makes this particularly problematic.

Scenario 4 – represents a breach of confidentiality during peer review. Reviewers must not use privileged information for competitive advantage, even if they provide a fair review. Scenario 5 involves failure to share data, which prevents verification and replication of research findings. While data loss can happen legitimately, the timing here suggests possible concealment.

Scenario 2 – demonstrates salami slicing, where a single study is divided into multiple publications. While frowned upon, this can be acceptable if each paper makes a distinct contribution and the overlap is clearly acknowledged. The ethical path requires transparency about the shared dataset and ensuring each publication adds genuine new insights rather than simply repackaging the same findings.

These scenarios illustrate the main categories of publication ethics issues. Image manipulation has become increasingly sophisticated with digital technology, making it easier to alter figures in ways that are difficult to detect. Plagiarism extends beyond copying someone else's words to include stealing ideas, recycling your own previously published work without attribution, and failing to properly credit sources.

Authorship disputes create some of the most acrimonious conflicts in science. Who deserves to be an author? In what order should authors be listed? Gift authorship, where someone receives credit without making substantial contributions, dilutes the meaning of authorship and can unfairly boost someone's academic standing.

Conflicts of interest deserve special attention because failing to disclose them is always unethical. A researcher who owns stock in a pharmaceutical company can potentially conduct unbiased research on that company's drug, but readers need to know about the financial interest to evaluate potential bias. Similarly, personal relationships, ideological commitments, or career incentives can create conflicts that should be disclosed even when they don't necessarily invalidate the research.

Publication bias operates at a systemic level. Journals prefer to publish positive results, creating pressure on researchers to find and report significant findings. Studies showing that an intervention doesn't work are less likely to be published, even though negative results are scientifically important. This bias distorts our collective understanding because the published literature systematically overrepresents positive findings.

The consequences of publication ethics violations vary enormously. Fraudulent research can directly harm people, as when fabricated clinical trial data lead to approval of dangerous treatments. More commonly, ethical violations waste resources as researchers attempt to build on false findings, damage public trust in science, and harm the careers of honest researchers who find themselves unable to replicate published results.

Understanding these issues helps explain why the scientific community takes publication ethics seriously. Journals employ increasingly sophisticated tools to detect image manipulation and plagiarism. Funding agencies investigate allegations of misconduct. Universities have integrity officers who handle complaints. But the most important safeguard remains a research culture that values honesty and transparency, where young researchers learn not just the technical skills of their discipline but also the ethical obligations that come with producing knowledge that others will rely upon.

In 2015, a large project tried to replicate 100 psychology studies – only 36 showed significant results. Similar failures appeared in cancer biology and economics, revealing what's now called the *replication crisis*. Many began to ask: how much of science can we really trust?

A key reason lies in the culture of publishing. Researchers are under pressure to publish exciting, positive results, while journals rarely accept studies showing no effect. This creates incentives for *p-hacking*–testing different analyses until something appears significant–and for *publication bias*, where only successful studies see the light of day. As a result, the scientific record becomes skewed toward false positives.

Other problems include small sample sizes, poor statistical understanding, and weak methodology. Many studies relied on narrow participant groups, like Western undergraduates, and omitted crucial details needed for replication.

The crisis has driven reform. More journals now require preregistration, where researchers outline hypotheses and analysis plans in advance, and registered reports, which are accepted based on the study design, not the results. Open data, transparent methods, and better statistical training are becoming standard.

Yet deep issues remain. These reforms take time and effort, and academic incentives still reward novelty over replication. The crisis isn't proof that science fails–it shows that improving reliability and transparency is essential for real progress.

For students, the lesson is clear: question striking results, value rigor over excitement, and see replication as a vital part of discovery. Science corrects itself–but only if we let it.

Scientific Consulting and Integrity Dilemmas

Scientists increasingly engage in consulting roles that extend beyond academic research–serving as expert witnesses, advising industry on R&D strategies, evaluating regulatory compliance, or providing media expertise on complex scientific issues. While these activities offer valuable knowledge transfer and public engagement, they also create potential conflicts between financial interests and scientific objectivity.

The core challenge lies in dual loyalty: consultants must balance client expectations with their commitment to scientific integrity. Funding from interested parties can subtly bias advice, pressure to emphasize favorable findings may compromise objectivity, and association with controversial industries can damage professional reputation. These tensions are particularly acute when scientific evidence is inconclusive or when clients seek specific conclusions rather than honest analysis.

Navigating these dilemmas requires a structured approach. Scientists must proactively identify conflicts of interest, assess how financial relationships might influence their judgment, and maintain transparency by disclosing all funding sources and relationships. Critical safeguards include maintaining control over research conclusions, preserving the right to publish findings regardless of outcomes, subjecting work to peer review, and clearly defining project scope and limitations from the outset.

The fundamental principle remains unchanged: scientific integrity must never be compromised for financial gain or client satisfaction. When conflicts cannot be adequately managed, declining the engagement is the ethical choice, preserving both personal credibility and public trust in science.

Ever wondered how scientists maintain their integrity when working with industry, testifying in court, or advising policymakers? This visual framework breaks down the real-world challenges consultants face–from financial conflicts to selective reporting pressures–and provides a clear decision-making process to navigate these ethical minefields. Discover the essential best practices that separate credible scientific advisors from those who compromise their principles, and learn when to proceed with a consulting opportunity and when to walk away.

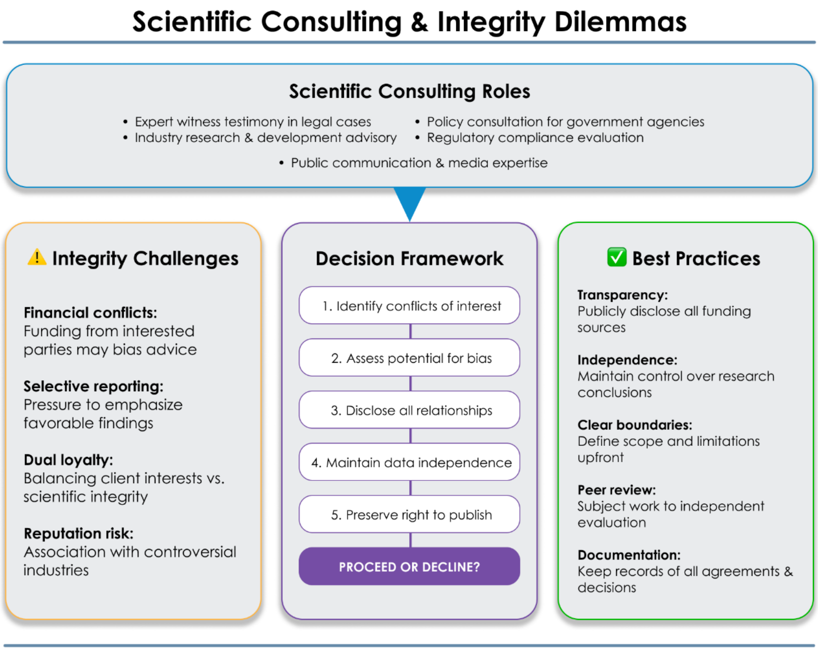

Figure 4.4. Scientific Consulting & Integrity Dilemmas

References

International Committee of Medical Journal Editors (ICMJE). (2023). *Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals*. Retrieved from http://www.icmje.org/recommendations/

McNutt, M. K., Bradford, M., Drazen, J. M., Hanson, B., Howard, B., Jamieson, K. H., ... & Verma, I. M. (2018). Transparency in authors' contributions and responsibilities to promote integrity in scientific publication. *Proceedings of the National Academy of Sciences*, *115*(11), 2557–2560.

Wislar, J. S., Flanagin, A., Fontanarosa, P. B., & DeAngelis, C. D. (2011). Honorary and ghost authorship in high impact biomedical journals: A cross sectional survey. *BMJ*, *343*, d6128. https://doi.org/10.1136/bmj.d6128

Committee on Publication Ethics (COPE). (2022). *COPE guidelines*. Retrieved from https://publicationethics.org/guidance/Guidelines

Ross-Hellauer, T. (2017). What is open peer review? A systematic review. *F1000Research*, *6*, 588. https://doi.org/10.12688/f1000research.11369.2

Fanelli, D. (2009). How many scientists fabricate and falsify research? A systematic review and meta-analysis of survey data. *PLOS ONE*, *4*(5), e5738. https://doi.org/10.1371/journal.pone.0005738

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. https://doi.org/10.1126/science.aac4716

Ioannidis, J. P. (2005). Why most published research findings are false. *PLOS Medicine*, *2*(8), e124. https://doi.org/10.1371/journal.pmed.0020124

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). The preregistration revolution. *Proceedings of the National Academy of Sciences*, *115*(11), 2600–2606.

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science*, *22*(11), 1359–1366.

Lo, B., & Field, M. J. (Eds.). (2009). *Conflict of interest in medical research, education, and practice*. National Academies Press.

National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. (2009). *On being a scientist: A guide to responsible conduct in research* (3rd ed.). National Academies Press.

Chapter 5
Research Integrity and Open Research Practices

The landscape of scientific research is undergoing a profound transformation. Open science represents not just a technical shift in how we share research outputs, but a fundamental reimagining of the research process itself. At its core, open science embodies the principles of transparency, accessibility, and collaboration–principles that are deeply intertwined with research integrity. This chapter explores how open research practices strengthen the foundations of research integrity and examines the European framework that is shaping this transformation.

Open Science Principles and Research Integrity

Open science is an umbrella term encompassing various movements and practices aimed at making scientific research, data, and dissemination accessible to all levels of society. It challenges the traditional model where research findings remain locked behind paywalls or confined to academic circles, advocating instead for openness at every stage of the research cycle.

Open science is not a single practice but rather an ecosystem of interconnected principles, each supporting and reinforcing the others. The diagram below illustrates how these principles work together, radiating from the central concept of openness to touch every aspect of the research process.

As shown in the diagram, the core principles of open science form an integrated framework:

1. Open Access ensures that research publications are freely available to everyone, promoting equity and transparency. Publicly funded research should be publicly accessible, allowing scholars worldwide to engage with the same knowledge base.
2. Open Data extends access to the underlying datasets, enabling others to verify results, avoid duplication, and conduct new analyses. Shared data turn static studies into ongoing sources of discovery.

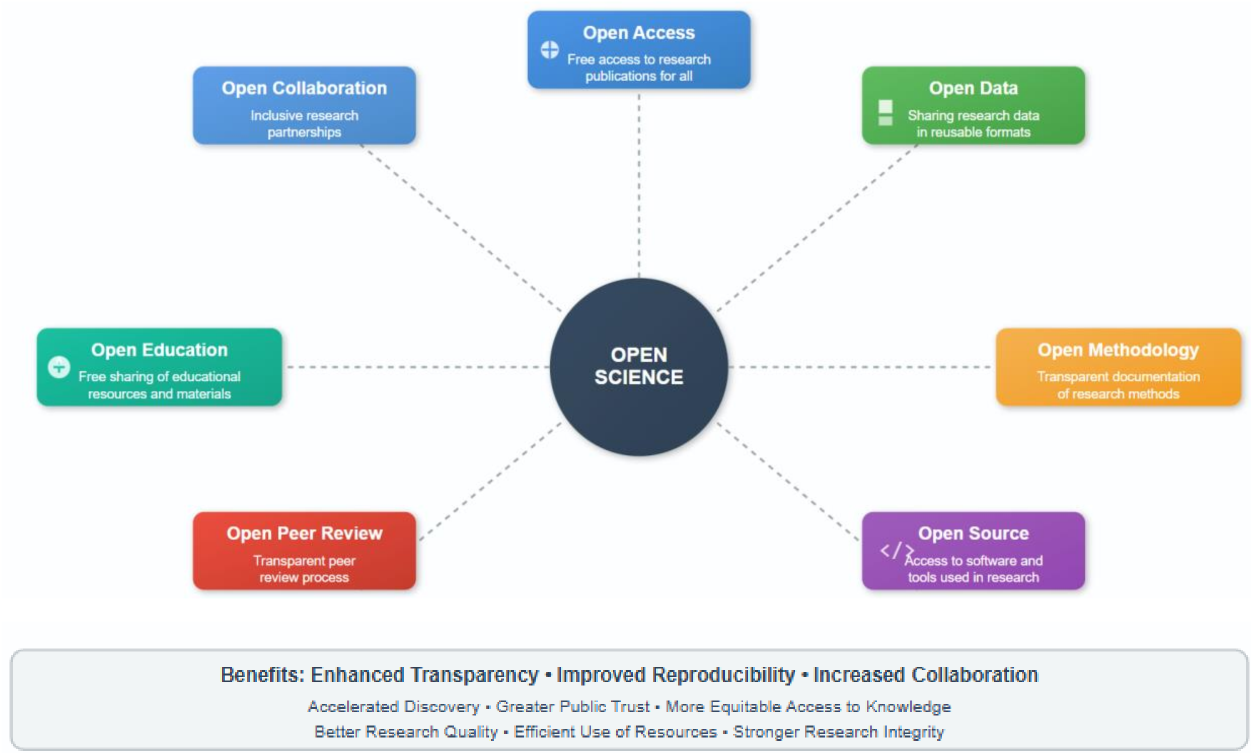

Figure 5.1. Open Science Principles

3. Open Methodology requires transparent documentation of research methods and decisions so others can reproduce and understand the process. It shares not just *what* was done, but *why* and *how*.
4. Open Source provides access to the software and code used in research. By sharing tools openly, scientists make their analyses verifiable and reusable, fostering collaboration instead of repetition.
5. Open Peer Review brings transparency to the review process by sharing reviewer comments or identities, helping readers assess rigor and improving accountability.
6. Open Education promotes free access to learning materials and resources, reducing barriers to knowledge and enabling educators to adapt and share teaching tools globally.
7. Open Collaboration encourages partnerships that cross disciplines, institutions, and countries, involving researchers, citizens, and organizations in shared problem-solving.

Together, these principles reinforce one another. Open data are most powerful with open code and transparent methods; open access gains credibility through open review; and open education flourishes through collaboration. Combined, they create a research ecosystem that is transparent, efficient, and aligned with the public good.

European Open Science Framework

Europe leads globally in promoting open science. The European Commission has integrated open science into research funding policies, ensuring publicly funded research benefits society. This reflects a commitment to democratic knowledge access and maximizing research impact.

Horizon Europe, the EU's flagship research program (2021–2027), requires open science practices. Researchers must make publications immediately available through open access and manage data according to FAIR principles (Findable, Accessible, Interoperable, Reusable).

The European Open Science Cloud (EOSC) creates a federated environment for research data storage and sharing across Europe. Instead of isolated repositories, EOSC provides an interconnected ecosystem where researchers can discover, access, and reuse data across disciplines and borders.

Plan S, launched in 2018, represents a coalition of research funders committed to full and immediate open access. Research funded by public grants must be published in open access journals or platforms, accelerating the shift from subscription-based publishing.

The European Code of Conduct for Research Integrity (revised 2023) explicitly connects research integrity with open science, positioning openness as integral to responsible research conduct.

Individual European countries have developed tailored open science strategies. The Netherlands' National Plan Open Science emphasizes recognition and rewards for open practices. Germany's Initiative for Information Infrastructure focuses on developing necessary technical infrastructure. France's National Plan for Open Science provides concrete measures and timelines.

The FOSTER Portal offers training materials on open science practices. OpenAIRE provides infrastructure and support. Universities across Europe have established open science support offices.

Understanding these resources is valuable for students beginning research careers. Data management, open access publishing, and transparent methodology are becoming essential competencies for modern researchers.

Now that you've learned about open science frameworks and policies, let's apply this knowledge practically. The following activity will help you recognize open science practices in real research scenarios and develop critical thinking about transparency and accessibility in research.

"Open or Not?" Interactive Quiz

Objective: Test and reinforce your understanding of open science practices.

Instructions: For each scenario, determine whether it represents open science. Consider transparency, accessibility, and reproducibility.

Scenarios:

- Sharing analysis code on GitHub with a clear README file → ✓ OPEN *Makes methods transparent and allows verification*

- Publishing in an open access journal without sharing data → × NOT FULLY OPEN *Paper is accessible, but findings cannot be verified without data*
- Using preregistration to document hypotheses and methods before data collection → ✓ OPEN *Prevents selective reporting and increases transparency*
- Publishing only statistically significant results → × NOT OPEN *Creates publication bias*
- Depositing research data in a public repository with DOI and metadata → ✓ OPEN *Makes data findable, accessible, and citable*
- Sharing anonymized participant data with controlled access → ✓ OPEN (with responsible constraints) *Balances openness with privacy protection*
- Posting manuscripts on preprint servers before journal submission → ✓ OPEN *Makes findings immediately available*
- Using proprietary software without documenting analysis steps → × NOT OPEN *Others cannot reproduce analysis*
- Creating detailed protocols and sharing them on platforms like protocols.io → ✓ OPEN *Enables precise replication*
- Publishing in subscription journals for higher impact factors → × NOT OPEN *Limits access to those with subscriptions*

Your Turn: Identify three practices from your own research. Are they open? If not, how could they become more open?

Challenges and Opportunities in Open Research

The transition to open science presents both obstacles and possibilities for researchers. Understanding this landscape is essential for navigating your research career effectively.

While open science offers significant benefits, implementation faces real challenges. Cultural resistance remains strong–academic careers traditionally depend on publication counts in high-impact journals, many operating on closed-access models. Early-career researchers often worry that time spent on open practices won't be rewarded in hiring or promotion decisions.

Technical and resource barriers also exist. Not all researchers have access to data repositories or the skills to make datasets truly reusable. Privacy concerns in research involving human subjects require balancing openness with ethical obligations. Additionally, intellectual property considerations in commercially relevant research create tension between openness and protection of innovations.

Despite these challenges, open science creates substantial opportunities. Open research reaches larger audiences, gets cited more frequently, and facilitates unexpected collaborations. Transparency enables error detection and correction, improving research quality. When researchers build on existing open datasets rather than duplicating efforts, science becomes more efficient.

For early-career researchers, engaging with open practices develops valuable skills in data management, documentation, and communication—competencies valued across all sectors. Open science also rebuilds public trust by making research processes visible and understandable.

During the COVID-19 pandemic, rapid sharing of viral genome sequences and research data demonstrated how open science mobilizes global responses to urgent challenges. This collaborative approach represents science at its best.

The interactive diagram below presents the complete landscape of challenges and opportunities in open research. Explore each element to understand how these factors might affect your research journey and discover practical strategies for navigating the transition to open science.

https://sites.google.com/mss.sumdu.edu.ua/
osee-challengesandopportunitie

Scan Me!

For students and early-career researchers, the key is thoughtful engagement. Start by incorporating open practices from day one of projects. Seek support from institutional resources and European initiatives. Be pragmatic–begin with manageable steps like sharing data for one project or trying preprint publication, then build gradually. Join discipline-specific discussions about open practices; your perspective as an early-career researcher is valuable in shaping how open science develops.

Remember that openness serves research integrity and transparency. The goal is conducting research responsibly, not being open for its own sake.

Understanding the principles of open science is one thing; recognizing them in practice is another. The following activity will help you develop the ability to assess openness in published research–a valuable skill for both consuming and producing scholarly work.

“Open Science Audit”

Objective: Evaluate openness in published research and develop critical evaluation skills.

Instructions: Find a published paper in your field (or use one provided by your instructor). Evaluate it using the checklist below.

Paper Details:

- Title: ___________________
- Authors: ___________________
- Journal: ___________________
- Year: ___________________

Openness Checklist:

Access (1 point each)

- ☐ Paper is open access or freely available
- ☐ Preprint version exists
- ☐ Author accepted manuscript is shared

Data (1 point each)

- ☐ Data availability statement is included
- ☐ Data is shared in a public repository
- ☐ Data has a persistent identifier (DOI)
- ☐ Data includes comprehensive metadata/documentation
- ☐ Data is in non-proprietary format

Methods (1 point each)

- ☐ Methods are described in sufficient detail to replicate
- ☐ Analysis code is available
- ☐ Code is documented and commented
- ☐ Software versions are specified

Transparency (1 point each)

- ☐ Study was preregistered (if applicable)
- ☐ Deviations from protocol are acknowledged
- ☐ Conflicts of interest are declared
- ☐ Funding sources are clearly stated
- ☐ Limitations are honestly discussed

Total Score: ______ / 18

Reflection Questions:

- What did this paper do well in terms of openness?
- What could be improved?
- Were there valid reasons for any closed aspects?
- How did the level of openness affect your confidence in the findings?

Discussion Prompt: Compare your audit results with classmates who evaluated different papers. Are certain types of openness more common in particular fields or journals? What patterns emerge across different research areas?

This audit exercise bridges theory and practice, helping you recognize what open science looks like in real research outputs and preparing you to implement these practices in your own work.

Research integrity and open science are not separate tracks in the research landscape–they are intertwined paths toward a more trustworthy, efficient, and impactful scientific enterprise. The European framework, with its policies, infrastructure, and resources, provides structure and support for this transformation. Yet challenges remain, particularly around changing institutional cultures and ensuring equitable access to open science tools and benefits.

For you as emerging researchers, this moment represents both responsibility and opportunity. You have the chance to shape your research practices according to principles of openness and integrity from the start, to develop skills that will serve you throughout your career, and to contribute to a research culture that better serves society. The path to an open science European community is not always smooth, but it is a path worth walking–for your own development as researchers and for the advancement of knowledge that benefits everyone.

References

European Commission. (2021). *Horizon Europe: Open science*. Retrieved from https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science_en

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., ... & Mons, B. (2016). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data*, *3*(1), 160018. https://doi.org/10.1038/sdata.2016.18

Vicente-Saez, R., & Martinez-Fuentes, C. (2018). Open science now: A systematic literature review for an integrated definition. *Journal of Business Research*, *88*, 428–436. https://doi.org/10.1016/j.jbusres.2017.12.043

European Commission. (2023). *The European code of conduct for research integrity* (Revised edition). ALLEA – All European Academies. Retrieved from https://allea.org/code-of-conduct/

Schiltz, M. (2018). Science without publication paywalls: cOAlition S for the realisation of full and immediate Open Access. *PLOS Medicine*, *15*(9), e1002663. https://doi.org/10.1371/journal.pmed.1002663

McKiernan, E. C., Bourne, P. E., Brown, C. T., Buck, S., Kenall, A., Lin, J., ... & Yarkoni, T. (2016). How open science helps researchers succeed. *eLife*, *5*, e16800. https://doi.org/10.7554/eLife.16800

Nosek, B. A., Alter, G., Banks, G. C., Borsboom, D., Bowman, S. D., Breckler, S. J., ... & Yarkoni, T. (2015). Promoting an open research culture. *Science*, *348*(6242), 1422–1425. https://doi.org/10.1126/science.aab2574

Ross-Hellauer, T. (2017). What is open peer review? A systematic review. *F1000Research*, *6*, 588. https://doi.org/10.12688/f1000research.11369.2

European Commission, Directorate-General for Research and Innovation. (2019). *Future of scholarly publishing and scholarly communication*. Publications Office of the European Union. https://doi.org/10.2777/836532

Pontika, N., Knoth, P., Cancellieri, M., & Pearce, S. (2015). *Fostering open science to research using a taxonomy and an eLearning portal*. In Proceedings of the 15th International Conference on Knowledge Technologies and Data-driven Business (i-KNOW '15). ACM. https://doi.org/10.1145/2809563.2809571

Fecher, B., & Friesike, S. (2014). Open science: One term, five schools of thought. In S. Bartling & S. Friesike (Eds.), *Opening science: The evolving guide on how the internet is changing research,* *collaboration and scholarly publishing* (pp. 17–47). Springer. https://doi.org/10.1007/978-3-319-00026-8_2

National Academies of Sciences, Engineering, and Medicine. (2018). *Open science by design: Realizing a vision for 21st century research*. The National Academies Press. https://doi.org/10.17226/25116

Chapter 6
Research Integrity and Artificial Intelligence

Imagine having a research assistant that never sleeps, can read thousands of papers in seconds, and helps you spot patterns invisible to the human eye. Sounds like science fiction? Welcome to 2025 – this is your reality as a researcher!

Artificial Intelligence is transforming science faster than smartphones changed communication. But with great power comes great responsibility. This chapter is your roadmap to navigating the exciting – and sometimes tricky – world of AI in research while keeping your integrity intact.

The Superpowers AI Gives You

Look, here's the thing about AI in research – it's not good or bad, it's just incredibly powerful. And like anything powerful, it can either accelerate your work or completely derail it depending on how you use it.

The strengths are obvious and genuinely impressive. We're talking about tools that can do in hours what used to take months. Pattern recognition that's better than human experts. Free access to capabilities that used to require million-dollar labs. That's not hype – that's real, and it's already changing how research gets done.

But the weaknesses are just as real. The whole "black box" thing isn't some theoretical concern – it's a fundamental problem for science. How do you build on research you can't reproduce? How do you trust results you can't explain? And the data bias issue goes deep. If your AI learned from biased data, it's going to give you biased results. Simple as that.

The opportunities are what should get you excited. We're potentially looking at breakthroughs in areas like drug discovery and climate science that could genuinely change the world. Research collaboration across borders and languages becomes seamless. Students in any country can access the same powerful tools. That's the kind of democratization that could reshape the entire research landscape.

But the threats keep me up at night, honestly. Research integrity could seriously suffer if people start cutting corners with AI. The digital divide could actually get worse if only well-funded institutions can afford the latest tools. We might create a generation of researchers who can't think critically because they've always had AI to do it for them. And the environmental cost of training these massive models? That's not trivial.

Figure 6.1. SWOT AI in research

Here's a take after looking at all this: AI is going to be part of your research life whether you like it or not. The question isn't "should I use AI?" but "how do I use it responsibly?" You need to be strategic – use AI where it genuinely adds value, but don't let it become a crutch. Always verify, always document, always think critically.

The researchers who'll thrive aren't the ones who blindly embrace AI or the ones who reject it entirely. They're the ones who understand both its potential and its limitations, who use it as a tool rather than a replacement for thinking, and who stay committed to integrity even when AI makes it easier to cut corners.

Bottom line: AI gives you superpowers, but with great power comes great responsibility. Use it wisely, stay skeptical, keep learning, and never forget that good research ultimately depends on good researchers, not just good tools.

Integrity Challenges with AI Systems

Interactive Challenge: Can You Spot the Integrity Issues?

Read these four real-world scenarios carefully. Each illustrates a different AI integrity challenge. Try to identify which problem each scenario represents before reading the explanations!

SCENARIO A: The Vanishing Methods

Maria's Research Journey:

Maria is a psychology PhD student studying social media's impact on mental health. She's been struggling to analyze 10,000 survey responses, so she decides to use an AI tool called "DataGenius Pro" to help with statistical analysis.

DataGenius Pro suggests using a specific regression model and identifies three significant correlations that Maria hadn't considered. Excited by these findings, she writes them up in her paper. In her methods section, she writes: "Statistical analysis was performed using standard regression techniques."

Six months after publication, another researcher emails Maria asking which specific regression model she used and what parameters she set. Maria realizes she doesn't remember the exact settings, and when she tries to recreate the analysis with DataGenius Pro, the software has updated to version 3.0 and gives slightly different results. The company says they can't provide access to the old version.

What's the problem here?

____

____

____

____

____

SCENARIO B: The Helpful Co-Author

James's Dilemma:

James is writing his master's thesis on renewable energy technologies. He's spent months conducting experiments and collecting data, but he's not a native English speaker and struggles with academic writing.

He uses ChatGPT to help him:

- Rewrite his introduction to sound more professional
- Generate transitions between sections
- Create compelling topic sentences for each paragraph
- Draft parts of his literature review based on his notes

ChatGPT ends up rewriting about 35% of his thesis. The writing is excellent, and his supervisor praises the improved clarity. James is relieved but wonders: Should he mention ChatGPT somewhere? He decides not to because "it was just helping with language" and all the ideas and research are his own.

When he submits the thesis, the acknowledgments section thanks his supervisor, lab mates, and family, but makes no mention of AI assistance.

A week later, his supervisor calls him to her office. She's run parts of his thesis through an AI detection tool and noticed something odd: certain sections show patterns typical of AI-generated text – overly formal phrasing, repetitive sentence structures, and unusually consistent tone that differs from James's writing style in other parts.

What's the problem here?

SCENARIO C: The Perfect Dataset

Dr. Chen's Discovery:

Dr. Chen is under pressure to publish. She's been collecting data on patient recovery rates after a new treatment, but her results are inconsistent and don't show the clear improvement she expected.

She decides to use an AI tool to "clean" her dataset by removing outliers. The AI suggests removing 23% of her data points as "anomalous." After removing them, her results show statistically significant improvement in patient outcomes.

She's not entirely sure why those specific data points were flagged as anomalous – the AI just said they were "inconsistent with expected patterns." But the results now look publishable, and they align with what she hypothesized.

In her paper, she writes: "Data were cleaned using automated quality control procedures. Outliers were removed following standard protocols."

What's the problem here?

SCENARIO D: The Invisible Bias

Aisha's Research Project:

Aisha is developing an AI system to help identify promising candidates for medical school admissions. She trains her model on historical admissions data from top medical schools over the past 30 years.

The AI performs impressively, correctly predicting 87% of past admission decisions. Excited, Aisha proposes implementing this system to make the admissions process more "objective" and efficient.

However, when she tests the system on current applications, she notices something odd: it consistently rates applications from women and applicants from rural areas lower than similar applications from men and urban applicants. When she investigates, she realizes that historically, these groups were admitted at lower rates – and her AI learned to replicate this pattern.

Aisha wonders whether to report this finding or just quietly adjust the algorithm.

What's the problem here?

Now You Try!

Before reading the explanations below, match each scenario to one of these integrity challenges:

A. Authorship and Credit

B. Data Integrity and Fabrication

C. Reproducibility Crisis

D. Bias Amplification

Write down your answers, then check below!

____

____

____

____

____

✓ ANSWERS AND EXPLANATIONS

SCENARIO A = C. Reproducibility Crisis 2.0

In this case, we're clearly dealing with a reproducibility problem. Maria's research can't be replicated anymore, which goes against one of the basic principles of science. Several things went wrong here:

- Version instability: AI tools get updated all the time, and the current version of DataGenius Pro (3.0) gives completely different results compared to the one Maria originally used.

- Insufficient documentation: simply writing “standard regression techniques” doesn’t really explain what the AI actually did or how it made its decisions.
- Black box problem: Maria doesn’t fully understand what model the AI used or what parameters it set.
- Lost methodology: Without access to the original AI version, no one can verify or build on her findings

To avoid this, Maria should have been much more careful with record-keeping. She needed to write down the exact name, version, and date of the AI tool she used – for instance, “DataGenius Pro v2.3, March 15, 2024.” It would also have been smart to save all parameters, prompts, and random seeds, as well as any code or configurations the AI generated. Keeping an exported version of the full workflow somewhere safe would have helped too. In general, using open-source tools is a better option since they allow for proper version tracking.

Looking at the bigger picture, this situation shows how AI could create a new kind of reproducibility crisis. Traditional research already struggles with reproducibility, but at least the methods don’t usually disappear or change overnight. With proprietary AI systems that constantly update themselves, we might end up with a lot of studies that can never be verified or built upon in the future.

SCENARIO B = A. Authorship and Credit

This situation is clearly an authorship problem. James used AI to write about 35% of his thesis but never mentioned it, which raises serious concerns about transparency and credit. The issue isn’t just that AI was involved – it’s that no one knows how much of the final work actually came from him.

The main problem is that readers believe the entire thesis was written by James, when in fact, a large part of it wasn’t. That creates a false impression of authorship. There’s also the question of accountability – if an error appears in one of the AI-written sections, who is responsible for it? On top of that, most universities now have clear rules requiring students to disclose any use of AI tools in academic writing, so not mentioning it becomes an ethical violation.

What makes the case even trickier is that James isn't wrong about one thing: the ideas and research really are his. But the way those ideas are expressed – how arguments are built, transitions made, and literature reviewed – is an essential part of the academic process. Writing isn't just about language; it's about shaping how readers understand your work.

What James probably didn't realize is that AI-generated text is often recognizable, even when it seems perfect.

Common AI writing patterns that give it away:

- Overly formal, "corporate" tone that sounds polished but impersonal
- Repetitive sentence structures (e.g., starting multiple paragraphs the same way)
- Unusual word choices that sound sophisticated but aren't quite natural
- Perfectly consistent tone throughout (humans naturally vary their writing style)
- Lack of personal voice or colloquialisms
- Overuse of certain transition phrases ("Moreover," "Furthermore," "It is important to note that")
- Tendency to hedge statements with phrases like "arguably," "potentially," "it appears that"

Take this example. In James's original writing, he said: "Solar panels are getting cheaper every year. This is good because more people can afford them now. In my experiments, I found that the new materials work well even when it's cloudy."

But in the version produced by AI, it became: "The cost trajectory of photovoltaic technology has demonstrated a consistent downward trend over recent years. This progressive affordability enhancement facilitates increased accessibility across diverse socioeconomic demographics. The experimental findings presented herein indicate that novel material compositions maintain optimal operational efficiency even under suboptimal irradiance conditions."

The difference is easy to spot – the AI version sounds overly polished, filled with big words, and almost mechanical. It's grammatically flawless but lacks a natural human voice. Both experienced readers and detection tools pick up on this instantly.

AI-generated text stands out for several reasons, like:

1. Tone consistency: Humans have mood changes, get tired, get excited – their writing reflects this. AI maintains the same tone relentlessly.
2. Vocabulary patterns: The vocabulary patterns are repetitive, with the same "fancy" words showing up again and again.
3. Logical but generic: AI writing makes sense but often lacks the specific insights, tangents, or personal touches that humans naturally include.
4. Too polished: And ironically, the smoothness of AI writing can make it suspicious –it's often too perfect, unlike real academic work, which usually has small variations and imperfections.

Some students think they can fix this by asking AI to "make it sound more human," but that rarely works. AI doesn't truly understand what makes writing human; it just imitates surface-level patterns. Detection tools are already trained to recognize this kind of "humanized" AI text. Plus, supervisors know their students' writing styles – any sudden change is a red flag. In the end, trying to hide AI use this way just adds another layer of dishonesty to the problem.

What James really should have done is quite simple – just be upfront about it. Honesty would have saved him a lot of trouble (and probably an awkward meeting with the academic integrity committee).

- One option would've been to include a short disclosure statement, something like:

  "ChatGPT-4 (OpenAI, 2024) was used to improve English language and clarity in approximately 35% of this thesis. All content was authored by the candidate and verified for accuracy."

  That single sentence could have turned a potential scandal into a small footnote. He should also have checked his university's AI policy – most of them have one now – and talked with his supervisor *before* letting ChatGPT become his co-author. Keeping both the original drafts and the AI-edited versions would've shown transparency and responsibility.

- Another, much safer approach would've been to use AI in a more limited, strategic way. Instead of letting it rewrite whole sections, James could have asked for vocabulary suggestions for specific sentences, or used it to explain tricky grammar points and then fixed the text himself. AI can also generate sample sentences to learn from, or review existing writing and point out what needs improvement. In other words, use it as a tool, not a ghostwriter.

Of course, this whole issue still lives in a kind of ethical gray zone. Is using AI for grammar checks any different from running a spell-checker? Most people would say no. But having it draft entire sections, even if you later "verify everything," is where opinions start to split. And as for the fine line between "help" and "authorship" – well, let's just say it's still being drawn (probably by a committee that's also secretly using AI to write its report).

The general rule of thumb? When in doubt, disclose. It's far better to overshare your use of AI than to have someone accuse you of hiding it later.

And finally, a word of caution for the optimists: don't assume you can fool detection systems. Between advanced software and supervisors who know your writing style better than you think, undisclosed AI use is getting easier to spot. But the bigger issue isn't getting caught – it's about honesty. Academic integrity means owning your work, not seeing how cleverly you can outsource it.

SCENARIO C = B. Data Integrity and Fabrication

This situation is a clear example of a data fabrication problem – even though Dr. Chen didn't sit down and fake any numbers herself. The issue lies in how she handled her data and, more importantly, what she allowed the AI to do with it. Here's what's wrong:

- Unjustified data removal: she removed 23% of her data without having solid, transparent criteria to justify it. That's not just "cleaning" the data – it's essentially creating a more convenient dataset.
- Black box decision: Dr. Chen doesn't understand why those data points were "anomalous" – the AI decided, and she just accepted its judgment, which turns the whole process into a black box.
- Confirmation bias: The AI's suggestions aligned with what Dr. Chen wanted to find, which should have been a red flag.

- Misleading methods: And when she described her methods as "standard protocols," it gave the impression of a well-established scientific process, when in fact she was relying on something quite opaque and poorly documented.

Why does this matter so much? Well, imagine if those so-called "anomalous" data points represented patients who had adverse reactions to the treatment, or participants from groups that responded differently. By letting the AI quietly erase them, Dr. Chen might have hidden exactly the kind of information that could reveal risks or complications – the stuff you *really* want to understand in medical research.

What's particularly concerning here is how the AI decided that the data didn't fit "expected patterns." But who defines what's expected? If the model was trained on previous studies that mostly showed successful outcomes, it might automatically treat any sign of failure as a mistake. That's how you end up with a self-fulfilling prophecy – where only positive results survive the algorithmic filter.

Dr. Chen should have handled this very differently, for instance:

- Investigate each flagged data point individually with clear criteria
- Consult with statisticians about appropriate outlier detection methods
- Consider whether "outliers" might represent important real-world variation
- Report analysis both with and without outliers removed
- Be transparent: "An AI tool flagged 23% of data as potential outliers. Upon investigation, we found [specific reasons]. We present results with and without these points."

At the end of the day, data cleaning is part of science, but every decision to remove information has to be based on logic and evidence – not just because "the AI said so." Making your dataset prettier by letting an algorithm do the dirty work isn't innovation; it's just a modern form of data fabrication, dressed up in code.

SCENARIO D = D. Bias Amplification

This situation is a classic case of bias amplification. Aisha's AI system ended up discriminating not because it was "evil" or intentionally unfair, but because it learned from the past – and the past wasn't exactly fair to begin with. The result? The AI didn't just mirror old biases; it actually made them stronger and wrapped them in the comforting illusion of objectivity.

The problem started with the data. The AI was trained on historical admissions records – data from a time when women and rural applicants were already at a disadvantage. Naturally, it learned that "good candidates" looked like those who were admitted before. To make matters worse, the system appeared perfectly neutral. It had numbers, graphs, and fancy algorithms, which made it look "scientific." But behind that shiny façade, it was quietly encoding decades of discrimination into its logic. By scoring women and rural applicants lower, the AI wasn't fixing inequality – it was helping it survive in digital form.

What makes this especially dangerous is the illusion of fairness. When a human makes a biased decision, we can call it out, question it, or even appeal it. When an algorithm does the same thing, people tend to shrug and say, "Well, the computer decided." Suddenly, bias starts looking like truth – precise, automated, and beyond question. And because AI systems make thousands of decisions at once, that bias spreads at lightning speed.

Even Aisha's attempt to "quietly adjust" the algorithm misses the deeper issue. The AI was doing exactly what it was trained to do – the problem is *what* it was trained on. Any system built on biased historical data will faithfully reproduce that history. In a field like medicine, where some groups were historically excluded, an AI trained on past data will simply continue the exclusion. It's like teaching a student from an outdated textbook – only this time, the student never forgets. A better approach would've been to face the issue head-on, for example:

- Understand that this isn't a glitch – the AI is doing exactly what it was built to do, the problem is with how it was built in the first place
- Be upfront about these findings in her research paper
- Advise against using this system for real admissions decisions
- Propose different approaches that don't just copy historical patterns

- Rethink what "success" means here: should we be reproducing old decisions or making better ones?
- Try to dig deeper with harder questions: who's represented in the training data? Who got left out? And what does "success" really look like – repeating the past or fixing it?

At the core, Aisha faced an ethical choice: cover up the bias and keep things moving, or expose it and risk slowing down her project. It's tempting to take the easy route, but academic integrity means being honest, even when it's uncomfortable.

Ultimately, this isn't just Aisha's problem – it's a systemic one. We can't build fair AI by feeding it unfair data. What's needed is more diverse and representative datasets, fairness constraints built directly into AI systems, regular audits to check for discrimination, and full transparency about limitations. Otherwise, we're just letting yesterday's biases wear tomorrow's technology.

Key Lessons from These Scenarios

Looking across all these cases, a few important themes stand out. First and foremost, transparency really is everything. In every example, the main issue came down to hiding or not clearly explaining how AI was used. Simply put – if you're not open about it, it's a problem.

Another takeaway is that understanding matters. Saying "I didn't know how the AI worked" isn't an excuse. As researchers, we're responsible for the tools we choose. And while AI can make life a lot easier, convenience alone doesn't make something ethical. Finally, good documentation is your best protection – detailed records show honesty, accountability, and allow others to verify your work.

There are also a few red flags worth keeping an eye on in your own research.

- ✕ Thinking "no one will notice" if you don't disclose AI use
- ✕ Getting results that are "too good" without understanding why
- ✕ Not being able to explain exactly what the AI did
- ✕ Accepting AI outputs without verification because they support your hypothesis
- ✕ Your writing suddenly sounds completely different from your usual style

✕ Using phrases like "it is important to note that" repeatedly
✕ Asking AI to "make it sound more human"

So, what should you do instead? The answer is simple but powerful.

✓ Always disclose your AI use and be specific about what the tool contributed
✓ Always verify the AI's outputs against reliable sources
✓ Make sure you actually understand how your chosen system works, at least at a basic level
✓ Stay curious and skeptical – especially when the results seem to fit your expectations a little too perfectly
✓ Keep careful records of every meaningful AI interaction.

Reflection

Take a moment to think about your own work.

1. Have you ever used AI in a way that resembles any of these situations?
2. Would you feel comfortable explaining – publicly – every decision you made with AI's help?
3. Do you understand enough about how your tools operate to stand by the results they produce?
4. Could someone else reproduce your findings with the information you've documented?
5. And finally, have you considered whether your AI tools might carry hidden biases of their own?

These aren't abstract, distant examples – they're based on real situations that researchers face all the time. The line between ethical and unethical AI use isn't about whether you use it or not; it's about how you use it. Being transparent, thoughtful, and critical – instead of blindly accepting convenient results – is what truly defines responsible research.

At the end of the day, your integrity as a researcher doesn't depend on avoiding AI altogether. It depends on using it wisely, honestly, and with full awareness of the responsibility that comes with it.

References

Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence*, *1*(9), 389–399. https://doi.org/10.1038/s42256-019-0088-2

Topol, E. J. (2019). High-performance medicine: The convergence of human and artificial intelligence. *Nature Medicine*, *25*(1), 44–56. https://doi.org/10.1038/s41591-018-0300-7

Obermeyer, Z., Powers, B., Vogeli, C., & Mullainathan, S. (2019). Dissecting racial bias in an algorithm used to manage the health of populations. *Science, 366*(6464), 447–453. https://doi.org/10.1126/science.aax2342

Hutson, M. (2018). Artificial intelligence faces reproducibility crisis. *Science*, *359*(6377), 725–726. https://doi.org/10.1126/science.359.6377.725

Nature. (2023). Tools such as ChatGPT threaten transparent science; here are our ground rules for their use. *Nature*, *613*(7945), 612. https://doi.org/10.1038/d41586-023-00191-1

Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A survey on bias and fairness in machine learning. *ACM Computing Surveys*, *54*(6), 1–35. https://doi.org/10.1145/3457607

Selbst, A. D., Boyd, D., Friedler, S. A., Venkatasubramanian, S., & Vertesi, J. (2019). Fairness and abstraction in sociotechnical systems. In *Proceedings of the Conference on Fairness, Accountability, and Transparency* (pp. 59–68). https://doi.org/10.1145/3287560.3287598

Gundersen, O. E., & Kjensmo, S. (2018). State of the art: Reproducibility in artificial intelligence. In *Proceedings of the AAAI Conference on Artificial Intelligence* (Vol. 32, No. 1). https://doi.org/10.1609/aaai.v32i1.11503

Hagendorff, T. (2020). The ethics of AI ethics: An evaluation of guidelines. *Minds and Machines*, *30*(1), 99–120. https://doi.org/10.1007/s11023-020-09517-8

Cotton, D. R., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT.

Innovations in Education and Teaching International, 1–12. https://doi.org/10.1080/14703297.2023.2190148

Strubell, E., Ganesh, A., & McCallum, A. (2019). Energy and policy considerations for deep learning in NLP. In *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics* (pp. 3645–3650). https://doi.org/10.18653/v1/P19-1355

European Commission. (2021). *Proposal for a Regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act)*. Retrieved from https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

Chapter 7

SMART-modelling of Institutional Research Integrity Policy

Research integrity stands at the crossroads of scientific excellence and ethical responsibility. As European institutions navigate the evolving landscape of open science, the need for robust, actionable integrity policies becomes increasingly paramount. This chapter presents a systematic approach to developing institutional research integrity policies through the SMART framework–a methodology that transforms abstract ethical principles into concrete, measurable institutional practices.

The journey from ethical ideals to operational policies often stumbles on the gap between aspiration and implementation. Many institutions possess well-intentioned codes of conduct that gather dust on digital shelves, disconnected from the daily realities of research practice. The SMART-modelling approach addresses this challenge by providing a structured pathway that ensures policies are not merely documents, but living instruments of cultural change.

Understanding the SMART Framework for Integrity Policies

The SMART framework–Specific, Measurable, Achievable, Relevant, and Time-bound–transforms vague institutional commitments into actionable policy components. When applied to research integrity, each element takes on particular significance that reflects the unique challenges of academic governance.

Specificity in research integrity policies means moving beyond broad statements like "researchers should be honest" to precise articulations such as "all primary data must be retained in original format for a minimum of ten years, with documented chain of custody protocols." This precision eliminates ambiguity that often becomes the refuge of misconduct.

Measurability introduces accountability mechanisms that allow institutions to track progress and identify areas requiring intervention. Rather than hoping for integrity, institutions can monitor concrete indicators: percentage of researchers completing integrity training, number of data management plans submitted, frequency of ethics committee consultations, and time to resolution for integrity concerns.

Achievability recognizes institutional constraints while maintaining ambitious standards. A policy requiring every researcher to undergo 40 hours of annual integrity training might be ideal but impractical. However, requiring completion of a foundational 8-hour program with quarterly one-hour updates creates a sustainable framework that balances thoroughness with feasibility.

Relevance ensures policies address actual challenges within the institution's research ecosystem. A computational science institute requires different integrity measures than a clinical research hospital. Policies must reflect disciplinary norms, institutional culture, and the specific vulnerabilities of different research domains.

Time-bound elements create urgency and enable periodic reassessment. Setting clear implementation timelines, review cycles, and sunset clauses for outdated provisions keeps policies dynamic and responsive to emerging challenges.

Interactive Exercise 1: SMART Goal Transformation

Transform this vague policy into a SMART goal:

Original: "Researchers should properly acknowledge contributions to their work."

Your SMART Version:

S (Specific):

____

M (Measurable):

____

A (Achievable):

____

R (Relevant):

____

T (Time-bound):

____

[Check your answer against the model solution below]

Model Solution:

- Specific: All research outputs must include a contributorship statement detailing each author's role using the CRediT taxonomy.
- Measurable: 100% of publications from the institution will include standardized contributorship statements.
- Achievable: Phased implementation starting with new projects, with templates and training provided.
- Relevant: Addresses authorship disputes, the institution's most common integrity issue.
- Time-bound: Full implementation within 12 months, with quarterly compliance reviews.

The Policy Development Process

Phase 1: Diagnostic Assessment

Before crafting new policies, institutions must understand their current integrity landscape. This diagnostic phase involves systematic examination of existing practices, identification of gaps, and recognition of both strengths and vulnerabilities.

The assessment begins with stakeholder mapping. Who conducts research within your institution? This extends beyond principal investigators to include doctoral students, technicians, data managers, and administrative staff who handle research materials. Each group interfaces with integrity challenges differently and requires tailored policy provisions.

Next comes the vulnerability audit. Where do integrity breaches most commonly occur? Analysis might reveal patterns: rushed grant application periods correlating with citation errors, specific departments with recurring authorship disputes, or systematic issues with data storage practices. These patterns inform policy priorities.

Cultural assessment proves equally crucial. Some institutions operate with high trust and minimal oversight, while others employ extensive monitoring systems. Neither approach is inherently superior, but policies must align with institutional culture to achieve buy-in and compliance. Attempting to impose rigid documentation requirements on a traditionally autonomous research culture without careful change management invites resistance and shadow practices.

Phase 2: Participatory Design

Research integrity policies imposed from above rarely achieve their intended outcomes. Successful policy development requires meaningful participation from those who will implement and follow the policies. This participatory approach serves multiple purposes: it generates better policies by incorporating practical insights, builds ownership among stakeholders, and begins the cultural change process before formal implementation.

The participatory design process employs structured workshops where researchers, administrators, and support staff collaborate to identify integrity challenges and co-create solutions. These workshops follow a specific progression from problem identification through solution design to implementation planning.

Interactive Exercise 2: Stakeholder Perspective Analysis

PERSPECTIVE MAPPING EXERCISE

Policy Proposal: “All research data must be deposited in institutional repository within 30 days of collection”

Complete the perspective analysis:

Early Career Researcher:

Concerns: ______________________________________

Benefits: _______________________________________

Modifications needed: ____________________________

Senior Principal Investigator:

Concerns: ______________________________________

Benefits: _______________________________________

Modifications needed: ____________________________

Data Manager:

Concerns: ______________________________________

Benefits: ____
Modifications needed: _________________________________
Institutional Administrator:
Concerns: ____
Benefits: ____
Modifications needed: _________________________________

Phase 3: Policy Architecture

The architecture of integrity policies determines their effectiveness. Well-structured policies create clear pathways for compliance while poorly organized policies generate confusion and non-compliance. The architectural framework consists of several interconnected layers, each serving distinct functions within the overall integrity ecosystem.

The foundational layer establishes core principles and values. These broad statements articulate the institution's commitment to integrity and provide the ethical framework for specific provisions. While not directly actionable, they serve as interpretive guides when ambiguities arise.

The operational layer translates principles into specific requirements and procedures. Here, the SMART framework becomes essential. Each operational element must specify what is required, who is responsible, how compliance will be measured, and when actions must occur.

The support layer details resources and assistance available to researchers. This includes training programs, consultation services, tools and templates, and remediation pathways for those who inadvertently violate policies. The support layer transforms policies from punitive instruments into enabling frameworks.

The accountability layer defines monitoring mechanisms, violation procedures, and consequences. Clear, proportionate accountability measures encourage compliance while avoiding the creation of a surveillance culture that undermines collegiality and trust.

Phase 4: Implementation Strategy

Implementation determines whether policies become embedded practices or remain paper exercises. The implementation strategy must address technical, cultural, and resource dimensions simultaneously.

Technical implementation involves creating systems and tools that make compliance straightforward. If the policy requires data management plans, the institution must provide templates, review processes, and storage infrastructure. Technical barriers to compliance become excuses for non-compliance.

Cultural implementation requires sustained engagement to shift norms and expectations. This involves regular communication about policy rationales, celebration of good practices, and gentle correction of violations. Cultural change happens through thousands of small interactions that gradually reshape what is considered normal and acceptable.

Resource implementation ensures adequate support for policy requirements. Unfunded mandates generate resentment and shadow practices. If policies require new activities, institutions must provide corresponding resources: time allocation, funding, personnel, or infrastructure.

Institutional Implementation Models

Model A: The Centralized Framework

The centralized model concentrates integrity oversight within a dedicated office or officer who coordinates all policy development, implementation, and monitoring activities. This approach offers several advantages: consistent application across the institution, specialized expertise in integrity matters, clear accountability lines, and efficient resource utilization.

Under this model, a Research Integrity Office serves as the institutional hub for all integrity-related matters. The office develops standardized policies, delivers training programs, investigates allegations, and maintains institutional records. Researchers interact with a single point of contact for all integrity concerns, simplifying navigation of institutional requirements.

However, centralization also presents challenges. The integrity office may become disconnected from disciplinary realities, imposing one-size-fits-all solutions that poorly match diverse research contexts. Centralization can also create bottlenecks when all decisions flow through a single office, potentially slowing research activities.

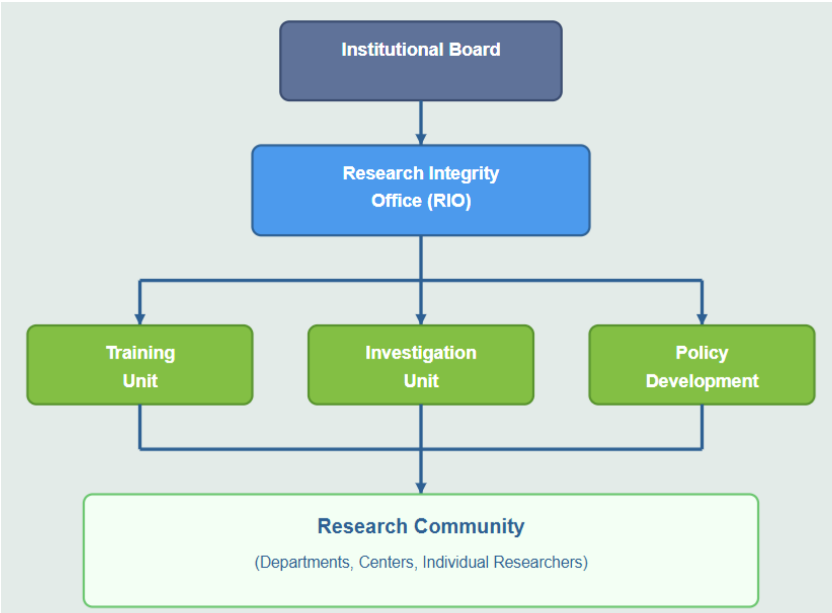

Figure 7.1. Visual Framework: Centralized Model Structure

Model B: The Distributed Network

The distributed model embeds integrity responsibilities throughout the organizational structure, with each unit maintaining primary responsibility for its research integrity. This approach recognizes that those closest to research activities are best positioned to identify and address integrity challenges.

In the distributed model, departments appoint integrity champions who understand local research practices and can provide contextualized guidance. These champions form a network, sharing experiences and coordinating responses to common challenges while maintaining autonomy to address unit-specific needs.

The distributed approach fosters ownership and buy-in, as policies emerge from within research communities rather than being imposed externally. It allows for disciplinary customization while maintaining institutional coherence through network coordination.

Yet distribution also creates risks. Inconsistent application across units may generate confusion or perceived unfairness. Quality varies with the commitment and capability of local champions. Without strong coordination mechanisms, the institution may struggle to respond to systemic issues or cross-departmental challenges.

Model C: The Hybrid Integration

The hybrid model combines centralized coordination with distributed implementation, attempting to capture advantages while mitigating disadvantages of pure approaches. A central integrity office establishes framework policies and minimum standards while departments develop specific implementation strategies appropriate to their contexts.

This model employs a hub-and-spoke structure where the central office provides expertise, training, and support while departmental integrity officers handle day-to-day implementation. Regular coordination meetings ensure consistency while preserving local flexibility.

The hybrid approach requires careful balance. Too much central control recreates centralization problems; too much local autonomy leads to fragmentation. Success depends on clear delineation of responsibilities and strong communication channels between center and periphery.

Interactive Exercise 3: Model Selection Matrix

INSTITUTIONAL MODEL SELECTION TOOL

Rate your institution (1-5 scale):

Organizational Characteristics:

- Size (1=small, 5=very large): ______
- Disciplinary diversity (1=focused, 5=highly diverse): ______

- Current governance (1=decentralized, 5=centralized): ______
- Resource availability (1=limited, 5=abundant): ______
- Change readiness (1=resistant, 5=eager): ______

Research Characteristics:

- Collaboration intensity (1=individual, 5=highly collaborative): ______
- External partnerships (1=few, 5=extensive): ______
- Regulatory requirements (1=minimal, 5=extensive): ______
- Data sensitivity (1=open, 5=highly sensitive): ______
- Funding diversity (1=single source, 5=many sources): ______

Scoring: Sum of scores: ______

Recommendation:

- 10–20: Distributed model likely most appropriate
- 21–35: Hybrid model recommended
- 36–50: Centralized model may work best

Your reflection on fit:

____
____
____
____
____
____

European Integration and Harmonization

European research operates within a complex multilevel governance structure where institutional, national, and supranational policies intersect. The European Union's commitment to creating a unified European Research Area necessitates harmonization of integrity standards while respecting institutional autonomy and national sovereignty.

The European Code of Conduct for Research Integrity provides a consensus framework that institutions can adapt to their contexts. This code represents not prescriptive rules but agreed principles that enable collaboration while preserving diversity. Understanding how institutional policies align with and diverge from this framework becomes essential for participation in European research networks.

Harmonization does not mean homogenization. European integration seeks interoperability rather than uniformity–ensuring researchers can move between institutions and collaborate across borders while maintaining confidence in integrity standards. This requires institutional policies that speak a common language while expressing local dialects.

International research collaborations present unique integrity challenges that institutional policies must address. When researchers from different integrity regimes collaborate, whose standards apply? How are disputes resolved when national regulations conflict? These questions require proactive policy provisions rather than ad hoc solutions.

Successful collaboration frameworks establish integrity agreements at project initiation. These agreements identify applicable standards, clarify responsibility allocation, and establish dispute resolution mechanisms before problems arise. They recognize that integrity challenges in collaborative research often stem from misaligned expectations rather than malicious intent.

The framework must address data ownership and sharing protocols that respect both open science principles and institutional interests. European projects increasingly require data management plans that specify how data will be collected, stored, shared, and preserved. Institutional policies must enable compliance with these requirements while protecting researcher interests and institutional assets.

Interactive Exercise 4: European Alignment Assessment

EUROPEAN CODE ALIGNMENT CHECKLIST

Assess your institutional policy against European standards:

RELIABILITY

- Quality assurance mechanisms defined
- Reproducibility requirements specified
- Data management protocols established

Policy gap identified:

____

HONESTY

- Transparency requirements articulated
- Conflict of interest procedures defined
- Error correction processes established

Policy gap identified:

____

RESPECT

- Authorship criteria specified
- Citation requirements defined
- Peer review standards established

Policy gap identified:

____

ACCOUNTABILITY

- Supervision responsibilities clarified
- Violation procedures defined
- Whistleblower protections established

Policy gap identified:

____

Priority actions for alignment:

____

____

____

Researcher mobility enriches European science but complicates integrity oversight. When researchers move between institutions, how do integrity records transfer? How are ongoing investigations handled? What training transfers between institutions? These practical questions require policy solutions that balance transparency with privacy, accountability with opportunity.

Mutual recognition agreements between institutions can establish equivalencies between different integrity training programs, reducing redundant requirements for mobile researchers. These agreements require careful mapping of learning outcomes and competencies rather than simple comparison of contact hours or course titles.

The development of integrity passports–portable records of training, certifications, and cleared investigations–offers one solution to mobility challenges. These documents, controlled by researchers themselves, provide new institutions with confidence while protecting researcher privacy. However, implementation requires careful consideration of data protection regulations and verification mechanisms.

The digitalization of research presents both opportunities and challenges for integrity policy harmonization. Digital research infrastructures enable unprecedented collaboration but also create new venues for misconduct. Policies must address integrity in computational research, artificial intelligence applications, and big data analytics where traditional frameworks may prove inadequate.

Open science mandates from European funders require institutional policies that support transparency while protecting legitimate interests. The transition from "publish or perish" to "share and care" cultures requires fundamental policy realignment. Institutions must create incentive structures that reward open practices while maintaining quality standards.

The COVID-19 pandemic demonstrated both the power and perils of accelerated research. Emergency provisions that enabled rapid research response also revealed integrity vulnerabilities when normal safeguards were relaxed. Post-pandemic policies must preserve agility while strengthening integrity frameworks for crisis situations.

Practical Implementation Workshop

This section provides a structured workshop for developing SMART integrity policies tailored to your institutional context. The workshop progresses through systematic exercises that build toward a complete policy framework.

Workshop Exercise 1: Institutional Context Mapping
INSTITUTIONAL PROFILE
Basic Information:
- Institution type: ________________________________
- Research staff (FTE): ____________________________
- Primary research domains: _________________________
- Annual research budget: ___________________________

Current Integrity Infrastructure:
- Existing policies (list): ___________________________
- Responsible office/officer: _________________________
- Training programs: _______________________________
- Investigation procedures: __________________________

Recent Challenges (last 3 years):
- Most common integrity issues: _____________________
- Number of investigations: _________________________
- Systemic problems identified: _____________________

Strategic Priorities:
- Open science commitments: ________________________
- International collaboration goals: __________________
- Regulatory requirements: _________________________

Workshop Exercise 2: SMART Policy Development Template
SMART POLICY COMPONENT BUILDER
Policy Area: [Select: Data Management / Authorship / Peer Review / Conflicts of Interest / Training / Other]
Selected:
____

Current State:
- Describe existing practice: ______________________
- Main problems: ______________________________
- Stakeholder concerns: _________________________

SPECIFIC Component:
- What exactly will be required? __________________
- Who must comply? ____________________________
- What constitutes compliance? ___________________

MEASURABLE Component:
- Quantitative indicator: ________________________
- Data collection method: _______________________
- Reporting frequency: __________________________

ACHIEVABLE Component:
- Required resources: ___________________________
- Implementation barriers: _______________________
- Mitigation strategies: __________________________

RELEVANT Component:
- Link to institutional mission: ___________________
- Addresses which problem: ______________________
- Stakeholder benefit: ___________________________

TIME-BOUND Component:
- Implementation timeline: _______________________
- Milestone dates: _____________________________
- Review schedule: _____________________________

Complete SMART Policy Statement:

____

____

____

____

Policies without monitoring mechanisms become aspirational statements rather than operational requirements. The monitoring framework must balance comprehensive oversight with practical feasibility, generating actionable intelligence without creating bureaucratic burden.

Key performance indicators should reflect both compliance rates and quality measures. Quantitative metrics–percentage of researchers completing training, proportion of publications with data availability statements, average time to resolve integrity concerns–provide objective assessment. Qualitative indicators–researcher satisfaction with integrity support, perceived fairness of procedures, cultural attitudes toward integrity–offer essential context for interpreting quantitative data.

The evaluation cycle should align with institutional planning processes, enabling integrity considerations to influence resource allocation and strategic decisions. Annual reviews assess operational effectiveness while triennial comprehensive evaluations examine strategic alignment and emerging challenges.

Final Reflection Exercise

IMPLEMENTATION READINESS ASSESSMENT

Rate your confidence (1–10) in implementing each component:

Policy Development:

- Stakeholder engagement process: ______
- SMART goal formulation: ;______
- Resource allocation: ______

Implementation:

- Communication strategy: ______
- Training delivery: ______
- Support systems: ______

Monitoring:

- Data collection systems: ______
- Evaluation procedures: ______
- Feedback mechanisms: ______

Three actions to strengthen readiness:

1. ________________________
2. ________________________
3. ________________________

Target date for policy launch:

____

Conclusion: From Policy to Practice

The journey from ethical principles to operational policies requires systematic approach, stakeholder engagement, and sustained commitment. The SMART framework provides structure for this journey, ensuring policies address real challenges with measurable solutions. Yet frameworks alone do not create integrity cultures. Success requires leadership commitment, resource investment, and recognition that integrity is not a compliance burden but an enabler of excellent research.

As European research becomes increasingly interconnected, institutional integrity policies must balance local needs with international interoperability. The frameworks and exercises in this chapter provide tools for achieving this balance, but each institution must chart its own course based on its unique context, challenges, and aspirations.

The development of research integrity policies is not a discrete project but an ongoing process of refinement and adaptation. As research practices evolve, new technologies emerge, and collaborative networks expand, policies must evolve correspondingly. The SMART framework provides not a final destination but a compass for navigating the evolving landscape of research integrity.

Remember that perfect policies implemented poorly produce worse outcomes than imperfect policies implemented well. Focus on progress rather than perfection, learning rather than blame, and support rather than surveillance. Through this approach, institutional research integrity policies become not bureaucratic obstacles but foundations for research excellence and societal trust.

The path toward comprehensive research integrity in the European Research Area requires each institution to contribute its part while collaborating toward common goals. Your institutional policies represent both local solutions and contributions to the broader European endeavor of maintaining and enhancing research integrity. The work you undertake in developing SMART policies strengthens not only your institution but the entire European research ecosystem.

Additional Resources and Further Reading

For those seeking to deepen their understanding and refine their policy development skills, the following resources provide valuable guidance:

The European Code of Conduct for Research Integrity serves as the foundational reference for European standards. Regular consultation ensures institutional alignment with evolving European norms.

National research integrity offices often provide contextualized guidance that bridges European frameworks with local requirements. These offices offer valuable resources, training materials, and consultation services.

Professional networks such as ENRIO (European Network of Research Integrity Offices) facilitate peer learning and sharing of best practices. Participation in these networks accelerates institutional learning and prevents redundant effort.

Remember that policy development is a collective endeavor. Engage with peers at other institutions, share experiences, and learn from both successes and failures. The path to research integrity is one we travel together, each institution contributing to our collective understanding and capability.

Appendix: Quick Reference Templates

SMART Policy Checklist

- **Specific**: Does the policy clearly define what, who, where, when, and how?
- **Measurable**: Can compliance be quantified and tracked?
- **Achievable**: Is the policy realistic given available resources?
- **Relevant**: Does it address actual institutional challenges?
- **Time-bound**: Are there clear deadlines and review dates?

Common Policy Areas Requiring SMART Development

1. **Data Management and Stewardship**
   a. Storage requirements and duration
   b. Access protocols and sharing procedures

c. Documentation standards
d. Preservation strategies

2. Authorship and Attribution

a. Contribution criteria
b. Order determination processes
c. Dispute resolution mechanisms
d. Acknowledgment standards

3. Peer Review Integrity

a. Confidentiality requirements
b. Conflict of interest disclosure
c. Constructive feedback standards
d. Timeline expectations

4. Training and Professional Development

a. Mandatory training requirements
b. Refresher course schedules
c. Competency assessment methods
d. Documentation procedures

5. Investigation and Remediation

a. Reporting mechanisms
b. Investigation timelines
c. Due process guarantees
d. Remediation pathways

Implementation Timeline Template

Months 1–3: Foundation Phase

- Stakeholder engagement
- Current state assessment
- Gap analysis
- Resource planning

Months 4–6: Development Phase

- Policy drafting
- Stakeholder consultation
- Revision and refinement
- Approval processes

Months 7–9: Preparation Phase

- Communication strategy
- Training development
- System implementation
- Pilot testing

Months 10–12: Launch Phase

- Policy rollout
- Training delivery
- Support activation
- Early monitoring

Months 13+: Sustainment Phase

- Ongoing monitoring
- Periodic review
- Continuous improvement
- Culture embedding

References

European Commission, Directorate-General for Research and Innovation. (2023). *The European code of conduct for research integrity* (Revised edition). ALLEA – All European Academies. Retrieved from https://allea.org/code-of-conduct/

Doran, G. T. (1981). There's a S. M.A. R.T. way to write management's goals and objectives. *Management Review*, *70*(11), 35–36.

Bouter, L. M., Tijdink, J., Axelsen, N., Martinson, B. C., & ter Riet, G. (2016). Ranking major and minor research misbehaviors: Results from a survey among participants of four World Conferences on Research Integrity. *Research Integrity and Peer Review*, *1*(1), 17. https://doi.org/10.1186/s41073-016-0024-5

National Academies of Sciences, Engineering, and Medicine. (2017). *Fostering integrity in research*. The National Academies Press. https://doi.org/10.17226/21896

Steneck, N. H. (2006). Fostering integrity in research: Definitions, current knowledge, and future directions. *Science and Engineering Ethics*, *12*(1), 53–74. https://doi.org/10.1007/s11948-006-0006-y

European Network of Research Integrity Offices (ENRIO). (2021). *Handbook of recommended practices for research integrity*. Retrieved from http://www.enrio.eu/

Shaw, D. M., & Satalkar, P. (2018). Researchers' interpretations of research integrity: A qualitative study. *Accountability in Research*, *25*(2), 79–93. https://doi.org/10.1080/08989621.2017.1413940

Godecharle, S., Nemery, B., & Dierickx, K. (2013). Guidance on research integrity: No union in Europe. *The Lancet*, 381(9872), 1097–1098. https://doi.org/10.1016/S0140-6736(13)60759-X

Hiney, M., Tierney, M. P., & O'Brien, M. (2020). *Research integrity and innovation in the European Research Area (RINA): Final project report*. League of European Research Universities (LERU).

Kleinert, S., & Wager, E. (2011). Responsible research publication: International standards for authors. A position statement developed at the 2nd World Conference on Research Integrity. In T. Mayer & N. Steneck (Eds.), *Promoting research integrity in a global environment* (pp. 309–316). Imperial College Press/World Scientific Publishing.

Transparency International. (2017). *Transparency in research integrity: A guide to best practice*. Retrieved from https://www.transparency.org/

Anderson, M. S., Ronning, E. A., De Vries, R., & Martinson, B. C. (2007). The perverse effects of competition on scientists' work and relationships. *Science and Engineering Ethics*, *13*(4), 437–461. https://doi.org/10.1007/s11948-007-9042-5

Izdevniecība «Baltija Publishing»
Avotu iela 8 k-1 - 25, Rīga, LV-1011
E-mail: office@baltijapublishing.lv

Iespiests tipogrāfijā SIA “Izdevniecība “Baltija Publishing”
Parakstīts iespiešanai: 2026. gada 18. maijā
Tirāža 300 eks.