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Editorial
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Two Worlds of AI in Research: Why Scientific Integrity Demands Governance Now

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Artificial intelligence (AI) is rapidly transforming the landscape of scientific research. Its promise is enormous: accelerated discovery, enhanced data analysis, optimized trial design, and reduced bias upon proper validation. Yet we are now drifting into two parallel AI worlds and nowhere is this divide more consequential than in basic and clinical research.

The first world is regulated, transparent, and accountable. In basic and translational research, responsible AI accelerates discovery by helping analyze omics data, identify drug targets, optimize trial design, detect signals in large datasets, and reduce bias when properly validated. In clinical research, it supports protocol optimization, patient stratification, adverse event detection, and real-world evidence generation, always within the framework of institutional review boards' oversight, data governance, reproducibility standards, and human accountability. This is AI as a scientific instrument: powerful, but constrained by method, ethics, and review.

The second world is unregulated and opaque, posing serious risks to scientific integrity. In this space, AI can fabricate plausible datasets, generate synthetic images or histopathology slides that appear real, write entire manuscripts with invented methods or citations, and manipulate statistical outputs to fit a desired conclusion. Without safeguards, AI can mass-produce fraudulent research, overwhelm peer review, and pollute the scientific record faster than it can be corrected.

In basic research, this manifests as fabricated or manipulated datasets that appear statistically sound but are entirely synthetic; irreproducible AI-generated hypotheses that collapse when tested in real biological systems; and image manipulation at scale, including Western blots, microscopy, and sequencing visualizations, that evade traditional detection. In clinical research, the risks are even more acute: AI-assisted falsification of trial data, endpoints, or adverse events that undermine patient safety; synthetic patient narratives or eligibility records that corrupt enrollment in decentralized trials; ghostwritten protocols and manuscripts that pass surface-level review but lack scientific rigor; and manipulation of real-world evidence to support commercial or ideological goals.

The danger here is not that AI is "thinking for itself." The danger is that scale, speed, and plausibility now allow bad science to masquerade as good science at volumes that exceed the capacity of peer reviewers, editors, regulators, and institutions to detect in real time.

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The following data underscore the urgency of implementing robust AI governance in research:[1]

METRIC	DATA
Total papers retracted (2000-2024)	55,000+
Retractions in 2023 alone	10,000+
Estimated paper mill articles in circulation	Up to 400,000
Paper mill article growth rate	Doubling every 1.5 years
Total publications growth rate	Doubling every 15 years
Retractions due to fake peer reviews (2024-2025)	6,400+
Retractions linked to AI-generated content	2,100+
Papers with tortured phrases detected	32,786+ (as of 2024)
Peer reviews using LLM-generated sentences (2024)	Up to 17%
NeurIPS 2025 papers with hallucinated citations	53 papers (100+ citations)
Retraction rate in EE & Computer Science	31.97 per 10,000 articles
Editors handling 30% of retractions at PLOS ONE	Only 0.25% of editors

What must be done? First, mandatory disclosure: all research outputs must specify which AI tools were used, the nature and extent of the AI contribution, and the extent of human oversight. Second, provenance tracking: all data and images must have documented origins, raw data must be retained for audit, and AI-generated content must be clearly distinguished from original research. Third, auditability: AI-assisted analyses must be reproducible with documented parameters, computational pipelines must be version-controlled, and independent verification must be possible for all AI-derived conclusions. Fourth, human accountability: a named individual must take responsibility for all AI-assisted outputs, AI cannot be listed as an author, and scientific judgment remains a human responsibility.

Certain uses must be strictly prohibited: generation of fabricated datasets or patient records, creation of synthetic images intended to represent real experimental results, manipulation of statistical outputs to achieve desired conclusions, generation of citations that do not exist, submission of AI-generated content without disclosure and validation, and any use that circumvents IRB oversight or regulatory requirements. Violations should be treated as research misconduct, with consequences that may include retraction, reporting to regulatory bodies, and termination of research privileges.

Some will argue that guardrails stifle innovation. The opposite is true. Guardrails are not anti-innovation; they are pro-science. Without them, the scientific literature becomes unreliable, peer review becomes

[1] *PNAS (Richardson et al., 2025); Retraction Watch Database; Web of Science; Nature; GPTZero Analysis; Problematic Paper Screener; Stanford University (Zou et al.)*

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meaningless, and the public trust that funds and sustains research erodes. AI will continue to transform discovery that is inevitable. What is not inevitable is whether science remains trustworthy in the process.

The real danger is not AI becoming "too intelligent." It is AI becoming untraceable, irreproducible, and unaccountable, quietly eroding the foundations of basic and clinical research before we realize what has been lost. We must ensure that AI augments, not replaces, scientific judgment, skepticism, and accountability. The choice before us is not whether to use AI in research. It is whether we will govern its use with the same rigor we apply to every other instrument in the scientific enterprise. The integrity of science depends on the answer.

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