Ethical Authorship in the Age of Artificial Intelligence

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From Gray Zones to Ethical Challenges

Scientific ethics have long occupied a gray zone, where practices like moonlighting, concealing conflicts of interest, or tailoring reports to appease sponsors sparked debate but escaped universal condemnation. Researchers historically agreed on just three clear breaches: fabrication, falsification, and plagiarism. Among these, plagiarism remains the most persistent issue in scientific research and publishing. In the pre-digital era, plagiarism required significant effort due to limited access to physical texts. However, with the advent of computers and the internet, this landscape shifted dramatically. By the early 2000s, scandals such as the case of 21 mechanical engineering graduates at Ohio University plagiarizing their master's theses signaled a troubling trend. James Visintainer from Kent State University noticed students using online content without citing it, treating it as free for the taking.[1] Marcel LaFollette, author of *Stealing into Print*, connected this behavior to the simplicity of "electronic looting."[2] When LaFollette found an editorial on plagiarism copied from her own work, it highlighted how common and bold this issue had become, showing how digital access blurred the lines of ownership.

By the 2020s, the internet evolved from a static repository into a dynamic ecosystem powered by artificial intelligence (AI), reshaping research and scientific writing. While AI has enabled breakthroughs in data analysis, predictive modeling, and synthesis planning, it has also introduced new ethical risks.[3] Fabrication and falsification, once rare, became easier to automate, while plagiarism detection struggled to keep up with AI-generated content. Students and researchers, shaped by a lifetime of tapping into this digital pool, often saw little wrong in borrowing without credit, a mindset linked to entrenched habits. To date, these concerns have peaked with AI not only facilitating misconduct but also challenging the very essence of authorship and accountability in science.

From Ethical Dilemmas to Publishing Guidelines

Recognizing these ethical challenges, the American Chemical Society (ACS) has taken a proactive stance, embedding integrity into the research process from the ground up. This approach begins in universities, guiding students and early-career scholars to build a strong ethical foundation that benefits authors, reviewers, and editors alike. The *ACS Ethical Guidelines to Publication of Chemical Research* (or *ACS Ethical Guidelines*)[4] and several educational initiatives showcase this commitment. Through the ACS On Campus, early career researchers gain access to quick guides with best practices such as "*Top 10 Tips for Managing Your Data*"[5] and "*Top 10 Tips for Ethical Authorship*".[6,7] These resources address data transparency and authorship accountability, countering the misuse observed by Visintainer and LaFollette. Likewise, ACS Publications provides free training through ACS Author Lab[8] and ACS Reviewer Lab.[9] ACS Author Lab includes modules on selecting the right journal, effectively describing research, and adhering to ethical guidelines while ACS Reviewer Lab covers ethics in peer review, assessing significance and technical

quality and writing a review. As ACS continues to expand its educational efforts, it is also exploring additional formats, such as webinars to enhance accessibility and engagement for researchers. In recent online discussions, the ACS journal editors have shared their perspectives on the strengths and weaknesses of using AI in manuscript preparation, its role in peer review, and the evolving landscape of scholarly communication.[10-12] These efforts contribute to shifting cultural attitudes about borrowing from digital sources while maintaining journal integrity.

Discussions about ethical considerations in publishing and research conduct were also central to the *ACS Symposium Series*, edited by Scheible and Elkins, which compiles contributions on how chemical organizations and researchers develop policies and educational strategies to uphold professional standards. The volume explores key aspects of scientific integrity, including academic honesty, data sharing, authorship, peer review, intellectual property, and codes of conduct from international perspectives with insights from Australia, India, South Korea, and United States.[13] As part of this broader conversation, the importance of transparently disclosing AI use in manuscript preparation is highlighted, reinforcing accountability in data visualization and predictive modeling. Building on this foundation, ACS Publications has updated its AI policy to address the growing availability of AI tools, ensuring their responsible use while maintaining the integrity and excellence of scientific publishing. Authors must use AI tools transparently and ethically, taking full responsibility for the accuracy of AI-generated content and for acknowledgement of the use of AI tools in their manuscripts. The ACS Guidelines specifically state: "The use of AI tools for text or image generation should be disclosed in the manuscript within the *Acknowledgment* section with a description of when and how the tools were used. For more substantial use cases or descriptions of AI tool use, authors should provide full details within the *Methods* or other appropriate section of the manuscript."[14] These policy updates address the nuances of AI, ensuring that tools enhancing research, uphold rigorous ethical standards in the evolving research landscape.

The ACS global alignment with the Committee on Publication Ethics (COPE) strengthens these efforts by rejecting AI authorship to preserve human accountability.[15] This stance counters the ownership confusion common in the digital age. Together, these initiatives ensure ethical training begins early and continues through publication, supporting all involved when submissions arrive at ACS journals.

From Drift to Duty

The transition from ethical gray zones to transformative influence of AI on the chemical industry exposes a disturbing ease of misconduct, fueled by technological advancements outpacing traditional safeguards such as peer review, institutional ethics oversight, plagiarism detection, and data verification. However, ACS turns this challenge into an opportunity for resilience. Through early education via ACS On Campus, Author Lab, and Reviewer Lab, along with webinars, guidelines, and best practices to publication, ACS integrates ethics into the foundation of research as AI technologies become more pervasive in scientific discovery and chemical manufacturing.[16] While past generations grappled with the rise of digital plagiarism, ACS continues to evolve, ensuring that emerging technologies reinforce scientific integrity rather than undermine it.

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