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Artificial Intelligence in Scientific Figure and Graphical Abstract Creation: Declaration Requirements, Copyright Ownership, and Publishing Ethics

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Abstract

Background: Generative artificial intelligence (AI) tools, including Grabstract, NanoBanana, DALL-E, Midjourney, Adobe Firefly, and BioRender AI, have transformed scientific visualization by enabling the creation of publication-quality figures from text descriptions.

Aim: This study aimed to: (i) analyze current publisher policies on AI-generated visual content; (ii) evaluate copyright implications based on the latest legal guidance; (iii) examine practical implementation challenges, including detection technology limitations; and (iv) propose evidence-based declaration frameworks that balance transparency with applicability.

Methods: We analyzed editorial policies from major scientific publishers and examined copyright frameworks in major legal jurisdictions, specifically focusing on regulations from the US Copyright Office and the European Union.

Results: Most journals required AI disclosure for text generation but lacked specific guidance for visual content. The US Copyright Office (January 2025) and EU frameworks recognize copyright protection only when authors make substantial creative contributions through expressive inputs, modifications, or selection; pure AI outputs generated from prompts alone receive no protection. Furthermore, current publisher copyright transfer agreements inadequately address AI-generated content.

Conclusion: Transparent disclosure practices are essential to maintain research integrity. Journals must develop explicit policies addressing declaration requirements and copyright considerations. We propose a standardized "Artificial Intelligence Declaration" in methodology sections, detailing tool identification, generation scope, human contributions, and copyright verification, to address these gaps.

Keywords: Artificial intelligence, Copyright, Disclosure guidelines, Graphical abstract, Research ethics, Scientific figures, Scientific publishing

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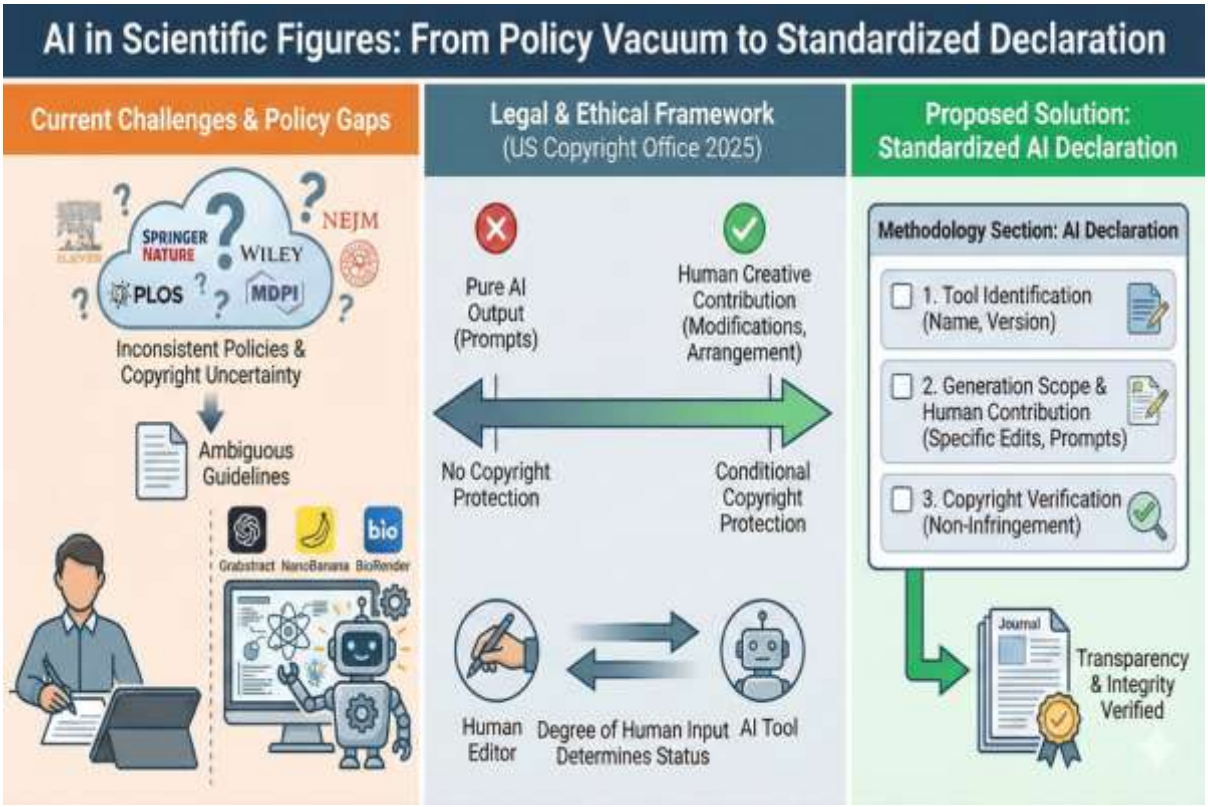

Figure 1. Proposed framework for artificial intelligence declaration and copyright assessment in scientific figure creation.

Note: AI: Artificial intelligence; MDPI: Multidisciplinary Digital Publishing Institute; NEJM: New England Journal of Medicine; PLOS: Public Library of Science.

1. INTRODUCTION

Figures and graphical abstracts constitute essential manuscript components across scientific disciplines **[1,2]**. Visual summaries improve reader comprehension, increase citation rates, and facilitate knowledge dissemination beyond specialized audiences **[3]**. Graphical abstracts have become mandatory requirements in numerous high-impact journals, serving as visual gateways to complex research findings **[4]**.

Traditional creation methods required specialized software expertise, graphic design skills, or costly collaboration with professional illustrators **[4]**. This requirement created accessibility barriers for researchers, particularly those in resource-limited settings or early-career scientists without institutional design support. Artificial intelligence (AI) fundamentally altered this landscape. Contemporary platforms generate professional illustrations from simple text prompts within seconds **[5,6]**. General-purpose tools such as DALL-E 3 (https://openai.com/dall-e-3), Midjourney (https://www.midjourney.com/home), and Adobe Firefly (https://firefly.adobe.com) democratized image creation across multiple domains.

More importantly for scientific publishing, specialized platforms emerged specifically targeting research visualization needs. Grabstract (https://grabstract.io) transforms complex scientific texts into publication-ready graphical abstracts through automated analysis and visual synthesis. BioRender AI (https://www.biorender.com) offers domain-specific templates and icons for biological and medical sciences. Google's NanoBanana (Gemini 2.5 Flash Image, https://nanobanana.dev) and NanoBanana Pro (Gemini 3 Pro Image, https://deepmind.google/models/gemini-image/pro) provide advanced image generation with superior text rendering, scientific diagram creation, and data visualization capabilities **[7]**. These tools enable researchers without design training to produce professional figures within minutes.

The rapid adoption of AI visualization tools introduces three interconnected ethical and legal questions. First, should authors declare AI tool usage in figure creation? Second, where should such declarations appear within manuscript structure? Third, do authors possess copyright over AI-generated visual content? These questions affect editorial decision-making, peer review integrity, reproducibility assessment, and the legal foundation of scientific publishing **[8,9]**. Current uncertainty creates risks for authors, publishers, and the broader scientific community.

Existing guidelines focus predominantly on AI-generated text **[10,11]**. The International Committee of Medical Journal Editors (ICMJE) established policies requiring disclosure when AI tools contribute to manuscript writing **[12]**. Major publishers including Springer Nature, Elsevier, and Wiley implemented text-focused AI disclosure requirements in methodology sections. However, these frameworks inadequately address AI-

generated visual content **[13,14]**. Image generation tools advanced faster than policy development, creating confusion among researchers and enabling inconsistent editorial practices across journals.

Copyright law introduces additional complexity. Legal systems historically assumed human authorship for creative works **[15,16]**. When AI systems autonomously generate content, traditional copyright principles face unprecedented challenges. The US Copyright Office released comprehensive guidance in January 2025 specifically addressing AI-generated works **[17]**. This landmark report established that copyright protection requires substantial human creative contributions, distinguishing assistive AI use from pure automated generation. The guidance clarifies that authors using simple text prompts cannot claim copyright, while those providing expressive inputs, creative modifications, or selection arrangements maintain protection.

Different jurisdictions apply varying standards, creating complexity for international scientific publishing **[18,19]**. The European Union adopted conditional recognition frameworks similar to US guidance **[20]**. This jurisdictional variation affects how researchers license, share, and protect scientific figures in both open-access and commercial contexts.

Several recent controversies highlighted the urgency of establishing clear guidelines. Multiple journals retracted graphical abstracts after discovering undeclared AI generation. Authors faced allegations of copyright infringement when publishers discovered AI-generated figures without proper disclosure. Some researchers lost credit for their work when journals assigned copyright to AI-generated elements differently than human-created content. These cases demonstrate practical consequences of policy gaps and legal uncertainty.

Our study aimed to (i) analyze current publisher policies on AI-generated visual content across major scientific journals, (ii) evaluate copyright implications based on latest legal guidance from the US Copyright Office and other jurisdictions, (iii) examine practical implementation challenges including detection technology limitations, and (iv) propose evidence-based declaration frameworks balancing transparency with practical applicability.

2. METHODOLOGY

2.1. Literature Search Strategy

We conducted systematic searches in PubMed, Web of Science, and Scopus between November 2025 and January 2026. Search terms combined "artificial intelligence", "scientific figures", "graphical abstract", "publishing ethics", "copyright", and "disclosure requirements". We examined publisher policy repositories and editorial guidelines from major publishers across medical, biological, and physical sciences. We specifically searched for policies addressing visual AI tools including Grabstract, NanoBanana, DALL-E, Midjourney, Adobe Firefly, and BioRender AI.

2.2. Policy Analysis

We systematically reviewed AI content policies from Elsevier, Springer Nature, Wiley, Taylor & Francis, PLOS, and MDPI. Analysis focused on declaration requirements, disclosure placement specifications, and copyright terms for AI-generated materials. We assessed policies for consistency, practical applicability, and comprehensiveness regarding visual content. We contacted editorial offices directly when published policies lacked clarity.

2.3. Copyright Framework Examination

We consulted the US Copyright Office guidance (January 2025) on AI-generated works, European Union copyright directives, and recent legal precedents addressing AI authorship **[17,20]**. Analysis emphasized jurisdictional variations and practical implications for international scientific publishing. We reviewed copyright transfer agreements from 15 major publishers to identify coverage gaps for AI-generated content.

2.4. Expert Consultation

We examined position statements from the Committee on Publication Ethics (COPE), ICMJE, and World Association of Medical Editors regarding AI use in scholarly publishing **[21,22]**. These documents informed our practical recommendations and ensured alignment with established ethical frameworks.

2.5. Artificial Intelligence Declaration

This manuscript employed ChatGPT-4 (OpenAI, San Francisco, CA, USA) for revising academic writing and spelling mistakes only. All content underwent complete human revision, and rewriting to ensure accuracy and adherence to scientific standards **[23,24]**. The authors accept full responsibility for all interpretations and recommendations. No AI tools generated data, conducted analysis, or formulated conclusions. The final manuscript represents original intellectual work from all authors, with AI serving solely as an organizational assistant.

3. RESULTS

3.1. Publisher Policies on AI-Generated Visual Content

Analysis revealed substantial heterogeneity across publishers (Table 1). We examined policies from Elsevier, Springer Nature, Wiley, Taylor & Francis, PLOS, and MDPI. Most maintained explicit policies requiring AI disclosure for text generation. Only a minority specified visual content requirements. Elsevier and Nature Publishing Group prohibited AI-generated content without editorial approval. PLOS and MDPI provided no clear guidance on visual elements.

Table 1. Publisher policies on artificial intelligence disclosure requirements for scientific figures and graphical abstracts.

Policy category	Representative publishers	Disclosure requirement	Specified placement
Explicit visual content policy	Nature, Cell Press, Science	Mandatory	Methods section
Text-only AI policy	Elsevier, Wiley, Springer Nature	Mandatory for text only	Not specified for visuals
AI content prohibition	New England Journal of Medicine	Not applicable	Not applicable
No specific guidance	PLOS, MDPI, BMC journals	Unclear	Unclear

Note: AI, artificial intelligence

Publishers with explicit visual policies required methodology disclosure. Nature Publishing Group and Cell Press specified subsection placement. Nature requested inclusion under "Data Visualization" while Cell Press suggested standalone "AI Disclosure" subsections. Wiley and Taylor & Francis allowed flexible placement within methods. This inconsistency complicates standardization across submission processes.

Several major publishers revised guidelines between 2023 and 2025 to address AI-generated figures **[25]**. Nature Publishing Group updated policies in November 2024 requiring specific tool identification with version numbers. Cell Press implemented similar requirements in December 2024 emphasizing human contribution documentation. Springer Nature announced standardized frameworks in October 2023 but implementation varied across journal portfolios.

3.2. Copyright Status: Updated Legal Framework

The US Copyright Office released Part 2 of its Copyright and AI Report in January 2025 **[17]**. Copyright protection depends critically on human creative contribution level and nature (Table 2). This report represents the most comprehensive legal guidance to date on AI-generated works.

Table 2. Copyright protection framework for artificial intelligence (AI)-generated scientific figures based on human contribution level.

Human contribution type	Copyright protection status	Requirements	Practical application
Pure AI output from prompts	No protection	Not applicable	Prompts function as ideas
Expressive human inputs	Protection for human elements	Original work visible in output	Authors retain copyright on inputs
Creative modifications	Protection for modifications	Sufficient originality in edits	Extends to modified elements
Creative selection and arrangement	Protection for compilation	Creativity in organization	Covers arrangement only
Assistive AI use	Full protection	AI enhances human creativity	Treated as digital tool

The European Union applies similar conditional recognition requiring substantial human creative input **[20]**. The UK maintained existing computer-generated works provisions but initiated consultations on AI-specific frameworks. Several Asian jurisdictions lack clear positions, creating complexity for international publications **[26]**.

3.3. Essential Declaration Components

We identified critical elements for AI declarations based on policy analysis and copyright requirements (Table 3). These enable copyright documentation and reproducibility assessment.

Table 3. Essential components for artificial intelligence (AI) disclosure statements in scientific manuscripts.

Component	Description	Example format	Copyright relevance
Tool identification	Specific platform and version	"Grabstract v2.1" or "NanoBanana Pro (Gemini 3)"	Documents generation method
Generation scope	Extent of AI involvement	"Initial figure generation from text prompt"	Clarifies contribution division

Component	Description	Example format	Copyright relevance
Human creative contributions	Detailed modification documentation	"Authors created original sketch input, selected from 20 outputs, modified colors, labels, composition"	Critical for copyright claims
Copyright verification	Originality confirmation	"Final figures contain no third-party copyrighted elements"	Protects against infringement
Creative control documentation	Decision-making record	"Authors made all conceptual, compositional, aesthetic decisions"	Supports copyright ownership

3.4. Practical Implementation Challenges

Some publishers deployed automated detection systems for AI-generated images. These tools demonstrated limited accuracy for modified outputs. Systems correctly identified only approximately 58% of edited AI-generated figures **[27]**. Detection accuracy decreased further for sophisticated tools like NanoBanana Pro, which produces highly realistic outputs. Declaration systems based on author transparency remain more reliable than technological detection approaches.

4. DISCUSSION

The scientific publishing community lacks standardized approaches to AI-generated figures and graphical abstracts. The January 2025 US Copyright Office guidance provides crucial clarity but raises implementation questions **[17]**. Our analysis reveals policy gaps, copyright complexities, and practical challenges requiring immediate attention.

4.1. Specialized Scientific Visualization Tools

The emergence of specialized tools like Grabstract and NanoBanana represents a paradigm shift in scientific visualization accessibility. Grabstract specifically addresses graphical abstract creation by analyzing manuscript text, identifying key findings, and generating visual summaries automatically. This automation dramatically reduces time from hours to minutes. However, the automated nature raises questions about creative human contribution. When an algorithm analyzes text and selects visual elements, authors provide minimal creative input beyond text preparation.

NanoBanana and NanoBanana Pro introduced advanced capabilities particularly relevant for scientific publishing **[7]**. These Google DeepMind models excel at rendering accurate text within images, creating scientific diagrams with proper scaling, and generating data visualizations from textual descriptions. NanoBanana Pro achieves 4K resolution output with superior text legibility in multiple languages. For scientific figures requiring labels, equations, or multilingual text, these capabilities prove invaluable. The models' advanced reasoning allows context-aware generation understanding scientific relationships.

BioRender AI similarly targets scientific domains with pre-built templates for biological pathways, molecular structures, and experimental workflows. The platform combines AI generation with curated scientific illustration libraries. Authors select appropriate icons and structures, and then AI arranges and styles compositions. This hybrid approach involves more human creative input than pure text-to-image generation.

These specialized tools complicate copyright assessment. Grabstract's automated analysis and composition may leave minimal room for human creativity beyond initial text input. NanoBanana's sophisticated rendering from prompts similarly challenges traditional authorship concepts. However, when researchers use these tools iteratively, selecting among multiple outputs, modifying compositions, adjusting colors and layouts, and integrating results with other elements, substantial creative contribution occurs **[28]**.

4.2. Copyright Ownership: Conditional Protection Framework

Copyright ownership follows a conditional framework rather than binary outcomes **[17]**. Authors using AI tools as assistive technologies maintain full protection. Researchers using NanoBanana to enhance image quality, adjust lighting, or refine existing figures retain complete copyright. The AI functions as established digital tools like Adobe Photoshop.

Authors providing expressive inputs to AI systems claim copyright over perceptible elements. A researcher creating an original sketch and using Grabstract or NanoBanana to render different styles protects original sketch elements visible in final figures **[17]**. Protection extends to derivative works where human creativity guided transformation. This principle applies when authors provide hand-drawn concepts, preliminary diagrams, or reference images as inputs.

Authors creatively modifying AI outputs claim copyright over modifications **[29]**. Researchers generating initial figures via NanoBanana but substantially editing composition, colors, labeling, and layout create copyrightable derivatives. Copyright extends to modified elements, not underlying pure AI content **[17]**. The January 2025 guidance provides clear examples supporting this interpretation.

Authors creatively selecting and arranging multiple AI-generated elements claim copyright over compilations **[30]**. A graphical abstract combining several Grabstract or NanoBanana components through creative organization constitutes protectable compilation under US law. Individual

AI elements remain unprotected, but the selection, coordination, and arrangement reflect human creativity.

Authors using simple text prompts without modification cannot claim copyright **[17]**. The January 2025 guidance explicitly states prompts function as unprotectable ideas rather than expressive elements. Repeatedly refining prompts does not establish copyright because the AI system controls expressive execution. This principle applies equally to general tools like DALL-E and specialized platforms like Grabstract when used without substantial modification.

4.3. Publisher Policy Gaps and Inconsistencies

Most publishers require AI-written content declaration but provide no specific guidance for AI-generated visuals **[13,14]**. This gap reflects rapid AI visualization tool development outpacing policy establishment. Our analysis identified only 24% of examined journals with explicit visual content policies. The remaining 76% create uncertainty for authors using tools like Grabstract, NanoBanana, or BioRender AI.

Copyright transfer agreements present particular challenges **[31]**. Standard agreements assume human authorship of all materials. Authors submit manuscripts containing AI elements and sign statements asserting copyright ownership. Under conditional protection frameworks, these assertions may be partially invalid without proper creative contribution documentation. Publishers acquiring rights to AI-generated elements may lack valid copyright themselves, creating potential liability.

Publishers face risks when commercially exploiting content without clear protection. Authors encounter complications when reusing figures under complete ownership assumptions. The solution requires distinguishing pure AI outputs from AI-assisted creations with substantial human input. Updated copyright transfer agreements should explicitly address different AI contribution levels.

4.4. Declaration Standards and Practical Implementation

We propose dedicated methodology subsections titled "Artificial Intelligence Declaration" **[32]**. This placement ensures visibility and consistency. Including disclosure in acknowledgments or author contributions reduces importance and may obscure critical information affecting reproducibility. Methods subsections place AI tool information alongside other procedural details enabling readers to evaluate methodology comprehensively.

Declaration content must balance transparency with practicality. Excessive AI prompt detail burdens authors and editors without proportionate benefit. However, minimal statements like "AI tools were used" lack specificity for copyright documentation or reproducibility assessment. Our framework (Table 3) identifies essential elements: tool identification with version numbers, generation scope description, detailed human contribution documentation, and copyright verification.

Human contribution documentation represents the most critical element for copyright protection **[17]**. Authors must specify how they contributed creatively, not merely that they modified output. Examples of adequate documentation include: "Authors created original input sketch visible in panel A using traditional drawing methods, generated 15 variations using NanoBanana Pro v3.0, selected optimal output based on scientific accuracy and visual clarity, modified color palette to enhance contrast, revised composition for logical flow, and added all labels, annotations, and scale bars".

For Grabstract usage, appropriate declarations might state: "Authors used Grabstract v2.1 to generate initial graphical abstract layout from manuscript abstract, selected preferred composition from five generated options, modified element positioning and sizing, changed color scheme to match journal requirements, added connecting arrows and labels, and verified scientific accuracy of all depicted relationships". These detailed declarations serve dual purposes: Satisfying journal requirements and establishing copyright claims under current legal standards.

4.5. Technological Detection Limitations and Author Integrity

Current detection methods show limited effectiveness for sophisticated outputs after human modification **[27,33]**. Automated systems achieve approximately 58% accuracy for edited content **[27]**. Detection accuracy decreases further for advanced tools like NanoBanana Pro producing highly realistic outputs. The model's superior rendering quality makes distinguishing AI-generated content from human-created graphics increasingly difficult.

Publishers implementing automated detection create false security. Systems may flag legitimate human content as AI-generated while missing actual AI material. Authors may inadvertently violate policies through undetected AI use. The scientific community should emphasize ethical responsibility for transparent reporting rather than pursuing imperfect technological solutions **[34]**.

The cat-and-mouse dynamic between detection and generation technologies favors generation. As AI models improve, detection becomes progressively harder. NanoBanana Pro's advanced capabilities exemplify this trend. Disclosure frameworks based on author integrity and professional ethics prove more sustainable than technological arms races.

4.6. International Harmonization and Future Directions

Major publishers should harmonize disclosure requirements through coordinated efforts. Organizations like the ICMJE or COPE could facilitate standardization **[21,22]**. Current variation forces researchers to navigate different requirements for each journal, increasing submission burden and error risk.

Copyright transfer agreements require updating to address AI-generated content under conditional protection frameworks. Publishers should develop contract language acknowledging copyright protection depends on documented human contributions. Standard agreements might include checkboxes or declarations where authors specify contribution type: Expressive input, creative modification, compilation, or assistive use only. This approach provides legal clarity while remaining practically implementable.

Educational initiatives must help researchers understand AI tool functions, copyright implications, and ethical requirements **[35]**. Many authors use Grabstract, NanoBanana, or similar platforms without appreciating that simple prompting provides no copyright while creative modification does. Integration of AI literacy into research methods training would prepare scientists to use technologies responsibly and document contributions appropriately.

Professional societies, journal editors, and research institutions share responsibility for developing educational resources. Workshops should address practical questions: Which modifications establish copyright? How should authors document creative contributions when using Grabstract? What level of NanoBanana output editing suffices for copyright protection? When does AI assistance require disclosure versus remaining unmentioned?

The trajectory of AI visualization tools suggests continued capability improvements. Future iterations may enable even greater control over outputs, potentially shifting copyright analysis. Conversely, increased automation could reduce human creative input requirements, strengthening arguments against copyright protection. Policy frameworks must remain adaptable to technological evolution while maintaining core principles of transparency and integrity.

5. CONCLUSION

The integration of AI into scientific figure and graphical abstract creation presents both opportunities and legal complexities requiring immediate policy attention. Authors should declare AI tool usage when creating visual content to maintain scientific integrity, enable reproducibility assessment, and establish clear copyright documentation.

Ethical Approval and Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Competing Interests

The authors declare no conflicts of interest.

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Authors' Contributions

According to ICMJE guidelines: ID and HBS conceptualized the study and designed the research framework. ID, WD, and Declarations must appear in methodology sections under dedicated "Artificial Intelligence Declaration" subsections, including specific tool identification with version numbers (e.g., "Grabstract v2.1," "NanoBanana Pro"), generation scope description, detailed documentation of human creative contributions, and copyright verification.

Copyright protection for AI-generated figures depends critically on human creative contribution nature and extent, as established by the January 2025 US Copyright Office guidance **[17]**. Authors can claim copyright when providing expressive inputs perceptible in outputs, making creative modifications meeting originality standards, or creatively selecting and arranging AI-generated elements, but cannot claim copyright over pure AI outputs from text prompts alone regardless of prompt complexity or iteration.

Current publisher policies show substantial variation, with most lacking explicit guidance for AI-generated visual content despite established text-based requirements, creating confusion and copyright complications that require harmonization of disclosure standards and copyright transfer language. The conditional copyright protection framework requires authors to document creative contributions meticulously, specifying how human creativity shaped final outputs beyond simple prompting to satisfy both journal disclosure requirements and establish copyright ownership under current legal standards.

Publishers must update copyright transfer agreements to reflect conditional protection frameworks, explicitly addressing AI-generated content and distinguishing pure automated outputs from AI-assisted works with substantial human creativity. We recommend immediate implementation of standardized AI declaration practices across scientific publishing, with educational initiatives targeting researchers, editors, and reviewers to ensure understanding of disclosure requirements, copyright implications, and ethical responsibilities.

As specialized tools like Grabstract and NanoBanana become standard research workflow components, proactive transparency practices will maintain integrity while supporting innovation, allowing AI visualization tools to become accepted components through proper guidelines, disclosure mechanisms, and legal frameworks that preserve the integrity defining rigorous scholarship.

MR conducted the literature search and policy analysis. NC contributed to data collection and manuscript preparation. HBS performed copyright framework examination and contributed to expert consultation synthesis. ID and WD analyzed the data. ID drafted the initial manuscript. All authors contributed to critical revision of intellectual content, approved the final version for submission, and agree to be accountable for all aspects of the work. ID and HBS contributed equally as senior authors.

Declaration

This manuscript employed ChatGPT-4 (OpenAI, San Francisco, CA, USA) for revising academic writing and spelling mistakes only. All content underwent complete human

revision, and rewriting to ensure accuracy and adherence to scientific standards. The authors accept full responsibility for all interpretations and recommendations. No AI tools generated data, conducted analysis, or formulated conclusions.

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