

The Development of BSA's Comprehensive AI Policy for Its Academic Journals

In today's society, artificial intelligence (AI) is rapidly advancing and expanding through all aspects of our lives. The release of ChatGPT in November of 2022 made AI accessible to anyone with a computer and an internet connection. After the explosion of interest and activity that followed, AI now has the potential to radically change our world as we know it. According to a recent Oxford University Press poll (Anderson, 2024), researchers across scientific disciplines today are increasingly using AI tools, but also have extensive misgivings about AI technology. For example, 76% of researchers globally currently use some form of AI in their research (e.g., chatbot, machine translations, AI-powered search engines and research tools), but only 8% trust the AI companies not to use their own data without permission, and 25% are concerned about AI reducing the need for critical thinking skills in science (Anderson, 2024). Most recently, publishers Taylor & Francis and Wiley agreed to sell access to academic content

to certain tech companies for training AI models, causing concern among the scientific community.

AI itself is a broad term that refers generally to non-human (machine) intelligence (De Waard, 2023), but AI can be adapted and used for specific purposes (Zhou, 2023). Underlying many AI tools are large language models (LLMs), which are trained on large amounts of existing text data or visual and sound recordings to decipher written human language and create media. LLMs are most useful for translation, summarizing existing text, and generating requested content such as Q&A. Generative AI tools such as ChatGPT use these LLMs with additional training to then create original content such as text, images, code, and even videos or music. AI can also be used in a process known as "inference" to draw conclusions from new data without depending upon only past examples.

By Theresa M. Culley^{1,11*}, Irene Cobo-Simón^{2*}, Robert L. Baker³, Aaron S. David⁴, Matthew A. Gitzendanner⁵, Matthew S. Olson⁶, Tilottama Roy⁷, William N. Weaver⁸, Pamela Diggle⁹, and Briana Gross¹⁰

¹ Department of Biological Sciences, University of Cincinnati, OH

² Institute of Forest Sciences (ICIFOR-INIA, CSIC), Madrid (Spain); Associate Editor of APPS

³ National Park Service, Fort Collins, CO; Associate Editor of APPS

⁴ Archbold Biological Station, Venus, FL; Associate Editor of AJB

⁵ Department of Biology, University of Florida, FL

⁶ Department of Biological Sciences, Texas Tech University, TX

⁷ Department of Biology, Missouri Western State University, MO

⁸ Department of Ecology and Evolutionary Biology, University of Michigan, MI

⁹ Department of Ecology & Evolutionary Biology, University of Connecticut, CT; Editor-in-Chief of AJB

¹⁰ Swenson College of Engineering and Science, University of Minnesota-Duluth, MN; Editor-in-Chief of APPS

¹¹ Corresponding author: theresa.culley@uc.edu

*Joint first authors

Generative AI tools are already impacting multiple fields of scientific research and the publication of scientific articles. Generative AI tools include a wide variety of technologies, such as natural language processing (NLP), which underlies generative pre-trained transformer (GPT) models, and image generation and editing. These tools can be used in writing to suggest text, correct grammar or spelling, or match a particular style of a scientific journal. AI tools are also extremely useful for data analysis; they can process large amounts of data with accuracy and speed, and identify patterns and information difficult to detect with traditional methods. AI can be used to generate code, automate repetitive tasks, and simulate experimental conditions. When used in these ways, AI has the exciting potential to propel science forward in ways we can only imagine today; however, its use also raises important ethical and practical considerations. Present-day AI-generated content can sometimes include incorrect, out-of-date, or nonexistent citations, or contain repetitive or inappropriate language, reflecting the biases/inaccuracies of the data on which the tools have been trained. AI tools can be used to manipulate images and may plagiarize existing text, but this technology can also be used to detect such actions with ever-increasing accuracy. For example, publishers such as Elsevier, Springer, and Wiley now use their own in-house AI tools to check for AI usage in submitted manuscripts to ensure integrity of their publications.

Recognizing the necessity of addressing the use of AI in the publication process, the Botanical Society of America (BSA) formed an ad hoc committee in fall 2023 to develop a policy regarding use of AI in its publications (*American Journal of Botany*, *Applications in Plant Sciences*, and *Plant Science Bulletin*). Committee members consisted of researchers selected from a special call for participants, BSA editorial staff (managing editors, production staff, associate/reviewing editors, and editors-in-chief), and the BSA Director-at-Large for Publications. This committee was charged to discuss generative

AI tools as they apply to publishing and to then develop guidelines, policies, and best practices for authors, reviewers, and editors of BSA journals. The committee specifically focused on the following three categories:

1. Defining how authors may or may not use AI when writing text, including how to properly acknowledge AI tools (if allowed in any circumstance)
2. Describing how AI tools can be used for generating code as a potentially acceptable use
3. Deciding how reviewers may or may not use AI in their reviews

The committee met several times during the following months as individual workgroups focused on drafting sample language for each point above, and then as the full group to fine-tune the language. This AI policy established guidelines to promote responsible and ethical use of AI in scientific publications—aiming to harness the potential of AI while safeguarding the integrity of scientific research. The AI policy was then added to the Author Guidelines for all BSA journals and released publicly in spring 2024, with required disclosure of AI use on the author and reviewer submission forms. As AI continues to evolve, ongoing dialogue and adaptation of these policies will be crucial to ensuring that the BSA community remains at the forefront of innovation and ethical practice.

The purpose of this article is to describe the key points considered by our ad hoc committee during our discussions, namely: (1) how other journals and publishers have addressed AI to date, (2) current opportunities and challenges of AI tools, and (3) a summary of our committee discussion that resulted in the final BSA AI policy.

CURRENT STATUS OF AI IN PUBLISHING

Here we review as of April 2024 the current guidelines and policies of the top six academic publishers, as identified by Scholarly Publishers Indicators 2022 (<https://spi.csic.es/>), on the use of AI generated content (AIGC):

- Cambridge University Press
<https://authorservices.wiley.com/ethics-guidelines/index.html>
- Elsevier
<https://www.elsevier.com/about/policies-and-standards/the-use-of-generative-ai-and-ai-assisted-technologies-in-writing-for-elsevier>
- Oxford University Press
<https://academic.oup.com/pages/authoring/books/author-use-of-artificial-intelligence>
- Taylor & Francis
<https://asset.routledge.com/rt-files/AUTHOR/Guidelines/Manuscript+preparation+guide.pdf>
- Springer
<https://www.springer.com/gp/editorial-policies/artificial-intelligence--ai-/25428500>
- Wiley-Blackwell
<https://authorservices.wiley.com/ethics-guidelines/index.html>

All publishers consider the use of AI an ethical issue. For example, Oxford University Press states, “AI must be consistent with the Press’s mission and the values inherent in our publishing, with all that this entails in terms of quality, integrity, and trust.” All six publishers agree that AI is a tool that simulates human intelligence, but is not an intelligent entity in itself. Consequently, none of the publishers allow a statement of authorship by any AI-based tool (such as ChatGPT) in scientific articles. This is consistent with the 2023 statement from the Committee On Publication Ethics (COPE; <https://publicationethics.org/cope-position-statements/ai-author>), which states that AI tools cannot perform the role of an author of

a work, nor therefore, appear in the list of authors of a work. As non-legal entities, AI tools cannot take responsibility for the ethical and legal aspects of the submitted work. Furthermore, Wiley and Elsevier point out the difference between the use of AI to make original intellectual contributions (without human direction)—which is not allowed—versus assistance in the preparation of scientific articles—which is allowed. Both publishers also point out the need for the authors to supervise the content generated by the AI tools. All publishers (except Oxford) state that authors are ultimately responsible for their manuscript content regardless of whether AI was used.

All publishers also agree that the use of AI to generate content must be transparent and correctly referenced, as required with any other tool. Any use of AI must be disclosed in the cover letter to the editor upon manuscript submission and/or in the Methods or Acknowledgments section of a manuscript. This is also consistent with COPE’s position statement on AI tools. Elsevier, Cambridge, and Taylor & Francis all state that the use of AI tools must comply with editorial policies on authorship and principles of publishing ethics (also mentioned in COPE’s position statement). Cambridge also emphasizes its anti-plagiarism policy, pointing out that any content generated by other authors and coming from AI-based tools must be cited and referenced in an appropriate and transparent manner.

There is a lack of consensus regarding the generation or modification of images through AI tools. Elsevier and Springer consider AI-generated figures separately from the generation of other types of content such as text, and prohibit it, with few exceptions. While Elsevier does not provide any explanation for this policy, Springer supports their policy by stating that legal issues relating to AI-generated images and videos remain broadly unresolved; consequently, Springer is unable to permit its use for publication. In contrast, Oxford evaluates AI-generated images in a similar way to the generation of other types of content (e.g., text,

code), allowing it as long as it meets the criteria of transparency and is cited correctly. The remaining publishers do not consider the use of AI to generate and/or modify images separately in their Author Instructions; therefore, it is understood that they consider images along with generation of content in general. This is also in line with COPE's position statement on authorship and AI tools, which considers AI-generated images similarly to other AI-generated content (text, graphical elements, data collection, and analysis) and allows it as long as authors are transparent in disclosing within the article how the AI tool was used and which tool was used. Authors are also considered fully responsible for any AI-generated content, including all of its ethical aspects.

Several publishers have also developed policies concerning the use of AI in the review process. Springer stresses transparency in the use of AI tools during the peer-review process, requiring reviewers to declare any use of AI in their peer-review report. Springer notes that this technology still has considerable limitations (e.g., as described below, such as outdated information). Furthermore, Springer also explicitly prohibits reviewers from uploading any manuscript content into generative AI tools because manuscript text may contain sensitive or proprietary information. Both Elsevier and Springer note the rapid advancement of AI tools and therefore the need to regularly review their AI-related policies and guidelines.

More recently, publishers Taylor & Francis and Wiley separately gave licensing rights to AI companies for their repository of past publications (Dutton, 2024); Oxford University Press and Cambridge University Press are now forming partnerships as well (Wood, 2024). Taylor & Francis' \$10 million deal with Microsoft is expected to assist their development of Copilot, Microsoft's AI assistant. Wiley's partnership with at least two undisclosed companies was reportedly worth \$23 million and \$21 million; in return, Wiley provides access to its published material to train LLMs by using book content and small pieces of individual

articles, and to make a narrow range of articles specific to a topic available for use in inference. At this point, it is unknown whether authors will even know if their publication has been used. Except for a few publishers, authors are not able to opt-out of having their material used in this way, which has created much consternation for many authors (Authors Guild, 2024). In the case of Wiley, the company has established guiding principles for AI technology and partnerships (<https://www.wiley.com/en-us/terms-of-use/ai-principles>).

OPPORTUNITIES OF AI TECHNOLOGY

Artificial intelligence and LLMs offer many new and exciting opportunities for researchers not only to enhance their science, but also to promote communication through the publication process (Buriak et al., 2023). One of the most common uses of AI by authors is as a "personal copy editor" to improve the quality and clarity of the language in their manuscript, polishing text created by the author. When used properly, these tools are not dissimilar to automatic spell checkers and grammar checkers. Even Microsoft Editor is now promoted as an AI-powered service. The popular Grammarly tool also boasts of an AI communication assistant to help authors pinpoint areas of weakness, such as typos, missing punctuation, or commonly confused words. The premium version of Grammarly is advertised as using AI to adjust the tone, rewrite full sentences, and generate text for over 1000 different AI prompts in manuscripts and even email. Other AI-based editing and rewriting tools include Wordtune (for rewriting, shortening, or expanding content), WordRake (which edits for brevity or simplicity), Writefull (helping to write and paraphrase scientific text), and LanguageTool (a grammar checker specialized for multilingual writers). More grammar checker and rewriting tools will undoubtedly be released in the future, especially as generative AI and the machine learning on which it relies continue to improve.

Such personal copy editors powered by AI may be especially helpful for multilingual authors for whom English might not be their primary language, particularly when submitting to an English-only journal. Some authors already upload their own text into ChatGPT and then review the rewording, grammar, or punctuation suggestions to enhance the clarity of their papers. ChatGPT can be used for any language within its repertoire, which now includes at least 50 languages, with more being added to make this tool increasingly accessible and useful. Currently, some AI-suggested text may still be scientifically nonsensical or inaccurate, so a careful eye is required before accepting and incorporating any recommendations (see below). However, with continued training, future renditions of AI tools will likely overcome these problems.

AI tools can also be used by researchers to explore the literature when first embarking on a new topic, and to identify suitable references for their manuscript. When asked to provide peer-reviewed papers on a specific topic, ChatGPT provides a short list of usually five papers, but can be prompted to retrieve more. As with all AI-generated results, the papers may or may not relate to the topic and need to be reviewed further. Recent papers are usually excluded from the list, as dates of retrieved papers reflect when the AI was initially trained. For example, ChatGPT-4 Turbo released in November 2023 can only identify literature published up to April 2023. Other AI-powered platforms such as scholarcy (<https://www.scholarcy.com/>) help authors quickly summarize and organize articles applicable to their own research, increasing the efficiency with which researchers can search the literature.

As more authors use generative AI for polishing existing text, there are multiple downstream benefits. First, the overall written quality of manuscripts submitted to journals may increase, making it easier for editors to ascertain if a manuscript is appropriate for the journal and should be sent out for external review. A well-written manuscript is more likely to be

perceived favorably by reviewers, who can focus on the scientific content rather than distractions of misspellings, grammatical errors, confusing sentence construction, and general disorganization. Such a manuscript will also reduce the amount of copy editing and time required for conversion into a publication-quality article, increasing the efficiency of the publication process.

For several years, publishers and editorial staff have been using their own AI tools to detect plagiarism and image manipulation, and to find appropriate reviewers for submitted manuscripts. BSA journals commonly use CrossRef's Similarity Check to review manuscripts for potential plagiarism. AI-powered platforms such as Proofig or imagetwin can also be used by editors and publishers to detect image manipulation. Publishers are now piloting AI to detect submitted papers generated from “papermills”—groups of individuals or an organization generating similar papers and submitting them fraudulently to multiple journals for financial gain. Editors can use AI to analyze a submitted manuscript's relevance to a journal, verify the identity of an author, and detect irregular publishing patterns by authors that may indicate fraud (e.g., a mathematician submitting papers to a medical journal). In a time where there are increasing numbers of predatory journals (Culley, 2018), AI can also be used to check the quality of references cited within an article. Publishers are also beginning to use AI tools to flag machine-generated content, especially when text may be translated into one language and then converted back in an effort to avoid detection (such as “big data” in English translated to “data grande” in Spanish and back to “greater data”). In a time when finding appropriate reviewers willing to read a submission is critical to the peer-review process, publishers are now using AI tools to locate suitable reviewers or to identify conflicts of interest (e.g., a proposed reviewer recently co-authoring a paper with the author) instead of a handling editor spending their own time to track down this information. In summary, incorporating AI tools to assist editors

and publishers can greatly decrease the amount of time spent per manuscript, while enhancing the quality of the review and publication process.

Finally, when properly trained, AI technology can also be used to effectively conduct science. For example, AI-based models can be used to synthesize vast quantities of data that would otherwise require multiple people and many hours of labor. Such synthesis also minimizes the chance of mistakes being made and enhances consistency of any particular process. The power of AI can also be harnessed to identify patterns and relationships within large data sets that would otherwise be difficult and time consuming to detect. For example, LLMs can now be used to interpret text in digitized images of herbarium specimen labels (Weaver and Smith, 2023; Weaver et al., 2023). Another example is the revolutionary and recently developed AI program AlphaFold 3, which is able to predict the structure and interactions of proteins with other molecules such as DNA and RNA with unprecedented precision and accuracy (Abramson et al., 2024). AI can also be used as an additional overlay to identify any information that otherwise would regularly go undetected. Finally, AI can check code or even generate code within an experiment that would take a human many hours to create. In summary, the advantages of using AI within the scientific process itself are many, provided of course that all results are supervised and checked by the researcher themselves.

CHALLENGES OF AI TECHNOLOGY

While AI poses exciting and innovative opportunities, it is not without serious concerns and challenges in the publication process, particularly when used incorrectly. Many of these concerns can be avoided by treating AI as a tool to assist human decisions and by recognizing the inherent limitations of AI, most of which reflect the underlying machine-learning and training technology.

On the most basic level, AI technology can be prone to inherent errors such as incorrect, nonsensical, or blatantly false output (Davis, 2023). Citations may be incorrect, incomplete, or outdated because the AI tool is limited by its most recent training date. AI can also be weak at judging whether an unusual outcome is “spurious, anomalous or groundbreaking” (Buriak et al., 2023). Even the ability to detect a typical outcome will depend solely on the data provided to the tool during its training—hence the strength of any current AI tool will always be temporally and contextually limited. AI-generated tools are also known for sometimes creating shallow and superficial text with a superfluous tone. There are now detectors that can be used to identify such AI-generated text, such as Turnitin, TraceGPT, Hive, and GPTZero, but their effectiveness, accuracy, and cost can vary (Walters, 2023). In addition, inadvertent errors could occur if generative AI incorporates phrases that are not in the author’s native language that may have an alternative meaning in another language that is not understood by the author (e.g., “background research” vs. “doing research in the background”). Finally, while AI can be effective at summarizing past studies (assuming it is able to detect all relevant content), the technology at the current time is still unable to look forward in time and provide a critical assessment of a topic and articulate next steps. These types of errors are especially concerning if readers assume AI-generated text is of human origin (Buriak et al., 2023). Such inaccurate information would also be very worrisome if it escapes detection by reviewers and is then published in a peer-reviewed journal, earning a scientific stamp of approval. In short, current AI technology is limited because it lacks human intuition and the ability to detect nuances and to conclusively project into the future.

Another major concern with the use of AI technology in the publication process involves confidentiality. When reviewers are asked to read a submission for a peer-reviewed journal, they must agree to confidentiality and not share the author’s work or ideas. However, confidentiality

could be violated if a reviewer uses generative AI to compose their written review by uploading part or all of the submitted manuscript into an AI tool. Although this is now starting to change, some popular AI tools may still incorporate text that has been entered into the search window in the subsequent training of its tool or technology, such that the same text or idea could potentially be suggested by the tool to another user in response to a related query. A potential solution is the use of private generative AI tools within individual laboratories in which training data are kept in-house; however, even a private generative AI tool may suffer from many of the same challenges outlined above. Using a private tool to generate a brief summary of the manuscript, as typically presented at the top of a formal review, could be helpful though, provided the platform is used with human oversight.

AI tools may also express inherent biases based on the algorithm and training data used to create the tool. Such bias can be sexist, racist, or even political, depending on what content was used in the initial training. For example, ChatGPT replicated gender bias when asked to construct recommendation letters for males (which used nouns such as “expert” and “integrity” and adjectives like “respectful” and “reputable”) and females (emphasizing “beauty” or “delight” and who were “stunning” and “emotional”) (Wan et al., 2023). In another example where ChatGPT was asked to create a crime drama, researchers used four-word prompts, only one of which changed (either “black” or “white”), to explore ChatGPT’s potential implicit bias (Piers, 2024). Motoki et al. (2023) also found that ChatGPT exhibits left-leaning political tendencies, such as towards Democrats in the United States, the Workers’ Party in Brazil, and the Labour Party in the United Kingdom. The reason for these biases is that many LLMs use data from the internet for their training, which largely reflects historical stereotypes and perspectives already present online. Thus, if left unchecked, the use of ChatGPT and other LLMs could inadvertently amplify existing and historical information on the internet and social media.

DEVELOPMENT OF THE BSA POLICY ON AI TECHNOLOGY

Our ad hoc committee met several times in 2023 and 2024 to discuss the ethical use of AI in the publishing process. We examined every aspect of the development of a research project: initial conceptualization, data collection, integration and analysis, interpretation and presentation of data, and writing the manuscript. Going into these discussions, many of our committee members were initially skeptical of using AI in the publication process due to its inherent limitations (see above) and the possibility of authors using it unscrupulously to fabricate text. In fact, several of us started the conversation thinking about excluding all elements of AI from the publication process but, as explained below, eventually we changed our minds. Ultimately, we agreed that there was no part of the scientific process for which AI should be banned because it has the potential to help in every aspect, if used appropriately. We recognized that there is no AI tool that is inherently beneficial or detrimental; it depends on how a given tool is used and the extent to which the user is aware of each tool’s limitations. AI has the potential to make research more thorough by uncovering additional information beyond an author’s immediate knowledge. Thus, we agreed that the development of guidelines for authors and reviewers for the publication process is key to taking advantage of this novel and promising technology, while avoiding its potential drawbacks.

We also recognized that the AI field is rapidly advancing with constantly evolving tools such that what we perceive today as cutting-edge may quickly become routine in the months and years to come. The AI of tomorrow will likely be different from the AI of today because machine learning algorithms and technology are rapidly improving. Consequently, our committee understood that any AI publication policy developed now will need to be revisited and modified in the future as AI technology changes.

CONSIDERATIONS FOR AUTHOR GUIDELINES

We all agreed at the onset that AI cannot be an author because a non-human entity cannot take responsibility for a paper. There must be human oversight of any AI assistance; it is imperative for authors to take full responsibility for any inclusion of AI-generated material in their research studies and manuscripts. Just as before AI was available, we trust authors to adhere to ethical standards while conducting their studies and writing their manuscripts. However, we also recognize that guidance and specific policy are necessary to prevent any intentional or inadvertent violations within the new AI landscape. Just as it is critical to specify when AI is *not* allowed, it is also important to spell out any approved uses of AI tools. We largely agreed with what publishers have already been doing: AI tools can enhance the quality of a manuscript in terms of grammar and sentence structure if it is used to polish an author's own words. AI can expand the information available to authors in the literature and locate otherwise difficult-to-find sources, and it can be used to help initially develop a research idea. If AI is used in any part of the paper, the reviewer should also be aware and take the time to confirm the accuracy and any potential biases of any AI-based information in the article. AI should never be used in isolation to produce text without human oversight or input.

We discussed whether the use of AI should be acknowledged in a manuscript through in-text citations or in the acknowledgments section, or if it only needs to be reported through the journal submission portal. These discussions focused on the question of who benefits from knowing that AI was used, and why they need to know. For uses related to improving the author's original writing, acknowledging AI software seemed unnecessary, and akin to acknowledging ubiquitous tools such as spell check within Microsoft Word. However, when the AI software was a critical component of the research, such as for image analysis, we deemed it necessary to acknowledge the AI software and

version. Finally, because these are still early days for generative AI, we decided to include a question in the submission portal about AI use to better understand how often researchers incorporate AI in their manuscripts. This information would be used only for data collection and would not be passed on to the reviewers or editors.

We also considered the use of AI in code development. We determined that using AI tools to derive code is no different than adapting R code found online for a user's specific purpose. However, while AI could be helpful in identifying holes or inconsistencies in a researcher's code, it should not be used in stress-testing that code. We eventually agreed that AI-generated code can be used, provided that the authors acknowledge the AI assistance and detail its usage in the Methods section. An acknowledgment in the Methods section suffices if the AI was used for writing functions, adding documentation, or refactoring code for clarity. For example:

We used OpenAI's ChatGPT-4o to generate the initial implementation of the data processing function and to add inline documentation for improved readability.

These tasks are comparable to assistance gained through Google searches or consulting Stackoverflow, where authors remain responsible for the accuracy and correctness of the code. However, a detailed explanation of AI usage is required when AI is used to automate analyses, such as performing statistical analyses on tabular data (see <https://help.openai.com/en/articles/8437071-data-analysis-with-chatgpt>). For instance:

We used OpenAI's ChatGPT-4o data analysis tool (gpt-4o-2024-05-13) to perform statistical analyses on our dataset, including generating summary statistics and visualizations. The AI tool's methodology and output were reviewed and validated by the authors to ensure accuracy.

In this example, the AI tool must be cited in a way that ensures the reproducibility of results because the AI significantly contributed to the analysis.

CONSIDERATIONS FOR REVIEWER GUIDELINES

Our committee also considered the use of AI in the review process. We decided that it does not help the journal or authors when the reviewer extensively uses AI to write their full review. The point of having peer reviewers is to obtain the researcher's own unique expertise, which any

AI tool would lack. To abide by an AI program's usage guidelines (such as for ChatGPT), reviewers should not input the manuscript or any part of it into a public AI tool because this would also be a breach of confidentiality. However, reviewers could potentially improve the spelling and grammar of their own written review using an AI tool, akin to a grammar or spell checker.

Based on these conversations, our ad-hoc committee created AI policy for BSA journals as shown in the following box.

General Author Guidelines

Use of artificial intelligence and large language models (generative AI):

Generative AI programs, such as ChatGPT, are widely accessible and commonly adopted across various scientific domains. When employing generative AI in scientific work, writing, or figure generation, it is crucial for authors to be aware that unintended content may arise, necessitating careful oversight. Authors must assume full responsibility for content produced by generative AI programs before incorporating it into the submitted manuscript.

Authors are requested to cite the use of generative AI when appropriate. For example, if generative AI is employed as an integral part of the methodology, it should be cited in the Methods section, specifying the manner of use, program, and version. The use of AI to address editing and proofreading does not require acknowledgement in the manuscript. Please see Wiley's Best Practice Guidelines on Research Integrity and Publishing Ethics (<https://authorservices.wiley.com/ethics-guidelines/index.html>) for more information.

For Reviewers:

At (AJB/APPS/PSB), we highly value the professional expertise of peer reviewers to improve manuscripts published by the journal. Artificial intelligence (AI), including large language models or generative AI such as ChatGPT, is not allowed in the reviewing process. Uploading any author-submitted text, including the manuscript, abstract, or title, into an AI platform is considered a violation of confidentiality. The only exception is using AI as a tool to edit or proofread the language of a reviewer's own work.

Regarding Software and Code:

AI coding assistants have become increasingly powerful and commonplace. However, authors must be vigilant about the quality and accuracy of the generated code and take full responsibility for the results. Furthermore, authors who choose to use AI coding assistants are encouraged to take full advantage of their capabilities to generate tests, write documentation, and create robust, user-friendly, functional programs that can be more easily maintained and repurposed. In cases where AI is an integral part of the methods of the study, the authors should cite the program within the Methods section.

ACKNOWLEDGMENTS

The authors thank Amy McPherson (managing editor of *AJB*), Beth Parada (managing editor of *APPS*), Richard Hund (production editor of *AJB*/managing editor of *PSB*), and Emily Sessa (BSA Director at Large for Publications) for their insight during committee discussions and for their careful review of this paper.

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