



COMPARISON OF AI TOOLS FOR CREATION OF SCIENTIFIC TEXTS IN BIOLOGY: BALANCING INNOVATION WITH INTEGRITY AND TRANSPARENCY

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ABSTRACT

Artificial intelligence (AI) tools are gaining popularity in the scientific community, including all areas of biology. This study evaluates and compares leading AI tools that specialise in supporting scientific and publishing activities. These tools can assist in writing scientific papers, forming hypotheses and enhancing understanding of complex topics such as complex biological processes and patterns. Although these tools increase productivity and make various aspects of our work more efficient, their integration raises concerns and critical questions about transparency in their use, ethical issues and data integrity - especially in our field where accuracy and reproducibility are essential variables. This study explores how these modern tools can be used in complex biological research while maintaining scientific rigor and avoiding ethical issues such as unintended misrepresentation of data or questions of plagiarism. The findings provide a framework for the responsible use of AI in biological research that balances innovation with the integrity and transparency that underpin the scientific process.

Keywords: artificial intelligence, GPT4, Lumina, SciSpace, scientific publishing

INTRODUCTION

We are now at the beginning of 2025, just a few years after GPT-3 first comes into wider public use in 2022. Artificial Intelligence (AI) has seen dramatic advances in this short time, both in its development and its implementation across a wide range of industries. Although only a few years have passed since its commercial launch, AI has undergone a significant transformation and has now found a place in a variety of fields, from administration and marketing, to the entertainment and multimedia content creation industries (Anantrasirichai & Bull, 2022), to applications in healthcare (Aung et al., 2021), where it is being used to diagnose and predict disease and develop new treatments and cures (Bohr & Memarzadeh, 2020). These generative models, including large language models (LLMs), are also finding applications in science and research (Platt & Platt, 2023). Their use in automating routine activities helps scientists save time, which they can devote to more challenging tasks in their projects (Caspi & Karp, 2024). In the field of healthcare, artificial intelligence systems have demonstrated an ability to facilitate earlier and more accurate disease detection than ever before (Badal et al., 2023; Caruccio et al., 2024; Javaid et al., 2023b). A similar transformation has occurred in the manufacturing industry. These systems have the capacity to oversee and orchestrate entire production networks, thereby enhancing productivity while minimizing waste and energy expenditure (Javaid et al., 2023a). But that's far from all, modelling complex situations, optimizing and developing new methodologies and analytical procedures is another great example of its integration into a system (Tian et al., 2024). It has also found its place in the processing of big data (Rahmani et al., 2021) and the results of research activities and their subsequent publication and presentation to the scientific community and the general public.

MATERIAL AND METHODS

In this study, a comparative analysis of selected AI tools was conducted to assess their effectiveness and reliability in supporting scientific publishing. The selection of specific platforms was based on a survey of publicly available software and applications specialised in supporting scientific work. In order to evaluate the capabilities of the AI tools, an empirical methodology was applied, involving their practical testing in real conditions of scientific work. The platforms were subjected to several usage scenarios, ranging from automated search of relevant scientific resources, to summarisation of scientific texts, to interactive analysis of research articles. The results are documented in tables. In the case of testing the ability to

generate research references, the task was formulated in a prompt optimised for LLM, and the search results were then manually analysed for the availability of the resources provided and their thematic relevance. Verification of DOI identifiers and availability of publications was carried out through online scientific databases (Google Scholar, ResearchGate, Scopus, and Web of Science).

The results obtained were subjected to a qualitative analysis that examined:

1. Authenticity of the references provided
2. Thematic agreement
3. Accuracy of information

RESULTS AND DISCUSSION

AI applications

The popularity of generative models is skyrocketing every day, and new and more innovative programs and applications are entering the market that allow scientists to automate, simplify, improve or facilitate their work. Today, scientists can simplify the process of publishing their results in almost every aspect of this task. Advanced AI search engines such as Lumina ai or Consensus ai can find relevant scientific publications and resources with high accuracy. Their biggest advantages are, that unlike conventional search methods, there is no need to search for keywords or the perfect combination of keywords to find relevant information (Katariya et al., 2023). They are able to find a suitable reference based on the title of your future article or even the research question you set them. Then, they can directly summarize the literature found for better and faster evaluation of its relevance to the research.

Applications such as Genei or Paperdigest can create short summaries of full texts based on the provided pdf files of the articles, highlighting the most important aspects of the paper, to make it as user-friendly as possible to study a large amount of literature when writing your own paper. Advanced translators such as DeepL (which could be classified as so-called "semi-AI") enable the complete breaking down of language barriers between the entire scientific community (Sun, 2024). 20 years ago, to translate a text from a foreign language, it was necessary to have a dictionary and to dedicate your time to translation. Then google translator revolutionised the way we translated texts in the browser by copying the text, and four years later direct translations were possible right on the pages we were viewing. Today, also thanks to artificial intelligence, we can not only translate any text on the Internet into the desired language in an instant, but it allows us to

complete translations of entire files, whether in pdf or other text formats, and even translate text in images or photos (Wang et al., 2022).

Another revolutionary application for the scientific community is the Sci Space ai platform. It allows users to upload pdf files, and then summarize, analyse, and directly extract the required data. Its greatest competitive advantage lies in the possibility to have a conversation with ai assistant about the uploaded pdf file, while the assistant answers any questions, helps to better understand the complex text in the paper or explain the methodology and clarify challenges and other research questions that have arisen due to the research being analysed.

The platform also provides full assistance in writing a scientific publication, from the abstract to the conclusions. In its interface, you can work with a text file, write your thoughts and let the AI check the text for stylistics and grammatical errors. In addition, it can lengthen or shorten written sentences, summarize the ideas generated, and even rewrite or "polish" sections of text so that the article is

appropriate in its value to the audience to whom it is to be presented. Sci Space is hardly the only one, many other platforms such as Jenni ai or generative models such as Jasper or ChatGPT themselves also provide such assistance in writing a paper.

In the Table 1 we provide list and comparison of some useful AI tools that are suitable for scientific work assistance. The list of AI tools was created based on a thorough search of publicly available software and programs specialized for scientific publishing. The selection process was complemented by a subjective and empirical analysis carried out by testing these tools. Information on their primary purpose of use was compiled based on the available whitelists of each application. The quality of their outputs and their potential shortcomings were assessed based on a subjective evaluation of the outputs of these applications, looking at the relevance of the generated content, linguistic accuracy and user-friendliness.

Table 1 List of AI tools and the comparison of its functions, with benefits and disadvantages (personal assessment).

Tool	Function	Main use	Benefits	Disadvantages	Specificity
Scite AI	Intelligent citations with context; assessing the reliability of sources (supporting/contrasting)	Evaluation of references and citations	Provides context for citations; can be used for quick verification of references	Some quotes may not be detailed or could be missing	Provides smart citations with context -an innovation over traditional citation tools
Consensus AI	AI search engine -summarizing results from scientific papers	Finding references and getting insights from publications	Saves time when searching for articles and results	Limited to certain databases	AI search engine that enables fast searches without the need for precise keyword input; Article summarization
Lumina AI	AI search engine	Searching for references with an evaluation of the percentage relevance to the search topic	Time efficient, Extensive database	Not „beginner friendly“ designed	Provides a wide range of article filtering and has the ability to create collections
Genei	Automatic summarization of scientific articles; annotation of PDF documents	Fast processing and reading of literature	Speeds up work with large amounts of literature	Occasionally superficial summaries	Automated summaries with PDF document annotation
Elicit AI	Extracting key information; generating summaries	Literature reviews and article analysis	Efficient article filtering and data extraction	Need for manual checking of results	Extracts key information and generates summaries
PaperDigest	Automatic generation of scientific abstracts based on DOI or PDF	Creation of summaries	Quick and automated article summaries	Focuses only on a basic overview	Generates automatic summaries based on DOI or PDF files, daily updates and summaries of new publications
Jasper AI / ChatGPT	Generating text; full assistance	Writing texts and abstracts	Flexible use; fast text creation	Risk of plagiarism or inaccuracies	Generating text based on requests; assisting with tasks in a conversational manner
Jenni AI	Collaborative scientific writing; suitable for academic publications	Collaboration in writing and editing text	Enables effective team writing	Limited functionality	Enables real-time collaboration on scientific writing
SciSpace Copilot	Interactive exploration of scientific articles; better understanding of complex concepts	Assistance with reading and comprehension	Allows "conversation" with articles	Still in development, needs resources PDF	Provides interactive assistance in understanding scientific articles

It is important to note that in addition to all these assistive tasks that these models help us to facilitate and improve our work, these models can do much more. The primary capability, as their name suggests, is text generation. Currently, models like GPT-4 and their competitors' similar versions, or all platforms based on these models, can generate very convincing texts (Herbold et al., 2023), with a lot of details and facts that often look as if they were written by a human (Májovský et al., 2023). Many models can already directly insert citations and references in the text to validate their ideas and relevance. However, it is very important to verify each piece of information and its source, as it is publicly known that despite their highly sophisticated systems, these models are still prone to hallucination (Guerreiro et al., 2023; Reddy et al., 2024), and sometimes generate false information supported by non-existent sources that on the surface, by their name and structure, may look like a convincing relevant resource.

However, the use of generative models does not have to be only in the creation of the text itself. The conversational form and its recently acquired ability to browse the internet and all current events (Xu et al., 2023) opens up new perspectives for brainstorming, and finding undiscovered trends and topics in numerous fields. An intelligent, well-directed conversation with ChatGPT, for instance, can be a very effective tool to identify or search for undiscovered topics and research challenges, due to the large database of information and knowledge the model already possesses. With the right and effective routing of well-posed questions, the generative model can be a beneficial research partner.

Possibilities of using AI

The conversational capability of the model can also be applied in many other spheres. The model itself can process, analyse, organize, or otherwise modify huge data sets, find potential anomalies in them, and fix them (Hassani & Silva, 2023; Kim, 2024). In statistical processing of results, ChatGPT can be used as a personalized personal assistant. The research results obtained have to be statistically processed, but a lot of scientists, despite being experts in their field of research, are not statisticians. However, the data can be sent to ChatGPT, and after providing sufficient information about your research, the results and workflows, the model can determine exactly what statistical analyses will be most beneficial for processing your results, documenting and explaining each recommended method, the output and the value of such an analysis. It can then accurately navigate step-by-step, implementing these analyses in the specific statistical program of the user's choice. Once such statistical results have been processed and obtained, they can again be shared with the model, which will accurately report the statistical significance of the results, explain all parameters, and recommend the best interpretation of the findings. Of course, this is the application of the model as a full-fledged assistant on the path of data processing with a complete understanding of the activity that the person is performing. But the model can do much more; based on the raw data provided, it can independently develop a complete data analysis, statistical processing, including the creation of graphs or tables, and the interpretation of the results (Huang et al., n.d.). However, such results and data

processing can often lead to errors, minor modifications in the data set, incorrect interpretations or other serious damage to the final results. Detecting such errors is usually very challenging, more so when the analysed data is checked by a non-specialist in the field of statistics. In such a case, errors in the generation of the results may be completely overlooked, and misleading theories that are not true are subsequently produced when such papers are published. For this reason, we draw attention to the importance of transparency in science when using AI tools and specifying the specific modifications to scientific publications that have been made using these models.

When extracting data from pdf files, it is recommended to verify the authenticity of the information presented. Despite the advancement of AI models, there may still be misinterpretation of certain information and erroneous output due to misunderstanding of the context by the LLM model (Barman et al., 2024). Back-checking such output can be easily done by searching for the extracted information directly in the document using the "find" function or by using the CTRL+F keyboard shortcut. If the output with the extracted information has been significantly altered, it is still possible to ask the model/AI assistant to provide us with which sentences in the text it has drawn its conclusions based on, and to subsequently trace this sentence and verify its correctness.

When searching for relevant resources and references for scientific publications using advanced search engines (such as Consensus ai), it is necessary to verify each publication provided by the search engine. Some generative models such as ChatGPT still tend to hallucinate (Reddy et al., 2024) and provide references that may look convincing but never existed (Májovský et al., 2023) and have not been published. This characteristic is presumably also due to models being set up to

maximally satisfy their user's requirements, even at the cost of the quality of the output. Thanks to the DOI or full text links that almost all of these models already provide along with the reference, it is possible to easily verify the veracity and overall existence of a publication by opening its original version on the website of a specific publishing journal. Such back-checking helps to avoid citing erroneous references in one's work that would lower the quality and relevance of the scientific paper.

Demonstration of AI capabilities

In a practical demonstration (generated in December 2024), we tested 3 tools to search for relevant references for our paper "Effect of toxic heavy metals on fatty acid composition in freshwater fish muscle tissue" (Table 2). In this experiment, we compared the output from ChatGPT-4o, Consensus AI and Lumina AI. We evaluated first the existence and authenticity of references, and then the relevance of these publications to the topic (based on the subjective assessment of the author of the study). The assignment for the specialized search engines was simpler; just the title of the planned paper was entered into the search. For ChatGPT, the assigned prompt was "You are a molecular biologist preparing to write a peer-reviewed scientific article for a high-impact journal. The title of your planned article is "Effect of toxic heavy metals on the total composition of fatty acids in the muscle tissue of freshwater fish". Please provide five references with DOI numbers that are most relevant and suitable for the literature review of this topic". In the Table 2 we provide an overview of the outputs obtained and our assessment of relevance.

Table 2 Summary of the obtained outputs (generated in December 2024) based on communication with AI in the preparation of the scientific text.

Tool	Title of publication	Authors	DOI/ Webpage	Existing article (yes/no)	Relevance to the topic
ChatGPT	Effects on heavy metal accumulation in freshwater fishes: species, tissues, and sizes	(Jia et al., 2017)	DOI: 10.1007/s11356-017-8606-4	yes	medium
	Impact of metal pollution on fatty acid profiles in freshwater fish species	N/A	DOI: 10.1007/s11356-018-1856-2	no	N/A
	Health Risk Assessment of Heavy Metals and Lipid Quality Indexes in Freshwater Fish from a Polluted River	(Łuczyńska & Paszczyk, 2019)	DOI: 10.3390/ijerph16193780	yes	high
	Bioaccumulation of non-essential hazardous heavy metals and metalloids in freshwater fish: a review	(Ali & Khan, 2018)	DOI: 10.1007/s10311-018-0734-7	yes	medium
	Heavy metal contamination in fish: sources, mechanisms and consequences	(Singh & Sharma, 2024)	DOI: 10.1007/s00027-024-01121-7	yes	medium
Lumina AI	Heavy metal effects on fish blood parameters.	(Çelik, 2006)	http://www.egejfas.org/tr/download/article-file/57674	yes	low
	Synergistic Effect of Nickel and Mercury on Fatty Acid Composition in the Muscle of Fish <i>Lates calcarifer</i>	(Senthamils et al., 2015)	https://doi.org/10.3923/jfas.2016.77.84	yes	high
	Effects of exposure to multiple heavy metals on biochemical and histopathological alterations in common carp, <i>Cyprinus carpio</i> L.	(Rajeshkumar et al., 2017)	https://doi.org/10.1016/j.fsi.2017.08.013	yes	high
	Free radicals and antioxidant enzymes in fish and their responses to metal pollutants	(Zelikoff & Flescher, 1994)	https://www.osti.gov/biblio/85950	yes	low
	Effect of Sublethal Concentrations of Cadmium on the Histopathological Changes of Muscles of <i>Planiliza abu</i> Juveniles (Heckel, 1843)	(Hashim & Al-Yassein, 2020)	https://doi.org/10.3707/7/25200860.2020.33.2.18	yes	medium
Consensus AI	Effects of Trace Elements on the Fatty Acid Composition in Danubian Fish Species	(Jovičić et al., 2024)	https://www.mdpi.com/2076-2615/14/6/954	yes	high
	Consequences of oxidative damage and mitochondrial dysfunction on the fatty acid profile of muscle of Indian Major Carps considering metal toxicity	(Das et al., 2018)	https://doi.org/10.1016/j.chemosphere.2018.05.108	yes	high
	Health Risk Assessment of Heavy Metals and Lipid Quality Indexes in Freshwater Fish from Lakes of Warmia and Mazury Region, Poland	(Łuczyńska & Paszczyk, 2019)	https://doi.org/10.3390/ijerph16193780	yes	high
	Analysis of certain fatty acids and toxic metal bioaccumulation in various tissues of three fish species that are consumed by Turkish people	(Kaya & Türkoğlu, 2017)	https://doi.org/10.1007/s11356-017-8632-2	yes	high
	Synergistic Effect of Nickel and Mercury on Fatty Acid Composition in the Muscle of Fish <i>Lates calcarifer</i>	(Senthamils et al., 2015)	https://doi.org/10.3923/jfas.2016.77.84	yes	high

Our results show that most of the tested models handled the task of generating publications correctly. In a single case using the GPT-4 model, we received a publication in the output whose title corresponded perfectly with the selected topic, but after trying to retrieve the provided DOI, or after searching for the article using Google Scholar based on the title, we were unable to find the article. The relevance of the studies with the topic was high in many cases, the provided publications always corresponded at least in a part with the researched topic. In general, based on this brief comparison, we can evaluate that the best results were obtained using Consensus ai. Since this was only a simple comparison of the results, we did not take into consideration other possibilities the platforms under study offer, such as the capability in Lumina AI to filter the results according to the year of publication or even the number of citations of a given reference or SJR Quartile. These features

can significantly affect the output we obtained. When working with ai, it is essential to make use of all these additional options to obtain the best possible outputs.

CONCLUSION

The majority of high-quality journals clearly state in their AI usage policies that it is unacceptable to accept in peer-reviewed articles any text or ideas that has been directly generated using AI generative models. In our paper, we lean towards this position and advise caution in any use of AI in scientific publishing. However, we do not dismiss progress and innovation, on the contrary, through this article and this overview of the possibilities that new AI technology provides, we want to

encourage the scientific community to make use of innovative tools in their own work. At the same time, we also support them in open approach, transparency and safe usage of these tools to avoid hoaxes, misrepresentations or false claims, which could have a serious impact on the future of the scientific community. The data clearly shows the actual error rate of AI-generated outputs, but just like AI, also humans can make mistakes in their work and its presentation. An example, consider the case of the German scientist Erich von Wolf, who in 1870 measured the amount of iron in spinach, but because of an unnoticed error in the decimals, it was believed for decades that the spinach contained ten times more iron than was actually true. The key to the successful integration of AI into our work should therefore be to ensure transparency in its use, encourage critical thinking, and provide sufficient education about the possibilities and potential consequences, and regular feedback. In the current climate, where AI is still in its early stages of development and society is beginning to divide into two camps - the opponents of AI progress who see its application to our work as a kind of "cheating", and the visionaries who see its use as a simplification of operations that will allow us to devote more time and energy to more complex tasks, it can be challenging to openly acknowledge the application of these tools into our work. As a result of the pressure and prejudice that those with opposing views may hold, many scientists prefer to conceal and hide the use of any AI tools in their work, making it more difficult to identify any potential misconduct that may have occurred in its use. We want therefore to reiterate the importance of transparency in this area, and encourage all scientists who use these tools to openly admit and specify how they have used them in their work, thus helping to create a safe environment for the future of science and all scientific publishing.

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