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SPOTLIGHT

Is the literature review paper dead? How AI is transforming the research landscape in DNA research

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VIEWPOINT

"...the use of AI...should be considered an effective resource rather than a tool to be feared."

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In academia and research, the review article has acted as an effective way to summarize, challenge, and push the future direction of research though scientific discourse [1]. Reviews can be used to identify gaps in the research and highlight recent discoveries, methods, and tools as well as helping to collate data. This is important when working in fields that are fast-paced and evolving. Reviews can also help summarize fields of research to help researchers understand and grasp new areas outside of their expertise.

This is particularly true within the DNA research domain, which is a constantly evolving field. Areas such as DNA nanostructures [2], enzymatic synthesis of DNA [3], DNA based storage systems [4], and new oligonucleotide-based therapeutics [5] have emerged as hot areas of research with accelerated growth over the last few years, and findings from these fields can quickly render previous findings obsolete. However, with the proliferation of review articles, which have increased exponentially [6],

there are some issues that have distorted the value of review papers. Review papers tend to be more highly cited than research articles leading to distorted measures of impact such as journal impact factors. Authors can in some cases cite review papers based on information provided from original research articles rather than citing the original source of research. Authors sometimes prefer to cite review articles over research articles to create the impression that the research conducted was more novel than it actually is. Review articles can also suffer from author selection bias, which can distort the true state of the field by highlighting the advantages of a technology, method or tool, while downplaying its limitations. There have also been highlighted cases of review papers where the authors have excessively self-cited their own work, which can also distort the true state and impact of a field [7].

Artificial intelligence (AI) is already having a transformative effect on academia and research in terms of increasing accessibility and productivity of researchers with the introduction of large language models (LLMs). In particular, LLMs can summarize and explain information in a variety of styles to suit the reader, making research more accessible to lay audiences. While ChatGPT, Co-pilot, and Gemini have dominated the headlines, the introduction of AI tools that are tailored for academia has rapidly grown. Earlier versions of LLMs were incapable of providing sources for the information given and in some cases, even generated fake references [8,9]. However, this has changed with the introduction of newer LLM models, which are capable of searching the internet in real time and providing real citations to back up their answers. Perplexity [10], Consensus [11], and Scite AI [12] are AI-based search engine tools that can be used to summarize a field, search for answers to questions through the research prompt, and provide a list of references to back up their findings.

The answers provided by Perplexity, Consensus, and Scite AI tend to provide more concise summaries with a limited number of sources. This is due to the maximum token limit at which AI tools can perform unless the reader subscribes to the premium service. These tokens are chunks of text that a LLM can process, and the maximum token limit can vary from each AI tool. The token limitation suggests that literature reviews performed by the majority of AI tools are currently not as comprehensive as published review papers. Storm [13], which was developed by Stanford University, can provide a more comprehensive article, which resembles a review article/Wikipedia page. SCISPACE [14] offers users a suite of several AI tools, including a literature review generator, AI writer, citation generator, and data extractor tool, providing researchers with everything they need to write and search for papers. NotebookLM [15] allows tailoring of the answers given by uploading multiple papers as sources to its server, so that in effect, researchers can summarize research from a number of papers without reading each individual paper. Jotlify [16] is another AI tool which is capable of turning research papers and summarizing them through an audio file, which extends the review article to a new format, while Mapify [17] can be used to summarize topics or papers in the DNA research field into the style of a mind map.

AI is not only transforming the way we search the literature for research but also providing a means to simplify and explain complex scientific concepts in DNA for non-experts and student readers. This is transforming the way in which universities teach and assess future generations of researchers within the natural sciences. While some types of assessments are now in danger of becoming obsolete, such as essays and lab reports, new deeper learning-based assessments could be introduced to encourage student learning through AI

use, and the development of prompt engineering as a critical research skill will be a feature of higher education in the next few years.

Although these AI tools can be used to summarize and review DNA research findings, they currently lack the robustness, accuracy, and oversight to replace review articles, which benefit both from being rigorously peer reviewed and from mainly using primary sources only. In addition, AI tools will likely carry over selection/information biases from the source they cite, can make mistakes, and sources still need to be checked for accuracy [8,9]. Despite this, AI tools are rapidly improving over time and may soon replace existing academic search engines such as Scopus, Web of Science, and Google Scholar as the primary means for searching the literature. The current subscription-based business models of these AI tools make them inaccessible to cash-limited individuals and universities due to the sheer number of AI tools out there. Nonetheless, overall, the use of AI is transforming the way we search the literature and perform research within the field of DNA, and should be considered an effective resource rather than a tool to be feared.

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BIOGRAPHY

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