Generation artificial intelligence (GenAI) and *Biomaterials Translational*: steering innovation without misdirection

Long Bai[1,5,6], Zhidao Xia[2,], James T. Triffitt[3,*], Jiacan Su[1,4,5,*]*

1 Organoid Research Center, Institute of Translational Medicine, Shanghai University, Shanghai, China; 2 Centre for Nanohealth, ILS2, Medical School, Swansea University, Swansea, UK; 3 Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, The Oxford University Institute of Musculoskeletal Sciences, The Botnar Research Centre, Nuffield Orthopaedic Centre, Oxford, UK; 4 Department of Orthopedics, Xinhua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, Shanghai, China; 5 National Center for Translational Medicine (Shanghai) SHU Branch, Shanghai University, Shanghai, China; 6 Wenzhou Institute of Shanghai University, Wenzhou, Zhejiang Province, China

***Corresponding authors:** Zhidao Xia, z.xia@swansea.ac.uk; James T. Triffitt, james.triffitt@ndorms.ox.ac.uk; Jiacan Su, drsujiacan@163.com.

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In the dynamic landscape of generative artificial intelligence (GenAI), recent developments, such as the artificial research organisation OpenAI's introduction of the text-to-video generation tool Sora, have again catapulted GenAI into the limelight. Thus reigniting discussions on the swift march towards an era of future controlled usage of artificial general intelligence (AGI). Concurrently, in the realm of scientific research, the use of GenAI tools like DALL·E to generate inaccurate scientific illustrations for publication and the skepticism surrounding findings published in *Nature* from the AI-driven automated laboratory, A-Lab, have sparked widespread scientific controversy.[1] While GenAI-generated imagery tools seemingly offer a plethora of exquisitely detailed scientific illustrations, inherent algorithmic flaws can lead to numerous inaccuracies in model constructions and molecular structures. A-Lab is known for its innovative integration of computing, historical data, machine learning, active learning and robotics in material design and synthesis and critical attention was drawn to the reported high success rate in synthesising new inorganic compounds. Recent critiques have questioned the systemic errors and dubious findings in this research, suggesting a near absence of novel material discoveries of new materials.[2] These instances highlight the complexities and potential pitfalls of unrestricted application of GenAI in scientific research.

The rapid rise of multimodal GenAI tools and their deep and extensive application in biomaterials translational research underscores their significant contributions-from discovering new materials,[3] drugs,[4] and proteins[5] to identifying novel clinical treatment targets.[6] Yet, as the incidents noted previously illustrate, AI, as a transformative tool in biomaterials translational research, presents a series of challenges, revealing the double-edged nature of this cutting-edge technology. These events serve as a wake-up call for the scientific community and policymakers, emphasizing the critical importance of harnessing the potential of GenAI whilst safeguarding against the cleverly designed, seemingly plausible pitfalls. This necessitates a deep understanding of the underlying algorithms and capabilities of GenAI and the formulation of relevant policies to mitigate or reduce the inherent risks of GenAI in biomaterials translational research.

To effectively manage the use of GenAI in biomaterials translational research, we propose the following policy recommendations:

1. Establishment of interdisciplinary collaboration mechanisms: Encourage cooperation among experts from diverse fields through interdisciplinary teams to study the societal impacts and application prospects of GenAI. For instance, advisory teams comprising computer scientists, clinicians, ethicists, legal experts, and industry specialists should be formed to collaboratively develop and evaluate GenAI projects. This collaboration not only fosters technological innovation but also ensures that the development and application of GenAI adheres to scientific norms and legal requirements. For instance, the MIT-IBM Watson AI Lab, a collaborative interdisciplinary research laboratory between MIT and IBM, focuses on AI research and application development. The lab brings together experts from computer science, biology, brain science, and other fields to explore the frontiers of AI.

2. Continuous ethical review and oversight: Establish ethics review committees for GenAI projects to regularly assess the ethical impacts and risks of GenAI applications. This includes ongoing scrutiny of data collection and processing transparency, the explainability of GenAI decision-making processes, and the protection of individual privacy. Such measures ensure that GenAI development not only meets current ethical standards but can also adapt to future challenges and standards. For instance, Google formed an internal ethics committee (Advanced Technology External Advisory Council, ATEAC) to review the company's internal AI projects, ensuring they meet ethical standards and societal values.

3. Enhancement of transparency and explainability in GenAI applications: Develop and promote transparent, explainable GenAI systems that enable researchers to understand the basis and logic behind GenAI decisions. This can be achieved by providing easily understandable decision explanations and disclosing the design principles and operational mechanisms of GenAI algorithms. Increasing transparency and explainability helps build user trust in GenAI applications and promotes responsible use of GenAI technology. For instance, the European Union's General Data Protection Regulation (GDPR) mandates "transparency in automated decision-making", requiring enterprises to explain the logic behind decisions made by AI that significantly impact individuals.

4. Standardization and sharing mechanisms for scientific data and GenAI applications: Formulate clear policies and standards to encourage and manage the sharing of scientific research data and GenAI applications. This includes establishing data sharing platforms and defining data standards and formats to ensure data interoperability and accessibility. Encouraging open scientific software and algorithms fosters collaboration and knowledge sharing within the scientific community, accelerating the process of scientific discovery while ensuring the quality and reliability of data and GenAI applications.

Through the implementation of these specific measures, a policy environment can be established that not only fosters innovation in biomaterials translational research but also ensures the quality of data and GenAI applications. This environment supports the fairness and transparency of scientific activities, providing a healthy ecosystem for the scientific community, facilitating multidisciplinary analysis of scientific problems, and fostering innovation and discovery in new research directions and fields.

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