

World Journal of *Stem Cells*

Monthly Volume 17 Number 4 April 26, 2025



EDITORIAL

Lu JS, Song CY, Cheng WJ, Wang KY. Mechanisms and challenges of mesenchymal stem cells in the treatment of knee osteoarthritis. *World J Stem Cells* 2025; 17(4): 102923 [DOI: [10.4252/wjsc.v17.i4.102923](https://doi.org/10.4252/wjsc.v17.i4.102923)]

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LETTER TO THE EDITOR

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Wang W, Song AR, Liu HW, Li YK. Enhancing the clinical translation of stem cell models by focusing on standardization and international regulatory cooperation. *World J Stem Cells* 2025; 17(4): 102788 [DOI: [10.4252/wjsc.v17.i4.102788](https://doi.org/10.4252/wjsc.v17.i4.102788)]

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Editorial Board Member of *World Journal of Stem Cells*, Luminita Labusca, MD, PhD, Senior Researcher, National Institute of Research and Development in Technical Physics Iasi, 47 D Mangeron Boulevard, Iasi 70050, Romania. drlluminita@yahoo.com

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The *WJSC* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, PubMed, PubMed Central, Scopus, Biological Abstracts, BIOSIS Previews, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The 2024 Edition of Journal Citation Reports® cites the 2023 journal impact factor (JIF) for *WJSC* as 3.6; JIF without journal self cites: 3.5; 5-year JIF: 4.2; JIF Rank: 105/205 in cell biology; JIF Quartile: Q3; and 5-year JIF Quartile: Q2. The *WJSC*'s CiteScore for 2023 is 7.8 and Scopus CiteScore rank 2023: Histology is 11/62; Genetics is 78/347; Genetics (clinical) is 19/99; Molecular Biology is 131/410; Cell Biology is 104/285.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Xiang-Di Zhang*; Production Department Director: *Xu Guo*; Cover Editor: *Jia-Ru Fan*.

NAME OF JOURNAL

World Journal of Stem Cells

ISSN

ISSN 1948-0210 (online)

LAUNCH DATE

December 31, 2009

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Shengwen Calvin Li

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/1948-0210/editorialboard.htm>

PUBLICATION DATE

April 26, 2025

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<https://www.wjgnet.com/bpg/gerinfo/242>

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<https://www.wjgnet.com/bpg/GerInfo/239>

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Enhancing the clinical translation of stem cell models by focusing on standardization and international regulatory cooperation

Wei Wang, An-Ran Song, Hong-Wen Liu, Yi-Kai Li

Specialty type: Cell and tissue engineering

Provenance and peer review: Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's classification

Scientific Quality: Grade A, Grade B

Novelty: Grade A, Grade B

Creativity or Innovation: Grade B, Grade B

Scientific Significance: Grade B, Grade B

P-Reviewer: de Sousa EB; Liu LK

Received: November 1, 2024

Revised: February 12, 2025

Accepted: March 10, 2025

Published online: April 26, 2025

Processing time: 174 Days and 23 Hours



Wei Wang, An-Ran Song, Department of Traditional Chinese Medicine, Youyang People's Hospital, Chongqing 409800, China

Hong-Wen Liu, Yi-Kai Li, School of Traditional Chinese Medicine, Southern Medical University, Guangzhou 510515, Guangdong Province, China

Co-corresponding authors: Hong-Wen Liu and Yi-Kai Li.

Corresponding author: Yi-Kai Li, MD, PhD, Chief Physician, Professor, School of Traditional Chinese Medicine, Southern Medical University, No. 1023 South Shatai Road, Baiyun District, Guangzhou 510515, Guangdong Province, China. ortho@smu.edu.cn

Abstract

The article by Granjeiro *et al* provided a thorough review of the role of stem cell models in the development of advanced therapy medicinal products. It emphasized the potential of stem cell models to refine preclinical studies and align with regulatory requirements for clinical applications. This article introduced a new perspective on enhancing the transition of stem cell research into clinical practice, focusing on the importance of international regulatory harmonization and the need for standardization in stem cell-based therapies.

Key Words: Stem cell models; Advanced therapy medicinal products; Tissue engineering; Preclinical studies; Clinical translation

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Core Tip: Granjeiro *et al* discussed the role of stem cells in advanced therapy medicinal products for tissue regeneration and drug screening. This article emphasized the importance of international regulatory harmonization and standardized protocols to address current challenges and enhance the global clinical translation, safety, and consistency of stem cell-based therapies.

Citation: Wang W, Song AR, Liu HW, Li YK. Enhancing the clinical translation of stem cell models by focusing on standardization and international regulatory cooperation. *World J Stem Cells* 2025; 17(4): 102788

URL: <https://www.wjgnet.com/1948-0210/full/v17/i4/102788.htm>

DOI: <https://dx.doi.org/10.4252/wjsc.v17.i4.102788>

TO THE EDITOR

We read with great interest the article titled “Bioengineering breakthroughs: The impact of stem cell models on advanced therapy medicinal product development” by Granjeiro *et al*[1], recently published in the *World Journal of Stem Cells*. The article provided a comprehensive review of the critical role that stem cell models play in advanced therapy medicinal products (ATMPs), particularly in providing alternatives to traditional preclinical testing methods. This discussion is timely and relevant, considering the increasing emphasis on reducing animal testing and improving the physiological relevance of preclinical models.

The freshness of this letter lies in its focus on two critical aspects that extend beyond the original review: The necessity of international regulatory harmonization and the urgent need for standardized protocols in the development of stem cell-based therapies. We believe that addressing these aspects is essential for facilitating the global clinical translation of stem cell models, which remains a significant challenge in the field[2,3]. To advance these goals, we propose the establishment of a global task force comprising regulatory agencies, research institutions, and industry stakeholders. This task force could develop unified guidelines for stem cell culture, differentiation, and quality control, leveraging existing frameworks such as the International Society for Stem Cell Research guidelines[4]. Such an initiative would harmonize regulatory approaches and foster international collaboration, ensuring that innovative therapies reach patients more efficiently and safely.

Firstly, while the original review acknowledged the role of regulatory frameworks in ensuring safety and efficacy, we propose that greater emphasis should be placed on the international harmonization of these regulations. Different regulatory approaches across regions currently create significant barriers to adopting ATMPs[5]. A more unified regulatory framework could streamline the approval process, making it easier for innovative stem cell therapies to reach patients worldwide[6]. For instance, efforts by the European Medicines Agency and the United States Food and Drug Administration to align their regulatory requirements for ATMPs have shown promising results[7]. Building on these achievements, we recommend expanding such collaborations to include emerging markets with evolving regulatory frameworks. Such an alignment would ensure patient safety and foster greater collaboration among international research institutions and regulatory bodies[8].

Secondly, we underscore the need for standardization in the protocols used for stem cell cultivation and differentiation. Variability in cell characteristics and differences in isolation and culture techniques can lead to inconsistent therapeutic outcomes, posing challenges for clinical application[9]. Recent advancements in good manufacturing practice-compliant protocols and the use of artificial intelligence for optimizing stem cell differentiation have demonstrated the feasibility of achieving high levels of standardization. For example, studies have successfully implemented artificial intelligence-driven platforms to predict and control stem cell differentiation trajectories, resulting in more reproducible outcomes[10]. Standardized protocols across laboratories could help minimize these discrepancies, ensuring that stem cell therapies are reproducible and reliable[11]. This focus on standardization is critical in clinical trials, where consistent results are crucial for gaining regulatory approval and achieving widespread clinical adoption[12].

In summary, while Granjeiro *et al*[1] contributed significantly to understanding the role of stem cell models in ATMP development, we believe that prioritizing international regulatory harmonization and protocol standardization is crucial for realizing the full potential of these therapies. Addressing these aspects can help bridge the gap between experimental models and clinical practice, ultimately leading to more effective and accessible patient treatments. We urge the scientific community to take immediate action by forming international consortia to develop and implement standardized protocols. At the same time, regulatory bodies should prioritize harmonizing their frameworks to facilitate global access to stem cell therapies.

CONCLUSION

Stem cell models hold significant promise for advancing ATMPs, offering new possibilities for tissue regeneration and drug development. However, the full potential of these models can only be realized through a greater focus on international regulatory harmonization and the establishment of standardized protocols. Addressing these challenges will enhance the safety, reproducibility, and accessibility of stem cell therapies, facilitating their transition from research settings to clinical applications and ultimately benefiting patients worldwide.

ACKNOWLEDGEMENTS

We thank the reviewers for their comments that helped to improve the manuscript.

FOOTNOTES

Author contributions: Wang W and Song AR participated in drafting the manuscript; Wang W and Liu HW wrote the original draft; Li YK contributed to conceptualization and writing, reviewing, and editing of this manuscript; Liu HW and Li YK made equal contributions to this work and are jointly designated as co-corresponding authors of this manuscript; All authors read and approved the final version of the manuscript.

Conflict-of-interest statement: All the authors report no relevant conflicts of interest for this article.

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Country of origin: China

ORCID number: Yi-Kai Li 0000-0003-0766-6051.

S-Editor: Wang JJ

L-Editor: Filipodia

P-Editor: Zheng XM

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