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EDITORIAL

Computational Biomechanics and Machine Learning: Charting the Future of Molecular and Cellular Biomechanics Field

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In our rapidly evolving world, the intersection of computational technology and biomedical research is opening new frontiers in our understanding of human health and disease. Over the past year, Molecular and Cellular Biomechanics (MCB) has been a focal point of these transformative explorations, revealing an intricate tapestry woven from computational models, machine learning algorithms, and meticulous biomechanical analysis. This synthesis of interdisciplinary efforts is revolutionizing how we decode cellular and molecular mechanobiological mechanisms, enhance diagnostic strategies, and optimise disease treatments. Reflecting on the 2022 volume of MCB, the breadth of topics underscores the multifaceted role of biomechanics in diverse fields–from cellular biology to sports science, from disease diagnosis to treatment strategies, and from health optimization to injury prevention. The diverse collection of articles illuminates the progressive trajectory of research in biomechanics and mechanobiology, and its profound impact on biomedical science.

Allena et al.'s [1] innovative use of computational modeling shed light on intricate cellular behaviors. Their *in silico* study illuminated how nuclear mechanics influence cellular function, offering insights into phenomena like lamina rupture or stretch-sensitive protein expression. Simultaneously, Bu et al.'s [2] research showcased how machine learning, particularly the YOLOv3 algorithm, can revolutionize diagnostic procedures, especially in lung nodule detection. Machine learning further demonstrated its value in hematological research with Sriram et al.'s study [3]. Utilizing the VGG16 Convolutional Neural Network Architecture, the researchers distinguished pathological cells from healthy ones, enhancing disease classification and reducing misdiagnosis risk. These advances indicate the transformative power of computational technology in medical diagnostics and patient care.

Sports biomechanics featured prominently in the 2022 volume, with studies exploring how biomechanical principles can improve athletic performance and reduce injury risk. He [4] examined leg dynamics in badminton players, while Lu et al. [5] investigated the effect of different footwear on knee and ankle loading during running. Both studies highlighted the importance of individualizing equipment and training regimens for optimal performance and injury prevention. Integrating nutritional science with biomechanics studies like Zar et al.'s [6] investigation into the effects of Spirulina platensis supplementation during resistance training, and Zhu's [7] study on the interplay of nutritional supplementation and sports training, enriched our understanding of how diet and exercise can synergistically enhance physical health and performance. The broad span of topics continued studies by Li [8] and Qin et al. [9] providing crucial insights into the prevention of exercise-induced lumbar injuries and the diagnosis and treatment of myopia, respectively. These explorations underscored the practical utility of biomechanics in managing diverse health challenges.

The 2022 volume also highlighted Samanipour et al.'s [10] exploration of decellularized collagen and Carboxymethyl Cellulose (CMC) as an injectable soft tissue filler, demonstrating biomechanics' potential contributions to skin tissue regeneration. In the realm of dental biomechanics, Xu et al. [11] utilized a computational approach to analyze stress distribution in dental implants, contributing valuable insights to the field of prosthetic dentistry.

This study exemplifies how computational modeling can inform best practices and contribute to the long-term success of medical implants.

The year 2022 was rich with such compelling explorations, each adding a unique thread to the complex tapestry of biomechanical research. As we look forward to the future, MCB remains committed to fostering the growth of this versatile field, promoting interdisciplinary research that can revolutionize our understanding of human health and disease.

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