Crimson Publishers
Wings to the Research

Opinion

The Importance of Bioengineering and Biosciences in the Era of Artificial Intelligence

James O Ijiwade*

Faculty of Science, Chemistry Department, University of Ibadan, Nigeria

ISSN: 2637-8078

***Corresponding author:** James O Ijiwade, Faculty of Science, Chemistry Department, University of Ibadan, Nigeria

Submission: May 12, 2025
Published: June 20, 2025

Volume 7 - Issue 3

How to cite this article: James O Ijiwade*. The Importance of Bioengineering and Biosciences in the Era of Artificial Intelligence. Significances Bioeng Biosci. 7(3). SBB. 000665. 2025.
DOI: 10.31031/SBB.2025.07.000665

Abstract

Bioengineering and biosciences are essential fields propelling advancements in medical, environmental sustainability, and biotechnology. In recent years, the use of Artificial Intelligence (AI) has expedited progress in various domains, augmenting proficiency in diagnostics, drug development, genetic engineering, and ecosystem modelling. This opinion article underscores the pivotal significance of bioengineering and biosciences in tackling global concerns, while accentuating how AI enhances their efficacy through expedited data processing, predictive modelling, and precision solutions. It examines the ethical and educational ramifications of this convergence, advocating for a responsible and interdisciplinary approach to forthcoming developments. Collectively, these domains constitute a formidable trinity that is transforming our comprehension of life and reconfiguring the future of science and technology.

Opinion

In an age characterized by swift technological progress, few domains possess as much transformational capacity as bioengineering and biosciences. These fields converge at the nexus of biology, technology, and innovation, providing potent instruments to tackle critical issues confronting humanity-disease, environmental deterioration, food scarcity, and ageing demographics. The integration of Artificial Intelligence (AI) into scientific research and healthcare, alongside bioengineering and biosciences, is not merely promising; it is transformative. The importance of these domains is clear in their capacity to transform medicine, promote environmental sustainability, and deepen our comprehension of life itself. The most direct and palpable effects of bioengineering and biosciences are observed in healthcare. Bioengineering is transforming the medical environment through tissue engineering sophisticated prosthetics, and medication research [1,2]. The use of AI into these breakthroughs enhances their efficacy and efficiency. Machine learning algorithms are utilized to create bespoke prosthetic limbs that react to neurological impulses, facilitating more natural movement for users [3,4]. AI-driven platforms can scrutinize extensive information from genetic sequencing to detect pathogenic mutations, facilitating precision treatment and early diagnosis. In medication discovery, AI has significantly lowered the time and expense needed to identify possible treatments by simulating chemical interactions and forecasting biological responses [5,6], an advancement that was particularly useful during the COVID-19 pandemic [7].

In addition to healthcare, bioengineering and biosciences are essential in tackling environmental and agricultural issues. Biosciences offer essential insights into ecosystems, microorganisms, and metabolic processes required for biotechnological advancements. Bioengineering utilizes this knowledge to create sustainable solutions, like biofuels, biodegradable plastics, and genetically modified crops that are resistant to pests and climate change [8,9]. Artificial intelligence improves these initiatives by facilitating precise modelling of ecological systems, optimizing microbial strains for industrial applications, and forecasting crop yields in response to fluctuating environmental conditions. AI models can analyze

satellite imagery and climatic data to facilitate precision agriculture, enabling farmers to make data-driven decisions that enhance production and sustainability [10]. In the field of biosciences, AI is revealing new dimensions in our comprehension of life. A notable example is DeepMind's AlphaFold, an AI system proficient at precisely predicting protein structures, an accomplishment that has evaded scientists for decades [11,12].

Comprehending protein folding is crucial for pharmaceutical development, enzyme modification, and the management of genetic diseases. This advancement demonstrates how AI can expedite bioscience research by examining extensive datasets that exceed human capability. Furthermore, AI tools assist scientists in deciphering intricate biological networks, encompassing gene regulation and metabolic pathways, so promoting novel insights into evolution, development, and illness. The intersection of AI, bioengineering, and biosciences presents significant ethical and educational dilemmas. As these technologies advance, the necessity for responsible innovation intensifies. Concerns around data privacy in genomic research, bias in health algorithms, and the unforeseen ramifications of genetic manipulation require careful consideration. This necessitates an interdisciplinary approach to education that integrates living sciences with computer science, ethics, and policy. Preparing the next generation of scientists and engineers with the expertise to address these challenges is essential for maintaining the alignment of innovation with societal values.

Conclusion

In conclusion, the importance of bioengineering and biosciences, particularly when combined with artificial intelligence, is paramount. These domains are crucial in addressing global health emergencies, enhancing environmental sustainability, and advancing the frontiers of biological knowledge. The assistance of AI is expediting research and innovation in several domains, providing renewed optimism for addressing intricate global challenges. Investing in these interconnected domains is not merely prudent; it is imperative. The world requires scientists, engineers, and policymakers capable of leveraging the complete potential of bioengineering, biosciences, and artificial intelligence to establish a healthier, more sustainable, and egalitarian future for everyone.

References

1. Ayman AH, Seung YK (2021) Reproductive tract tissue/organ engineering and regenerative medicine for reproduction. Reproductive Sciences 28(6): 1571-1572.
2. Sean VM, Anthony A (2013) Organ engineering-combining stem cells, biomaterials, and bioreactors to produce bioengineered organs for transplantation. BioEssays: News and Reviews in Molecular, Cellular and Developmental Biology 35(3): 163-172.
3. Moosa SMAK, Matasam AM, Mohammed SAO, Said AM, Sulaiman AM (2024) AI-driven design and fabrication of customized prosthetic limbs using additive manufacturing and patient-specific optimization. ASME International Mechanical Engineering Congress and Exposition 1: 1-7.
4. Choo YJ, Chang MC (2023) Use of machine learning in the field of prosthetics and orthotics: A systematic narrative review. Prosthetics and Orthotics International 47(3): 226-240.
5. Janssens R, Rizzolo K, Artin E, Wagner JP, Riester M, et al. (2024) Abstract 4910: AI predicts drug response from the genomic features of cells and the kinase activity changes induced by compounds. Cancer Research 84(6_Supplement): 4910.
6. Rani P, Dutta K, Kumar V (2022) Artificial intelligence techniques for prediction of drug synergy in malignant diseases: Past, present, and future. Computers in Biology and Medicine 144: 105334.
7. Sekaran K, Gnanasambandan R, Thirunavukarasu R, Iyyadurai R, Karthik G, et al. (2023) A systematic review of artificial intelligence-based COVID-19 modeling on multimodal genetic information. Progress in Biophysics and Molecular Biology 179: 1-9.
8. Bisht DS, Bhatia V, Bhattacharya R (2019) Improving plant-resistance to insect-pests and pathogens: The new opportunities through targeted genome editing. Seminars in Cell & Developmental Biology 96: 65-76.
9. Kamatham S, Munagapati S, Manikanta KN, Vulchi R, Chadipiralla K, et al. (2021) Recent advances in engineering crop plants for resistance to insect pests. Egyptian Journal of Biological Pest Control 31(1): 1-14.
10. Aslan MF, Sabanci K, Aslan B (2024) Artificial intelligence techniques in crop yield estimation based on sentinel-2 data: A comprehensive survey. Sustainability 16(18): 8277.
11. John J, Richard E, Alexander P, Tim G, Michael F, et al. (2021) Highly accurate protein structure prediction with AlphaFold. Nature 596(7873): 583-589.
12. Ohno S, Manabe N, Yamaguchi Y (2024) Prediction of protein structure and AI. Journal of Human Genetics 69: 477-480.