

# “In Silico Dreams: How Artificial Intelligence and Biotechnology will Create the Medicines of the Future”

**By Brian S. Hilbush (Director, Digital Solutions, Veranome Biosystems LLC, USA), John Wiley & Sons Inc, Hoboken, USA, 2021, 352 pp, ISBN: 978-1-119-74563-1, £34.99, €38.50**

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## NON-PEER REVIEWED FEATURE

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## Introduction

“In Silico Dreams: How Artificial Intelligence and Biotechnology will Create the Medicines of the Future” is authored by Brian Hilbush whose education in biosciences and career in the biotechnology and pharmaceutical sectors (developing and commercialising emerging and next-generation biotechnologies) offers significant insight into the application of bioinformatics (‘gold’ biotechnology) to understand and solve biological issues using computational techniques.

The book opens with a brief introduction setting the scene for what follows, including a brief overview of the book. This is followed by eight chapters that delve into aspects of this field. The first four chapters examine the science and engineering underpinning the field, while the second four chapters look towards the future.

## Science and Engineering

Chapter 1, ‘The Information Revolution’s Impact on Biology’, offers an overview of significant

milestones in technology development, highlighting the scientific discipline (for example biology, chemistry, computing and physics) underpinning the technology and how that is woven into the book’s content. This is followed by examples of *in silico* approaches to ‘omics’ and structural/systems biology, laying the foundations for the subsequent chapters.

Chapter 2, ‘A New Era of Artificial Intelligence’, discusses artificial intelligence (AI) and deep or machine learning, highlighting different approaches to machine learning, neural network design concepts and deep learning. It provides a tentative timeline for the integration of AI into medical practice, with an insightful overview of the limitations of AI.

Chapter 3, ‘The Long Road to New Medicines’, offers a historical perspective on drug development, particularly natural products and the importance of the efforts of global industry to develop robust therapeutics. It then discusses the impact of biotechnological approaches on the development of medicines in the 21st century.

Chapter 4, ‘Gene Editing and the New Tools of Biotechnology’, covers the exciting field of DNA- and RNA-related biotechnologies, with an overview of tools used in precision genome engineering and of clinical trials using gene editing.

## The Future

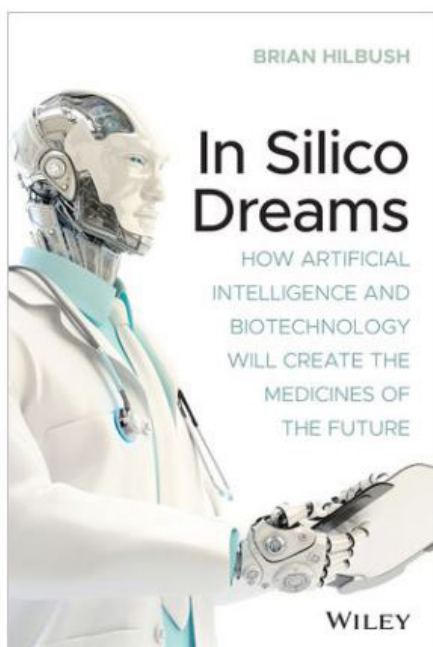
Chapter 5, ‘Healthcare and the Entrance of the Technology Titans’, examines some of the opportunities being invested in by Alphabet, Amazon, Apple, Microsoft and others in biotechnology-informed healthcare. It highlights

*in silico* approaches applied in healthcare technologies (for example, data, devices, software) to address specific market opportunities and some of the drivers to adopt innovation in the field.

Chapter 6, 'AI-Based Algorithms in Biology and Medicine', examines opportunities for AI and machine learning in medicine, highlighting the current applications of AI-based algorithms in medicine and some of the respective challenges for the implementation phase of clinical AI.

Chapter 7, 'AI in Drug Discovery and Development', covers *in silico* biotechnology methods in pharmaceutical development. Examples include chemoinformatics, elucidating structure-activity relationships, high-throughput screening and virtual screening.

Chapter 8, 'Biotechnology, AI, and Medicine's Future', is a forward-looking discussion of how *in silico* biotechnology may impact the world. It highlights the discovery cycles in biology, pharmaceuticals and medicine; opportunities to build tools to decipher molecular structures and biological systems; and how this leads to the new therapeutic development landscape of engineering medicine.



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## Conclusion

The book is accessible to readers with a background in natural and computational sciences working in academia and industry, offering insights into the economic, health and societal impacts that this technology is currently having and will have in the future. While there are other books which cover aspects of the underpinning science in more detail (1–3), what I really enjoyed about this book is that it encapsulates exciting recent developments at a period when there is an explosion of activity in the field.

## References

1. "Encyclopedia of Bioinformatics and Computational Biology", eds. S. Ranganathan, M. Gribskov, K. Nakai, C. Schönbach, Elsevier Inc, Amsterdam, The Netherlands, 2019
2. "In Silico Chemistry and Biology: Current and Future Prospects", eds. G. K. Gupta, M. H. Baig, Walter de Gruyter, Berlin, Germany, 2022
3. J. Harvey, "Computational Chemistry", Oxford University Press, Oxford, UK, 2018

## The Author



John Hardy received his MSci and PhD in Chemistry from the University of Bristol, UK, and University of York, UK, respectively. Thereafter he undertook postdoctoral research in biochemistry, biomedical engineering, materials science and pharmacy (in France, Germany, Northern Ireland and the USA) before returning to the UK to lead a research group developing materials for technical and medical applications, during which time he developed an appreciation of the potential of computational and data science and artificial intelligence in his field of interest.