



BOOK REVIEW

John Rhodes, *How to Make a Vaccine: An Essential Guide for COVID-19 and Beyond* (Chicago, IL, and London: University of Chicago Press, 2021), pp. xiv + 170, \$15.00, paperback, ISBN: 13: 978-0-226-79251-4.

The COVID-19 pandemic had a profound global impact, wherein vaccines played a pivotal role in saving countless lives and mitigating the death toll. The unprecedented swiftness of the development and delivery of the vaccines, although a monumental global achievement, left many people sceptical about their effectiveness and safety. The speedy rollout of COVID-19 vaccines was indeed both a source of hope and a cause of concern, necessitating the dissemination of scientifically accurate information about the process of vaccine development amidst a flood of misinformation.

Impelled by a shared concern with the public about COVID-19's death toll, immunologist and vaccinologist John Rhodes set out to 'calm this public uncertainty' and share his optimism and more importantly, expertise about the potential of 'vaccine development to stop future pandemics' (p.ix). The outcome, in just about a year, was *How to Make a Vaccine*, a concise yet comprehensive account of the process of vaccine discovery and development. Over the eight meticulously crafted chapters, Rhodes explains the basic science behind COVID-19 vaccines and the crucial role of regulatory policies to ensure their equitable distribution across the globe. By highlighting the advancements in tools and techniques to study viruses and their interaction with the human immune system, the book enlightens readers about the ever-evolving field of vaccinology, essential for thwarting future pandemics.

Set within the pandemic, the initial three chapters walk the reader through the intricate biology of SARS-CoV viruses, the complexities of the human immune system, and the evolution of immunisation strategies from variolation to modern-day vaccinations. Rhodes skilfully recounts historical anecdotes of the instrumental discoveries in biomedicine and immunology, unveiling the power of keen observation, serendipity, and scientific rigour to a wider audience. In contrast to the first chapter, which offers an engaging and lively account of the coronaviruses, the second chapter, which delves into the immune system, appears somewhat lacklustre. This section might have been enhanced with more vivid imagery and analogies, which Rhodes is certainly capable of, as demonstrated by his use of familiar and mundane to explain antigen presentation: 'the pathogen fragment is like a hot dog and the MHC molecule is like the bun' (p. 25).

In chapters four and five, 'Develop Vaccines' and 'Evaluate the Contenders', which form the meat of the book, Rhodes introduces the reader to the conventional six-staged trajectory of vaccine development and elucidates the different types of vaccines available in neighbourhood pharmacies. Interestingly, the first COVID-19 vaccines to secure regulatory approval were the nucleic acid vaccines, a novel class that was administered to humans for the first time in history. While the public's trepidation towards these new entrants is understandable, Rhodes's detailed account of the refinements and optimization in nucleic acid vaccine design (pp. 85-91) would certainly help lay such fears to rest. It is somewhat surprising not to see any mention of the Hungarian–American biochemist, Katalin Karikó, who, alongside Drew Weissman, was awarded the Nobel Prize in Physiology and Medicine for the groundbreaking discovery of mRNA vaccines. But then again, since Rhodes's primary purpose here was not to deliver a history and accord credit where due, but rather to inform and reassure the public as quickly as possible, perhaps this omission is not out of place.

Up to this juncture, Rhodes has successfully informed the reader about the out-of-sight scenes of vaccine production and the variable timescales of developing certain vaccines. A careful reader can glean insights into the rapid development of COVID-19 vaccines through the author's discussions on 'vaccine platforms' or 'plug and play' techniques (p. 53), alongside the global collaborative efforts by pharmaceutical companies and policymakers. In the final three chapters, however, the presentation of the

challenges and pitfalls in delivering vaccines to the public is slightly overlooked. For instance, Rhodes could have delved more deeply into the global political and economic framework that regulates vaccine production and distribution worldwide. An in-depth description of these facets might have better illuminated the intersection of science, politics, and economics that dictates the journey from laboratory to populace.

Overall, *How to Make a Vaccine: An Essential Guide for COVID-19 and Beyond* is a well-written and readily comprehensible book which should appeal to a diverse audience base. Although Rhodes may have intended this book primarily for the general public, professionals in medicine, drug discovery, chemistry, biology, and allied fields will also enjoy this short read. To this readership, I would include small companies and innovative academic teams who spurred on by the exigencies of the COVID-19 pandemic, should find it useful to have at hand. The somewhat tongue-in-cheek title, *How to Make a Vaccine*, akin to a recipe book or handbook of instructions, reveals the book's pragmatic essence. Beyond the simplicity of its title, the narrative cultivates an appreciation for the extensive pipeline of vaccines – encompassing those in the developmental phase and still others yet to enter the race!

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