

1. Record Nr.	UNINA9910877230703321
Autore	Chavda Vivek P
Titolo	Nanocarrier Vaccines : Biopharmaceutics-Based Fast Track Development
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2024 ©2024
ISBN	9781394175468
Edizione	[1st ed.]
Descrizione fisica	1 online resource (519 pages)
Altri autori (Persone)	ApostolopoulosVasso
Soggetti	Nanoparticles Vaccines
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Dedication Page -- Contents -- Preface -- Part 1 General -- Chapter 1 History of Nanoparticles -- 1.1 Introduction -- 1.2 History of Nanoparticles -- 1.3 Modern Development of Nanoparticles -- 1.4 Type of Nanoparticles -- 1.5 Properties of Nanoparticles -- 1.5.1 Size -- 1.5.2 Shape -- 1.5.3 Surface Area -- 1.6 Importance of Nanoparticles -- 1.7 Conclusion and Future Prospect -- References -- Chapter 2 Composition of Nanoparticles -- 2.1 Introduction -- 2.2 Types of Nanoparticles -- 2.2.1 Polymeric Nanoparticles -- 2.2.1.1 Polymeric Micelles -- 2.2.1.2 Dendrimer -- 2.2.1.3 Nanosphere -- 2.2.1.4 Nanocapsule -- 2.2.1.5 Polymersome -- 2.2.1.6 Nanocomplex -- 2.2.1.7 Nanogel -- 2.2.2 Inorganic Nanoparticle -- 2.2.2.1 Gold Nanoparticle -- 2.2.2.2 Silica Nanoparticle -- 2.2.2.3 Magnetic Nanoparticle -- 2.2.2.4 Quantum Dots -- 2.2.2.5 Nanocarbon -- 2.2.3 Hybrid Nanoparticle -- 2.2.3.1 Cell Membrane Coated Nanoparticle -- 2.2.3.2 Lipid Polymer Nanoparticle -- 2.2.3.3 Organic-Inorganic Nanocomposite -- 2.2.4 Bioinspired Nanoparticle -- 2.2.4.1 Exosomes -- 2.2.4.2 Protein Nanoparticle -- 2.2.4.3 DNA Nanostructure -- 2.2.5 Lipid-Based Nanoparticle -- 2.2.5.1 Liposome -- 2.2.5.2 Lipoplex -- 2.2.5.3 Solid Lipid Nanoparticle -- 2.3 Composition of Nanoparticles -- 2.3.1 Chitosan -- 2.3.2 Albumin -- 2.3.3 Polylactic Acid -- 2.3.4 Polylactide-co-glycolide (PLGA) -- 2.3.5 Polyacrylate -- 2.4 Synthesis of

Nanoparticles -- 2.4.1 Top-Down Approach -- 2.4.1.1 Ball Milling --  
2.4.1.2 Physical Vapor Deposition (PVD) -- 2.4.1.3 Melt Mixing --  
2.4.1.4 Pulse Laser Ablation -- 2.4.2 Bottom-Up Approach -- 2.4.2.1  
Chemical Vapor Deposition (CVD) -- 2.4.2.2 Thermal Decomposition  
Method -- 2.4.2.3 Chemical Methods -- 2.4.2.4 Biological Methods --  
2.5 Nanoparticle Characterization by Various Instrumental Techniques.  
2.5.1 Dynamic Light Scattering (DLS) -- 2.5.2 Zeta Potential -- 2.5.3  
Microscopic Techniques to Characterize Nanoparticles -- 2.5.3.1  
Scanning Electron Microscopy (SEM) -- 2.5.3.2 Transmission Electron  
Microscopy (TEM) -- 2.5.4 Spectroscopic Techniques to Characterize  
Nanoparticles -- 2.5.4.1 Ultraviolet-Visible Spectroscopy (UV-Vis) --  
2.5.4.2 Raman Spectroscopy -- 2.5.4.3 Fourier Transform Infrared  
Spectroscopy (FTIR) -- 2.5.5 X-Ray Diffraction Method (XRD) -- 2.6  
Understanding Nanotoxicity: Potential Risks and Implications -- 2.7  
Conclusion -- References -- Chapter 3 Nanotechnology and Vaccine  
Development -- 3.1 Introduction -- 3.2 Overview of Vaccine  
Development -- 3.3 Advantages of Nanoparticles in Vaccine Delivery --  
3.4 Types of Nanoparticles as Vaccine Carriers -- 3.4.1 Liposomes --  
3.4.2 Polymer-Based Nanoparticles -- 3.4.3 Virus-Like Particles (VLPs)  
-- 3.4.4 Nanogels -- 3.4.5 Inorganic Nanoparticles -- 3.5  
Development of Nanoparticle-Based Vaccine -- 3.5.1 Viral Vector-  
Based Nanoparticle -- 3.5.2 Lipid-Based Nanoparticles -- 3.5.3 DNA-  
Based Nanoparticles -- 3.5.4 mRNA-Based Nanoparticles -- 3.5.5  
Protein-Based Nanoparticles -- 3.6 Adjuvants and their Role in Vaccine  
Development -- 3.7 Nanoscale Adjuvants -- 3.8 Advantages -- 3.9  
Techniques for Nanoscale Adjuvants -- 3.10 Route of Administration  
for Vaccines -- 3.11 Recent Advances in Nanotechnology-Based  
Vaccines -- 3.12 The Regulatory Perspective of Nanoparticle-Based  
Vaccine Development -- 3.13 Future Prospects -- 3.14 Conclusion --  
References -- Chapter 4 Nanoparticle Formulations: A Sustainable  
Approach to Biodegradable and Non-Biodegradable Products -- 4.1  
Introduction -- 4.2 Types of Nanoparticles -- 4.3 Preparation of  
Nanoparticles -- 4.4 Factors Affecting Selection of Method -- 4.4.1  
Pressure -- 4.4.2 Particle Shape and Size -- 4.4.3 Environment -- 4.4.4  
Pore Size.  
4.4.5 Particular Method or Technique -- 4.4.6 Cost of Preparation --  
4.4.7 Proximity -- 4.4.8 Time -- 4.4.9 Other Variables -- 4.5 Polymers  
Used in NP Formulation -- 4.6 Nanoparticle Formulations Based on  
Biodegradable Polymers -- 4.7 Nanoparticle Formulations Based on  
Non-Biodegradable Polymers -- 4.8 Nanoparticle Formulations Based  
on Natural Polymers -- 4.9 Challenges in NPs from Laboratory to  
Industrial Scale-Up -- 4.10 Nanoparticle-Based Approved & --  
Marketed Formulations -- 4.11 Future Aspects & -- Conclusion --  
References -- Chapter 5 Nanoparticle Properties: Size, Shape, Charge,  
Inertness, Efficacy, Morphology -- 5.1 Introduction -- 5.2 Applications  
of Nanoparticle Formulations -- 5.3 Interaction with Cells -- 5.4  
Properties of Nanoparticles -- 5.4.1 Classification of Nanoparticle  
Properties -- 5.4.1.1 Physicochemical Properties -- 5.4.1.2 Optical  
Properties -- 5.4.1.3 Magnetic Properties -- 5.4.1.4 Catalytic  
Properties -- 5.4.1.5 Mechanical Properties -- 5.4.2 Different  
Properties -- 5.4.2.1 Size -- 5.4.2.2 Shape -- 5.4.2.3 Charge --  
5.4.2.4 Inertness -- 5.4.2.5 Efficacy -- 5.4.2.6 Morphology -- 5.5 Role  
of Physicochemical Properties in Nanoparticle Toxicity -- 5.6  
Conclusion -- References -- Part 2 Nanoparticles to Deliver Antigen --  
Chapter 6 Viral Vector-Based Nanoparticles -- 6.1 Introduction -- 6.2  
Characteristics of Viral Vector-Based Nanoparticles -- 6.3 Applications  
-- 6.3.1 Viral Nanoparticles for Drug Delivery -- 6.3.1.1 Antimicrobial  
Therapies -- 6.3.1.2 Cardiovascular Therapies -- 6.3.2 Viral

Nanoparticles for Imaging -- 6.3.2.1 Nanoparticles are Used in PET/SPECT Scans -- 6.3.2.2 Nanoparticles Used in Ultrasonic Tests -- 6.3.2.3 Nanoparticles Utilized in CT Scans -- 6.3.2.4 Nanoparticles Employed in MRI Biomedical Applications -- 6.3.2.5 Illustrations of Nanoparticles Utilized in Fluorescence-Based Biological Applications. 6.3.3 Viral Nanoparticles for Immunotherapy -- 6.3.4 Viral Nanoparticles for Theranostic Applications -- 6.4 Novel Advancements in Applications of Viral Nanoparticles -- 6.5 Limitations and Prospects of Viral Vector-Based Nanoparticle Approach -- 6.6 Conclusion -- Acknowledgment -- References -- Chapter 7 Lipid-Based Nanoparticles -- 7.1 Introduction -- 7.2 Types of Lipid-Based Nanoparticles -- 7.2.1 Solid Lipid Nanoparticles (SLNs) -- 7.2.2 Nanostructured Lipid Carriers (NLCs) -- 7.3 Synthesis of Lipid-Based Nanoparticles -- 7.3.1 Introduction to Lipids -- 7.3.2 Methods for Formulating Lipid Nanoparticles -- 7.3.2.1 High-Pressure Homogenization -- 7.3.2.2 Solvent Emulsification-Evaporation -- 7.3.2.3 Microemulsion-Based Method -- 7.3.2.4 Hot-Melt Homogenization -- 7.3.2.5 Spray Drying -- 7.3.2.6 Solvent Injection Method -- 7.3.2.7 Microfluidics -- 7.4 Characterization of Lipid Nanoparticles -- 7.4.1 Size and Shape -- 7.4.2 Surface Charge -- 7.4.2.1 Analytical Techniques for Surface Charge Characterization -- 7.4.2.2 Zeta Potential Measurement -- 7.4.2.3 Electrophoresis -- 7.4.2.4 Isoelectric Focusing -- 7.4.3 Encapsulation Efficiency -- 7.4.3.1 Factors Affecting Encapsulation Efficiency -- 7.4.3.2 Analytical Techniques for Encapsulation Efficiency Characterization -- 7.4.4 Stability -- 7.4.4.1 Factors Affecting Stability -- 7.4.4.2 Analytical Techniques for Stability Characterization -- 7.5 Applications of Lipid-Based Nanoparticles in Vaccines -- 7.5.1 Enhancement of Immune Response -- 7.5.2 Targeted Delivery -- 7.5.2.1 Cancer Immunotherapy -- 7.5.2.2 mRNA-Based Vaccines -- 7.5.2.3 Gene Therapy -- 7.5.3 Adjuvant Effects -- 7.5.3.1 mRNA COVID-19 Vaccines -- 7.5.3.2 Human Papillomavirus (HPV) Vaccine -- 7.5.3.3 Influenza Vaccine -- 7.6 Challenges and Future Directions -- 7.6.1 Safety and Toxicity Concerns -- 7.6.1.1 Preclinical Safety Evaluation. 7.6.1.2 Human Pharmacology Studies -- 7.6.1.3 Postmarketing Surveillance -- 7.6.1.4 Adverse Event Reporting -- 7.6.2 Stability Issues -- 7.6.2.1 Formulation Optimization -- 7.6.2.2 Analytical Method Development -- 7.6.2.3 Accelerated Stability Studies -- 7.6.2.4 Quality by Design (QbD) -- 7.6.3 Scale-Up Production Challenges -- 7.6.3.1 Equipment Design -- 7.6.3.2 Process Optimization -- 7.6.3.3 Regulatory Compliance -- 7.6.4 Opportunities for Future Research -- 7.6.4.1 Novel Antigen and Adjuvant Formulations -- 7.6.4.2 Targeted Delivery -- 7.6.4.3 Manufacturing Process Optimization -- 7.6.4.4 Immunological Mechanisms -- 7.6.4.5 Opportunities for Future Research -- 7.7 Conclusion -- References -- Chapter 8 Nanoparticle-Based mRNA Vaccines: Are We One Step Closer to Targeted Cancer Therapy? -- 8.1 Introduction -- 8.2 Use of mRNA in Vaccines: Advantages and Challenges -- 8.3 How Do mRNA Vaccines Work? -- 8.4 Nanocarriers for mRNA Delivery -- 8.4.1 Liposomes and RNA Lipoplexes -- 8.4.2 Lipid Nanoparticles -- 8.4.3 Polymer-Based Nanoparticles -- 8.4.4 Hybrid Nanoparticles -- 8.5 Nanoparticle-Based mRNA Vaccines in Cancer Therapy -- 8.5.1 Breast Cancer -- 8.5.2 Colorectal Cancer -- 8.5.3 Lung Cancer -- 8.5.4 Glioma Tumor -- 8.5.5 Other Tumors -- 8.6 Clinical Trials -- 8.6.1 Considerations for Clinical Translation -- 8.7 Conclusion -- References -- Chapter 9 Protein Delivery by Nanoparticles -- 9.1 Introduction -- 9.2 Major Challenges in Protein Delivery -- 9.3 Nanotechnology -- 9.4 Nanoparticles -- 9.4.1 Nanocarriers -- 9.4.2 Protein Nanocarrier --

9.4.3 Protein and Its Type Used to Produce Protein Nanoparticles --  
9.4.3.1 Silk Protein Fibroin -- 9.4.3.2 Human Serum Albumin --  
9.4.3.3 Gliadin -- 9.4.3.4 Gelatin -- 9.4.3.5 Legumin -- 9.4.3.6  
30Kc19 Protein Obtained from Silkworm Hemolymph -- 9.4.3.7 Ferritin  
-- 9.5 Methods of Preparation.  
9.5.1 Chemical Methods.

---

#### Sommario/riassunto

This book, edited by Vivek P. Chavda, provides a comprehensive overview of nanocarrier vaccines, focusing on the fast-track development of these innovative solutions in immunology. It covers the history, types, and properties of nanoparticles, as well as their applications in vaccine delivery. The book delves into the advantages of using nanoparticles as vaccine carriers, exploring various types such as liposomes, polymer-based nanoparticles, and virus-like particles. Additionally, it addresses the synthesis, formulation, and characterization of nanoparticles, along with the potential risks associated with nanotoxicity. The text is targeted at researchers, professionals, and students in the fields of pharmacy, biotechnology, and nanotechnology, aiming to equip them with the knowledge to advance in vaccine development and nanoparticle technology.

---