

# Contents

<i>Dedication</i> .....	v
<i>Preface</i> .....	vii
<i>Contributors</i> .....	xiii

## PART I VACCINES: INTRODUCTION

1 Challenges for Vaccinologists in the First Half of the Twenty-First Century .....	3
<i>Sunil Thomas, Ann Abraham, Patrick J. Callaghan, and Rino Rappuoli</i>	
2 Principles in Immunology for the Design and Development of Vaccines .....	27
<i>Claudius U. Meyer and Fred Zepp</i>	
3 Revisiting the Principles of Designing a Vaccine .....	57
<i>Shubhbranshu Zutshi, Sunil Kumar, Prashant Chauhan, and Bhaskar Saha</i>	
4 Status of COVID-19 Pandemic Before the Administration of Vaccine .....	93
<i>Sunil Thomas</i>	

## PART II TRENDS IN VACCINOLOGY

5 mRNA Vaccines to Protect Against Diseases .....	111
<i>Sunil Thomas and Ann Abraham</i>	
6 Artificial Intelligence in Vaccine and Drug Design .....	131
<i>Sunil Thomas, Ann Abraham, Jeremy Baldwin, Sakshi Piplani, and Nikolai Petrovsky</i>	

## PART III VACCINES FOR HUMAN VIRAL DISEASES

7 Vaccines Targeting Numerous Coronavirus Antigens, Ensuring Broader Global Population Coverage: Multi-epitope and Multi-patch Vaccines .....	149
<i>Sukrit Srivastava, Spyros D. Chatziefthymiou, and Michael Kolbe</i>	
8 Use of Micro-Computed Tomography to Visualize and Quantify COVID-19 Vaccine Efficiency in Free-Breathing Hamsters .....	177
<i>Laura Seldeslachts, Christopher Cawthorne, Suzanne F. Kaptein, Robbert Boudewijns, Hendrik Jan Thibaut, Lorena Sanchez Felipe, Sapna Sharma, Georg Schramm, Birgit Weynand, Kai Dallmeier, and Greetje Vande Velde</i>	

9	Design of Replication-Competent VSV- and Ervebo-Vectored Vaccines Against SARS-CoV-2.....	193
	<i>Qixing Liu, Zhe Ding, Jiaming Lan, and Gary Wong</i>	
10	CRISPR Engineering of Bacteriophage T4 to Design Vaccines Against SARS-CoV-2 and Emerging Pathogens .....	209
	<i>Jingen Zhu, Neeti Ananthaswamy, Swati Jain, Himanshu Batra, Wei-Chun Tang, and Venigalla B. Rao</i>	
11	Techniques for Developing and Assessing Immune Responses Induced by Synthetic DNA Vaccines for Emerging Infectious Diseases .....	229
	<i>Ziyang Xu, Michelle Ho, Devivasha Bordoloi, Sagar Kudchodkar, Makan Khoshnejad, Leila Giron, Faraz Zaidi, Moonsup Jeong, Christine C. Roberts, Young K. Park, Joel Maslow, Mohamed Abdel-Mohsen, and Kar Muthumani</i>	
12	Towards Determining the Epitopes of the Structural Proteins of SARS-CoV-2 .....	265
	<i>Sunil Thomas</i>	
13	Development, Production, and Characterization of Hepatitis B Subviral Envelope Particles as a Third-Generation Vaccine .....	273
	<i>Juan Manuel Battagliotti, Diego Fontana, Marina Etcheverrigaray, Ricardo Kratje, and Claudio Prieto</i>	
14	Generation of CpG-Recoded Zika Virus Vaccine Candidates .....	289
	<i>Ivan Trus, Daniel Udenze, and Uladzimir Karniychuk</i>	
<b>PART IV VACCINES FOR HUMAN BACTERIAL DISEASES</b>		
15	Salmonella Uptake into Gut-Associated Lymphoid Tissues: Implications for Targeted Mucosal Vaccine Design and Delivery.....	305
	<i>Angelene F. Richards, Fernando J. Torres-Velez, and Nicholas J. Mantis</i>	
16	Development of Human Recombinant Leptospirosis Vaccines.....	325
	<i>Natasha Rodrigues de Oliveira, Thaís Larré Oliveira, Sérgio Jorge, and Odir Antônio Dellagostin</i>	
17	Induction of T Cell Responses by Vaccination of a <i>Streptococcus pneumoniae</i> Whole-Cell Vaccine .....	345
	<i>Emily M. Roy, Fan Zhang, Richard Malley, and Ying-Jie Lu</i>	
18	Development of a Bacterial Nanoparticle Vaccine Against <i>Escherichia coli</i> .....	357
	<i>Melibea Berzosa, Yadira Pastor, Carlos Gamazo, and Juan Manuel Irache</i>	
19	Construction of Novel Live Genetically Modified BCG Vaccine Candidates Using Recombineering Tools .....	367
	<i>Mario Alberto Flores-Valdez and Michel de Jesús Aceves-Sánchez</i>	

20	An Update on Tuberculosis Vaccines . . . . .	387
	<i>Radha Gopalaswamy and Selvakumar Subbian</i>	
21	Structure-Based Design of Diagnostics and Vaccines for Lyme Disease . . . . .	411
	<i>Sunil Thomas</i>	
22	Development of a SONIX Vaccine to Protect Against Ehrlichiosis . . . . .	423
	<i>Sunil Thomas</i>	

PART V VACCINES FOR HUMAN PARASITIC DISEASES

23	Development of the Antileishmanial Vaccine . . . . .	433
	<i>Sunil Kumar, Shubbranshu Zutshi, Mukesh Kumar Jha, Prashant Chauhan, and Bhaskar Saha</i>	
24	In Silico Design of Recombinant Chimera T Cell Peptide Epitope Vaccines for Visceral Leishmaniasis . . . . .	463
	<i>Amanda Sanchez Machado, Vivian Tamietti Martins, Maria Victoria Humbert, Myron Christodoulides, and Eduardo Antonio Ferraz Coelho</i>	
25	Preclinical Assessment of the Immunogenicity of Experimental <i>Leishmania</i> Vaccines . . . . .	481
	<i>Vivian Tamietti Martins, Amanda Sanchez Machado, Maria Victoria Humbert, Myron Christodoulides, and Eduardo Antonio Ferraz Coelho</i>	
26	Production of Oral Vaccines Based on Virus-Like Particles Pseudotyped with Protozoan-Surface Proteins. . . . .	503
	<i>Lucía Lara Rupil, Marianela del Carmen Serradell, and Hugo Daniel Luján</i>	
27	A Fast-Track Phenotypic Characterization of <i>Plasmodium falciparum</i> Vaccine Antigens through Lyse-Reseal Erythrocytes Mediated Delivery (LyRED) of RNA Interference for Targeted Translational Repression . . . . .	539
	<i>Malabika Chakrabarti, Swati Garg, Akshay Munjal, Sweta Karan, Soumya Pati, Lalit C. Garg, and Shailja Singh</i>	
28	<i>Plasmodium falciparum</i> Antigen Expression in <i>Leishmania</i> Parasite: A Way Forward for Live Attenuated Vaccine Development . . . . .	555
	<i>Akriti Srivastava, Swati Garg, Sweta Karan, Shikha Kaushik, Anand Ranganathan, Soumya Pati, Lalit C. Garg, and Shailja Singh</i>	
29	Molecular Characterization of a Vector-Based Candidate Antigen Using the 3'-RACE and Genome Walking Methods and In Silico Analysis of the Correspondent Protein for Vaccine Design and Development . . . . .	567
	<i>Abbasali Raz, Mahdieh Manafi, and Mahdokht Ilbeigi Khamseh Nejad</i>	
30	In Vitro Culture of <i>Plasmodium falciparum</i> for the Production of Mature Gametocytes for Performing Standard Membrane Feeding Assay and Infection of <i>Anopheles</i> spp. . . . .	581
	<i>Abbasali Raz and Mahdokht Ilbeigi Khamseh Nejad</i>	

31	<i>Plasmodium berghei</i> Infection in BALB/c Mice Model as an Animal Model for Malaria Disease Research . . . . .	589
	<i>Abbasali Raz</i>	
32	Standard Membrane Feeding Assay for Malaria Transmission Studies. . . . .	597
	<i>Abbasali Raz, Jafar J. Sani, and Hemn Yousefi</i>	
PART VI DEVELOPMENT OF CANCER VACCINES		
33	Generation of Tumor Targeted Dendritic Cell Vaccines with Improved Immunogenic and Migratory Phenotype . . . . .	609
	<i>Adam M. Swartz, Kelly M. Hotchkiss, Smita K. Nair, John H. Sampson, and Kristen A. Batich</i>	
34	Monocytes as a Cellular Vaccine Platform to Induce Antitumor Immunity . . . . .	627
	<i>Min-Nung Huang, Vincent M. D'Anniballe, and Michael D. Gunn</i>	
35	Beyond Sequencing: Prioritizing and Delivering Neoantigens for Cancer Vaccines . . . . .	649
	<i>Alexander S. Roesler and Karen S. Anderson</i>	
PART VII VACCINES FOR ALLERGY		
36	Proteomics for Development of Food Allergy Vaccines . . . . .	673
	<i>Mónica Carrera and Susana Magadán</i>	
PART VIII VACCINES FOR TOXINS		
37	Estimating Vaccine Potency Using Antibody-Based Competition Assays . . . . .	693
	<i>Jennifer Doering, Greta Van Slyke, Oreola Donini, and Nicholas J. Mantis</i>	
	<i>Index</i> . . . . .	707