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## Preface

“We are protecting children from polio at the cost of our lives.”  
Sabeeha Begum (a lady healthcare worker providing polio vaccines in  
Quetta, Pakistan)

Vaccinations have prevented several diseases; however, as yet, there are only two diseases that have been eradicated globally. Mass awareness programs and aggressive vaccination strategies in the twentieth century were able to control smallpox, and the disease was officially declared eradicated in 1980. Rinderpest, a serious disease of cattle, was officially eradicated in 2011, thereby becoming only the second disease to be completely eradicated. Recently, the Americas (North and South America) were declared free of endemic transmission of rubella, a contagious viral disease that can cause multiple birth defects as well as fetal death when contracted by women during pregnancy. The achievement was due to a 15-year effort that involved widespread administration of the vaccine against measles, mumps, and rubella (MMR) throughout the Western Hemisphere.

One of the dreaded diseases—[poliomyelitis](#)—is in the last phases of eradication, thanks to the effective vaccines against the disease. The [public health](#) effort to eliminate [poliomyelitis](#) infection around the world began in 1988, and vaccination strategies have reduced the number of annual [diagnosed](#) cases of polio from the hundreds of thousands to couple of hundreds. Nigeria was the last country in Africa to eradicate polio; as of writing this book, no polio is reported in Nigeria since last year. Currently, polio remains endemic in two countries—Afghanistan and Pakistan. Until poliovirus transmission is interrupted in these countries, all countries remain at risk of importation of polio. Illiteracy, ignorance to vaccines, death threats, as well as killing of healthcare workers providing polio vaccines have slowed immunization programs in Pakistan. This toxic scenario coupled with the migration of people has led to the persistence of polio in Pakistan and neighboring Afghanistan. With awareness on the need of vaccination, knowledge on the importance of vaccination, and new rules that may penalize resistance to vaccination, it may be possible to eliminate polio by the end of the decade.

When I was given the opportunity to author this book (*Vaccine Design: Methods and Protocols*), I wished to have at least one chapter on vaccine design or vaccine development from every country. Unfortunately, it dawned on me later that not every country invests in science! It was also unfortunate to realize that research and development on vaccines is not a priority even in some developed countries with resources or influence. New sustainable technologies are to be developed to create more jobs and improve the well-being of humans as well as conservation of nature; hence, it is high time countries invest at least 5 % of their GDP for science including vaccine development.

*Vaccine Design: Methods and Protocols* is a practical guide providing step-by-step protocol to design and develop vaccines. The purpose of the book is to help vaccinologists develop novel vaccines based on current strategies employed to develop vaccines against several diseases. The book provides protocols for developing novel vaccines against infectious bacteria, viruses, and parasites for humans and animals as well as vaccines for cancer, allergy, and substance abuse. The book also contains chapters on how antigenic proteins

for vaccines should be selected and designed in silico, vectors for producing recombinant antigenic proteins, and the production of antigenic proteins in plant systems. Most vaccinologists are not aware of the intellectual property (IP) of vaccines, the importance of patents before commercialization, and what components of vaccines could be patented; hence, chapters on these aspects are also included in the book. The book also contains a chapter on the regulatory evaluation and testing requirements for vaccines.

The *Methods in Molecular Biology*<sup>TM</sup> series *Vaccine Design: Methods and Protocols* contains 103 chapters in two volumes. Volume 1, *Vaccines for Human Diseases*, has an introductory section on how vaccines impact diseases, the immunological mechanism of vaccines, and future challenges for vaccinologists and current trends in vaccinology. The design of human vaccines for viral, bacterial, fungal, parasitic, and prion diseases as well as vaccines for drug abuse, allergy, and tumor are also described in this volume. Volume 2, *Vaccines for Veterinary Diseases*, includes vaccines for farm animals and fishes, vaccine vectors and production, vaccine delivery systems, vaccine bioinformatics, vaccine regulation, and intellectual property.

It has been 220 years since Edward Jenner vaccinated his first patient in 1796. This book is a tribute to the pioneering effort of his work. My sincere thanks to all the authors for contributing to *Vaccine Design: Methods and Protocols* Volume 1 (*Vaccines for Human Diseases*) and Volume 2 (*Vaccines for Veterinary Diseases*). The book would not have materialized without the efforts of the authors from all over the world. I would also like to thank the series editor of *Methods in Molecular Biology*<sup>TM</sup>, Prof. John M. Walker, for giving me the opportunity to edit this book. My profound thanks to my wife Jyothi for the encouragement and support, and also to our twins—Teresa and Thomas—for patiently waiting for me while editing the book. Working on the book was not an excuse for missing story time, and I made sure that you were told a couple of stories every day before bedtime.

**Wynnnewood, PA, USA**

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