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Preface

Viral nanotechnology is a young and emerging discipline. A highly interdisciplinary field, viral nanotechnology inhabits the interface between virology, chemistry, and materials science. The field exploits viral nanoparticles (VNPs) for potential applications in diverse fields that range from electronics and energy to novel materials and medicine.

From a materials science point of view, VNPs are attractive building blocks for several reasons. In general, VNPs are on the nanometer-size scale; they are monodisperse with high degree of symmetry and polyvalency; they can be produced with ease on large scale; they are exceptionally stable and robust; and they are biocompatible, and in some cases, orally bioavailable. VNPs are “programmable” units that can be modified by either genetic modification or chemical bioconjugation methods.

This book will give a survey of the applications of VNPs in fields ranging from materials science to biomedicine. An introduction to the field of viral nanotechnology is given in Chapter 1. Chapter 2 provides an overview of the many different VNP building blocks currently in use for viral nanotechnology. Various methods have been established that allow efficient production of VNPs as well as their non-infectious counterparts, the virus-like particles (VLPs), as discussed in Chapter 3. A large variety of bioconjugation methods have been applied and optimized for VNPs that facilitate chemical modification, fine-tuning, and immobilization of VNPs; these techniques are described in Chapter 4. Chapter 5 summarizes strategies to entrap or encapsulate non-natural cargos into VNPs and VLPs. Mineralization chemistries are discussed in Chapter 6. With the different chemistries in hand, a range of highly interesting VNP-based materials has been fabricated with potential applications in sensors, electronics, and medicine. Toward the development of nanoelectronic devices, Chapter 7 describes the efforts that have been directed to the generation of thin-film arrays of VNPs immobilized on solid supports. Last but not least, Chapter 8 provides an overview of the advances of designing VNPs for biomedical applications, including their uses as vaccines, imaging modalities, targeted therapeutics, and gene therapies.

As this young discipline matures, a new era has begun in which pathogens have become useful material building blocks for next-generation
nanodevices. The field has even greater promise given the enormous variety of available VNPs with their vast diversity of sizes, structures, chemical reactivities, and biocompatibilities. This promise drives an inspiring field with wide-ranging opportunities for discovery.

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Nicole F. Steinmetz, PhD
Marianne Manchester, PhD