Foreword

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Physical Virology is a nascent discipline involving the development and application of physics-based quantitative methods for characterization of various aspects of the “life cycle” of viruses. These include the structure and self-assembly of viral capsids, the nature and energetics of packaging of the genome, the dynamics and nanoscale interactions responsible for its delivery to the host, the systemic spreading of viral infections and the adaptive response to evolutionary pressure of the highly optimized viral genome.

The recent upsurge in quantitative studies of these open issues has at least two reasons. On the one hand, the “molecular minimality” of viruses implies that their life cycle must rely on passive physical mechanisms to an extent that has no parallel in organizationally more complex bacteria and eukarya. On the other hand, the continuous advancements in experimental techniques capable of probing the living and inanimate matter at the nanoscale is providing an unprecedented opportunity to characterize in detail the structural and dynamical behaviour of viruses, both *in vitro* and *in vivo*. In parallel, the proteinaceous capsids from viruses serve as platform technologies enabling unique applications in nanotechnology, materials, bioengineering, and medicine. Based on their highly symmetrical structures, virus-based nanoparticles have a high propensity to self-assemble into higher-order crystalline structures, yielding hierarchical hybrid materials.

This special issue of the Journal of Biological Physics is entirely dedicated to physical virology and aims to present a broad overview of the current state of the art in various subtopics of physical virology and stimulate additional activity in this rapidly developing field. The contributors were also among the lecturers at the “Physical Virology” workshop that was held in 2017 at the International Center for Theoretical Physics in Trieste, Italy. It is with great sadness that we remember Prof. Vladimir Lorman, a member of the editorial board for this special issue of Journal of Biological Physics, who passed away before its publication.

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