Importance of electrostatic interactions for virus assembly and structure

Antonio Šiber[1], Anže Lošdorfer Božič[2] and Rudolf Podgornik[2,3]

[1] Institute of physics, Bijenička cesta 46, 10000 Zagreb, Croatia

[2] Department of Theoretical Physics, Jožef Stefan Institute, SI-1000 Ljubljana, Slovenia

[3] Department of Physics, Faculty of Mathematics and Physics, University of Ljubljana, SI-1000 Ljubljana, Slovenia

Viruses incarnate the versatile and tunable nature of protein-protein and protein-DNA/RNA interactions. These need to be precisely evolutionary adjusted to suit each stage of the virus „life-cycle“ [1]. Some of the proteins encoded by virus genome perform enzymatic function, but some of them, capsid proteins in particular, need to be specifically shaped and physically designed to interact appropriately with other proteins, cellular membrane, and the virus genome. In that respect, electrostatic interactions are of importance as the genome is negatively charged, and geometrical distribution of charge on the proteins may steer the assembly and stabilize the assembled structure in a functional state [2]. I shall discuss some of the roles electrostatic interactions play in an assembled virus [1,2,3,4] and in the process of the assembly [5,6].

[1] A. Šiber, A. Lošdorfer Božič, and R. Podgornik, *"Energies and pressures in viruses: contribution of nonspecific electrostatic interactions“*, Phys.Chem.Chem.Phys. 14, 3746 (2012).

[2] A. Lošdorfer Božič, A. Šiber, and R. Podgornik, *„How simple can a model of an empty viral capsid be?“*, accepted for publication in Journal of Biological Physics (2012).

[3] A. Leforestier, A. Šiber, F. Livolant, and R. Podgornik *"Protein-DNA Interactions Determine the Shapes of DNA Toroids Condensed in Virus Capsids“*, Biophys. J. 100, 2209 (2011).

[4] A. Šiber and R. Podgornik, *"Nonspecific interactions in spontaneous assembly of empty versus functional single-stranded RNA viruses“*, Phys. Rev. E 78, 051915 (2008).

[5] A. Šiber and R. Podgornik, *"Role of electrostatic interactions in the assembly of empty spherical viral capsids"*, Phys. Rev. E 76, 061906 (2007).

[6] A. Šiber and A. Majdandžić, *"Spontaneous curvature as a regulator of the size of virus capsids“*, Phys. Rev. E 80, 021910 (2009).