

Structure and Virulence of *Pseudomonas Aeruginosa* Bacteriophages

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We used the single-particle cryo-electron microscopy and three-dimensional (3D) structural approach to solve the 3D structures of several bacteriophages that infects *Pseudomonas aeruginosa*. These gram-negative bacteria are frequently pathogenic in humans, and can cause severe diseases such as nephropathy, fibrosis and inflammation. Therefore, they have high potential for phage therapy [1,2].

We calculated the 3D reconstructions of the capsids of the following bacteriophages: SN, KMV, YuA at the resolution 35Å and better (table 1). The capsids of all phages except YuA represent the regular icosahedrons with a triangulation T=9 (SN) and T=7 (KMV). YuA bacteriophage represents the elongated icosahedron with the C5 type of symmetry.

All phages possess the unique surface architecture of their capsids with prominent décor elements (Fig. 1, A-C). Using the polyclonal antibodies directed against structural components: pg22 of the phage SN, pg47 of the phage KMV and pg63 of the phage YuA we were able to demonstrate the surface distribution of these structural proteins (Fig.2, A-C).

To reveal the structural principles of phage virulence, we used the electron tomography as a powerful tool to study the interactions of phages with the wild type and mutant *P. aeruginosa*. The tomographic low-resolution reconstructions explained the specificity while binding of phages to bacteria cell surface for initiation of infection.

References

[1] Shaburova et al., *Genetika* 44, (2008) 713-716

[2] Krylov et al., *Can. J. Microbiol.* 30 (1984) 758-762

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TABLE 1. Parameters for the 3D reconstruction.

Phage	Systematics	No of images	Resolution	No of particles	Type of simmetry	Resolution of reconstruction
SN	<i>Myoviridae</i>	56	4.5 Å	645	ICOS, C5	25 Å
KMV	<i>Podoviridae</i>	126	3.5 Å	9320	C5	35 Å
YuA	<i>Siphoviridae</i>	54	3.5 Å	3142	C5	35 Å

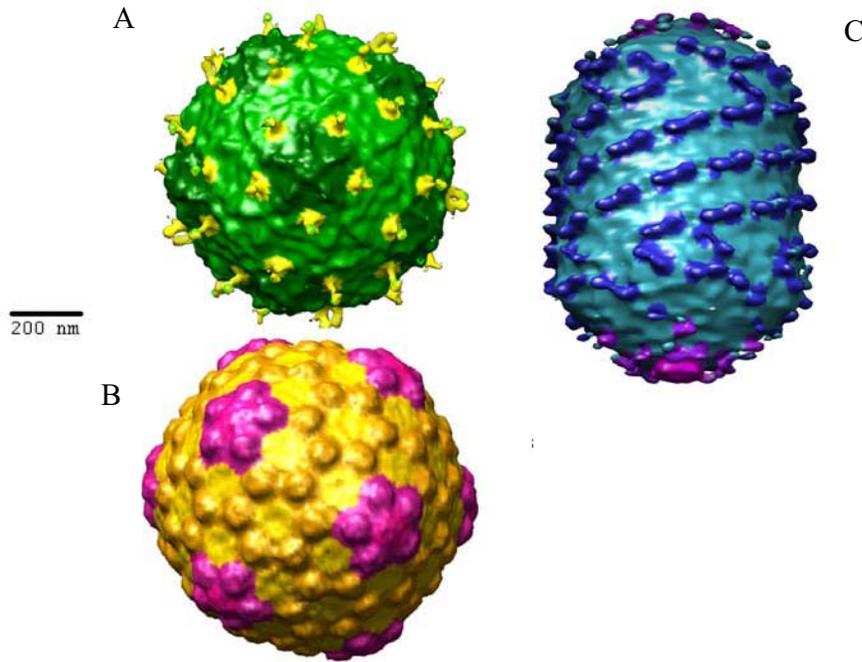


FIG. 1. 3D reconstructions of capsids of phages: (A) KMV; (B) SN; (C) YuA.

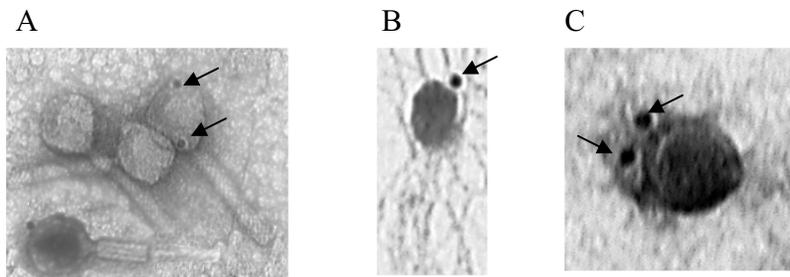


FIG. 2. Distribution of gold labeled antibodies (arrows) against (A) pg22; (B) pg63; (C) pg 57