

## iNEXT workshop on Integrated methodologies and approaches for structural biology

Name of Speaker: **Pavel Plevka**

University / Research Institute / Department: **Masaryk University / CEITEC / Structural biology**

Title of Lecture: **Structure and DNA delivery mechanism of gene transfer agent of *Rhodobacter capsulatus***

### Abstract:

Gene transfer agents (GTAs) are extracellular particles that enable high-frequency horizontal gene transfer among prokaryotes and thus accelerate their development. GTAs are derived from phages and were independently acquired by several bacterial and archaeal lineages. Because the evolution of bacterial genomes is slower than those of phages, GTA represent living fossils of phage development. In spite of their importance for adaptation and diversification of prokaryotes, the structure and mechanism of DNA delivery of GTA are unknown. Here we used cryo-electron microscopy to show that GTA of *Rhodobacter capsulatus* resembles bacteriophage from the family Siphoviridae. However, the genome-containing head of GTA is shortened in the direction of GTA tail relative to the icosahedral heads of phages. The reduced size of the head limits the genome packaging capacity of GTA to 50%, which could be a mechanism ensuring that it is not capable of transferring all genes required for its construction. The capsid is decorated with head-spikes, similar in structure to head spikes of both eukaryotic and prokaryotic viruses. Attachment of GTA tail to the head is strengthened by interaction of dodecamer head complementation protein 1 with major capsid protein. Tape-measure protein, which determines the length of GTA tail to six discs of tail protein, exhibits similarities in 3D structure to those of phages with both short and long tails and may therefore correspond to their common ancestor. The ejection of GTA DNA is triggered by a signal mediated through baseplate proteins, leading to structural rearrangements of C-terminal domain of tape measure protein and internal portal protein. Our findings explain how bacteria utilized phage structural proteins for gene transfer and describes the mechanism of GTA DNA delivery. Structural characterization of GTA enables its in biotechnology for gene delivery.

### Research Profile:

Pavel Plevka is research group leader at Central European Institute of Technology, Masaryk University. He obtained his Ph.D. in structural biology from Uppsala University in 2009. From 2009 till 2013 he was a post-doctoral fellow with Michael Rossmann at Purdue University.

Plevka has determined structures of several viruses most notably that of human enterovirus 71, tick borne encephalitis virus, several honeybee viruses, and bacteriophages. He focuses on X-ray

crystallography and cryo-electron microscopy of virus particles, their mechanism of genome delivery, and virus replication *in vivo*.

### Three selected publications:

1. Füzik T, Formanová P, Růžek D, Yoshii K, Niedrig M, **Plevka P**. *Structure of tick-borne encephalitis virus and its neutralization by a monoclonal antibody*. **Nat Commun**. 2018; 9(1):436. (IF 12.1; 0 citations)
2. Škubník K, Nováček J, Füzik T, Přidal A, Paxton RJ, **Plevka P**. *Structure of deformed wing virus, a major honey bee pathogen*. **PNAS**. 2017; 114(12):3210-3215. (IF 9.7; 3 citations)
3. Kalynych S, Füzik T, Přidal A, de Miranda J, **Plevka P**. *Cryo-EM study of slow bee paralysis virus at low pH reveals iflavirus genome release mechanism*. **PNAS**. 2017; 114(3):598-603. (IF 9.7; 1 citation)