

Personal information

**Name** Petr G. Leiman  
**Date of birth** January 2, 1976  
**Nationality** Russian Federation  
**Work address** Ecole Polytechnique Fédérale de Lausanne (EPFL)  
 Institute of Physics of Biological Systems (IPSB)  
 BSP- 415, CH-1015 Lausanne, Switzerland  
**Phone** +41 21 69 30441  
**Fax** +41 21 69 30422  
**E-mail** [petr.leiman@epfl.ch](mailto:petr.leiman@epfl.ch)

Education

**1999 – 2003 Ph.D.** Structural Biology  
 Purdue University, USA  
  
**1993 – 1999 M.S.** Physics and Applied Mathematics  
 Moscow Institute of Physics and Technology, Russia  
 Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, Moscow, Russia

Professional appointments and academic experience

**2008 – now** Assistant Professor and Head of the Laboratory of Structural Biology and Biophysics.  
 Ecole Polytechnique Fédérale de Lausanne (Switzerland).  
  
**1998 – 2008** Research Assistant (1998), Graduate Research Assistant (1999), Postdoctoral  
 Research Associate (2003), and Assistant Research Scientist (2006).  
 Purdue University (USA). Laboratory of Michael G. Rossmann  
  
**1996 – 1999** Research Assistant.  
 Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of  
 Sciences (Moscow, Russia). Laboratory of Vadim V. Mesyanzhinov.

Scientific interests and areas of expertise

- X-ray crystallography and cryo-electron microscopy of biological macromolecules.
- Structure, function, evolution and genetics of bacteriophages and eukaryotic viruses.
- Protein secretion in bacteria.

Current group

- 4 Postdocs (internal and external funding)
- 1 Ph.D. Student (external funding)

Funding record

Ongoing research support

Start date	Duration	Amount (CHF)	Funding agency and title
10/1/2013	36 months	200,000	<b>Swiss National Science Foundation.</b> <i>Molecular and structural characterization of Listeria bacteriophage-host interactions : from protein function to supermolecular structure.</i> Co-applicant with Jochen Klumpp (ETH Zurich) and Takashi Ishikawa (PSI)
2/1/2013	42 months	184,670	<b>National Competence Center for Biomedical Imaging (NCCBI).</b> <i>In vitro and in vivo 3D structural analysis of biological macromolecules by cryoelectron microscopy/tomography.</i> Co-applicant with Takashi Ishikawa (PSI)

1/1/2013	36 months	544,800	<b>Swiss National Science Foundation</b> <i>Structure, function, and assembly of macromolecular machines involved in infection of bacterial and eukaryotic cells</i>
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## Completed research support

Start date	Duration	Amount (CHF)	Funding agency and title
5/1/2011	12 months	400,000	<b>R'Equip (Swiss National Science Foundation)</b> . <i>Request for a 200 keV FEG-equipped transmission electron cryomicroscope</i>
10/1/2010	36 months	330,950	<b>Swiss National Science Foundation</b> . <i>Structure, function, and assembly of macromolecular machines involved in infection of bacterial and eukaryotic cells</i>
5/1/2009	3 months	9,600	<b>Scientific and Technological Cooperation Program Switzerland-Russia</b> . <i>Structural and functional characterization of the bacterial Type VI secretion system</i>

Referee/reviewer activities

- Editorial boards  
*Virology; Bacteriophage*
- Refereed grants for  
European Research Council (ERC); Swiss National Science Foundation (SNSF); Science Foundation Ireland (SFI); French National Research Agency (ANR); German Israeli Foundation for Scientific Research and Development (GIF)
- Refereed papers for  
*Nature; Nature Reviews Microbiology; PNAS USA; Nature Structural and Molecular Biology; Cell, Host and Microbe; EMBO Journal; Molecular Microbiology; Journal of Molecular Biology; Journal of Structural Biology; Cellular and Molecular Life Sciences; Virology; Applied and Environmental Microbiology; Microbiology, and others*
- Reviewed books  
*Phages: Their Role in Bacterial Pathogenesis and Biotechnology*, edited by Matthew K Waldor, David I Friedman, and Sankar L Adhya (ASM Press, 2005) for *The Quarterly Review of Biology*.

International Committees (evaluation of programs and proposals)

- French Evaluation Agency for Research and Higher Education (AERES). Expert in the committee on the creation of the Institute of Integrative and Cell Biology (I2BC), Autumn-winter 2014.
- Swiss Light Source Proposal Evaluation Committee. 2012-ongoing.
- BioStruct-X <http://www.biostruct-x.eu/> (coordinated access to large European research facilities: synchrotrons, protein production facilities, etc). Proposal Evaluation Committee Member. 2011-2015.
- Austrian Science Fund (FWF). Expert in the committee for the evaluation of a new multi-university doctoral program "NanoCell". Spring-summer of 2011.
- iNEXT: Infrastructure for NMR, EM and X-rays for Translational Research. <http://www.inext-eu.org/> Proposal reviewer. September 2015-now.

Invited talks

## International conferences:

- 2nd International hands-on PHAGE BIOTECHNOLOGY course. Braga, Portugal, 15-19 June 2015.
- 23rd International Union of Crystallography Congress. Montreal, August 2014.
- Viruses of Microbes. Zurich, Switzerland, 14 - 18 July, 2014.
- From Solid State to Biophysics VII, Dubrovnik, Croatia, 7-14 June 2014.
- GRC Protein Translocation Across Membranes. Galveston, March 2014.
- Physical Virology Workshop. Leiden, February 2014.
- Fifth Congress of European Microbiologists (FEMS 2013). Leipzig, Germany. July 21-25, 2013.
- Japanese Bacteriophage Meeting. Gunma, Japan, 20 - 22 September, 2012.
- Viruses of Microbes. Brussels, Belgium, 16 - 20 July, 2012.

- Virus Structure and Assembly (FASEB summer research conference). Saxtons River, Vermont, USA, June 10 – 15, 2012.
- SLS X06DA Beamline and Crystallization Facility Inauguration. Swiss Light Source, Villigen, Switzerland, September 21, 2010.
- Advanced Electron Microscopy in Nanomedicine Symposium. UCLA, Los Angeles, October 2-3, 2009 (Keynote speaker).
- 3rd Workshop on Structural Biology at CIC bioGUNE. Bilbao, Spain. June 4-5, 2009.
- Indiana Microscopy Society Spring Meeting. Indiana University, Bloomington, IN. April 18, 2008
- 3rd International meeting on polysialic acid. Bad Lauterberg, Germany. March 10-13, 2007
- American Society for Microbiology 106th General Meeting. Orlando, FL. May 21-25, 2006.
- 16th Biennial International Evergreen Phage Biology Meeting. Olympia, WA. August 7-12, 2005.
- Gordon Research Conference: Three-dimensional Electron Microscopy. Colby-Sawyer College, New London, NH, USA, June 12-17, 2005.
- The New Phage Biology ASM Conference. Key Biscayne, FL, USA. August 1-4, 2004.

Recent departmental seminars (outside EPFL/Lausanne):

- University of Bern. Institute of Anatomy. May 7, 2015.
- ETH Zurich. Department of Chemistry. October 31, 2014.
- UT Medical Branch Galveston. TX, USA. March 14, 2014.
- Purdue University. Structural Biology Seminar. West Lafayette, IN, USA, June 17, 2013.
- Indiana University Biochemistry Seminar. Bloomington, IN, USA, June 19, 2013.
- University of Geneva. Department of Microbiology and Molecular Medicine. February 4, 2013.
- Harvard Medical School. Department of Microbiology. Boston, MA, USA. June 8, 2012.
- Aix-Marseille University. Campus de Luminy. Marseilles, France, March 28, 2012
- Biozentrum, University of Basel, September 18, 2012

#### Teaching and academic service

- 2014-now. *General physics III* (Electromagnetism). Second year undergraduates. Autumn semester.
- 2010-2013. *General physics I (Mechanics)*. First year undergraduates. Autumn semester.
- 2009-now. *Diffraction methods in structural biology*. Master students. Spring semester.
- 2009-2010. *Three-dimensional reconstruction of biological macromolecules from electron microscope images*. Ph.D. course. Autumn semester.
- 2012-now. CH-624. *How to determine the structure of a single crystal from diffraction data*. Ph.D. course (physics/chemistry/material science). Winter/summer break.
- Member of the Physics Ph.D. program (EDPY) committee.
- President of 6 thesis defense committees (EPFL), evaluation and opponent of 4 theses (EPFL and Marseilles).

#### Organization of conferences

- 26th Rhine-Knee Regional Meeting on Biocrystallography. EPFL Campus. September 26-28, 2012.
- Viruses of Microbes. Zurich, Switzerland, 14 - 18 July, 2014.
- XIV Phage/Virus Assembly Conference. June, 2015.

#### Artistic and scientific visualization of experimental data

Cover illustrations:

- *Structure*, volume 20, issue 2, 2012
- *Cell*, volume 118, issue 4, 2004
- *Nature Structural Biology*, volume 10, issue 9, 2003
- *Acta Crystallographica* section D, issue 57, part 9, 2001
- 2001 Purdue Biophysics Symposium abstracts booklet

Movies with Seyet LLC (<http://www.seyet.com>):

- Infection of *Escherichia coli* by bacteriophage T4.
- Morphogenesis and assembly of the bacteriophage T4 particle.

Structures determined at the Laboratory of Structural Biology and Biophysics (10 new structures are not yet deposited to or have not been released by PDB/EMDB)

1. Protein Data Bank (PDB): <http://www.ebi.ac.uk/pdbe/> or <http://www.rcsb.org/>

<b>PDB ID</b>	<b>Title and Authors</b>
4RU5	Crystal structure of the Pseudomonas phage phi297 tailspike gp61 Browning C, Sycheva LV, Shneider MM, Leiman PG
4RU3	Crystal structure of the cell puncturing protein gp41 from Pseudomonas phage SN Browning C, Shneider MM, Leiman PG
4QNL	Crystal structure of tail fiber protein gp63.1 from E. coli phage G7C Ricchio C, Browning C, Leiman PG, Prokhorov N, Letarov A
4OSD	Dimer of a C-terminal fragment of phage T4 gp5 beta-helix Buth SA, Leiman PG, Shneider MM
4MTK	Crystal structure of PA0091 VgrG1, the central spike of the Type VI Secretion System Sycheva LV, Shneider MM, Leiman PG
4MTM	Crystal structure of the tail fiber gp53 from <i>Acinetobacter baumannii</i> bacteriophage AP22 Sycheva LV, Shneider MM, Leiman PG
4KU0	Phage T4 spike tip protein gp5.4 in complex with T4 gp5 beta-helix Buth SA, Shneider MM, Leiman PG
4HIZ	Catalytic domain of phage phi92 endosialidase (residues 76-756 of gp143) Schwarzer D, Browning C, Leiman PG
3WIT	PAAR-repeat binding tip (residues 561-633) of the Z0707 VgrG protein of <i>E. coli</i> EDL933 Uchida K, Leiman PG, Arisaka F, Kanamaru S
4HRZ	Phage T4 baseplate protein gp25 Browning C, Shneider MM, Leiman PG
4JIW	c1882 PAAR-repeat protein of E. coli CFT073 in complex with T4 gp5-VgrG chimera Buth SA, Shneider MM, Leiman PG
4JIV	VCA0105 PAAR-repeat protein of V. cholerae O1 biovar El Tor str. N16961 in complex with T4 gp5-VgrG chimera Buth SA, Shneider MM, Leiman PG
4JK6	Human urokinase-type plasminogen activator uPA with bound bicyclic peptide inhibitor UK18-D-Aba Buth SA, Leiman PG, Chen S, Heinis C
4JK5	Human urokinase-type plasminogen activator uPA with bound bicyclic peptide inhibitor UK18-D-Ser Buth SA, Leiman PG, Chen S, Heinis C
4GLY	Human urokinase-type plasminogen activator uPA with bound bicyclic peptide inhibitor UK504 Buth SA, Leiman PG, Chen S, Heinis C
4GBF	C-terminal fragment of phage phiKZ tail fiber protein gp131 (residues 375-771) Sycheva LV, Shneider MM, Leiman PG
3PQH	C-terminal fragment of phage phi92 central spike protein gp138 (residues 121-245) Browning C, Shneider MM, Leiman PG
3PQI	Phage phi92 central spike protein gp138 Browning C, Shneider MM, Leiman PG
3QR7	C-terminal fragment of phage P2 central spike protein gpV (residues 97- 211) Browning C, Shneider MM, Leiman PG
3QR8	Phage P2 central spike protein gpV Browning C, Shneider MM, Leiman PG

2. Electron Microscopy Data Bank (EMDB): <http://www.ebi.ac.uk/pdbe/emdb/>

EMDB ID	Title and Authors
EMD-5409	Cryo-electron microscopy structure of bacteriophage phi92 tail Nazarov S, Bowman VD, Leiman PG
EMD-2064	Cryo-electron microscopy structure of bacteriophage phi92 baseplate Browning C, Nazarov S, Bowman VD, Leiman PG
EMD-2063	Cryo-electron microscopy structure of bacteriophage phi92 capsid Browning C, Nazarov S, Bowman VD, Leiman PG

Publication list**h-index:**

Web of Knowledge (Thomson Reuters) and Scopus: **21**. Google Scholar: **24**.

**Research papers (\* Corresponding author)**

- Buth SA, Menin L, Shneider MM, Engel J, Boudko SP, **Leiman PG\***. Structure and Biophysical Properties of a Triple-Stranded Beta-Helix Comprising the Central Spike of Bacteriophage T4. *Viruses*. **7**, 4676-4706 (2015).
- Ge P, Scholl D, **Leiman PG**, Yu X, Miller JF, Zhou ZH. Atomic structures of a bactericidal contractile nanotube in its pre- and postcontraction states. *Nature Struc Mol Biol* **22**, 377–382 (2015) .
- Schwarzer D, Browning C, Stummeyer K, Oberbeck A, Mühlenhoff M, Gerardy-Schahn R, **Leiman PG\***. Structure and Biochemical Characterization of Bacteriophage Phi92 Endosialidase. *Virology* **477**, 133-143 (2015).
- Habann M, **Leiman PG**, Vandersteegen K, Van den Bossche A, Lavigne R, Shneider MM, Biemann R, Eugster MR, Loessner MJ, Klumpp J. Listeria phage A511, a model for the contractile tail machineries of SPO1-related bacteriophages. *Mol. Microbiology*. **92**, 84–99 (2014).
- Uchida K, **Leiman PG**, Arisaka F, Kanamaru S. Structure and properties of the C-terminal  $\beta$ -helical domain of VgrG protein from *Escherichia coli* O157. *J Biochem*. **155**, 173-182 (2013).
- Shneider MM, Buth SA, Ho BT, Basler M, Mekalanos JJ, **Leiman PG\***. PAAR-repeat proteins sharpen and diversify the type VI secretion system spike. *Nature*, **500**, 350-353 (2013).
- Chen S, Gfeller D, Buth SA, Michielin O, **Leiman PG**, Heinis C. Improving binding affinity and stability of peptide ligands by substituting glycines with D-amino acids. *Chembiochem*. **14**, 1316-1322 (2013).
- Chen S, Rentero Rebollo I, Buth SA, Morales-Sanfrutos J, Touati J, **Leiman PG**, Heinis C. Bicyclic Peptide Ligands Pulled out of Cysteine-Rich Peptide Libraries. *J Am Chem Soc*. **135**, 6562-6569. (2013).
- Sycheva LV, Shneider MM, Sykilinda NN, Ivanova MA, Miroshnikov KA, **Leiman PG\***. Crystal structure and location of gp131 in the bacteriophage phiKZ virion. *Virology*. **434**, 257-264 (2012).
- Schwarzer D, Buettner FF, Browning C, Nazarov S, Rabsch W, Bethe A, Oberbeck A, Bowman VD, Stummeyer K, Mühlenhoff M, **Leiman PG\***, Gerardy-Schahn R. A multivalent adsorption apparatus explains the broad host range of phage phi92: a comprehensive genomic and structural analysis. *J Virol*. **86**, 10384-10398 (2012).
- Browning C, Shneider MM, Bowman VD, Schwarzer D, **Leiman PG\***. Phage pierces the host cell membrane with the iron-loaded spike. *Structure*. **20**:326-339 (2012).
- Yap ML, Mio K, **Leiman PG**, Kanamaru S, Arisaka F. The baseplate wedges of bacteriophage T4 spontaneously assemble into hubless baseplate-like structure in vitro. *J Mol Biol*. **395**, 349-360 (2010).
- Xiang Y, **Leiman PG**, Li L, Grimes S, Anderson DL, Rossmann MG. Crystallographic insights into the autocatalytic assembly mechanism of a bacteriophage tail spike. *Mol. Cell*. **34**, 375-386 (2009).
- Leiman PG**, Basler M, Ramagopal UA, Bonanno JB, Sauder JM, Pukatzki S, Burley SK, Almo SC, Mekalanos JJ. Type VI secretion apparatus and phage-tail associated protein complexes share a common evolutionary origin. *Proc. Natl. Acad. Sci. USA* **106**, 4154-4159 (2009).
- Aksyuk AA, **Leiman PG**, Shneider MM, Mesyanzhinov VV, Rossmann MG. The structure of gene product 6 of bacteriophage T4, the hinge-pin of the baseplate. *Structure*. **17**, 800-808 (2009)
- Aksyuk AA, **Leiman PG**, Kurochkina LP, Shneider MM, Kostyuchenko VA, Mesyanzhinov VV, Rossmann MG. The tail sheath structure of bacteriophage T4: a molecular machine for infecting bacteria. *EMBO J*. **28**, 821-829 (2009).

17. **Leiman PG\***, Battisti AJ, Bowman VD, Stummeyer K, Mühlenhoff M, Gerardy-Schahn R, Scholl D, Molineux IJ. The structures of bacteriophages K1E and K1-5 explain processive degradation of polysaccharide capsules and evolution of new host specificities. *J. Mol. Biol.* **371**, 836-849 (2007).
18. **Leiman PG\***, Shneider MM, Mesyanzhinov VV, Rossmann MG. Evolution of bacteriophage tails: Structure of T4 gene product 10. *J. Mol. Biol.* **358**, 912-921. (2006).
19. Kostyuchenko VA, Chipman PR, **Leiman PG**, Arisaka F, Mesyanzhinov VV, Rossmann MG. The tail structure of bacteriophage T4 and its mechanism of contraction. *Nature Structural and Molecular Biology* **12**, 810-813 (2005).
20. Fokine A<sup>#</sup>, **Leiman PG<sup>#</sup>**, Shneider MM, Ahvazi B, Boeshans KM, Steven AC, Black LW, Mesyanzhinov VV, Rossmann MG. Structural and functional similarities between the capsid proteins of bacteriophages T4 and HK97 point to a common ancestry. *Proc. Natl. Acad. Sci. USA* **102**, 7163-7168 (2005). (<sup>#</sup> Equal contributors)
21. Vishnevskiy AY, Kurochkina LP, Sykilinda NN, Solov'eva NV, Shneider MM, **Leiman PG**, Mesyanzhinov VV. Functional role of the N-terminal domain of bacteriophage T4 gene product 11. *Biochemistry (Mosc)*. **70**, 1111-1118 (2005).
22. **Leiman PG**, Chipman PR, Kostyuchenko VA, Mesyanzhinov VV, Rossmann MG. Three-dimensional rearrangement of proteins in the tail of bacteriophage T4 on infection of its host. *Cell* **118**, 419-429 (2004).
23. Fokine A, Chipman PR, **Leiman PG**, Mesyanzhinov VV, Rao VB, Rossmann MG. Molecular architecture of the prolate head of bacteriophage T4. *Proc. Natl. Acad. Sci. USA*. **101**, 6003-6008 (2004).
24. Kostyuchenko VA, **Leiman PG**, Chipman PR, Kanamaru S, Van Raaij MJ, Arisaka F, Mesyanzhinov VV, Rossmann MG. Three-dimensional structure of bacteriophage T4 baseplate. *Nature Structural Biology* **10**, 688-693 (2003).
25. **Leiman PG**, Shneider MM, Kostyuchenko VA, Chipman PR, Mesyanzhinov VV, Rossmann MG. Structure and location of gene product 8 in the bacteriophage T4 baseplate. *J. Mol. Biol.* **328**, 821-833 (2003).
26. Kanamaru S<sup>#</sup>, **Leiman PG<sup>#</sup>**, Kostyuchenko VA, Chipman PR, Mesyanzhinov VV, Arisaka F, Rossmann MG. Structure of the cell-puncturing device of bacteriophage T4. *Nature* **415**, 553-557 (2002). (<sup>#</sup> Equal contributors)
27. Simpson AA, **Leiman PG**, Tao Y, He Y, Bodasso MO, Jardine PJ, Anderson DL, Rossmann MG. Structure determination of the head-tail connector of bacteriophage phi29. *Acta Cryst.* **D57**, 1260-1269 (2001).
28. Kurochkina LP, **Leiman PG**, Venyaminov SY, Mesyanzhinov VV. Expression and properties of bacteriophage T4 gene product 11. *Biochemistry (Mosc)* **66**, 141-146 (2001).
29. Simpson AA, Tao Y, **Leiman PG**, Bodasso MO, He Y, Jardine PJ, Olson NH, Morais MC, Grimes S, Anderson DL, Baker TS, Rossmann MG. Structure of the bacteriophage  $\phi$ 29 DNA packaging motor. *Nature* **408**, 745-750 (2000).
30. Bodasso MO, **Leiman PG**, Tao Y, He Y, Ohlendorf DH, Rossmann MG, Anderson DL. Purification, crystallization and initial X-ray analysis of the head-tail connector of bacteriophage  $\phi$ 29. *Acta Cryst.* **D56** 1187-1190 (2000).
31. **Leiman PG**, Kostyuchenko VA, Shneider MM, Kurochkina LP, Mesyanzhinov VV, Rossmann MG. Structure of bacteriophage T4 gene product 11, the interface between the baseplate and short tail fibers. *J. Mol. Biol.* **301**, 975-985 (2000).
32. Zhao L, Takeda S, **Leiman PG**, Arisaka F. Stoichiometry and inter-subunit interaction of the wedge initiation complex, gp10-gp11, of bacteriophage T4. *Biochim. Biophys. Acta* **1479**, 286-292 (2000).

#### Reviews

33. **Leiman PG\***, Molineux IJ. Evolution of a new enzyme activity from the same motif fold. *Mol Microbiol.* **69**, 287-90 (2008).

#### Book chapters and invited reviews

34. **Leiman PG**, Molineux IJ. Editorial. *Virology*. **477**, 99 (2015)
35. **Leiman PG\*** and Shneider MM. *Contractile Tail Machines of Bacteriophages*. pp. 93-114. In *Viral Molecular Machines*. Eds. Rossmann MG and Rao VB. Springer, New York (2012).
36. **Leiman PG\***, Arisaka F, van Raaij MJ, Kostyuchenko VA, Aksyuk AA, Kanamaru S, Rossmann MG. Morphogenesis of T4 and T4 tail fibers. *Virol J.* **7**: 355. (2010).

37. Rossmann MG, Arisaka F, Battisti AJ, Bowman VD, Chipman PR, Fokine A, Hafenstein S, Kanamaru S, Kostyuchenko VA, Mesyanzhinov VV, Shneider MM, Morais MC, **Leiman PG**, Palermo LM, Parrish CR, Xiao C. From structure of the complex to understanding of the biology. *Acta Cryst.* **D63**, 9-16 (2007).
38. Rossmann MG, Morais MC, **Leiman PG**, Zhang W. Combining X-ray crystallography and electron microscopy. *Structure* **13**, 355-362 (2005).
39. Mesyanzhinov VV, **Leiman PG**, Kostyuchenko VA, Kurochkina LP, Miroshnikov KA, Sykilinda NN, Shneider MM. Molecular architecture of bacteriophage T4. *Biochemistry (Mosc)* **69**, 1190-1202 (2004).
40. Rossmann MG, Mesyanzhinov VV, Arisaka F, **Leiman PG**. The bacteriophage T4 DNA injection machine. *Curr Opin Struct Biol.* **14**, 171-180 (2004).
41. Arisaka F, Kanamaru S, **Leiman P**, Rossmann MG. The tail lysozyme complex of bacteriophage T4. *Int. Journal of Biochem. and Cell Biol.* **35**, 16-21 (2003).
42. **Leiman PG\***, Kanamaru S, Arisaka F, Mesyanzhinov VV, Rossmann MG. Structure and morphogenesis of bacteriophage T4, *Cellular and Molecular Life Science* **60**, 2356-2370 (2003).
43. Miroshnikov KA, **Leiman PG**. Beta-helical proteins. *Uspekhi Biokhimii, Russian Academy of Sciences*, **XIX**, 33-45 (1999).

#### **Papers in the final stage of preparation or submitted**

44. Browning C, Shneider MM, Shcherbakova A, Buettner FFR, Lindner B, Oberbeck A, Gerardy-Schahn R, **Leiman PG\***, Schwarzer D. Crystal structure of phage phi92 colanidase tailspike: hydrolysis of colanic acid with a novel glucosidase activity.
45. Sycheva LV, Shneider MM, Basler M, Ho BT, Mekalanos JJ, **Leiman PG\***. The conserved architecture of the T6SS central spike complex.
46. Nazarov S, Morais M, Shneider MM, Sherman M, Molineux I, **Leiman PG\***. CryoEM structure of bacteriophages  $\phi$ Eco32 and 7-11 possessing extremely prolate capsids.