Michael Y. Tolstorukov, Ph.D.

Assistant Professor
Department of Biological and Medical Physics
V.N. Karazin Kharkov National University
Svobody Sq., 4
Kharkov, 61077 Ukraine

ph: +38-050-777-8906
+38-057-707-5576
fax: +1-831-308-7657
e-mail: tolstorukov@gmail.com
web: http://home.ccr.cancer.gov/lecb/tolstorukov/

OBJECTIVE: research and teaching in
genome biology / structural biology / bioinformatics / computational biology / biophysics

AREAS OF PROFESSIONAL INTERESTS

Bioinformatics and computational biology

- **Genomics and genome biology**
  - Genome packaging
  - Gene regulation
- **Structural biology**
  - Protein-DNA interactions
  - Nucleic acid structure and conformational dynamics, hydration

PROFESSIONAL EXPERIENCE

10 years of academic research and teaching (since 1995):

- **1995 – Present -** Department of Molecular and Applied Biophysics**, V. Karazin Kharkov National University**, Kharkov, Ukraine

Titles: Assistant Professor (1999-present), Junior Research Scientist (1997-1999)

Research: Bioinformatics and computational biology: Nucleosome positioning; CpG islands; Comparative analysis of pro- and eukaryotic transcription pathways; Bacterial chromosome packaging; Bioinformatic analysis and modeling protein-DNA interaction; Conformational transitions in DNA.

Teaching: Lecturing for undergraduate and graduate students: Undergraduate course: Numerical Analysis in Biophysics with Computer Practicum. Graduate course: Computer Modeling of Biological Macromolecules. Supervision of student projects.

- **March 2000-2005** Laboratory of Experimental and Computational Biology, **National Cancer Institute**, **National Institutes of Health**, Bethesda, MD

Titles: Post-doctoral Visiting Fellow

Research: Sequence-dependence of the DNA structure and gene regulation in pro- and eukaryotic genomes; DNA packing in bacterial nucleoid; Bioinformatic analysis of DNA sequence-dependent deformability in the protein-DNA complexes; Sequence-dependence of B/A transition in DNA.

COMPUTATIONAL EXPERTISE

Scientific programming in FORTRAN (more than 10 years of experience), experience with C, Perl
Linux/Windows environment, basics of Unix
Molecular modeling in NAMD, VMD; Chimera, DS ViewerPro
Standard bioinformatics methods and web services for sequence and structure analysis such as BLAST, ClustalW, TRANSFAC, PDB/NDB, EASE, etc

EDUCATION

1995-1999	**School of Radiophysics, V. Karazin Kharkov National University,** Kharkov, Ukraine **Ph.D. in Physics and Mathematics with specialty in Biophysics,** 1999 **Ph.D. Thesis**: "Influence of hydration on dynamical properties of nucleic acids", Supervisor: Prof. V.Ya. Maleev
1998	**International Centre for Theoretical Physics,** Trieste, Italy **Workshop on the Structure of Biological Macromolecules**, March 16-27, 1998
1993-1995	**National Technical University "Kharkov Polytechnic Institute",** Kharkov, Ukraine **M.S. in Patent Law & Information Technology,** 1995
1990-1995	**School of Radiophysics, V. Karazin Kharkov National University,** Kharkov, Ukraine **Combined B.S.&M.S. in Physics of Biological Systems** (with Honors)**,** 1995 **M.S. Thesis**: "Study of hysteresis phenomenon in the nucleic acid-water system", Supervisors: Prof. V.Y. Maleev, Dr. A.I. Gasan, and Dr. S.V. Gatash **B.S. Thesis**: "Influence of hydration on conformational changes in biopolymers", Supervisor: Dr. A.I. Gasan

GRANTS, AWARDS, ACHIEVEMENTS

2000 - 2005	Postdoctoral Visiting Fellow Award, NIH Visiting Program
1999	Travel Fellowship to attend XIII Biophysical Congress in New Delhi under IUPAB / UNESCO / ICSU Programme
1998	Grant from ICTP, Italy to attend the Workshop on "Structure of biological macromolecules"
1997	CRDF Travel Grant #97093 to attend the International Conference ANDM'97
1996 -1997	Post-graduate Soros Student Fellowship, IRF (Switzerland-Ukraine)
1995 -1998	Full Merit Post-graduate Scholarship, School of Radio Physics, V. Karazin Kharkov National University
1994	1st prize in the Young Scientist Paper Contest, School of Radio Physics, V. Karazin Kharkov National University
1990 -1995	Full Merit Scholarship, School of Radio Physics, Kharkov National University

MEMBERSHIPS IN PROFESSIONAL SOCIETIES

- Since 2000: Member, Biophysical Society of America
- Since 1995: Member, Biophysical Society of Ukraine

PROFESSIONAL SERVICE

- Secretary of the School Scientific Council, School of Radiophysics, Kharkov National University, 1999-2000
- Local Organizing Committee Member, II Ukrainian Biophysical Society Congress, Kharkov, Ukraine, 1999
- Local Organizing Committee Member, International Conference on Mathematical Methods in the Electromagnetic Theory, Kharkov, Ukraine, 1998
- Paper reviewing for scientific journals (*Biopolymers; Bioinformatics; Proteins: Structure, Function, and Bioinformatics; FEBS Letters*)

CONFERENCE AND SEMINAR PRESENTATIONS

- "Role of base-pair sliding in superhelical folding of nucleosomal DNA: Implications for sequence-directed nucleosome positioning," Department of Computer Science and Applied Mathematics, Weizmann Institute of Science, Rehovot, Israel, July 2006; Laboratory of Molecular Biology, NCI, NIH, January 2006 (seminar)
- "Formation of superhelical trajectory of DNA in nucleosomes," Kiev branch of Ukrainian Biophysical Society, Kiev, Ukraine, December 2005 (seminar)
- "A-tract clustering, DNA looping and bacterial genome packaging," 14th Conversations on Biomolecular Stereodynamics, Albany, NY, June 2005 (invited presentation)
- "Nonrandom distribution of A-tracts assists DNA packaging in bacterial nucleoid," Computational Biology Branch, NCBI, NIH, February 2004 (seminar)
- "Periodic distribution of A-tracts may facilitate bacterial genome packaging," Gordon Research Conference: Nucleic acids, Salve Regina Univ. RI, June 2003 (poster presentation)
- "DNA deformability in nucleoprotein complexes: Local B-to-A transition facilitates protein-DNA recognition in the minor groove," "Chocolate talk," NICHD, NIH, May 2002 (seminar)
- Poster presentations at Biophysical Society Meetings, Boston, MA, 2001; San Francisco, CA, February 2002
- Poster presentations at the 12th and 13th Conversations on Biomolecular Stereodynamics, Albany, NY, June 2001 and June 2003
- "Non-sequence dependent interactions in DNA minor groove," Kharkov branch of Ukrainian Biophysical Society, Kharkov, Ukraine, November 2001 (seminar)
- "Protein-DNA interactions in the minor groove," Laboratory of Prof. Wilma Olson, Department of Biochemistry, Rutgers University, Piscataway, NJ, May 2000 (seminar)
- "Influence of hydration on DNA conformational dynamics," Institute of Theoretical Physics, Kiev, Ukraine, December 1998 (seminar)
- "Mathematical model of the conformational transitions and nonlinear dynamics of the nucleic acid – water system," 2nd Int. Symp.: Algorithms for Macromolecular Modelling, Berlin, Germany, May 1997 (oral presentation)

PUBLICATIONS

Book chapters:

1. Zhurkin, V.B., Tolstorukov, M.Y., Xu, F., Colasanti, A.V. & Olson, W.K. "Sequence-dependent variability of B-DNA: An update on bending and curvature." In: T. Ohyama (ed.) **DNA Conformation and Transcription.** Austin, TX: LANDES Bioscience; 2005.

2. Tolstorukov, M.Y. & Virnik, K.M. "Mathematical model of the nucleic acids conformational transitions with hysteresis over hydration-dehydration cycle." In: P. Deuflhard, J. Hermans, B. Leimkuhler, A.E. Mark, S. Reich, R.D. Skeel (eds.) **Computational Molecular Dynamics: Challenges, Methods, Ideas -- Proceedings of the 2nd International Symposium on Algorithms for Macromolecular Modelling, Berlin, 1997; in Series: Lecture Notes in Computational Science and Engineering**, Vol. 4, Berlin, Springer-Verlag, 1998.

Journal papers:

1. Tolstorukov, M.Y., Colasanti, A.V., McCandlish, D., Olson, W.K. & Zhurkin, V.B. "A Novel 'Roll-and-Slide' Mechanism of DNA Folding in Chromatin. Implications for Nucleosome Positioning," **Submitted** (2007).
2. Tolstorukov, M.Y., Virnik, K.M., Adhya, S. & Zhurkin, V.B. "A-tract clustering may facilitate DNA packaging in bacterial nucleoid," **Nucleic Acids Research** (2005), 33: 3907–3918.
3. Semsey, S., Tolstorukov, M.Y., Virnik, K., Zhurkin, V.B. & Adhya, S. "DNA Trajectory in the Gal Repressosome," **Genes & Development** (2004), 18:1898-1907.
4. Liu, M., Tolstorukov, M.Y., Zhurkin, V.B., Adhya, S. & Garges, S. "A new promoter element, *UP2*, makes the *E.coli* P_{lac} promoter hyperactive and CRP independent," **Proceedings of the National Academy of Sciences of the USA** (2004), 101:6911-6916.
5. Tolstorukov, M.Y., Jernigan, R.L. & Zhurkin, V.B. "Protein – DNA hydrophobic recognition in the minor groove is facilitated by sugar switching," **Journal of Molecular Biology** (2004), 337:65-76.
6. Virnik, K., Lyubchenko, Y.L., Karymov, M.A., Dahlgren, P., Tolstorukov, M.Y., Semsey, S., Zhurkin, V.B. & Adhya, S. "'Antiparallel' DNA Loop in Gal Repressosome Visualized by Atomic Force Microscopy," **Journal of Molecular Biology** (2003), 334(1): 53-63.
7. Tolstorukov, M.Y., Ivanov, V.I., Malenkov, G.G., Jernigan, R.L. & Zhurkin, V.B. "Sequence-dependent B↔A transition in DNA evaluated with dimeric and trimeric scales," **Biophysical Journal** (2001), 81(6): 3409-3421.
8. Tolstorukov, M.Y. & Maleev, V.Y. "Conformational transitions of DNA induced by changing water content of the sample: A theoretical study," **Journal of Biomolecular Structure and Dynamics** (2000), 17 (5): 913-920.
9. Tolstorukov, M.Y. & Gatash, S.V. "Self-organization and nonlinear dynamics of nucleic acid-water system," **Special Issue of International Journal on Bifurcation and Chaos** (1999), 9(2): 371-381.
10. Virnik, K.M. & Tolstorukov, M.Y. "Binding energy differentiation of water molecules in DNA hydration shell," **Digest of Kharkov State University, Biophysical Bulletin** (1998), 422 (2): 35-38.
11. Virnik, K.M. Tolstorukov, M.Y. & Maleev, V.Y. "Surface diffusion of bound water in hydrate surroundings of DNA," **Digest of Kharkov State University, Biophysical Bulletin** (1998), 422(2): 23-28.
12. Tolstorukov, M.Y. & Virnik, K.M. "Experimental study of hysteresis phenomenon in the process of hydration-dehydration of NaDNA," **Biopolymers and Cell** (1998), 14: 524-528 (in Russian).
13. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "Parameter distributed model of the conformational transitions induced with change of relative humidity in the nucleic acid samples," **Digest of Kharkov State University, Biophysical Bulletin** (1998), 410(1): 33-40 (in Russian).
14. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "Mathematical model of nucleic acids' conformational dynamics in wetted samples," **Vestnik Problem Biologii i Mediciny** (1998), 16: 6-12 (in Russian).
15. Virnik, K.M. & Tolstorukov, M.Y. "Calculation of fractal dimensions of DNA in various conformations," **Vestnik Problem Biologii i Mediciny** (1998), 2: 5-15, (in Russian).
16. Tolstorukov, M.Y., Gasan, A.I., Gatash, S.V., & Maleev, V.Y. "The molecular mechanism of the sorption hysteresis in the DNA - water system," **Biophysics** (1997), 42: 847-857.

Conference papers:

1. Tolstorukov, M.Y., Colasanti, A.V., McCandlish, D., Olson, W.K. & Zhurkin, V.B. "Superhelical path of nucleosomal DNA is controlled by base-pair slide," **Journal of Biomolecular Structure and Dynamics** (2005), 22:854-855.

2. Virnik, K., Tolstorukov, M., Zhurkin, V. & Adhya, S. "Structural organization of bacterial nucleoid," **Journal of Biomolecular Structure and Dynamics** (2005), 22:848.

3. Tolstorukov, M., Virnik, K., Adhya, S. & Zhurkin, V. "Genome-wide A-tract distribution and DNA packaging in pro- and eukaryotes," **Journal of Biomolecular Structure and Dynamics** (2003), 20: 869-870.

4. Tolstorukov, M.Y., Jernigan, R.L. & Zhurkin, V.B. "Effect of sugar puckering on protein-DNA interactions in DNA minor groove," **Biophysical Journal** (2002), 82: 2265.

5. Tolstorukov, M.Y., Jernigan, R.L., & Zhurkin, V.B. "Non-random distribution of A-tracts in pro- and eukaryotic genomes," In: Chakravarti, A., Eisen, M., and Zhang, M., (Eds.): **Proceedings of the 2001 Meeting on Integrating Genome Sequence, Sequence Variation and Gene Expression.** Cold Spring Harbor, NY (2001), p. 67.

6. Tolstorukov, M.Y., Jernigan, R.L. & Zhurkin, V.B. "Protein-DNA minor groove recognition," **Journal of Biomolecular Structure and Dynamics** (2001), 18: 944-945.

7. Tolstorukov, M.Y., Jernigan, R.L. & Zhurkin, V.B. "Minor groove interaction profiles of protein/DNA complexes," **Biophysical Journal** (2001), 80: 568a.

8. Tolstorukov, M.Y., Ivanov, V.I., Minchenkova, L.E., Krylov, D.Y., Jernigan, R.L. & Zhurkin, V.B. "Trimeric model for the B-A transition in DNA," **Biophysical Journal** (2001), 80: 484a.

9. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "Conformational dynamics of a nucleic acid molecule over hydration-dehydration cycle: A theoretical study," **Journal of Biomolecular Structure and Dynamics** (1999), 16 (6): 1256.

10. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "Effect of hydration on conformational dynamics of nucleic acid molecule. Spatially extended model," **Proceedings of the Conference on Physics of Biological Systems.** Kiev, Ukraine (1998), p. 25.

11. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "Model of conformational transitions of nucleic acid molecule induced with changing relative humidity of the sample," **Proceedings of the 2nd . Congress of Ukrainian Biophysical Society.** Kharkov, Ukraine (1998), p. 23 (in Ukrainian).

12. Tolstorukov, M.Y. "Mathematical model of the conformational transitions and nonlinear dynamics of the nucleic acid – water system," In: Deuflhard, P. and Reich, S. (Eds): **2nd International Symposium: Algorithms for Macromolecular Modelling.** Berlin, Germany (1997), pp. 25-26.

13. Virnik, K.M. & Tolstorukov, M.Y. "Estimation of the diffusion coefficients of water bound to the DNA surface," **Proceedings of the 17th Discussion Conference: Surface and Interfacial Phenomena in Macromolecular Systems.** Prague, Check Republic (1997), p. 5.

14. Virnik, K.M., Tolstorukov, M.Y. & Maleev, V.Y. "Diffusion of bound water molecules along fractal biopolymer surface," **Proceedings of the 3rd International Conference: The physical phenomena of condensed matter.** Kharkov, Ukraine (1997), p. 114 (in Russian).

15. Tolstorukov, M.Y., Gatash, S.V. & Maleev, V.Y. "The conformational transitions with hysteresis in the nucleic acid - water system," **Proceedings of the 3rd International Conference: The Physical Phenomena of Condensed Matter.** Kharkov, Ukraine (1997), p. 115 (in Russian).

16. Tolstorukov, M.Y. & Gatash, S.V. "Self-organization and nonlinear dynamics of nucleic acid-water system," **Proceedings of the International Conference: Nonlinearity, Bifurcation, Chaos: The Doors to the Future.** Lodz, Poland (1996), pp. 231-234.