# CURRICULUM VITAE

## Dr. Zakharia Frenkel

**December, 2012**

ORT Braude College, Department of Software Engineering,
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### EDUCATION

Postdoctoral researcher (2003 - 2008), Genome Diversity Center, Institute of Evolution, University of Haifa; *Supervisor*: Prof. Trifonov E.N. (trifonov@research.haifa.ac.il).

Ph.D. in physics and mathematics (January 2003), Department of Metal Physics and Computer Technologies, Physics and Mechanics Faculty, St. Petersburg State Polytechnical University;
Dissertation title**: Investigation of Biopolymer Self-organization by Molecular Dynamics Method.** Supervisor: Prof. Melker A.I. (NDTCS@spes.phmf.spbstu.ru).

M.Sc. in Physics (June 1999), Department of Biophysics, Physics and Mechanics Faculty, St. Petersburg State Polytechnical University;
Research title**: Mathematical Modeling of Mammalian Cell Cycle.**
Supervisor: Prof. Melker A.I. (NDTCS@spes.phmf.spbstu.ru).

B.Sc. in Physics (June 1997), Department of Biophysics, Physics and Mechanics Faculty, St. Petersburg State Polytechnical University

### RESEARCH INTERESTS

- Sequence biology, bioinformatics, protein evolution, biophysics, protein folding, protein structure prediction, mathematical modeling of the bio-molecular processes, sequence analysis.

### ACADEMIC APPOINTMENTS

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| 2010 – present | Senior Lecturer, ORT Braude College of Engineering, Karmiel, Israel. |
| 2010 – 2012 | External Lecturer, ORT Braude College of Engineering, Karmiel, Israel. |
| 2008 – present | Researcher, Institute of Evolution, Univ. of Haifa, Israel. |
| 2005 – 2007 | Node manager (Univ. of Haifa) in Israeli National Center for Bioinformatics Infrastructure |
| 2003 – 2008 | Research assistant, Institute of Evolution, Univ. of Haifa, Israel. |
| 1997 – 2000 | Research assistant, Institute of Cytology RAS, Petersburg, Russia. |

**TEACHING EXPERIENCE**

**ORT Braude College of Engineering:**

**Graduate Courses:**

Advanced algorithms in Molecular Biology

**Undergraduate Courses:**

Data mining
Graph theory
Data compression
Analysis of Network Data

## ACADEMIC AND PROFESSIONAL AWARDS AND GRANTS

2006 – 2009 Research grant of the I. Horwitz Center for Complexity Science
2003 – 2006 Research Felow, supported by the Ministry of Absorption
2003 – 2005 Post-Doc Fellow of the I. Horwitz Center for Complexity Science
In addition:

- I was awarded by ISSEP scholarships as a student in 1996, 1997, 1998, and 1999 and as a Ph.D. student in 2000. I was awarded by scholarships of the St.-Petersburg government in a competition of the diploma projects in 1998.

## LIST OF PUBLICATIONS

### Refereed Papers

1. **Frenkel Z.** and Volkovich Z. Repeated Bisections approach for local clustering of PPINs, *Journal of Modern Mathematics Frontier,* (JMMF), (Accepted), 2012.
2. Trifonov E., Volkovich Z., **Frenkel Z.** Multiple levels of meaning in DNA sequences, and one more. *Annals of the New York Academy of Sciences*. 2012 Sep; 1267(1):35-8.
3. **Frenkel Z**, Trifonov, E., Origin and evolution of genes and genomes. Crucial role of triplet expansions. *Journal of Biomolecular Structure & Dynamics,* 2012; 30(2): 201-10.
4. Bettecken T., **Frenkel Z.**, Altmüller J., Nürnberg P., Trifonov E., Apoptotic cleavage of DNA in human lymphocyte chromatin shows high sequence specificity. *Journal of Biomolecular Structure & Dynamics,* 2012; 30(2): 211-6.
5. **Frenkel Z.**, Trifonov E., Volkovich Z., Bettecken T. Nucleosome positioning patterns derived from human apoptotic nucleosomes. *Journal of Biomolecular Structure & Dynamics,* 2011; 29(3): 577-83.
6. Bettecken T., **Frenkel Z**. and Trifonov E. Human nucleosomes: special role of CG dinucleotides and Alu-nucleosomes. *BMC (BioMed Central) Genomics*, 2011, 12:273 doi:10.1186/1471-2164-12-273
7. **Frenkel, Z. M.,** Bettecken T., Trifonov E. N. Nucleosome DNA sequence structure of isochores. *BMC (BioMed Central) Genomics,* 2011, 12:203 doi:10.1186/1471-2164-12-203

8. Rapoport A.E., **Frenkel, Z.M.** and Trifonov, E.N. Nucleosome positioning pattern derived from oligonucleotide compositions of genomic sequences. *Journal of Biomolecular Structure & Dynamics*, 2011 Feb; 28(4): 567-74.
9. **Frenkel Z.M.,** Snir S., Trifonov E.N. and Frenkel Z.M. Structural relatedness via flow networks in protein sequence space. *Journal of Theoretical Biology*, 260 (2009) 438–444.
10. Trifonov, E. N. & **Frenkel, Z. M.** Evolution of protein modularity. *Current Opinion in Structural Biology*, 2009, 19, 1-6.
11. **Frenkel Z.M.** Does protein relatedness require sequence matching? Alignment via networks in sequence space. *Journal of Biomolecular Structure & Dynamics*, 2008 Oct; 26(2): 215-222.
12. **Frenkel, Z.M**. and Trifonov, E.N. From protein sequence space to elementary protein modules. *Gene*, 2008, 408: 64−1.
13. Sobolevsky, Y., **Frenkel, Z.M**. and Trifonov, E.N. Combinations of ancestral modules in proteins. *Journal of Molecular Evolution*, 2007, 65: 640-650.
14. **Frenkel, Z.M**. and Trifonov, E.N. Evolutionary networks in the formatted protein sequence space. *Journal of Computational Biology*, 2007 Oct; 14(8):1044-57
15. **Frenkel Z**, Trifonov, E., Walking through the protein sequence space: Towards new generation of the homology modeling. *PROTEINS: Structure, Function, and Bioinformatics*, 2007 67 271-284.
16. **Frenkel Z**, Trifonov, E., Walking through protein sequence space. *Journal of Theoretical Biology*, 2007 Jan 7; 244(1):77-80.
17. **Frenkel Z.M**., Trifonov E.N., Closed loops of TIM barrel protein fold. *Journal of Biomolecular Structure & Dynamics*, 2005. 22(6): 615-878.
18. **Frenkel Z.M**., Melker A.I., Molecular dynamics of protein folding. *Proceedings of SPIE (international society for optical engineering)*, 2003. 5127: 63-75.
19. Mendeleev S.A., **Frenkel Z.M**., Melker A.I., Vorobyeva T.V. Self-organization of polynucleotides: a molecular dynamics study. *Proceedings of SPIE (international society for optical engineering)*, 2003. 5127: 5962.
20. **Frenkel Z. M**., Melker A. I Protein self-organization with helical domains. *Proceedings of SPIE (international society for optical engineering)*, 2002. 4627: 154-159.
21. **Frenkel Z. M**., Melker A. I. Types of polypeptide self-organization. Molecular dynamics simulations. *Proceedings of SPIE (international society for optical engineering)*, 2001, 4348: 195-206.
22. **Frenkel Z. M**., Melker A. I. The system of self activating gene as a nonlinear oscillator. *Proceedings of SPIE (international society for optical engineering)*, 2000, 4064: 171-179.
23. Popov N.B., **Frenkel Z.M**., Bondar T.O., Popov B.V. Construction and purification of glutathione-S-transferase fusion proteins including retinoblastoma protein fragment. *Vestnik Sankt-Peterburgskogo universiteta. Seria 3: Biologia.* 1998, 4(24): 92-104 (in Russian).
24. Popov B.V., Kulakova I.A., Popov N.B., **Frenkel Z.M**. The nature of the phosphorylation of retinoblastoma gene product in stable mouse and human cell lines.Ontogenez 1998 Jul-Aug; 29(4): 245-53 (in Russian).

25. Popov B.V., Kulakova I.A., Popov N.B., Bondar T.O., **Frenkel Z.M**. Growth of stable clones of mouse fibroblast cell line C3H10T1/2 expressing the human retinoblastoma gene product. *Tsitologiia* 1998; 40(2-3): 152-60 (in Russian).
26. Popov B.V., Popov N. B., **Frenkel Z.M**. Preparation of a retinoblastoma gene with a mutation in the C-domain and assessment of growth-suppressing activity of its product. *Molecular Biology (Mosk)* 1997 Mar-Apr; 31(2): 324-31.

**Book Chapters**

1. **Frenkel, Z.M.** and Trifonov, E.N. On the nature and possible functions of silent modules in proteins. in "Protein Misfolding". Nova Science Publishers, 2008, Inc. 400 Oser Avenue, Suite 1600 Hauppauge, NY 11788, Editors: Cian B. O'Doherty and Adam C. Byrne.
2. **Frenkel, Z.M**. and Trifonov, E.N. Structural relatedness via sequence space of protein modules. in "Protein Conformation: New Research" Nova Science Publishers 2008, Inc. 400 Oser Avenue, Suite 1600 Hauppauge, NY 11788, Editor: Linda B. Roswell, pp. 239-250.

**Conference Proceedings and Abstracts**

1 **Frenkel Z.M**., Trifonov E.N. Flow Networks in Protein Sequence Space. *6th Congress of the Federation of the Israel Societies for Experimental Biology (ILANIT Congress 2011)*. Hotels of the Herod's Forum, Eilat, February 7-10, 2011
2 **Frenkel Z.M**., Trifonov E.N. Sequence Alignment via Networks in Sequence Space. *11th meeting of the Israel Bioinformatics Symposium (IBS 2008)*.Tel-Aviv University on April 27th, 2008
3 **Frenkel Z.M**., Trifonov E.N. Evolutionary reconstruction by networks in formatted protein sequence space. (invited lection) *ILASOL (Israel Society for Astrobiology and the Study of the Origin of Life) 21st annual meeting*, Wolfson Auditorium, Weizmann Institute of science (December 2nd, 2007).
4 **Frenkel Z.M**., Trifonov E.N. Modular structure of proteins by use of the sequence space. *CCS Open-Day meeting*, Gonda Multidisciplinary Brain Research Center at Bar-Ilan University (15th of February 2007).
5 **Frenkel Z.M**., Trifonov E.N. Protein sequence space: A new opening for bioinformatics. *9th meeting of the Israel Bioinformatics Symposium* (IBS 2006, Abstract ID: IBS06abs3).
6 **Frenkel Z.M**., Aharonovsky E., Sobolevsky Y., Trifonov E.N. Extraction of the hidden protein sequence patterns of evolutionary prototypes of closed loops. *Exploring Protein Structure*, University of Haifa (September 14-16 2005)
7 **Frenkel Z.M**., Trifonov E.N. Ancestral Module of TIM Barrel Protein Fold. *Albany 2005 Conversation 14* (June 14-18 2005).
8 Aharonovsky E., **Frenkel Z**., Sobolevsky Y., Trifonov E.N., Protein Modules: The Closed Loop Prototype Database. *Albany Conversation 14* (June 14-18 2005).
9 **Frenkel Z.M**., Trifonov E.N. Small protein modules with similar 3D structure but different amino acid sequence. *8th meeting of the Israel Bioinformatics Symposium* (IBS 2005, poster 34).

10 Aharonovsky E., **Frenkel Z.,** Sobolevsky Y., Trifonov E.N., Protein Modules: The Closed Loop Prototype Database. *8th meeting of the Israel Bioinformatics Symposium* (IBS 2005, poster 14).
11 **Frenkel Z.M**., Trifonov E.N., Aharonovsky E., Sobolevsky Y. Extraction of the Hidden Protein Sequence Patterns of Evolutionary Prototypes of Closed Loops. *Meeting of the Center for Complexity Science*, Tel-Aviv University, Israel 19 April 2005 (poster 45).
12 **Frenkel Z.M**., Berezovsky I.N., Trifonov E.N. Closed loops of TIM barrel protein fold. *7th meeting of the Israel Bioinformatics Symposium* (IBS 2004, poster 23).
13 **Frenkel, Z.M**., Melker A.I., Self-organization of proteins: a molecular dynamics study of myoglobine. Abstracts of Polymerwerkstoffe 2002. *Martin-Luther-Universit.t Halle-Wittenberg, Germany*, 25-27 September 2002, P. 129-130.
14 **Frenkel Z.M**., Melker A.I., Molecular dynamics of protein folding. *NDTCS-2002. Proceedings of SPAS, St. Petersburg, Russia*, 10-16 June, 2002, Vol. 6, C11-C23.
15 Mendeleev S.A., **Frenkel Z.M**., Melker A.I. Self-organization of polynucleotides: a molecular dynamics study. *NDTCS-2002. Proceedings of SPAS, St. Petersburg, Russia*, 10-16 June, 2002, Vol. 6, C5-C10.
16 **Frenkel Z.M**, Melker A.I., Role of helices in protein self-organization. NDTCS2001. *Proceedings of SPAS*, 2001, Vol. 5, C36-C40.

17 Melker A.I., **Frenkel Z.M**., Folding of polypeptides. Polymerwerkstoffe 2000. *Martin-Luther-Universitat Halle-Wittenberg, Germany*, 2527 Sept. 2000, p. 467.
18 **Frenkel Z.M**, Melker A.I., Computer simulation of polypeptides structure self-organization. *NDTCS-2000. Proceedings of SPAS*, 2000, Vol. 4, C30-C35.
19 **Frenkel Z.M.**, Alexander I. Melker. Growth activation: cell cycle enging as a nonlinear oscillator. *NDTCS-99. Proceedings of SPAS*, 1999, Vol. 3, C20-C22.
20 **Frenkel Z.M**, Melker A.I. Model of cell cycle regulation. St. Petersburg State Technical University, 7-8 December 1998. Abstract published in Vestnik SPBGTU (1998), 17-18 (in Russian).
21 Bondar T.O., **Frenkel Z.M**., Popov N.B., Popov B.V. Experimental model with application of marker enzymes to estimation of cell cycle and differentiation regulation by RB. *St. Petersburg State University, 7-8 April 1998. Vestnik St-Peterburgskogo universiteta. Seria 3: Biologia.* (1998), 4(24): 92104 (in Russian).
22 Popov, B.V., Popova, I.A., Osipova, O.E., **Frenkel, Z.M**., Popov, N.B. Two steps induction of muscle differentiation in established cell lines of multipotential mouse fibroblasts expressing the exogenous retinoblastoma gene product. Abstracts of AARC conference "Transcriptional control of cell growth and differentiation", Chatham, 1994. A-18.