Alexey N. Spiridonov

Curriculum Vitæ

E-mail:	lesha@mit.edu	91 Belmont St. #2	6404 Landon Lane
Phone:	(617) 253-4110	Somerville, MA 02143	Bethesda, MD 20817
	(301) 320-0264	(Sep–May 2009)	(Permanent)

Website: `http://math.mit.edu/~lesha`

Languages: English and Russian (fluent), Spanish and French (reading, basic conversation)

Education

Ph.D., Applied Mathematics, Massachusetts Institute of Technology, GPA 5/5	2004–2009
A.B. with honors, Mathematics, Princeton University, GPA 3.8/4 Certificate (minor) in Computer Science	2000–2004

Research Interests

Combinatorics	Pattern-avoidance; geometric, structural and probabilistic problems; bijective and linear-algebraic methods.
Computational biology	Evolution of sequence function; mutation biases; function of non-coding DNA; sequence design; SNP–phenotype associations.
Machine learning	Feature selection, constructing ontologies, deducing relations.

Teaching Experience

Teaching assistant in 18.02A (time-intensive multivariable calculus) for Professor Arthur Mattuck at MIT; ≈ 10 contact hours per week.	January 2008
Teaching assistant in 18.06 (linear algebra for engineers, unusually theory-intensive this term) for Professor Steven Johnson at MIT. ≈ 4 contact hours per week.	Fall 2007
Repeatedly spoke in the MIT graduate student seminars (**S**imple **P**erson's **A**pplied **M**ath **S**eminar, and **Pu**re **Ma**th **Gra**duate **S**tudent **S**eminar). Spoke in Prof. Daniel Kleitman's and Prof. Jeffrey Kahn's combinatorics seminars. Gave over 10 talks.	2005–present

Research Projects

Thesis research at MIT under Dr. Postnikov, including combinatorial rigidity [2], and pattern-avoidance [7].	2006–present
Collaboration with Dr. Diatchenko, University of North Carolina on SNP-phenotype association analyses [6].	2007–present
Collaborations with NIH and University of Utah researchers on regulatory RNAs [3, 4, 5], and on optimal siRNA design [8, 15].	2005–present
Princeton senior thesis on sparse random graphs under Dr. Sinai [9], see website for some further results.	2004

Princeton mathematics department junior research projects, see website.	2003
Memory profiling research for COS320 Compiling Techniques at Princeton [10].	Spring 2002
NIH Undergraduate Scholarship Program at Dr. Koonin's lab [11, 12].	Summer 2002
Research project for COS302 Artificial Intelligence (Dr. Littman); designed and implemented a modular system for solving SAT analogies, produced $\approx 50\%$ correct answers.	Fall 2001
Computational biology collaborations with Univ. of Utah and NIH researchers [16, 13].	1999–2000
Research Science Institute [17]	Summer 1999

Patents

1. Petakov, A., Minogue, D., **Spiridonov, A.N.** "Searching Structured Geographical Data", 20080189249 (pending), filed February 5, 2007

Papers

2. Postnikov, A., **Spiridonov, A.N.** "The parallel rigidity index of a graph" 2009 (preprint, 2008), available at `http://math.mit.edu/~lesha/papers/graph-rigidity-preprint.pdf`

3. Shabalina S.A., Novichkov P., **Spiridonov, A.N.**, Koonin E. "Genomic architecture of alternative events in mammals" 2009 (in preparation)

4. **Spiridonov, A.N.**, Shabalina S.A. "Positive and negative selective pressures preserve microRNA secondary structure", 2009 (in preparation)

5. Matveeva O., Kang Y., Nechipurenko Yu., **Spiridonov, A.N.**, Shabalina S.A. "Optimization of the key parameters for design of efficient siRNAs and shRNAs" 2009 (in preparation)

6. Nackley A., Shabalina S.A., Lambert J., Conrad M., Gibson D., **Spiridonov, A.N.**, Satterfield S., Diatchenko L. "Hitchhiking of neutral variants with common catechol-O-methyltransferase haplotypes" PLoS One, 2009 (to appear)

7. **Spiridonov, A.N.**. "Pattern-avoidance in binary fillings of grid shapes" (extended abstract), 20th Annual International Conference on Formal Power Series and Algebraic Combinatorics, FPSAC 2008, DMTCS Proceedings, to appear; available at:
`http://math.mit.edu/~lesha/papers/pattern-pair-avoidance-extended-abstract.pdf`

8. Shabalina S.A., **Spiridonov, A.N.**, Ogurtsov A.Yu. "Computational models with thermodynamic and composition features improve siRNA design." BMC Bioinformatics 2006, **7**:65

9. **Spiridonov, A.N.** "Spectra of sparse graphs and matrices." Princeton University Senior Thesis, May 2004, Online. Available at `http://web.mit.edu/lesha/www/princeton-thesis.pdf`

10. Wu J.Q., Pyatakov A.S., **Spiridonov, A.N.**, Raman E., Clark D.W., August D.I. "Exposing memory access regularities using object-relative memory profiling." Proceedings of the Second International Symposium on Code Generation and Optimization (CGO), March 2004

11. Rogozin I.B., Makarova K.S., Natale D.A., **Spiridonov, A.N.**, Tatusov R.L., Wolf Y.I., Yin J., Koonin E.V. "Congruent evolution of different classes of non-coding DNA in prokaryotic genomes." Nucleic Acids Res. 2002, 30(19), 4264-71

12. Rogozin I.B., **Spiridonov, A.N.**, Sorokin A.V, Wolf Y.I., Jordan I.K., Tatusov R.L., Koonin E.V. "Purifying and directional selection in overlapping prokaryotic genes." Trends in Genetics, 2002, Vol. 18, No. 5, 228-32

13. Matveeva O.V., Tsodikov A.D., Giddings M., Freier S.M., Wyatt J.R., **Spiridonov, A.N.**, Shabalina S.A., Gesteland R.F. and Atkins J.F. "Identification of sequence motifs in oligonucleotides whose presence is correlated with antisense activity." Nucleic Acids Research, 2000, Vol. 28, No. 15, 2862-5

Presentations

13. **Spiridonov, A.N.** "Positive and negative selective pressures preserve microRNA secondary structure" RECOMB Regulatory Genomics 2008, abstract 217, available at: `http://compbio.mit.edu/recombsat/2008/Booklet.pdf`

14. **Spiridonov, A.N.** "Pattern-avoidance in binary fillings of grid shapes", FPSAC, June 2008, poster at: `http://math.mit.edu/~lesha/papers/fpsac-2008-poster.pdf`

15. **Spiridonov, A.N.**, Ogurtsova A., Shabalina S.A. "Applying machine learning for rational siRNA design." RECOMB 2005, article 168, 329-30

16. Shabalina S.A., **Spiridonov, A.N.**, Kondrashov A.S. "Pattern of selective constraint in *C. elegans* and *C. briggsae* genomes." RECOMB 2000, 228-9

17. **Spiridonov, A.N.**, Mitros P., Abelson H., Sussman G.J. "Determining sound source location by means of a closed form solution to hyperboloid intersection." Abstracts of the 2000 AAAS Meeting, February 17-22, 2000, Washington, DC, A108-9

Other Conferences Attended

AMS Special Session on Algebraic and Analytic Combinatorics, University of Connecticut, Storrs	October 28-29, 2006
Discrete Mathematics Day at Worcester Polytechnic Institute	September 10, 2005

Employment

Consultant, Algynomics, Inc. Developed software for finding associations between multiple SNPs and phenotype. Analyzed a cohort of fibromyalgia patients and controls.	2008 part-time
Chief Engineer, WorkSmart Labs, Inc. Built a product prototype for a fitness technology start-up. Developed sensor hardware for a stationary exercise bike. Designed and programmed a beautiful 3D game with one-of-a-kind gameplay to motivate the bike's user.	Summer 2007
Engineering Intern, Google, Inc. Designed and implemented most of the back-end for the "user-created content" search on Google Maps, see patent [1].	Summer 2006
Engineering Intern, Google, Inc. Designed and implemented a sophisticated parallel algorithm for removing cycles from huge oriented graphs.	Summer 2005
Development Intern, VMware, Inc. Rearchitected and expanded parts of the performance monitoring infrastructure; maintained and improved tools.	Summer 2003
Software Design Engineer (Intern), Microsoft Corporation. Created a new status bar architecture, enabling customization, skinning, and new controls. Rebuilt Word and Excel status bars, see Office 2007.	Summer 2002
Research Assistant, Princeton University. Continuing work from the 2000–2001 academic year. Created new user interfaces and an automated data entry tool for the database of election and economic data. Doubled the database size.	2001–2002
Research Intern, National Center for Biotechnology Information, National Institutes of Health. Conducted a large-scale analysis of overlapping genes in prokaryotes, and found patterns suggesting that Darwinian selection operates in novel overlapping regions [11, 12].	Summer 2001
Research Assistant, Princeton University. Redesigned and maintained a database of election and economic data from Eastern European countries.	2000–2001

Fellowships and Awards

National Science Foundation Graduate Fellowship	2005–2007, 2008–2009
MIT Presidential Fellowship	2004–2005
The Shapiro Prize for Academic Excellence, Princeton University	2000–2001
Richard V. Stringham Cornell Fingerlakes Credit Union Scholarship	2000
National AP Scholar	2000
American Regions Mathematics League: Team High Scorer	1999
Tests of Engineering Aptitude, Mathematics and Science: National Finalist Team	1999
National Champion Team	1998
New York State Mathematics League: Team High Scorer	1998

Service

Volunteered to help organize RECOMB Satellite 2008. Designed and realized a successful access control scheme using unique color-coded badges; staffed registration desk.	October 2008
Helped organize a Russian intellectual game festival at MIT. Chief designer and programmer of the festival's website and registration database: `http://chai3.chgk.info`	Winter 2008
Built and maintained a system at the MIT Mathematics Department to enable all to play StepMania, an open-source social step-to-the-rhythm game (for exercise and fun).	2006–present
Made contributions to open-source software, by submitting patches, publishing small applications, and debugging/reporting bugs; see website.	2003–present

Miscellany

Competent bicycle mechanic and computer technician.

Fluent in 5 programming languages, used 12 more.

Can build simple microcontroller-based devices.