

## ALENA SHMYGELSKA PH. D.

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### EDUCATION:

- 2006 – present STANFORD UNIVERSITY, Stanford, CA  
**Postdoctoral Fellow**, Computational Structural Biology
- 2001 – 2006 UNIVERSITY OF BRITISH COLUMBIA (UBC), BC, Canada  
Ph. D. in Computer Science  
**Dissertation:** Novel Heuristic Search Methods for Protein Folding and Identification of Folding Pathways.
- 1998 – 2001 SLIPPERY ROCK UNIVERSITY (SRU), Slippery Rock, PA  
B. Sc. with Highest Honors (*summa cum laude*) in Computer Science  
B. A. in Biology with minors in Physics and Mathematics
- 1995 – 1998 DNEPROPETROVSK STATE UNIVERSITY, Ukraine  
Completed a Physics and Biomedical Engineering Honors Program

### GRANTS AND FELLOWSHIPS:

- 2006 – 2008 POSTDOCTORAL FELLOWSHIP, Natural Sciences and Engineering Research Council of Canada (CDN\$80,000 over 2 years). Fellowship given for outstanding research potential in the field of natural sciences, academic excellence, communication and inter-personal skills.
- 2004 – 2006 Ph. D. SCHOLARSHIP, Natural Sciences and Engineering Research Council of Canada (CDN\$42,000 over 2 years). Award given for high research potential, academic achievements in the field of natural sciences, communication and inter-personal skills.
- 2004 AWARD to attend *Theory and Computation in Molecular Biological Physics* Research Workshop and Summer School, University of California, San Diego.
- 2002 – 2004 M. Sc. SCHOLARSHIP, Natural Sciences and Engineering Research Council of Canada (CDN\$38,000 over 2 years). Award given for academic achievements, research potential in the field of natural sciences, communication and inter-personal skills.
- 2000 – 2001 SCOLARSHIP, Joseph S. and Eva Puntureri Memorial Scholarship for Outstanding Juniors, Slippery Rock University (USD\$1,500 for 1 year).

### HONORS:

- 2005 BEST STUDENT PAPER AWARD, Claxo Smith Kline Bioinformatics Prize in the International Conference on Intelligent Systems for Molecular Biology (ISMB).
- 2002 – 2004 TEACHING AWARD, Department of Computer Science, University of British Columbia.
- 2002 BEST PAPER AWARD, Best Paper Presentation Award in Ant Colony Workshop (ANTS).
- 2001 OUTSTANDING SENIOR WOMAN OF GRADUATING CLASS 2001, Slippery Rock University. This award is conferred upon one female graduating student who attained the highest scholarly excellence in the judgment of the university.
- 2001 OUTSTANDING SENIOR, Computer Science Department, Slippery Rock University.

## PROFESSIONAL EXPERIENCE:

### RESEARCH:

**Postdoctoral Fellow**, DEPARTMENT OF STRUCTURAL BIOLOGY, Stanford University, Stanford CA (2006 – present)  
Conduct research in the Computational Structural Biology group on adaptive randomized search algorithms and biologically inspired methods for problems in structural biology. Combine machine learning methods with randomized search algorithms to enhance sampling for the protein folding, RNA folding, and protein-protein docking.

**Researcher**, COMPUTER SCIENCE DEPARTMENT, University of British Columbia, BC, Canada (2001 – 2006)  
Addressed the protein folding problem and the closely related problem of identifying folding pathways. Results showed that biologically inspired approaches, particularly artificial colonies of ants that capture self-organization and cooperation phenomena, is a promising area of study for the protein-folding problem. Developed a novel adaptive search framework that can be used with state-of-the-art algorithms, such as generalized ensemble methods (Monte Carlo and Replica Exchange Monte Carlo) to advance the search when progress is unsatisfactory. Developed a new graph-theoretical method that allows exploration of large search neighborhoods for identifying the folding pathways of proteins.

**Research Assistant**, DEPARTMENT OF PHYSICS, University of British Columbia, BC, Canada (2004 – 2006)  
Worked on a project that involved derivation of knowledge-based (derived from known structures) energy potentials for a large representative data-set of proteins. Designed and implemented a number of efficient algorithms to perform and analyze physical molecular dynamics simulations. Publications of this research are under preparation.

### TEACHING:

UNIVERSITY OF BRITISH COLUMBIA, Canada

**Sessional Lecturer**, DEPARTMENT OF COMPUTER SCIENCE, (5/05 – 6/05)

Taught *Intermediate Algorithm Design and Analysis* course that included 40 hours of lectures, assignments and examination preparation, and marking for 80 students. Presented a systematic study of basic concepts and techniques in the design and analysis of algorithms, illustrated algorithm design principles from various problem areas. Topics included: models of computation; choice of data structures; graph-theoretic, algebraic, and text processing algorithms. Designed and supervised the lab component of the course, developed tutorial materials.

**Teaching Assistant**, DEPARTMENT OF COMPUTER SCIENCE, (9/04 – 12/04)

Taught tutorials and labs for *Basic Algorithms and Data Structures* course. Facilitated two hour tutorials explaining fundamental concepts in problem solving, algorithms, data structure development and analysis. Managed the lab component of the course and developed tutorial materials, taught four hours per week.

**Teaching Assistant**, DEPARTMENT OF COMPUTER SCIENCE (1/03 – 5/03 & 1/04 – 4/04)

Taught tutorials and labs for *Software Development Laboratory* course. Provided graphical, engaging examples to illustrate concepts covered, answered student's questions, helped with any technical difficulties students encountered during the lab. Helped students to understand concepts covered in class. Six hours per week were spent in the classroom teaching. One hour per week was spent answering students' questions in person and via the e-mail.

**Teaching Assistant**, DEPARTMENT OF COMPUTER SCIENCE (9/03 – 12/03)

Designed and graded assignments, directly supervised a group project of graduate students, and gave guest lectures for *Algorithms in Bioinformatics* course. One hour per week was spent on meeting with students to discuss their projects, assignments, course material covered and in consultation with the professor teaching the course to discuss assignments, course material covered and any other teaching-related issues.

**Teaching Assistant**, DEPARTMENT OF COMPUTER SCIENCE (1/02 – 6/02 & 1/02 – 4/02)

Taught tutorials for *Principles of Computer Science II* course. Designed resourceful tutorial notes and extra practice exercises to help students to test their knowledge of important concepts taught. Helped students to understand concepts covered in lectures by going over practical examples during the tutorial.

**Teaching Assistant**, DEPARTMENT OF COMPUTER SCIENCE (9/01 – 12/01)

Taught tutorials and labs for *Principles of Computer Programming* course. Introduced students to the key concepts of programming and C++ language.

## RELEVANT EXPERIENCE:

**Co-Supervisor**, UNIVERSITY OF BRITISH COLUMBIA, BC, Canada (2005)

Supervised Master of Science student in Computer Science. Assisted with the selection of the M. Sc. project in bio-molecular computation. Provided needed references and resources to successfully start the project. Met weekly to help with any difficulties arising during the course of research.

**Mentor**, WOMEN IN COMPUTER SCIENCE, University of British Columbia (2002 – 05)

Worked with undergraduate Computer Science female students to help them find resources for their coursework. Conducted workshops that assist Computer Science female students in pursuing their academic goals.

**Intern**, HBOC MCKESSON HEALTHCARE, Pittsburgh, PA (2000 – 01)

Developed software for tracking patients and prescriptions. Developed software for dispensing prescription medications.

**Researcher**, ARTIFICIAL INTELLIGENCE LABORATORY, Department of Computer Science, SRU (1998 – 2001)

Designed and implemented Distributed Agent-based Approach for solving vehicle routing and scheduling problems. The research project involved parallel computing on distributed systems, networking, and optimization of scheduling algorithms.

## PUBLICATIONS:

### *Refereed Journal Articles*

Thachuk, C., **Shmygelska**, A., Hoos, H. H. (2007) A Replica Exchange Monte Carlo for Protein Folding in the HP Model, BMC Bioinformatics, 8:342 (Ph. D. and Post-doctoral work).

**Shmygelska**, A., Hoos, H. H. (2007) An Adaptive Bin Framework Search for a Protein-like Homopolymer Model, BMC Bioinformatics, 8:136 (Ph. D. work).

**Shmygelska**, A. (2005) Search for Folding Nuclei in Native Protein Structures, Bioinformatics, 21, i394 - i402. **This paper won the Best Student Paper award at ISMB 2005** (Ph. D. work).

**Shmygelska**, A., Hoos, H. H. (2005) An Ant Colony Optimization Algorithm for the 2D and 3D Hydrophobic Polar Protein Folding Problem, BMC Bioinformatics, 6:30 (Ph. D. work).

### *Refereed Conference Papers*

**Shmygelska**, A. (2007) An Extremal Optimization Search Method to the Protein Folding Problem, Genetic and Evolutionary Computation Conference (GECCO 2007). (Post-doctoral work).

**Shmygelska**, A., Hoos, H. H. (2003) An Improved Ant Colony Optimization Algorithm for the 2D HP Protein Folding Problem, In Proceedings of the 16<sup>th</sup> Canadian Conference on Artificial Intelligence, LNCS 2671, Springer Verlag, 400-417 (Ph. D. work).

**Shmygelska**, A., Hernandez, A. R. and Hoos, H. H. (2002) An Ant Colony Optimization Algorithm for the 2D HP Protein Folding Problem, In Proceedings of Ant Colony Workshop (ANTS 2002), LNCS 2453, Springer Verlag, 40-52. **This paper won the ANTS 2002 Best Paper Award** (Ph. D. work).

Thangiah, S. R., **Shmygelska**, A. (2002) Multi-Depot VRP with Time Windows: A Distributed Computer Systems Approach, Proceedings of International Federation of Operation Research Society Conference, 53-59.

Thangiah, S. R., **Shmygelska**, A., Mennell, W. (2001) An Agent Architecture for Vehicle Routing Problems, In Proceedings of the Association for Computing Machinery's (ACM) Symposium on Applied Computing, 517-521 (Undergraduate work).

### *Manuscripts in Preparation*

**Shmygelska**, A., Levitt, M. Adaptive Hamiltonian Replica Exchange Method for De Novo Protein Structure Prediction. (Post-doctoral work).

**CONFERENCE PRESENTATIONS AND POSTERS:**

GECCO 2007 conference presentation: "Extremal Optimization for Protein Folding." (Post-doctoral work).

ISMB 2005 conference presentation: "Search for folding nuclei." (Ph. D. work).

Canadian AI 2004 conference presentation: "An Improved Ant Colony Optimization Algorithm for the 2D HP Protein Folding Problem." (Ph. D. work).

ANTS 2002 conference presentation: "An Ant Colony Optimization Algorithm for the 2D HP Protein Folding Problem." (Ph. D. work).

ACM symposium on applied computing 2001 presentation: "An agent architecture for vehicle routing problems." (Undergraduate work).

**PROFESSIONAL SERVICES:**

Served as Referee for conferences such as Ant Colony Workshop (ANTS), International Joint Conference on Artificial Intelligence (IJCAI), Intelligent Systems for Molecular Biology (ISMB), and Research in Computational Molecular Biology (RECOMB). Journals include Bioinformatics, BMC Bioinformatics, Journal of Evolutionary Computation. Conference Volunteer for Neural Information Processing Systems (NIPS).

**PROFESSIONAL AFFILIATIONS:**

- Member, International society for Computational Biologists (ISCB) (2005 – present)
- Member, Upsilon Pi Epsilon Honor Society for Computing Sciences (1999 – 2006)
- Member, Tri Beta Biology Society (1999 – 2001)
- Member, Golden key National Honor Society (1999 – 2001)

**ADDITIONAL INFORMATION:**

- Member, Computational Structural Biology Group, Structural Biology, Stanford University (2006 – present)
- Member, Biological Physics and Protein Folding Groups, Dept. of Physics, University of British Columbia (2004-06)
- Member, Empirical Algorithms and Bioinformatics Groups, University of British Columbia (2002 – 06)
- Participant, NCBI Bioinformatics Workshop, University of British Columbia (2004)
- Participant and Winner, Association for Computing Machinery Programming Contests (1998-2001)

**LANGUAGES:** English and Russian.