

**Anton Burykin, Ph.D.**

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 Department of Surgery  
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[www.burykin.com](http://www.burykin.com)  
 Skype: anton.burykin

Place of Birth: Moscow, Russia;  
 Languages: Russian, English;  
 Military Status: Lieutenant, Strategic Rocket Forces (ROTC, Russia, 1996-1999)

Citizenship: Russia;  
 US Visa Status: H1B;

CURRENT POSITION *Research Associate* 2009-present  
 Emory University School of Medicine  
 Emory Center for Critical Care (ECCC) and Department of Surgery

RESEARCH INTERESTS: Biomedical Physics & Complex Systems  
 METHODS: Computer Simulation & Time Series Analysis

**EDUCATION**

- University of Southern California (USC), Los Angeles, CA  
 Ph.D. COMPUTATIONAL CHEMISTRY. (GPA 3.54 out of 4.00) 2005  
 Thesis: “*Computer Simulation of Charge Transfer through Biological and Artificial Membrane Channels*”  
 Advisor: Arieh Warshel
- Moscow Institute of Physics and Technology (MIPT, PhysTech), Moscow (Dolgoprudny), Russia  
 Department of Molecular and Biological Physics  
 M.S. BIOPHYSICS & ECOLOGY with honor (GPA 5.00 out of 5.00) 2000  
 Thesis: “*Development of New Methods for Computer Simulation of Human Body Systems (for the Case of the Cardiovascular System)*” Advisor: Eugen N. Timin
- B.S. APPLIED MATHEMATICS & PHYSICS with honor (GPA 4.92 out of 5.00) 1998  
 Thesis: “*Theoretical Investigations of Conversion of Non-Coherent Radiation to Coherent Radiation Inside of a Thin Layer of Dye and Its Removal through the Lateral Surface of the Layer by Means of Defocusing*”  
 Advisor: Vladimir P. Bykov

**Other Educational Programs, Summer Schools & Workshops:**

- USC Center for Excellence in Teaching (CET):  
 CERTIFICATE, Preparing Future Faculty Program (1 year program designed to prepare doctoral students considering careers as faculty members in higher education) 2005
- Moscow Institute of Physics and Technology (MIPT)  
 Department of Applied Mathematics and Economics & MIPT Center for Business Education  
 DIPLOMA, HI-TECH MANAGEMENT (GPA 4.73 out of 5.00) 1999  
 Thesis: “*Design of the Federal Medical Network ‘Russian Telemedicine’*” Advisor: Eugen N. Timin
- CERTIFICATE, HI-TECH CONSULTING (GPA 4.75 out of 5.00) 1998
- Santa Fe Institute, Santa Fe, NM:  
Complex Systems Summer School (CSSS2005) June 2005
  - Classes (theory/simulation/experiment) in non-linear dynamics, chaos and self-organization, non-extensive entropy, power laws, agent-based modeling, cellular automata and networks;
  - Project: “*Agent-Based Modeling (RePast/Java) of Networks of Logistic Maps with Long-Range Coupling: Synchronization, Pattern Formation and Probability Distributions*” (with B. Adamcsek).Summer School “Mathematical and Computer Models in Medicine: Disease and Treatment” August 2004
  - Research project: “*Simulation of Multiple Organ Failure: Coupled Stochastic Oscillators Approach*” (with A. J. E. Seely & G. Ernst)
- American Psychological Association  
*Advanced Training Institute in Non-Linear Methods for Psychology*, University of Cincinnati, OH July 2006  
 Organizers: Guy Van Orden, Michael Riley & Michael Turvey

- Winter School “*Future Directions in Physico-Chemical Biology & Biotechnology*” February 1998, 1999 & 2000  
M.M. Shemyakin & Yu.A. Ovchinnikov Institute of Bioorganic Chemistry, Russian Academy of Sciences, Moscow.
- *Effective Research Management Workshop*, Washington University, St. Louis, MO March 2008
- *Grant Writing Workshop*, Washington University, St. Louis, MO December 2006
- *COMSOL Multiphysics Workshops*, St. Louis, MO September 14, 2006 & October 25, 2007
- *Time Series Analysis Tutorial* (organized by Erik Herzog, WUSTL) St. Louis, MO September 2007
- *Field Guide to GenBank and NCBI Molecular Biology Resources*, St. Louis, MO January 30, 2007  
(molecular sequence databases and computational biology tools)
- Institute for Complex Adaptive Matter  
Workshop: “*Multiscale Interactions & Dynamics in Biological Systems*”, St. Louis, MO May 2006
- *Heart Rate Variability Workshop* (organized by Ary L. Goldberger, Harvard Medical School), Boston, MA April 2006
- *Workshop in Computational Biophysics* (organized by Klaus Schulten, TCBG, UIUC), Lake Tahoe, CA May 2005

### SCHOLARSHIPS & AWARDS

- DARPA Postdoctoral Fellowship 2005-2007
- Multiple travel grants from various institutions, including SFI, UCI and others 2002-2007
- Predoctoral Scholarship, Department of Chemistry, USC 2003-2005
- Best Poster Award. American Chemical Society, Physical Chemistry Division (227<sup>th</sup> ACS National Meeting) March 2004
- Graduate Research Award in Chemistry (USC) May 2003
- Scholarship from the Investment Group “Russian Funds” (MIPT) 1999-2000
- Moscow Mayor Scholarship (MIPT) 1998-1999
- Best Undergraduate Student Talk (XLI MIPT Research Conference) 1998

### PROFESSIONAL SERVICE

- Reviewer for:
  - *Physiological Measurement*
  - *Proteins: Structure, Function, and Bioinformatics*
  - *Biochimica et Biophysica Acta (BBA) - Bioenergetics*
  - *IEEE Transactions on Biomedical Engineering*
  - *IEEE/ACM Transactions on Computational Biology and Bioinformatics*
  - *The 2009 North American Conference on Computing & Philosophy (NACAP): “Networks & Their Philosophical Implications” (member of the reviewer committee).*
  - *The 5<sup>th</sup> Asia-Pacific Computing and Philosophy Conference (AP-CAP 2009).*
- Member of Postdoctoral Policy Committee, Washington University in St. Louis, School of Medicine (2006-2007).

### RESEARCH EXPERIENCE

Emory University School of Medicine  
Emory Center for Critical Care (ECCC) (Director: Prof. Timothy G. Buchman)  
Research Associate 2009-present

AND

Washington University in St. Louis, School of Medicine,  
Department of Surgery (Prof. Timothy G. Buchman)  
Staff Scientist 2008-present  
Postdoctoral Research Associate 2005-2008

- Multi-Organ Dynamics Project:
  - Databasing: continuous 24/7 recordings of main physiologic signals from critically ill patients in intensive care unit;
  - Time series analysis and modeling of multi-organ (organism) dynamics & synchronization;
- Supervised 4 undergraduate students: acquisition, analysis & animation of physiological signals

University of Southern California, Department of Chemistry, Los Angeles 2000-2005  
Theoretical Chemistry and Biophysics Group (Director - Prof. Arieh Warshel)  
Research Assistant

Extensive use of supercomputer clusters and molecular modeling methods such as:

- Molecular & Stochastic (Langevin) Dynamics (MD&LD);
- Langevin Dipoles Solvation Models (PDL & PDL/S);
- Free Energy Perturbation (FEP);
- Empirical Valence Bond (EVB);

for electrostatic calculations and structure-function correlations of biological and artificial water, ion and proton channels (aquaporin, KcsA, gramicidin A, carbon nanotubes);

#### MAIN RESEARCH ACCOMPLISHMENTS (*under the guidance of Prof. A. Warshel*):

- explained the mechanism of proton blockage in aquaporin water channels;
- applied this mechanism for theoretical construction of a water nanofilter using carbon nanotube membranes;
- developed novel stochastic QM/MM (Stochastic EVB) models for proton transport in solution;
- developed multilevel hierarchical approach (MD=>Free Energy=>Stochastic Dynamics) for simulation of the single ion channel current and selectivity based on its atomic (X-Ray) structure.

A. V. Vishnevsky Surgery Institute, Russian Academy of Medical Sciences, Moscow 1998-2000  
 Medical Cybernetics Lab (Director: Prof. Eugen N. Timin)  
 Research Assistant

- Development of computer models of cardiovascular system (Advisor: Prof. Eugen N. Timin).

Moscow Institute of Physics and Technology (State University), 1998-2000  
 Ecological Research Lab (Director: Prof. B. K. Tkachenko)  
 Research Scientist

- Worked on two software development projects (Pascal, Java, UML): computer simulation in systems physiology (Project Advisor: Prof. A. S. Kholodov).
- Supervised team of five undergraduate students (scientific software development).

A. M. Prokhorov General Physics Institute, Russian Academy of Sciences (GPI RAS), Moscow 1997-1998  
 Research Assistant

- Theoretical investigation of transmission of electro-magnetic waves in thin layers of dielectrics and metal with applications to dye lasers (Advisor: Prof. Vladimir P. Bykov).

State Institute of Genetics and Selection of Industrial Microorganisms ("GosNIIgenetika"), Moscow Fall 1995  
 Lab Technician (Prof. V. E. Sterkin Lab)

### **OTHER RESEARCH PROJECTS**

- DARPA Fundamental Law of Biology Program (FunBio) 2007 – present
  - Conceptual modeling of physiological signals using Complex Adaptive Systems (CAS): mechanisms of maintenance, loss & restoration of physiological variability & adaptability.
- Systems Analysis Group (SAG) & Center for Critical Illness and Health Engineering (CRIHELP) 2005 – 2009  
 Washington University, St. Louis (Prof. J. Perren Cobb)
  - Analysis of time series of microarray gene expression data from critically ill patients.
- Washington University, School of Medicine, Department of Anesthesiology (Prof. I. Kangrga): 2008-2009
  - Visualization & analysis of physiologic signals (vital signs) recorded during liver transplant surgery
- University of Ottawa, Ottawa Hospital, Dynamical Analysis Lab (Prof. Andrew J.E. Seely), Ottawa, Canada September 2004
  - Simulation of multi-organ dynamics (coupled stochastic oscillator models).
- Moscow Institute of Physics and Technology, Ecological Research Lab (Director: Prof. B. K. Tkachenko) Fall 1999
  - Experimental studies of extrasensory perception.
- Moscow Institute of Physics and Technology, Applied Biophysics Lab (Director: Prof. E. M. Trukhan) Fall 1997
  - Experimental studies of optical properties of the acupuncture points and meridian system.

### **SCIENTIFIC SOFTWARE DEVELOPMENT**

1. Multi Wave Animator (MWA) – Open source MATLAB scripts to create animations (videos) of patient vital signs recorded from bedside monitors. Burykin, A. Available at [www.burykin.com/mwa/](http://www.burykin.com/mwa/) 2008-2009
2. Boltzmann (Fortran77/90) – Numerical calculation of properties of different statistical ensembles from the first principles of statistical mechanics. An attempt to build statistical mechanics based on algorithms, not on analytical derivations ("NKS paradigm"). The program is used for teaching of computational statistical mechanics classes. Burykin, A, Warshel, A. 2002
3. CHANNELIX (Fortran77/90) – Langevin Dynamics simulation of 1D & 3D ion transport through single ion channel (numerical solution of systems of stochastic differential equations). Burykin, A, Villa, J. and Warshel A. 2001-2003

4. MOLARIS (Fortran77) - Molecular Modeling Package (A. Warshel et al.). Modification (added new modules: stochastic dynamics, etc), debugging, support, and documentation 2000–2005
5. USE (Java) - “UNIVERSAL SIMULATION ENVIRONMENT” for visual simulations of the human organism under the normal conditions and under the influence of various external/internal factors. The program is based on object-oriented (UML & Java) library of models of basic human organs and uses “decentralized” modeling methodology. (Kholodov, A, Evdokimov, A, Burykin, A, et al.) 1998-2000

### DATABASE DEVELOPMENT

1. ICU VSDB (Vital Sign Databank): Physiologic signals (ECG, respiration, blood pressure, ...) recorded from critically ill patients during 1year period (Oct05-Oct06). Approximately  $3.35 \times 10^3$  recordings from  $1.2 \times 10^3$  patients (total size 4.5TB,  $2 \times 10^5$  files) 2005-2006

### SCIENTIFIC ANIMATIONS (VIDEO)

1. “*Cardiac Arrest and Resuscitation During Orthotopic Liver Transplantation: Real Time Hemodynamic and Ventilator Recordings*” Computer animation (video) of a patient vital signs (waveforms & numeric data) recorded during liver transplant surgery. The display of the physiologic signals mimics their appearance on a real bedside monitor. Created with Multi Wave Animator (MWA) Software. Short (AVI, 7min, 600MB) & full (AVI, 32min, 1.84GB) versions. To be submitted to a medical journal. 2008-2009
2. Transport of the potassium ions ( $K^+$ ) through the KcsA ion channel (AVI, 1min, 10MB). Animation of a fragment of a long (1ns) ion trajectories – numerical solution of the Langevin equation. Available at [www.burykin.com/movies/KcsA.avi](http://www.burykin.com/movies/KcsA.avi) 2003

### SOFTWARE SKILLS

OS:	Windows, MacOS X, Linux, DOS.
OS Emulations & Virtualization:	CygWin, VMware, Virtual PC.
Office Software:	MS Office, EndNote.
Programming/Scripting Languages:	Fortran77/90, C/C++, Java, Pascal, UML, HTML, Unix Shells, make.
Database Management:	MS SQL Server 2005
Mathematical Packages:	MATLAB, O-Matrix, Scilab, Octave, MathCad, Maple, Mathematica, Origin.
Statistical Packages:	SPSS, R
Nonlinear Time Series Analysis:	TISEAN
Physiological Signal Acquisition:	TrendFace, BedMasterEx
Physiological Signal Analysis:	KubiosHRV, PhysioNet Toolkit (WFDB, WAVE).
Network Analysis:	Pajek
Molecular Modeling:	Molaris (Enzymix, Polaris, Analyze), ChemSol, QCFF/PI, Q, NAMD, etc...
Molecular Visualization:	VMD, WebLab Viewer, PyMOL, Swiss-Pdb Viewer, XMol, etc...
Graphical Packages:	Adobe Illustrator, Adobe Photoshop.
Digital Video Software:	VirtualDub, CamStudio, etc...

### MEMBERSHIP

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|---|---|
| <ul style="list-style-type: none"> <li>➤ New York Academy of Sciences</li> <li>➤ World Academy of Young Scientists</li> <li>➤ American Physical Society</li> <li>➤ International Society for Complexity in Acute Illness</li> <li>➤ Internet Society (ISOC)</li> <li>➤ Society for the Internet in Medicine</li> <li>➤ International Community for Auditory Display (ICAD)</li> </ul> | <ul style="list-style-type: none"> <li>➤ International Society for Free Radical Research</li> <li>➤ International Zeolite Association</li> <li>➤ World Transhumanist Association</li> <li>➤ Calorie Restriction Society</li> <li>➤ Immortality Institute</li> <li>➤ Science Advisory Board</li> </ul> |
|---|---|

### FORMER MEMBERSHIP

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>➤ American Association for the Advancement of Science (AAAS)</li> <li>➤ Biomedical Engineering Society (BMES)</li> <li>➤ American Chemical Society (ACS)</li> <li>➤ American Biophysical Society</li> <li>➤ Protein Society</li> <li>➤ American Thoracic Society</li> <li>➤ Systems Analysis Group (SAG)</li> </ul> | <ul style="list-style-type: none"> <li>➤ Institute of Nanotechnology (UK)</li> <li>➤ Foundation for the Study of Cycles</li> <li>➤ Foresight Nanotech Institute</li> <li>➤ Russian Transhumanist Movement</li> <li>➤ National Postdoctoral Association</li> <li>➤ Missouri Coalition for Lifesaving Cures</li> <li>➤ CuresNow</li> </ul> |
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## TEACHING EXPERIENCE

### University of Southern California, Department of Chemistry

Teaching Assistant: *Computer Simulations of Chemical and Biological Systems* (graduate)

Spring 2004

Teaching Assistant: *Computational Statistical Mechanics* (graduate)

Spring 2002, Spring 2003

Teaching Assistant: *General Chemistry* (undergraduate)

Fall 2000

### Moscow Institute of Physics and Technology

Lecturer: *Introduction to Object-Oriented Programming & Java Technologies* (undergraduate)

Spring 2000

Teaching Assistant: *Introduction to Informational Technologies* (undergraduate)

Fall 1999

## PUBLICATIONS

### I. Publications in Refereed Journals

**Cited 225 times (ISI Web of Knowledge 10/16/09)**

1. **Burykin, A.**, Peck, T., Krejci, V., Vannucci, A., Kangrga, I., Buchman T. G., Towards Optimal Display of Physiologic Status in Critical Care: I. Recreating Bedside Displays from Archived Physiologic Data. Submitted to *J. of Critical Care*.
2. **Burykin, A.**, Peck, T., Hoertel J.R., Buchman T. G., Using "Off-the-Shelf" Tools for Terabyte-Scale Vital Sign Recording in Intensive Care: Design of the Computer System, Description of the Selected Datasets and Lessons Learned During the Databasing. Submitted to *Computer Methods and Programs in Biomedicine*.
3. Lu\*, Y., **Burykin\***, A., Deem, M.W., Buchman T. G., Predicting clinical physiology: A Markov chain model of heart rate recovery after spontaneous breathing trials in mechanically ventilated patients. *J. of Critical Care* 24(3):347-361 (2009).  
\* equal authorship

featured in:

- Invited Commentary, Raphael, D.T. *J. of Critical Care* 24(3):362-363 (2009);
  - DARPA Highlight (in preparation)
4. Polpitiya, A. D., McDunn, J. E., **Burykin, A.**, Ghosh, B. K., Cobb, J. P. Using Systems Biology to Simplify Complex Disease: Immune Cartography. *Critical Care Medicine*. 37(1 Suppl): S16-21 (2009).
  5. **Burykin, A.**, Buchman T. G. Cardiorespiratory Dynamics during Transitions between Mechanical and Spontaneous Ventilation in Intensive Care. *Complexity*, 13(6): 40-59 (2008) (COVER IMAGE) [times cited: 1].
  6. McDunn, J. E., Husain, K. D., Polpitiya, A. D., **Burykin, A.**, Rua, J., Li, Q., Schierding, W., Lin, N., Dixon, D., Zhang, W., Coopersmith, C. M., Dunne, W. M., Colonna, M., Ghosh, B., Cobb, J. P. Plasticity of the Systemic Inflammatory Response to Acute Infection During Critical Illness: Development of the Riboleukogram. *PLoS ONE* 3(2): e1564. doi:10.1371/journal.pone.0001564 (2008) [times cited: 3].

featured in (for up-to-date media coverage search "*riboleukogram*" in Google):

[for locally saved copies see: [www.burykin.com/systems\\_biology.html](http://www.burykin.com/systems_biology.html)]

- <http://record.wustl.edu/news/page/normal/11270.html>
- <http://mednews.wustl.edu/news/page/normal/11047.html>
- [www.physorg.com/news/122099499.html](http://www.physorg.com/news/122099499.html)
- [www.medicalnewstoday.com/articles/97182.php](http://www.medicalnewstoday.com/articles/97182.php)
- [www.pharmaceutical-business-review.com/article\\_feature.asp?guid=6E22A01F-6A52-4954-9D17-F5039B4D0939](http://www.pharmaceutical-business-review.com/article_feature.asp?guid=6E22A01F-6A52-4954-9D17-F5039B4D0939)
- [www.modernmedicine.com/modernmedicine/Internal+Medicine/Gene-Profile-May-Predict-Pneumonia-Risk-in-Critica/ArticleNewsFeed/Article/detail/492635](http://www.modernmedicine.com/modernmedicine/Internal+Medicine/Gene-Profile-May-Predict-Pneumonia-Risk-in-Critica/ArticleNewsFeed/Article/detail/492635)
- [www.genomeweb.com/issues/news/145055-1.html](http://www.genomeweb.com/issues/news/145055-1.html)
- [www.rtmagazine.com/respiratoryreport/2008-02-21\\_10.asp](http://www.rtmagazine.com/respiratoryreport/2008-02-21_10.asp)
- [www.infectioncontrolday.com/hotnews/gene-chip-differentiates-vap.html](http://www.infectioncontrolday.com/hotnews/gene-chip-differentiates-vap.html)
- [www.scientistlive.com/European-Science-News/Biotechnology/Gene\\_chips\\_used\\_to\\_ID\\_pneumonia/19743/](http://www.scientistlive.com/European-Science-News/Biotechnology/Gene_chips_used_to_ID_pneumonia/19743/)
- [www.innovations-report.com/html/reports/medicine\\_health/report-103410.html](http://www.innovations-report.com/html/reports/medicine_health/report-103410.html)
- [www.sciencecentric.com/news/08021406.htm](http://www.sciencecentric.com/news/08021406.htm)
- [www.newswise.com/articles/view/537725/](http://www.newswise.com/articles/view/537725/)
- [www.datamonitor.com/industries/news/article/?pid=6E22A01F-6A52-4954-9D17-F5039B4D0939&type=CommentWire](http://www.datamonitor.com/industries/news/article/?pid=6E22A01F-6A52-4954-9D17-F5039B4D0939&type=CommentWire)
- [www.redorbit.com/news/health/1262343/bacterial\\_diagnostics\\_gene\\_expression\\_signals\\_way\\_forward/index.html](http://www.redorbit.com/news/health/1262343/bacterial_diagnostics_gene_expression_signals_way_forward/index.html)
- [www.reportbuyer.com/blog/bacterial-diagnostics-gene-expression-signals-way-forward/](http://www.reportbuyer.com/blog/bacterial-diagnostics-gene-expression-signals-way-forward/)
- [www.zibb.com/article/2726979/Bacterial+diagnostics+gene+expression+signals+way+forward](http://www.zibb.com/article/2726979/Bacterial+diagnostics+gene+expression+signals+way+forward)
- <http://penchart.com/content/view/24/27/>
- <http://google-sina.com/2008/02/18/gene-chip-technology-used-to-distinguish-ventilator-associated-pneumonia-from-underlying-critical-illness/>
- <http://health.go2blogging.com:80/2008/02/13/ventilator-associated-pneumonia-distinguished-from-underlying-critical-illness-by-gene-chips>

7. **Burykin, A**, Warshel, A, Membranes Assembled from Narrow Carbon Nanotubes Block Proton Transport and Can Form Effective Nano Filtration Devices. *J. of Computational and Theoretical Nanoscience* 3. 237-242 (2006) (COVER IMAGE) [times cited: 4].
8. Braun-Sand, S, **Burykin, A.**, Chu, Z. T., Warshel, A, Realistic Simulation of Proton Transport Along the Gramicidin Channel: Demonstrating the Importance of Solvation Effects. *J. of Physical Chemistry B* 109:586-592 (2005) [times cited: 27].
9. **Burykin, A**, Warshel, A, On the Origin of the Electrostatic Barrier for Proton Transport in Aquaporin. *FEBS Letters*, 570(1-3):41-46 (2004) (COVER IMAGE) [times cited: 34].
10. **Burykin, A**, Warshel, A, What Really Prevents Proton Transport through Aquaporin? Charge Self-Energy vs. Proton Wire Proposals. *Biophysical J.* 85:3696-3706 (2003) [times cited: 64].  
featured in:
  - Blockade in the Cell's Water Way, Yarnell A. *Chemical and Engineering News*, 82:42-44 (2004)
  - Why Can't Protons Move through Water Channel? (New and Notable). Bob Eisenberg. *Biophysical J.* 85:3427-3428 (2003)
  - Faculty of 1000 (Biology), F1000 Factor: 3.00. ([www.f1000biology.com/article/14645061/evaluation](http://www.f1000biology.com/article/14645061/evaluation))
11. **Burykin, A**, M. Kato, A. Warshel, Exploring the Origin of the Ion Selectivity of the KcsA Potassium Channel. *Proteins: Structure, Function, and Genetics* 52:412-426 (2003) [times cited: 36].
12. **Burykin, A**, Schutz C. N., Villa J., Warshel A., Simulations of Ion Current in Realistic Models of Ion Channels: The KcsA Potassium Channel. *Proteins: Structure, Function, and Genetics* 47:262-280 (2002) (COVER IMAGE) [times cited: 56].

## II. Manuscripts in Preparation

13. **Burykin, A.**, Costa, M.D., Peng, C-K., Goldberger, A.L. Buchman T. G. Construction of Asymmetric Time Series.
14. Cardiac Arrest and Resuscitation During Orthotopic Liver Transplantation: Real Time Hemodynamic and Ventilator Recordings.

## III. Other Publications & Technical Reports

15. **Burykin, A.**, Understanding Time Series Modularity, *Report for DARPA FunBio Project*, 2009.
16. **Burykin, A**, Adamcsek, B., Agent-Based Modeling of Networks of Logistic Maps with Long-Range Coupling. *Proceedings of the 2005 Complex Systems Summer School*. Santa Fe Institute, 7pp.  
(Online version: [www.santafe.edu/education/csss/csss05/papers/burykin\\_et\\_al.\\_csss05.pdf](http://www.santafe.edu/education/csss/csss05/papers/burykin_et_al._csss05.pdf))
17. **Burykin, A**, Computer Simulation Studies of Charge Transfer through Biological and Artificial Membrane Channels (*Ph.D. Thesis*, 300 pp.) (2005). [www.burykin.com/PhD/PhD\\_thesis\\_Burykin.pdf](http://www.burykin.com/PhD/PhD_thesis_Burykin.pdf)
18. **Burykin, A**, Ernst, G., Seely, A. J. E. Altered Variability in Multiple Organ Failure: Model of Coupled Stochastic Oscillators. *Project Report for 2004 Summer School "Mathematical and Computer Models in Medicine: Disease and Treatment"*, Santa Fe Institute, 10pp.
19. **Burykin, A**, Development of Methods for Computer Simulation of Human Body Systems (for the Case of the Cardiovascular System) (*M.S. Thesis*, 87pp. in russian) (2000) [www.burykin.com/MS\\_Thesis2000.pdf](http://www.burykin.com/MS_Thesis2000.pdf)
20. Kholodov, A, **Burykin, A**, Evdokimov, A., et al., Future Development of the Computer Model of Human Organism. *MIPT Working Paper (Project GARKUSHA)* (in russian) (2000).
21. Kholodov, A, **Burykin, A**, Evdokimov, A, Lobanov, A., Safarov, A., et al., Computer Model of Human Organism for Prediction of Effects of External Ecological (Physical, Chemical and Biological) Factors. *MIPT Technical Report (Project GARBIA-3)* (in russian). Part 1, 190 pp. (1998), Part 2, 553 pp. (1999).
22. **Burykin, A.**, Design of the Federal Medical Network "Russian Telemedicine". *Diploma Thesis*, 21 pp. (in russian) (1999).
23. **Burykin, A.**, Bykov, V.P., Formation of Coherent Radiation Inside of an Infinitely Long Thin Layer of Dielectric and Its Removal through the Lateral Surface of the Layer by Means of Defocusing. *MIPT Working Paper*, 9 pp (in russian) (1999). [www.burykin.com/papers/Burykin\\_Bykov\\_1999.pdf](http://www.burykin.com/papers/Burykin_Bykov_1999.pdf)
24. **Burykin, A.**, Theoretical Investigations of Conversion of Non-Coherent Radiation to Coherent Radiation Inside of a Thin Layer of Dye and Its Removal through the Lateral Surface of the Layer by Means of Defocusing (*B.S. Thesis*, 24pp. in russian) (1998). [www.burykin.com/papers/Burykin\\_BS\\_Thesis\\_1998.pdf](http://www.burykin.com/papers/Burykin_BS_Thesis_1998.pdf)

#### IV. Published Abstracts

25. **Burykin A**, Lu, Y., Deem, M.W., Buchman T. G., Fluctuation-Dissipation Theorem Provides a Simple Analytical Relationship between Post-Stress Heart Rate Recovery and Heart Rate Variability During the Stress. *J. of Critical Care* 24(3) e31. Sept. 2009.
26. **Burykin A**, Buchman T. G. Cardiorespiratory Dynamics in Critical Care. *J. of Critical Care* 21 (4): A350-A351. Dec 2006.
27. McDunn J.E., **Burykin A**, Schierding W, Cobb J.P., Ghosh B., Stormo G.D., Polpitiya A.D. Plasticity of the Human Innate Immune Response to Acute Infection During Critical Illness: Development of the Riboleukogram. *Critical Care Medicine* 34 (12): A47-A47 183 Sp. Iss. SI Suppl. S Dec 2006.
28. **Burykin, A**, Warshel, A, What Really Prevents Proton Transport through Aquaporin? Charge Self-Energy vs. Proton Wire Proposals. *Abstracts of Papers of the American Chemical Society* 227: U319-U319 397-PHYS Part 2, Mar 28 2004.
29. **Burykin, A**, Warshel, A, What Really Prevents Proton Transport through Aquaporin? Charge Self-Energy vs. Proton Wire Proposals. *Biophysical J.* 86 (1): 612A-612A Part 2 Suppl. S, Jan 2004.
30. **Burykin, A**, M. Kato, A. Warshel, Simulating Ion Current and Selectivity in Realistic Models of the KcsA Potassium Channel. *Abstracts of Papers of the American Chemical Society* 225: U462-U462 193-PHYS Part 2, Mar 2003.
31. **Burykin, A**, Schutz C. N., Villa J., Warshel A., On-the-fly Simulations of Ion Current in Realistic Models of Ion Channels: The KcsA Potassium Channel. *Biophysical J.* 82 (1): 207A-208A 1011 Part 2, Jan 2002.

#### TALKS

1. **Burykin, A.**, Fluctuation-Dissipation Theorem (FDT) Provides a Simple Analytical Relationship between Post-Stress Heart Rate Recovery (HRR) and Heart Rate Variability (HRV) During the Stress. 8<sup>th</sup> International Conference on Complexity in Acute Illness (SCAI) August 28-30, 2009, Palo Alto, CA.
2. **Burykin, A.**, Construction of Asymmetric Functions. DARPA Fundamental Law of Biology (FunBio) Program Meeting. August 20-22, 2008, San Francisco, CA.
3. **Burykin, A.**, , McDunn, J. E, Polpitiya, A. D., Dixon, D., Schierding, W., Ghosh, B., Cobb, J. P. *Principal Component Dynamics of Systemic Inflammation due to Critical Illness and Pneumonia: Evidence for an Immunological Attractor State* Classification Society Annual Meeting, June 11–13, 2009, St. Louis, MO.
4. **Burykin, A.**, Buchman T. G., *Synchronization of Cardio-Respiratory Dynamics in Critically Ill Patients*. American Physical Society Meeting, New Orleans, LA, March 2008.
5. Lu, Y, Deem, M., **Burykin, A.**, Buchman T. G., *Markov Chain Model of Heart Rate Response to Mechanical Ventilation*. American Physical Society Meeting, New Orleans, LA, March 2008.
6. **Burykin, A.**, *How to Model Ion Channels: From Atomic Structure to Single Channel Electrophysiology*. Washington University, Biomedical Engineering Department, Prof. Y. Rudy Group, January 22, 2008, St. Louis, MO (INVITED TALK).
7. **Burykin, A.**, *Synchronization of Cardio-Respiratory Dynamics in Critically Ill Patients*. Center for Neurodynamics, University of Missouri - St. Louis (UMSL), December 7, 2007, St. Louis, MO (INVITED TALK).
8. **Burykin, A.**, *Numerical Analysis of Single & Multi Scale Complexity Measures Using Synthetic Time Series*. DARPA Fundamental Laws of Biology (FunBio) Program (Variability Group) Web Conference. November 3, 2007, WWW.
9. **Burykin, A.**, *Indices of Phase Synchronization*. Time Series Analysis Tutorial (Prof E. Herzog Group), Washington University, September 7, 2007, St. Louis, MO (INVITED TALK).
10. **Burykin, A.**, *Physiological Variability, Complex Adaptive Systems & Fundamental Laws of Biology*. DARPA Fundamental Laws of Biology (FunBio) Program (Variability Group) Meeting, June 25 2007, New York (INVITED TALK).
11. **Burykin, A.**, Buchman T. G. *Cardio-Respiratory Dynamics in Critically Ill Patients*. Systems Analysis Group, Washington University. March 7, 2007 St. Louis, MO. (INVITED TALK)
12. **Burykin, A.**, Buchman T. G., *Cardio-Respiratory Dynamics in Critical Care: Synchronization & Variability*. Dynamics Days 2007. January 6, 2007, Boston, MA.
13. **Burykin, A.**, *Cardio-Respiratory Dynamics in Critically Ill Patients: Synchronization by Mechanical Ventilation*. Washington University, Department of Electrical and Systems Engineering Seminar, November 3, 2006, St. Louis, MO (INVITED TALK).

14. **Burykin, A.** *Cardio-Respiratory Dynamics in Critically Ill Patients: Synchronization and Entrainment*, Washington University, Biomedical Engineering Department, Prof. I. R. Efimov Group, October 9, 2006, St. Louis, MO (INVITED TALK).
15. **Burykin, A.** *Attractors in Microarray Gene Expression Time Series*. Systems Analysis Group, Washington University. May 26, 2006, St. Louis, MO (INVITED TALK).
16. **Burykin, A.**, Adamcsek, B., *Agent-Based Modeling (RePast/Java) of Networks of Logistic Maps with Long-Range Coupling: Synchronization, Pattern Formation and Probability Distributions (Preliminary Results)*. Complex Systems Summer School, June 30, 2005, Santa Fe, NM.
17. **Burykin, A.**, Ernst, G., Seely, A. J. E. *Simulating Changes in Variability and Complexity During Multiple Organ Dysfunctions: A Model of Coupled Stochastic Oscillators*. 3<sup>rd</sup> International Conference on Complexity in Acute Illness, November 7-9, 2004, Pittsburgh, PA.
18. **Burykin, A.**, Braun-Sand, S, Warshel, A. *Stochastic QM/MM Models of Proton Transport in Solution: Empirical Valence Bond Approach*. Graduate Student Symposium, Catalina Island, CA, September 2004.
19. **Burykin, A.**, Ernst, G., Seely, A. J. E. *Role of Altered Variability in Multiple Organ Failure: A Model of Coupled Stochastic Oscillators*. Summer School "Mathematical and Computer Models in Medicine: Disease and Treatment" Santa Fe Institute, Santa Fe, NM, August 5, 2004.
20. **Burykin, A.**, and Warshel, A. *Energetics and Dynamics of Charge Transfer through Membrane Channels*. Graduate Student Symposium, Asilomar, CA, September 2003.
21. **Burykin, A.**, Kato, M, Warshel, A. *Simulating Ion Current and Selectivity in Realistic Models of the KcsA Potassium Channel*. 225<sup>th</sup> National Meeting of American Chemical Society. New Orleans, LA, March 2003 (INVITED TALK).
22. **Burykin, A.**, Schutz, C. N., Villa, J, Warshel, A. *Simulation of Ion Current in KcsA Channel*, Graduate Student Symposium, Catalina Island, CA, September 2001
23. **Burykin, A.**, Evdokimov, A. *On the Application of Object-Oriented Analysis for the Design of Sophisticated Computer Models in Physiology*. XLII MIPT Research Conference, Moscow-Dolgoprudny, Russia, 1999.
24. **Burykin, A.**, Evdokimov, A. *Visual Simulation Environment for Simulation of the Human Body*. XLII MIPT Research Conference, Moscow-Dolgoprudny, Russia, 1999.
25. Evdokimov, A, **Burykin, A.** *On the Data Storage and Representation in Simulation Systems*. XLII MIPT Research Conference, Moscow-Dolgoprudny, Russia, 1999.
26. **Burykin, A.**, Kholodov, A, Evdokimov, A, Budnik, S. *Mathematical Model with Distributed Parameters of Human Body Systems*. XLI MIPT Research Conference, Dolgoprudny, Russia, 1998.
27. **Burykin, A.**, Bykov, V. *Conditions of Conversion of Non-Coherent Radiation to Coherent Radiation on Its Leaving of Thin Layer of Dye by Means of Defocusing*. XLI MIPT Research Conference, Dolgoprudny, Russia, 1998.

## POSTERS

1. **Burykin, A.**, McDunn, J. E, Polpitiya, A. D., Dixon, D., Schierding, W., Ghosh, B., Cobb, J. P. *Evidence for an Immunological Attractor State: Phase Space Dynamics of Systemic Inflammation due to Critical Illness and Pneumonia*. 4<sup>th</sup> Washington University Postdoctoral Scientific Symposium, St. Louis MO, February 26, 2008.
2. **Burykin, A.**, Buchman, T. G. *Mechanical Ventilation of Critically Ill Patients Entrain Cardiac Rhythm and Increases Cardio-Respiratory Synchronization*. American Thoracic Society (ATS) International Conference, San Francisco, CA, May 18, 2007.
3. **Burykin, A.**, McDunn, J. E, Polpitiya, A. D., Dixon, D., Schierding, W., Ghosh, B., Cobb, J. P. *Evidence for an Immunological Attractor State: Phase Space Dynamics of Systemic Inflammation due to Critical Illness and Pneumonia*. American Thoracic Society (ATS) International Conference, San Francisco, CA, May 18, 2007.
4. **Burykin, A.**, Buchman, T. G. *Changes in Cardio-Respiratory Dynamics during Transitions between Mechanical and Spontaneous Ventilation in Critically Ill Patients*. 3<sup>rd</sup> Washington University Postdoctoral Scientific Symposium, St. Louis MO, March 1, 2007.
5. **Burykin, A.**, Buchman, T. G. *Changes in Cardio-Respiratory Dynamics during Transitions between Mechanical and Spontaneous Ventilation in Critically Ill Patients*. 5th International Conference on Complexity in Acute Illness, McLean, VA, October, 2006.

6. **Burykin, A.**, Warshel, A. *Water Filtration Using Carbon Nanotube Membrane*. Institute for Complex Adaptive Matter Workshop: "Multiscale Interactions & Dynamics in Biological Systems". St. Louis MO, May 27, 2006.
7. **Burykin, A.**, Robertson, T. E., Hoertel, J., Buchman, T. G. *Mechanical Ventilation of Critically Ill Patients Entrains Cardiac Rhythm and Increases Cardio-Respiratory Synchronization*. 2<sup>nd</sup> Washington University Postdoctoral Scientific Symposium, St. Louis MO, February 2006.
8. **Burykin, A.**, Warshel, A. *Water Filtration Using Carbon Nanotube Membrane*. AAAS Annual Meeting, St. Louis MO, February 2006.
9. **Burykin, A.**, Braun-Sand, S, Warshel, A. *Stochastic QM/MM Models of Proton Transport in Biological Systems: Empirical Valence Bond (EVB) Approach*. Graduate Student Research Poster Session USC, Los Angeles CA, April 5 2005
10. **Burykin, A.**, Braun-Sand, S, Warshel, A. *Stochastic QM/MM Models of Proton Transport in Solutions: Empirical Valence Bond (EVB) Approach*. American Physical Society Meeting, Los Angeles, CA, March 2005.
11. **Burykin, A.**, Braun-Sand, S, Warshel, A. *Stochastic QM/MM Models of Proton Transport in Biological Systems: Empirical Valence Bond (EVB) Approach*. 49<sup>th</sup> American Biophysical Society Annual Meeting, Long Beach, CA, February 2005.
12. **Burykin, A.**, Ernst, G., Seely, A. *Dynamics of Multiple Organ Systems: A Model of Coupled Stochastic Oscillators*. Dynamics Days 2005. Long Beach, CA, January 7, 2005.
13. **Burykin, A.**, and Warshel, A. *What Really Prevents Proton Transport through Aquaporin? Charge Self-Energy vs. Proton Wire Proposals*. 227<sup>th</sup> National Meeting of American Chemical Society, Anaheim, CA, March 2004.
14. **Burykin, A.**, and Warshel, A. *What Really Prevents Proton Transport through Aquaporin? Charge Self-Energy vs. Proton Wire Proposals*. 48<sup>th</sup> Biophysical Society Annual Meeting, Baltimore, MA, February 2004.
15. Braun-Sand, S, Schutz, C. N., **Burykin, A.**, Warshel A. *What Controls Proton Transport in Biological Systems?* Gordon Research Conference "Isotopes in Biological & Chemical Sciences", Ventura, CA, February 2004.
16. **Burykin, A.**, Warshel, A. *Multi-level Model for Simulation of Ion Current and Selectivity in Single KcsA Potassium Channel: From Atomic Structure to Electrophysiology*. 38<sup>th</sup> Western Regional Meeting of the American Chemical Society, Long Beach, CA, October 15-18 2003.
17. **Burykin, A.**, Schutz, C N, Villa, J, Warshel, A. *Simulations of Ion Current in Realistic Models of Ion Channel: The KcsA Potassium Channel*. 16<sup>th</sup> Symposium of the Protein Society. San Diego CA, August 2002.
18. **Burykin, A.**, Schutz, C N, Villa, J., Warshel, A., *On-the-fly Simulation of Ion Current in Realistic Models of Ion Channels: The KcsA Potassium Channel*. 46<sup>th</sup> Biophysical Society Annual Meeting, San Francisco, February 2002.
19. **Burykin, A.**, Schutz C. N., Villa J., Warshel A. *Simulations of Ion Current in Realistic Models of Ion Channels: The KcsA Potassium Channel*. Graduate Student Research Poster Session, USC, Los Angeles, April 16, 2002.
20. **Burykin, A.**, Villa, J, Schutz, C N, Warshel, A. *Stochastic Dynamics Simulation of Ion Transport in an Ion Channel*. Graduate Student Research Poster Session, USC, Los Angeles, April 23, 2001.