

# CURRICULUM VITAE

**Ruben A. Tikidji – Hamburyan, Ph.D.**

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## **FIELD OF RESEARCH:**

Computational and Theoretical Neuroscience

## **SCIENTIFIC INTERESTS:**

- Information processing and information coding in neural networks.
- Detailed biophysical models of local neural networks. Analysis of neural network dynamics influenced by single neuron dynamical properties (afterpolarization, bursting, postinhibitory rebound, etc.).
- Neuronal mechanisms of sensory perception.
- Formation and stabilization of neuronal assemblies. Development of network connectivity. Synaptic plasticity, spines, back propagated action potential, calcium, and biochemical kinetics.

## **EDUCATION:**

2000 – 2003 Ph.D. in Computer Science (Technical science) at A.B.Kogan Research Institute for Neurocybernetics (KRINC), Southern Federal University (SFedU), Russia;  
Thesis: “Design and Study of Single Neuron Model for Recurrent Medium- and Large-Scale Networks”  
Advisers: Prof. Boris M. Valdimirski (Mathematics and Modeling) and Dr. Lubov N. Podladchikova (Neuroscience)

1986 - 1991 M.Sc.(Diploma) in Physics, SFedU.  
Thesis: "Study of He-Sr Recombination Lasers in a System Generator - Amplifier"  
Advisors: Dr. Leonid M. Bukshpun and Dr. Evgeni L. Latush

### TRAINING:

2017 – 2019 Senior Postdoctoral Researcher in Computational Neuroscience at LSUHSC

2015 – 2017 Senior Postdoctoral Researcher in Computational Neuroscience at the Institute of Massively Parallel Applications and Computer Technologies (IMPACT), School of Engineering and Applied Science (SEAS), George Washington University (GWU), Washington, D.C.

2011 – 2015 Postdoctoral Researcher at LSUHSC

October 2008 Training Course "Methods and Approaches for Modeling Human Colour Appearance" at the School of Engineering and Information Science, Middlesex University, London

### PROFESSIONAL APPOINTMENTS:

2019 to present Senior Researcher Scientist at Department of Physiology & Pharmacology School of Medicine and Health Sciences, George Washington University (GWU), Washington, D.C.

2017 – 2019 Senior Postdoctoral Research Scientist in Computational Neuroscience at LSUHSC

2015 – 2017 Senior Postdoctoral Research Scientist in Computational Neuroscience at IMPACT, SEAS, GWU

2011 – 2015 Postdoctoral Researcher at the Louisiana State University, Health Sciences Center (LSUHSC)

2007 - 2015 Senior Researcher / Principal investigator, KRINC, SFedU

2005 – 2007 Senior Researcher, KRINC, SFedU

2004 – 2005 Researcher, KRINC, SFedU

- 2002 – 2004 Junior Researcher, KRINC, SFedU
- 2000 – 2003 Postgraduate Student, KRINC, SFedU
- 1991 – 2000 Junior Researcher, Research Institute of General Physics, the Russian Academy of Sciences

### PROFESSIONAL ACHIEVEMENTS:

- since 2021 Review Editor in the Editorial Board of *Frontiers in Computational Neuroscience*
- 2019 to present Guest Editor for the Third Special Volume on “Applications of Operations Research for Neuroscience” in *Annals of Operations Research*, Springer.
- 2018 – 2019 Guest Editor for the Second Special Volume on “Applications of Operations Research for Neuroscience” in *Annals of Operations Research*, Springer.
- 2014 – 2017 Guest Editor for a Special Volume on “Applications of Operations Research for Neuroscience” in *Annals of Operations Research*, Springer.
- 2014 – 2018 Reviewer in Proceedings in National Academy of Science (PNAS), Hippocampus and PloS One journals
- 2014 Invited speaker at the Neuroscience Gateway Portal workshop, Washington D.C., 2014.
- 2006 – 2007 Co-investigator in the grant 05-01-00689 “Modeling and Studying the Mechanisms of Choosing the Most Informative Fragments While Viewing Images of Different Types”
- 2005, 2006 Member of review committee of Computational Neurosciences conference
- 2004, 2007 Reviewer in Neurocomputing journal, Elsevier
- 2001 – 2004 Co-investigator in the grant 015.07.01.002 “Study of High-Specificity Neuron Ensembles”, supported by the program “University of Russia”

- 2003 – 2005 Co-investigator in the grant 00-04-48369 "Investigation of Variability Mechanisms of Simple and Complex Spike Activity of the Cerebellar Purkinje Cell", supported by Russian Foundation for Basic Research.
- 2001 – 2002 Co-investigator in the grant 00-04-49344 "Studying Mechanisms of Integration of Inputs of Various Modality to Cerebellum Purkinje Cells with Shared and Different Climbing Fibers", supported by Russian Foundation for Basic Research.

### RESEARCH FUNDING:

- 2005 – 2006 PI of the grant UR.07.01.277 "Study of Neuronal Mechanisms of Multimodal Information Integration by Modeling the Cerebellar Purkinje Cells with Shared Olivary Afferent Fiber", supported by the program "Universities of Russia".
- 2003 – 2004 PI of the grant: "Searching for Clusters in the Multidimensional Biologically Plausible Neural Network", supported by KRINC

### SELECTED WORKSHOPS, SEMINARS, ORAL PRESENTATIONS:

1. **Resonant Interneurons Can Increase Robustness Of Gamma Oscillations.** *UT Austin Conference on Learning & Memory, Austin, 2015*
2. **Microsecond Accuracy in Detection of Interaural Time Differences by Population of Sluggish and Noisy Integrating Neurons: Why Do We Need Large-Scale Network Simulations and Neuroscience Gateway Portal.** *Workshop of Neuroscience Gateway Portal, Washington D.C., 2014*
3. **Resonant Interneurons Make Network Oscillations Robust to Noise and Heterogeneity.** *Seminar at the Neuroscience Center of Excellence, LSUHSC, New Orleans, 2014*
4. **Super Stable Solution and Two Types of Nesting in Feed-Forward, Multifrequencies Oscillatory Networks.** *Phase-Resetting Theory Workshop, Atlanta, 2012*
5. **Theta Entrainment/Modulation of Gamma Modules: Effect of Noise.** *Phase-Resetting Theory Workshop, New Orleans, 2011*
6. **The Necessary and Sufficient Conditions for Population Coding of Interaural Time Differences by Trough-Type Neurons.** *Seminars at the Center for Neural Science (Prof. J. Rinzel's lab), New York University, NY and the Department of Neuroscience, University of Connecticut Health Center, Farmington, CT, 2010*

## TEACHING AND ORGANIZATIONAL EXPERIENCE:

- 2015            Lecturer for Special topic course ANAT 280 at LSUHSC (theoretical and computational neuroscience course)
- 2011, 2012     Founder for “Neuroscience” specialization (a set of courses) at the Summer School “Achievements in Contemporary Mathematics, Informatics and Physics”, The National Technical University "Kyiv Polytechnic Institute" [<http://summerschool.ssa.org.ua>] (AACIMP NTTU KPI), Kyiv, Ukraine.
- 2010            Co-organizer for “Physics, Chemistry and Live Systems” stream AACIMP NTTU KPI, Kyiv, Ukraine
- 2010            Invited lecturer at Moscow Annual Winter School Neuroinformatics-2010, Moscow, Russia.
- 2010            Lecturer at “Neurotechnology” Summer School, BioN (Tempus Program), Moscow, Russia.
- 2006 – 2010    Invited lecturer at AACIMP NTTU KPI, Kyiv, Ukraine
- 2004 – 2013    Scientific adviser for more than 6 undergraduate students and two postgraduate students: Viacheslav A. Vasilkov (PhD in Biophysics) and Irina A. Ischenko (PhD in Physiology).

## HONORS AND AWARDS:

- 2015            Best Abstract and Invited Poster Talk Award at UT Austin Conference on Learning & Memory
- 2007, 2010, 2012    Best Lecturer Award in AACIMP NTTU KPI
- 2004, 2012     Best Research Award in annual SFedU competition of publications
- 2001            "Best Paper Award" at Summer School “Neuroinformatics: Modern Approach”, KRINC, SFedU
- 1989 – 1991    “The Best Student’s Report” Awards at annual student scientific conferences, SFedU

**PROFESSIONAL SKILLS:**

- Specific simulation environments XPP, Neuron (ParallelContext, Neuron+Python), Brian, Genesis, NEST;
- Numerical methods, Applied Mathematics, Probability Theory, Stochastic Dynamical systems;
- Optimization procedures, genetic and evolutionary algorithms, parameters fitting;
- Programming C and C++, Python, Matlab, Euphoria, Bash script, etc.
- Linux parallel programming OpenMP / MPI (OpenMPI, MPICH2)
- Linux parallel environment (slurm, PBS, SGE etc)
- Linux HPC cluster design and system administration (nisms.krinc.ru, beowolf.lsuhsu.edu, etc).

## PUBLICATION LIST

Ruben A. Tikidji – Hamburyan, Ph.D.

### Publications in peer-reviewed journals:

1. **Tikidji-Hamburyan, R.A.\*** Colonnese M.T. (2021) *Polynomial, piecewise-Linear, Step (PLS): a simple, scalable and efficient framework for modeling neurons*. Frontiers in Neuroinformatics **15**:642933.
2. **Tikidji-Hamburyan, R.A.\*** Kropat, E. & Weber, G. (2020) *Preface: operations research in neuroscience II*. Ann Oper Res **289**: 1–4 (preface for the Special Volume on “Applications of Operations Research for Neuroscience II”)
3. **Tikidji-Hamburyan R.A.**, Canavier C.C. (2019) *Shunting Inhibition Improves Synchronization in Heterogeneous Inhibitory Interneuronal Networks with Type 1 Excitability Whereas Hyperpolarizing Inhibition is Better for Type 2 Excitability* eNeuro **7** (3) ENEURO.0464-19.2020
4. **Tikidji-Hamburyan R.A.**, Leonik C.A., Canavier C.C. (2019) *Phase Response Theory Explains Cluster Formation in Sparsely but Strongly Connected Inhibitory Neural Networks and Effects of Jitter due to Sparse Connectivity* J Neurophysiol **121**: 1125–1142
5. Kropat, E., **Tikidji-Hamburyan, R.A.**, Weber, G. W. (2017) *Operations research in neuroscience*. Annals of Operations Research, **258**(1): 1-4 (preface for the Special Volume on “Applications of Operations Research for Neuroscience”)
6. **Tikidji-Hamburyan R.A.\***, Narayana V., Bozkus Z., El-Ghazawi T.A. (2017) *Software for Brain Network Simulations: A Comparative Study* Frontiers in Neuroinformatics **11**: 46
7. Canavier C.C., **Tikidji-Hamburyan R.A.** (2017) *Globally Attracting Synchrony in a Network of Oscillators with All-to-All Inhibitory Pulse Coupling* Phys. Rev. E **95**, 032215
8. **Tikidji-Hamburyan R.A.\***, El-Ghazawi T.A., Triplett J.W. (2016) *Novel Models of Visual Topographic Map Alignment in the Superior Colliculus* PLoS Comput Biol **12**(12): e1005315. doi:10.1371/journal.pcbi.1005315

9. **Tikidji-Hamburyan R.A.**, Martínez J.J., White J.A., Canavier C.C. (2015) *Resonant Interneurons Can Increase Robustness of Gamma Oscillations* J Neurosci **35**(47): 15682-15695
10. Hooper R., **Tikidji-Hamburyan R.A.**<sup>+</sup>, Canavier C.C., Prinz A. (2015) *Feedback Control of Variability in the Cycle Period of a Central Pattern Generator* J Neurophysiol **114**: 2741–2752
11. **Tikidji-Hamburyan R.A.**, Lin E., Gasparini S., Canavier C.C. (2014) *Effect of Heterogeneity and Noise on Cross Frequency Phase-Phase and Phase-Amplitude Coupling*. in Special issue "Computations in oscillating neuronal networks", Network: Computation in Neural Systems **25**(1–2): 38–62
12. Vasilkov V.A., Ischenko I.A., **Tikidji-Hamburyan R.A.**\* (2013) *Modeling of the localization phenomena of the auditory image caused by brain regions dysfunctions*. Biophysics, 2013 **58**(3):547-553.
13. Vasilkov V. A. and **Tikidji-Hamburyan R.A.**\* (2012) *Accurate Detection of Interaural Time Differences by a Population of Slowly Integrating Neurons*. Phys. Rev. Lett. **108**, 138104.
14. Vasilkov V. A. and **Tikidji-Hamburyan R.A.**\* (2010) Study of input jitter influence on interaural time differences sensitivity of EI neuron population Neurocomputers: design and application, 2010, v. 2, 65-72 (in Russian).
15. L.N. Podladchikova, D.G. Shaposhnikov, A.V. Tikidji-Hamburyan, T.I. Koltunova, **R.A. Tikidji-Hamburyan**, V.I. Guskova, A.V. Golovan (2009) *Model-Based Approach to Study of Mechanisms of Complex Image Viewing, Optical Memory & Neural Networks* (Information Optics). v.18 No. 2, pp 114-121
16. Podladchikova L.N., Bondar G.G., Ivlev S.A., **Tikidji-Hamburyan R.A.**, Dunin-Barkowski W.L. (2008) *Activity Dynamics of the Cerebellar Purkinje Cells at Complex Spike Duration Change*. Biophysics v.53 No. 3 - pp.488-494.
17. **Tikidji – Hamburyan R.**\* (2008) *Modification of genetic algorithm based on elite selection for search of biologically plausible neuron model parameters*. Neuroinformatics, electronic journal, v3, 1: 1-12; <http://www.niisi.ru/iont/ni/Journal/V3/N1/TikH.pdf> (in Russian)
18. Tikidji – Hamburyan A., **Tikidji – Hamburyan R.A.**\* (2008) *The model of retinal mechanisms of color bound detection*. Neurocomputers: design and application, 2008, v. 5-6, 48-53 (in Russian).



19. Vasilkov V.A., and **Tikidji-Hamburyan R.A.\*** (2008) *Study of possible mechanisms for short time delay detection by E-I neural population*. Neurocomputers: design and application, 2008, v. 5-6, 18-28 (in Russian).
20. Podladchikova L.N., **Tikidji-Hamburyan R.A.**, Bondar G.G., Gusakova V.I., Ivlev S.A., Dunin-Barkowski W.L. (2004) *Temporal dynamics of activity of "Fast" and "Slow" neurons in the visual cortex and cerebellum*. Neurocomputers: design and application, № 11, pp. 41-49 (in Russian)
21. **Tikidji-Hamburyan R.A.\***, Polevaya S.A. (2004) *Sound-Source Localization by Neural Network Based on Modified Integrate-and-Fire Neuron Model with Autopolarization*. Neurocomputers: design and application, v. 11, pp. 41-49 (in Russian)
22. **Tikidji-Hamburyan R.A.\*** (2002) *Modified integrate-and-fire neuron as basic model for biologically plausible neural network*. Neurocomputers: design and application, v. 7-8, pp. 97-103 (in Russian)..
23. Zinchenko S.P., Latush E.L., Sem M.F., **Tikidji-Hamburyan R.A.** (1992) *Dye laser pumped by He-Sr recombination laser*, Quantum Electronics, 19, № 9, pp. 860 – 861.

\*-corresponding author; + -second first author.

### Conference proceedings:

24. Podladchikova L.N., **Tikidji-Hamburyan R.A.**, Tikidji-Hamburyan A.V., Shevtsova N.A., Vasilkov V.A., Belova E.I., Ishenko I.A. (2011) *Activity synchronization of different neuron types in the columns of the cerebral visual cortex*. Apply nonlinear dynamics (in Russian)
25. **Tikidji-Hamburyan R.A.** (2010) *Detailed modeling of neurons and neuron networks: how to and why*. In. lect. of the Moscow annual winter school, Moscow, pp. 49-104 (in Russian).
26. Ischenko I. A., Vasilkov V. A. and **Tikidji-Hamburyan R. A.** (2010) *Research of influence of internal stochastic processes at primary auditory nuclei neurons system on occurrence in them of phase noise*. In proc. of the Moscow annual conference: Neuroinformatics-2010, Moscow, v. 1, pp. 35-43 (in Russian).

27. Vasilkov V.A., **Tikidji-Hamburyan R.A.** (2009) *Study of robustness of short time delays detection by I-E neurons population with presence of phase noise in input signal.* // In proc. of the XI All-Russian Scientific Conference "Neuroinformatics 2009", Moscow, v.1, pp. 202-210, (in Russian).
28. **Tikidji-Hamburyan R.** (2005) *Method of search for the connection structure by dynamics of elements activity of natural or biological plausible neural network.* In Proc. of the Moscow Annual Conference: Neuroinformatics-2005, Moscow, pp. 116-124 (in Russian).
29. **Tikidji-Hamburyan, R.A.** (2003) *Analysis of the modified "integrate-and-fire" neuron dynamic properties influenced by the spike generator.* In Proc. of the Moscow Annual Conference: Neuroinformatics-2003, Moscow, pp. 123-129 (in Russian).
30. **Tikidji-Hamburyan, R.A.** (2002) *Thalamic circuitry model based on modified "Integrate-and-Fire Neurons".* In Proc. of the 9<sup>th</sup> International Conference on Neural Information Processing, Singapore, pp. 576-581.

### Conference abstracts/presentations:

31. **Tikidji-Hamburyan R.A.** Govindaiah G.I., Guido W., Colonnese M.T. (2021) *Synchrony filtering by electrical synapses in developing thalamus.* Program No. 1353, 2021 Neuroscience Meeting Planner. Chicago, IL.: Society for Neuroscience, 2021. Online.
32. **Tikidji-Hamburyan R.A.** Canavier C.C. (2019) *Mechanisms of inhibitory interneuronal network synchrony for type 1 versus type 2 excitability.* Program No. 336.09, 2019 Neuroscience Meeting Planner. Chicago, IL.: Society for Neuroscience, 2019. Online.
33. **Tikidji-Hamburyan R.A.** Canavier C.C. (2017) *Interneural postinhibitory rebound can mediate gamma oscillations in pyramidal-interneuronal network.* Program No. 83.12, 2017 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2017. Online.
34. Elcin D, **Tikidji-Hamburyan R.A.** Canavier C.C. (2017) *The effect of neural orientation on action potential generation elicited by transcranial magnetic stimulation: a computational study.* Program No. 202.04, 2017 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2017. Online.

35. Canavier C.C., **Tikidji-Hamburyan R.A.** (2016) *Small conduction delays induce global synchrony in sparsely but strongly connected inhibitory networks*. Program No. 462.13, 2016 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2016. Online.
36. **Tikidji-Hamburyan R.A.**, El-Ghazawi T.A., Triplett J.W. (2016) *Theoretical models of visual map alignment in the superior colliculus*. Program No. 678.10, 2016 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2016. Online
37. Combe1 C. L., **Tikidji-Hamburyan R.A.**, Canavier C. C., Gasparini S.(2015) *Frequency-dependent input processing in hippocampal CA1 pyramidal neurons*. Program No. 37.04, 2015 Neuroscience Meeting Planner. Chicago, IL: Society for Neuroscience, 2015. Online.
38. Hooper R., **Tikidji-Hamburyan R.A.**, Canavier C.C., Prinz A. (2014) *Estimation of optimal neuron parameters to obtain minimal variability of periods in an oscillatory hybrid network* Program No. 40.10, 2014 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2014. Online.
39. **Tikidji-Hamburyan R.A.**, Canavier C.C. (2014) *Gamma networks with sparse, random connectivity: sparse synchrony, clustering and the effect of conduction delays*. Program No. 369.10, 2014 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2014. Online.
40. Hooper R., **Tikidji-Hamburyan R.A.**, Canavier C.C., Prinz A. (2014) *Estimation of artificial neuron parameters that obtain a required distribution of coupled system periods in a hybrid network*. BMC Neuroscience, 15(Suppl 1), P64.
41. **Tikidji-Hamburyan R.A.**, Rawls E., Canavier C.C.(2013) *Critical role for noise and resonance in gamma band synchronization*. Program No.425.16 2013 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2013. Online.
42. **Tikidji-Hamburyan R.A.**, Gasparini S., Canavier C.C.(2012). *Two types of theta-gamma nesting in feed-forward oscillatory network*. Program No. 147.04. 2012 Neuroscience Meeting Planner. New Orleans, LA: Society for Neuroscience, 2012. Online.
43. **Tikidji-Hamburyan R.A.**, Canavier C.C(2012) *Theta entrainment of gamma modules: effects of heterogeneity and non-stationarity*. BMC Neuroscience 2012, 13(Suppl 1):P170

44. Vasilkov V. A. and **Tikidji-Hamburyan R.A.**(2011) *Resolution of ITD detection: stochastic vs. exquisite system*. BMC Neuroscience, 2011. - 12(Suppl 1). - P335.
45. Vasilkov V and **Tikidji-Hamburyan R** (2011). *ITDs curve steepness is influenced by stochastic delays in auditory pathways*. Front. Neuroinform. Conference Abstract: 4th INCF Congress of Neuroinformatics.
46. **Tikidji-Hamburyan R.** and Dunin-Barkowski W. (2011) *Flicker-Fusion Frequency For Acoustic Signals* Front. Neuroinform. Conference Abstract: 4th INCF Congress of Neuroinformatics.
47. **Tikidji-Hamburyan R** and Tikidji-Hamburyan A (2009). *Calmodulin-calcium complexes kinetics as a source of nonlinearity for calcium dependent plasticity*. Frontiers in Neuroinformatics. Conference Abstract: 2nd INCF Congress of Neuroinformatics
48. Vasilkov V, Ischenko I and **Tikidji-Hamburyan R** (2009). *A hierarchical neural model sensitive to interaural time differences*. Frontiers in Neuroinformatics. Conference Abstract: 2nd INCF Congress of Neuroinformatics.
49. **Tikidji-Hamburyan R.** (2009) *Nonlinear behavior of kinetics of calmodulin-calcium complexes* // BMC Neuroscience 2009, 10(Suppl 1):P223
50. Vasilkov V.A., Tikidji – Hamburyan R.A. (2009) *Interaural time difference detection by the auditory system model in the presence of phase noise* // BMC Neuroscience 2009, 10(Suppl 1):P314.
51. **Tikidji-Hamburyan R.**, Markin S. (2008) *NeuroCAD - the Modular Simulation Environment for Effective Biologically Plausible Neuromodeling*. BMC Neuroscience 2008, 9(Suppl 1):P91
52. **Tikidji-Hamburyan R.** (2008) *Genetic Algorithm Modification to Speed Up Parameters Fitting of Multicompartment Neuron Model* BMC Neuroscience 2008, 9(Suppl 1):P90
53. Vasilkov V.A., **Tikidji-Hamburyan R.A.** (2008) *Study of additional mechanism of short time delay detection in input signal by the homological neural network*. BMC Neuroscience 2008, 9(Suppl 1):P12
54. **Tikidji-Hamburyan R.** and Polevaya S. (2004) *Sound-source localization by neural network based on modified "Integrate-and-Fire Neuron" model with autopolarization*. In: Computational Neuroscience 2004 Abstracts Book, pp. 96.