

Curriculum Vitae  
**Taro Toyoizumi, Ph.D.**

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## Education

- B.S. Department of Physics, Tokyo Institute of Technology, Japan, March 2001. (Supervisor: Prof. Hidetoshi Nishimori).
- M.S. Department of Complexity Science and Engineering, The University of Tokyo, Japan, March 2003. (Supervisor: Prof. Kazuyuki Aihara).
- Ph.D. Department of Complexity Science and Engineering, The University of Tokyo, Japan, March 2006. (Supervisor: Prof. Kazuyuki Aihara).

## Academic positions

- Visiting JSPS student (DC1) at Wulfram Gerstner Lab, EPFL, Switzerland, from December 2003 to November 2004.
- JSPS Postdoctoral Research Fellow at Shun-ichi Amari Lab, RIKEN Brain Science Institute, Japan, from April 2006 to August 2006.
- JSPS Postdoctoral Research Fellow (from September 2006 to February 2008) and The Patterson Trust Postdoctoral Fellow (from March 2008 to February 2010) at Kenneth D. Miller Lab and L. F. Abbott Lab, Columbia University, USA.
- Special Postdoctoral Researcher at Shun-ichi Amari Lab, RIKEN Brain Science Institute, Japan, from April 2010 to March 2011.
- Adjunct Associate Professor, Department of Computational Intelligence and Systems Science, Tokyo Institute of Technology, Japan, from April 2013 to March 2016.

- Laboratory Head, Laboratory for Neural Computation and Adaptation, Brain Science Institute (RIKEN, Japan) from April 2011 to April 2018.
- Team Leader, Laboratory for Neural Computation and Adaptation, Center for Brain Science (RIKEN, Japan) from April 2018.

## Honors

- The International Neural Network Society, Young Investigator Award, 2008.
- The Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology, The Young Scientists' Prize 2016

## Professional activities

- *Scientific Reports*, Editorial Board 2016-
- *F1000Prime, Theoretical & Computational Neuroscience*, Faculty Member 2017-
- *Neural Networks*, Editorial Board 2012-
- *Network: Computation in Neural Systems*, Editorial Board 2012-
- *Frontiers in Computational Neuroscience*, Review Editor 2009-
- *Frontiers in Computational Neuroscience*, Associate Editor 2017-
- *Organization for Computational Neuroscience*, Program Committee 2014-2016
- *Organization for Computational Neuroscience*, Board of Directors 2017-2019
- *HFSP Fellowship*, Review Committee 2016

# Publication

1. H. Okazaki, A. Hayashi-Takagi, A. Nagaoka, M. Negishi, H. Ucar, S. Yagishita, K. Ishii, T. Toyozumi, K. Fox, and H. Kasai, *Neuroscience Letters* 671, 99-102 (2018). "Calcineurin knockout mice show a selective loss of small spines."
2. C. L. Buckley and T. Toyozumi, *PLOS Computational Biology* 14, e1005926 (2018). "A theory of how active behavior stabilizes neural activity: neural gain modulation by closed-loop environmental feedback"
3. T. Isomura and T. Toyozumi, *Scientific Reports* 8, 1835 (2018). "Error-Gated Hebbian Rule: A Local Learning Rule for Principal and Independent Component Analysis"
4. T. Danjo, T. Toyozumi, and S. Fujisawa, *Science* 359, 213-218 (2018). "Spatial representations of self and other in the hippocampus"
5. Ł. Kuśmierz and T. Toyozumi, *Physical Review Letters* 119, 250601 (2017). "Emergence of Lévy walks from second order stochastic optimization"
6. Ł. Kuśmierz, T. Isomura, and T. Toyozumi, *Current Opinion in Neurobiology* 46, 170-177 (2017). "Learning with three factors: modulating Hebbian plasticity with errors"
7. S. Tajima, T. Mita, D. Bakkum, H. Takahashi, and T. Toyozumi, *Proc. Natl. Acad. Sci. USA* 114, 9517-9522 (2017). "Locally embedded presages of global network bursts"
8. T. Keck, T. Toyozumi, L. Chen, B. Doiron, D. E. Feldman, K. Fox, W. Gerstner, P. G. Haydon, M. Hubener, H.-K. Lee, J. E. Lisman, T. Rose, F. Sengpiel, D. Stellwagen, M. P. Stryker, G. G. Turrigiano, M. C. van Rossum, *Philosophical Transaction of the Royal Society B* 372, 1715 (2017). "Integrating Hebbian and homeostatic plasticity: the current state of the field and future research directions"
9. V. Jacob, A. Mitani, T. Toyozumi, and K. Fox, *Journal of Neurophysiology*, 117, 4-17 (2017). "Whisker row deprivation affects the flow of sensory information through rat barrel cortex"
10. H. Huang and T. Toyozumi, *Physical Review E* 94, 062310 (2016). "Unsupervised feature learning from finite data by message passing: discontinuous versus continuous phase transition"

11. M. Lankarany, J. Heiss, I. Lampl, and T. Toyoizumi, *Frontiers in Computational Neuroscience*, 10:110 (2016). "Simultaneous Bayesian estimation of excitatory and inhibitory synaptic conductances by exploiting multiple recorded trials"
12. T. Isomura and T. Toyoizumi, *Scientific Reports* 6, 28073 (2016). "A local learning rule for independent component analysis"
13. H. Huang and T. Toyoizumi, *Physical Review E* 93, 062416 (2016). "Clustering of neural code words revealed by a first-order phase transition"
14. S. Tajima, T. Yanagawa, N. Fujii, and T. Toyoizumi, *PLOS Computational Biology* 11, e1004537 (2015). "Untangling brain-wide dynamics in consciousness by cross-embedding"
15. H. Huang and T. Toyoizumi, *Physical Review E* 91, 050101 (2015). "Advanced mean field theory of restricted Boltzmann machine"
16. H. Shimazaki, K. Sadeghi, T. Ishikawa, Y. Ikegaya, and T. Toyoizumi, *Scientific Reports* 5, 9821 (2015). "Simultaneous silence organizes structured higher-order interactions in neural populations."
17. T. Toyoizumi and H. Huang, *Physical Review E* 91, 032802 (2015). "Structure of attractors in randomly connected networks"
18. T. Toyoizumi, M. Kaneko, M. P. Stryker, and K. D. Miller, *Neuron* 84, 497-510 (2014). "Modeling the dynamic interaction of Hebbian and homeostatic plasticity"
19. S. Tajima and T. Toyoizumi, *Seitai-no-Kagaku* 65, 478-479 (2014). "Understandig large-scale dynamical systems by the embedding theorem" (in Japanese)
20. T. Toyoizumi, H. Miyamoto, Y. Yazaki-Sugiyama, N. Atapour, T. K. Hensch, and K. D. Miller, *Neuron* 80, 51-63 (2013). "A theory of the transition to critical period plasticity: inhibition selectively suppresses spontaneous activity"
21. M. Lankarany, W. P. Zhu, M. N. S. Swamy, T. Toyoizumi, *Frontiers in Computational Neuroscience* 7:109 (2013). "Inferring trial-to-trial excitatory and inhibitory synaptic inputs from membrane potential using Gaussian Mixture Kalman Filtering"
22. S. Amari, H. Ando, T. Toyoizumi, and N. Masuda, *Physical Review E* 87, 022814 (2013). "State concentration exponent as a measure of quickness in Kauffman-type networks"

23. T. Toyoizumi, *Neural Computation* 24, 2678-2699 (2012). "Nearly extensive sequential memory lifetime achieved by coupled nonlinear neurons"
24. T. Toyoizumi and L. F. Abbott, *Physical Review E* 84, 051908 (2011). "Beyond the edge of chaos: Amplification and temporal integration by recurrent networks in the chaotic regime"
25. J. Gjorgjieva, T. Toyoizumi and S. J. Eglen, *PLoS Computational Biology* 5, e1000618 (2009). "Burst-time-dependent plasticity robustly guides ON/OFF segregation in the lateral geniculate nucleus"
26. T. Toyoizumi and K. D. Miller, *Journal of Neuroscience* 29, 6514-6525 (2009). "Equalization of ocular dominance columns induced by an activity-dependent learning rule and the maturation of inhibition"
27. T. Toyoizumi, K. Rahnema Rad and L. Paninski, *Neural Computation* 21, 1203-1243 (2009). "Mean-field approximations for coupled populations of generalized linear model spiking neurons with Markov refractoriness"
28. Y. Sato, T. Toyoizumi and K. Aihara, *Neural Computation* 19, 3335-3355 (2007). "Bayesian inference explains perception of unity and ventriloquism aftereffect: identification of common sources of audiovisual stimuli."
29. D. Sussillo, T. Toyoizumi and W. Maass, *Journal of Neurophysiology* 97, 4079-4095 (2007). "Self-tuning of neural circuits through short-term synaptic plasticity"
30. T. Toyoizumi, J.-P. Pfister, K. Aihara and W. Gerstner, *Neural Computation* 19, 639-671 (2007). "Optimality Model of Unsupervised Spike-Timing-Dependent Plasticity: Synaptic Memory and Weight Distribution"
31. T. Toyoizumi, K. Aihara and S. Amari, *Physical Review Letters* 97, 098102 (2006). "Fisher Information for Spike-Based Population Decoding"
32. T. Toyoizumi and K. Aihara, *Journal of the Society of Instrument and Control Engineers* 45, 741-747 (2006). "A Synaptic Plasticity Rule Derived Based on the Information Maximization Principle and Firing Rate Control" (A review in Japanese)
33. J.-P. Pfister, T. Toyoizumi, D. Barber and W. Gerstner, *Neural Computation* 18, 1318-1348 (2006). "Optimal Spike-Timing Dependent Plasticity for Precise Action Potential Firing"

34. T. Toyoizumi and K. Aihara, International Journal of Bifurcation and Chaos 16, 129-136 (2006). "Generalization of the mean-field method for power-law distributions"
35. T. Toyoizumi, J.-P. Pfister, K. Aihara and W. Gerstner, Proc. Natl. Acad. Sci. USA 102, 5239-5244 (2005). "Generalized Bienenstock-Cooper-Munro rule for spiking neurons that maximizes information transmission"
36. T. Toyoizumi, J.-P. Pfister, K. Aihara and W. Gerstner, Advances in Neural Information Processing Systems 17, 1409-1416 (2005). "Spike-timing dependent Plasticity and mutual information maximization for a spiking neuron model"
37. T. Toyoizumi and K. Aihara, Transactions of the Institute of Electronics 86-D2, 959-965 (2003). "Mean-field and Variational Methods for alpha-families"
38. T. Sasamoto, T. Toyoizumi and H. Nishimori, Journal of Physics A 34, 9555-9567 (2001). "Statistical mechanics of an NP-complete problem : Subset sum"