

## Tiberiu Teşileanu

Initiative for the Theoretical Sciences  
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- Education**
- CUNY Graduate Center** New York, NY *Aug 2014 – present*  
Postdoctoral fellow with the Initiative for the Theoretical Sciences.
- University of Pennsylvania** Philadelphia, PA *Dec 2014 – present*  
Visiting scholar with the Biophysics Group.
- Institute for Advanced Study** Princeton, NJ *Sep 2011 – Aug 2014*  
Postdoctoral member in the School of Natural Sciences, working in the Simons Center for Systems Biology.
- Rockefeller University** New York, NY *Mar 2012 – Feb 2013*  
Visiting fellow in Professor Stanislas Leibler's lab.
- Princeton University** Princeton, NJ *Sep 2006 – Aug 2011*  
PhD in theoretical high-energy physics under the supervision of Professor Igor Klebanov, working on the AdS/CFT duality in string theory. Thesis title: "Charged Black Holes and the AdS/CFT Correspondence".
- Jacobs University** Bremen, Germany *Sep 2003 – Jun 2006*  
Bachelor's degree in physics, with electives in mathematics, electrical engineering, and computer science.
- Research Experience**
- Efficient coding of speech sounds** UPenn (Philadelphia, PA) *Jun 2017 – present*  
Identifying statistical features that distinguish speech from other environmental sounds. Using these features to develop predictions for how the auditory system in humans is adapted to speech.
- Predicting mutation effects** CUNY Graduate Center (New York, NY) *May 2017 – present*  
Working on a regression technique for predicting the fitness effect of mutations in proteins by combining multiple sequence alignments with a small set of fitness measurements.
- Timescales in behavior** CUNY Graduate Center (New York, NY) *Sep 2016 – present*  
Developing a framework for building behavioral models that exhibit long-timescale correlations, and fitting these models to data. Looking in particular at hidden Markov models and dynamical systems.

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**Olfactory receptor distribution** CUNY Graduate Center (NY) *Apr 2016 – present*

Working out predictions for the distribution of olfactory receptors in the mammalian nose assuming that it is adapted to maximize information regarding odorant concentrations in the environment. Developing dynamical models for the population of sensory neurons that solve the optimization problem.

**Visual textures** CUNY Graduate Center (New York, NY) *Sep 2015 – present*

Investigating the natural statistics of visual textures, defined in terms of 1-, 2-, 3-, and 4-point correlations, and analyzing the differences in statistics for different classes of objects. Making predictions regarding the adaptation of the human visual pathway to these natural statistics. Using texture information to improve the determination of the “gist” of a scene without the need for parsing objects.

**Birdsong** CUNY Graduate Center (New York, NY) *Sep 2014 – Sep 2016*

Developed a model of two-stage learning in the bird brain, in which one brain region adapts to the plasticity properties of a different region. Tested the findings in simulations of rate-based and spiking neural networks, and compared spiking patterns from the model to recordings from singing birds at various ages.

**CRISPR bacterial immunity** CUNY Graduate Center (NY) *Sep 2014 – Oct 2015*

Developed mathematical models to gain insight into the functioning and design of the CRISPR immune system in bacteria and archaea. Found conditions for establishing a coexistence state between bacteria and phage.

**Protein families** Institute for Advanced Study (Princeton, NJ) *Sep 2011 – Jul 2014*

Employed methods from statistics, random matrix theory, and statistical physics to study the relation between protein evolution and protein function and structure. Worked on extending some of this work to nucleic acids and to interactions between proteins and nucleic acids.

**Transcriptional regulation** Princeton Univ. (Princeton, NJ) *Nov 2010 – Jul 2011*

Worked on quantitative models of transcriptional regulation based on high-throughput assay data. Worked on developing a C++ framework for the automatic inference of thermodynamic models of transcription factor binding.

**String theory** Princeton University (Princeton, NJ) *Sep 2006 – Aug 2011*

Studied the AdS/CFT correspondence in string and M theory. Explored connections between string theory and condensed matter physics. Searched for approximate solutions for random matrix models related to gauge/gravity duals.

**Neutrino physics** Gran Sasso National Lab (l'Aquila, Italy) *Jun 2006 – Aug 2006*

Developed methods for discriminating between  $\alpha$  and  $\beta$  radioactive events in the neutrino detector Borexino. Worked on improving position reconstruction. Wrote a program for the visualization of events in the detector in three dimensions plus time.

**High-pressure physics** University of Missouri, Kansas City *Summer 2005*

Performed spectroscopy on nanocrystalline and negative thermal expansion materials under high pressures.

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**Astrophysics** Jacobs University (Bremen, Germany) *Sep 2005 – Jun 2006*  
Worked on an efficient algorithm for calculating multipole vectors using an expansion in Bloch states. Employed this algorithm to shed light on the quadrupole-octopole alignment problem for the cosmic microwave background radiation.

**Language dynamics** Jacobs University (Bremen, Germany) *Jan 2004 – Aug 2005*  
Worked on models describing the temporal and spatial dynamics of human languages.

- Publications T. Teşileanu, B. Ölveczky, V. Balasubramanian. *Rules and mechanisms for efficient two-stage learning in neural circuits*. eLife **6**: e20944 (2017). [arXiv:1608.08040].
- S. Bradde, M. Vucelja, T. Teşileanu, V. Balasubramanian. *Dynamics of adaptive immunity against phage in bacterial populations*. PLoS Comput. Biol. **13**(4): e1005486 (2017). [arXiv:1510.06082].
- T. Teşileanu, L. J. Colwell, and S. Leibler. *Protein sectors: statistical coupling analysis versus conservation*. PLoS Comput. Biol. **11**(2): e1004091 (2015) [arXiv:1405.7081].
- A. Melnikov, A. Murugan, X. Zhang, T. Teşileanu, L. Wang, P. Rogov, S. Feizi, A. Gnirke, C. G. Callan Jr., J. B. Kinney, M. Kellis, E. S. Lander, and T. S. Mikkelsen. *Systematic dissection and optimization of inducible enhancers in human cells using a massively parallel reporter assay*. Nature Biotechnology **30**, 271–277 (2012).
- C. P. Herzog, I. R. Klebanov, S. S. Pufu, and T. Teşileanu. *Multimatrix models and tri-Sasaki Einstein spaces*. Phys. Rev. D **83**, 046001 (2011) [arXiv:1011.5487].
- I. R. Klebanov, S. S. Pufu, and T. Teşileanu. *Membranes with topological charge and  $AdS_4/CFT_3$  correspondence*. Phys. Rev. D **81**, 125011 (2010) [arXiv:1004.0413].
- C. P. Herzog, I. R. Klebanov, S. S. Pufu, and T. Teşileanu. *Emergent quantum near-criticality from baryonic black branes*. JHEP **1003**, 093 (2010) [arXiv:0911.0400].
- S. S. Gubser, C. P. Herzog, S. S. Pufu, and T. Teşileanu. *Superconductors from Superstrings*. Phys. Rev. Lett. **103**, 141601 (2009) [arXiv:0907.3510].
- R. C. Helling, P. Schupp, and T. Teşileanu. *CMB statistical anisotropy, multipole vectors and the influence of the dipole*. Phys. Rev. D **74**, 063004 (2006) [arXiv:astro-ph/0603594].
- T. Teşileanu and H. M.-Ortmanns. *Competition of Languages and their Hamming Distance*. International Journal of Modern Physics C **17**, issue 3 (2006) [arXiv:physics/0508229].

## Tiberiu Teşileanu

Teaching Experience	<b>University of Pennsylvania</b> Philadelphia, PA <i>Apr 2017 – Aug 2017</i> Co-advised several undergraduate students on biophysics projects including: using textures to infer the gist of a visual scene; using deep learning to model the processing of signals from retinal ganglion cells; and modeling the optimal immune repertoire for bacterial populations that are protected by the CRISPR immune system.
	<b>University of Pennsylvania</b> Philadelphia, PA <i>Apr 2016 – Aug 2016</i> Co-advised an undergraduate physics student on a biophysics project related to the CRISPR immune system in bacteria. The project involved analyzing the relation between the distribution of CRISPR spacers and the survival probability of a bacterial colony under attack from a given distribution of viruses.
	<b>University of Pennsylvania</b> Philadelphia, PA <i>Apr 2016</i> Taught the synaptic plasticity and learning section of the Theoretical Neuroscience course aimed for graduate and advanced undergraduate students.
	<b>Princeton University</b> Princeton, NJ <i>Sep 2007 – Jan 2010</i> Graded homework and held problem sessions for various courses, including General Physics, Analytical Mechanics, Quantum Mechanics, junior Electromagnetism, and an introductory class on String Theory.
	<b>Jacobs University</b> Bremen, Germany <i>Sep 2003 – Jun 2006</i> Graded homework and held problem sessions for Mathematical Methods for Physics and Engineering, Introductory and Advanced Quantum Mechanics, and Introductory Quantum Field Theory.
Talks and posters	<b>APS March Meeting</b> New Orleans, LA <i>Mar 2017</i> Environmental adaptation of olfactory receptor distributions (talk).
	<b>Comp. and Systems Neuroscience (Cosyne)</b> Salt Lake City, UT <i>Mar 2017</i> Environmental adaptation of olfactory receptor distributions (poster).
	<b>Society for Neuroscience</b> San Diego, CA <i>Nov 2016</i> Matching tutor to student: rules and mechanisms for efficient two-stage learning in neural circuits (poster).
	<b>APS March Meeting</b> Baltimore, MD <i>Mar 2016</i> Matching tutors and students: effective strategies for information transfer between circuits (talk).
	<b>Comp. and Systems Neuroscience (Cosyne)</b> Salt Lake City, UT <i>Feb 2016</i> Matching tutors and students: effective strategies for information transfer between circuits (poster).
	<b>Janelia Research Campus – Neurotheory workshop</b> Ashburn, VA <i>Nov 2015</i> Matching tutors and students: effective strategies for information transfer between circuits (talk).

## Tiberiu Teşileanu

**University of Pennsylvania – CNI group meetings** Philadelphia, PA *Sep 2015*  
Modeling two-stage learning in birdsong (talk).

**Awards** **Teaching Award** Princeton University (Princeton, NJ) *2008*  
Received the Physics Department teaching award.

**International Physics Olympiads** UK, Turkey, Indonesia *2000 – 2002*  
Awarded a silver medal and an honorable mention.

**Computer Skills** **Programming languages**

Python	Matlab	C++
Mathematica	C	Javascript
HTML	Haskell	Fortran

Experienced with multithreading and parallel computing (using MPI). Machine learning with scikit-learn, Keras, and TensorFlow. Worked extensively on various flavors of Linux, Mac OS, and Windows.

**Languages** **Romanian** Native **English** Fluent  
**Italian** Basic **Spanish** Basic

**References** **Vijay Balasubramanian** Cathy and Marc Lasry Professor  
University of Pennsylvania, Philadelphia, PA 19104  
vijay@physics.upenn.edu

**Stanislas Leibler** Gladys T. Perkin Professor, Systems Biology Professor  
Rockefeller University, New York, NY 10065  
Institute for Advanced Study, Princeton, NJ 08540  
livingmatter@rockefeller.edu

**Jonathan D. Victor** Professor, Brain and Mind Research Inst. and Dept. of Neurology  
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