

Thomas Jiaxian Li

Curriculum Vitae

Education

- 2011–2015 Ph.D. Degree in Applied Mathematics, *Department of Mathematics and Computer Science, University of Southern Denmark, Odense, Denmark.*
Dissertation Title: *Combinatorics of shapes, topological RNA structures and RNA-RNA interactions.* Supervised by Prof. Christian M. Reidys.
- 2008–2011 Master&Ph.D. Program in Discrete Mathematics, *Center for Combinatorics, Nankai University, Tianjin, China.*
- 2004–2008 Bachelor Degree in Mathematics, *Department of Mathematics, Nankai University, Tianjin, China.*
Special Class in mathematics founded by Shiing-Shen Chern

Work Experience

- 2021–present Research Scientist, *Biocomplexity Institute, University of Virginia, Charlottesville, United States.*
- 2018–2020 Senior Research Associate, *Biocomplexity Institute, University of Virginia, Charlottesville, United States.*
- 2015–2018 Postdoctoral Research Associate, *Virginia Bioinformatics Institute, Virginia Tech, Blacksburg, United States.*

Research Interests

Discrete mathematics
Bioinformatics and computational biology
RNA secondary structure, RNA pseudoknot, RNA-RNA interaction
RNA sequence, structure, evolution and phylogenetic implications
Topology of large data sets

Publications

- [1] Barrett, C., Bura, A., He, Q., Huang, FW, **Li, T.J.X.** and Reidys, C.M. (2023) [Motifs in SARS-CoV-2 evolution.](https://doi.org/10.1101/2023.01.27.525936) Available from: <https://doi.org/10.1101/2023.01.27.525936>. Submitted to RNA, under review.
- [2] Barrett, C., Huang, FW, **Li, T.J.X.**, Warren, A. and Reidys, C.M. (2022) [Rapid threat detection in SARS-CoV-2.](https://doi.org/10.1101/2022.08.05.22278480) Available from: <https://doi.org/10.1101/2022.08.05.22278480>. Submitted to PLOS ONE, under review.

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- [3] Bura, A., Dutta, N., **Li, T.J.X.** and Reidys, C.M. (2022) [A computational framework for weighted simplicial homology](#). Available from: arXiv:2206.04612. Submitted to Journal of Symbolic Computation, under review.
- [4] **Li, T.J.X.** and Reidys, C.M. (2022) [On Weighted Simplicial Homology](#). Available from: arXiv:2205.03435. Submitted to Rocky Mountain Journal of Mathematics, under review.
- [5] Barrett, C., Bura, A., He Q., Huang, FW, **Li, T.J.X.** and Reidys, C.M. (2021) [Buying time: detecting VOCs in SARS-CoV-2 via co-evolutionary signals](#). Available from: <https://doi.org/10.1101/2022.07.21.500897>. bioRxiv.
- [6] **Li, T.J.X.** and Reidys, C.M. (2021) [On the Loop Homology of a Certain Complex of RNA Structures](#). *Mathematics*, 9(15):1749.
- [7] Barrett, C., Bura, A., He Q., Huang, FW, **Li, T.J.X.**, Waterman, M. and Reidys, C.M. (2021) [Multiscale feedback loops in SARS-CoV-2 viral evolution](#). *Journal of Computational Biology*, 28(3):248–256.
- [8] **Li, T.J.X.** and Reidys, C.M. (2020) [On an enhancement of RNA probing data using Information Theory](#). *Algorithms for Molecular Biology*, 15: 15.
- [9] **Li, T.J.X.**, Burris, C. S., and Reidys, C.M. (2019) [The block spectrum of RNA pseudoknot structures](#). *Journal of Mathematical Biology*, 79(3): 791–822.
- [10] **Li, T.J.X.** and Reidys, C.M. (2018) [From unicellular fatgraphs to trees](#). Available from: <https://doi.org/10.48550/arXiv.1806.03319>. arXiv.
- [11] **Li, T.J.X.** and Reidys, C.M. (2018) [The rainbow spectrum of RNA secondary structures](#). *Bulletin of Mathematical Biology*, 80(6):1514–1538.
- [12] **Li, T.J.X.** and Reidys, C.M. (2017) [Statistics of topological RNA structures](#). *Journal of Mathematical Biology*, 74(7):1793–1821.
- [13] Barrett, C. L., **Li, T.J.X.** and Reidys, C.M. (2016) [RNA secondary structures having a compatible sequence of certain nucleotide ratios](#). *Journal of Computational Biology*, 23(11):857–873.
- [14] **Li, T.J.X.** and Reidys, C.M. (2015) [A combinatorial interpretation of the \$\kappa_g^*\(n\)\$ coefficients](#). arXiv preprint, arXiv:1406.3162.
- [15] Han, H.S.W., **Li, T.J.X.** and Reidys, C.M. (2014) [Combinatorics of \$\gamma\$ -structures](#). *Journal of Computational Biology*, 21:591–608.
- [16] **Li, T.J.X.** and Reidys, C.M. (2013) [The topological filtration of \$\gamma\$ -structures](#). *Mathematical Biosciences*, 241(1):24–33.
- [17] **Li, T.J.X.** and Reidys, C.M. (2012) [Combinatorics of RNA-RNA interaction](#). *Journal of Mathematical Biology*, 64(3):529–556.
- [18] **Li, T.J.X.** and Reidys, C.M. (2011) [Combinatorial analysis of interacting RNA molecules](#). *Mathematical Biosciences*, 233(1):47–58.

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Conferences

- 2019, Oct International Symposium on Biomathematics and Ecology Education and Research (BEER19), University of Wisconsin, La Crosse, USA, Invited Talk, Title: [On an Enhancement of RNA Probing Data Using Information Theory](#).
- 2019, Apr Quantitative and Computational Biology Colloquium, University of Southern California, USA, Invited Talk, Title: [Exploring large RNA secondary structures via information theory](#).
- 2017, July SIAM: SIAM Conference on Applied Algebraic Geometry (AG17), Atlanta, USA, Title: [Statistics of Topological RNA Structures](#).
- 2016, June SIAM: SIAM Conference on Discrete Mathematics (DM16), Atlanta, USA, Title: [Analyzing RNA Secondary Structures with Fixed Percentage of Bases](#).
- 2014, Sep Significance of Knotted Structures for Function of Proteins and Nucleic Acids, *Thematic Meeting of the Biophysical Society*, Warsaw, Poland, Poster Presentation: [A combinatorial interpretation of the \$\kappa_g^*\(n\)\$ coefficients](#).
- 2014, June The 25th International Conference on Probabilistic, Combinatorial and Asymptotic Methods for the Analysis of Algorithms (AofA 2014), Paris, France.
- 2013, July Topology Driven Methods for Complex Systems (TOPDRIM), San Benedetto del Tronto, Italy, Talk title: [Bijections on planar bicellular maps](#).

Professional Activities

- 2015–present **Reviewer for academic journals and databases**, Computational and Mathematical Biophysics, Journal of Theoretical Biology, Mathematics, Non-Coding RNA, Entropy, Axioms, Symmetry, Mathematical Reviews, Zentralblatt MATH Open.
- 2015–present **Grant Writing**, Biocomplexity Institute, University of Virginia & Virginia Tech, I have experience in writing proposals for NSF, NIH, Simons Foundation, CDC, VDH, and DARPA.
- 2018–present **Software Developer**, Biocomplexity Institute, University of Virginia, I developed a software package `RNAstructureIdentifier` for identifying the target secondary structure from an RNA structure ensemble. I worked with my colleagues on implementing a Python software package `WeightedSimplicialHomology` for computing weighted simplicial homology over a discrete valuation ring.
- 2017–2018 **Graduate Student Mentor**, Virginia Tech, I mentored graduate student Christina Burris on her master thesis: *Analytic Combinatorics Applied to RNA Structures*.
- 2013–2015 **Project Participation**, University of Southern Denmark, I participated in the ERC project TOPDRIM (Topology Driven Methods for Complex Systems).
- 2011–2015 **Teaching Assistant**, University of Southern Denmark, I taught the following courses: Measure and Integration Theory, Linear algebra, Rings and Number Theory, Algebra, Representation theory, Probability theory I&II, Geometry of Surfaces, Current topics in geometry, Algebraic topology, Combinatorics.

Computer Skills

Proficient at C, Maple, Mathematica, Matlab, Python, Sage, R, SPSS, LaTeX.

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