Qijun He

Curriculum Vitae

Positions

2021 - present	**Research Scientist**, *Biocomplexity Institute and Initiative, University of Virginia*, Charlottesville, VA.
2018 - 2021	**Postdoc Associate**, *Biocomplexity Institute and Initiative, University of Virginia*, Charlottesville, VA, Advisor: Christian Reidys.
2016 - 2018	**Postdoc Associate**, *Biocomplexity Institute of Virginia Tech*, Blacksburg, VA, Advisor: Christian Reidys.

Education

2016	**Ph.D., Mathematical Sciences**, *Clemson University*, Clemson, SC. 4.0 GPA, Advisor: Matthew Macauley.
2012	**M.S., Mathematical Sciences**, *Clemson University*, Clemson, SC.
2010	**B.S., Mathematics**, *Zhejiang University*, Hangzhou, Zhejiang.

Awards

2014	**Outstanding in Teaching Award**, *Department of Mathematical Sciences*, Clemson University.

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Publications

Refereed journal publications:

1. Barrett C, Bura A, He Q, Huang F, Reidys C. The arithmetic topology of genetic alignments. Journal of Mathematical Biology. 2023 Mar;86(3):34.

2. Bura AC, He Q, Reidys CM. Loop homology of bi-secondary structures II. Journal of Algebraic Combinatorics. 2022 Nov;56(3):785-98.

3. Bura A, He Q, Reidys C. Weighted Homology of Bi-Structures over Certain Discrete Valuation Rings. Mathematics. 2021 Mar 31;9(7):744.

4. Barrett, C., Bura, A. C., He, Q., Huang, F. W., Li, T. J., Waterman, M. S., and Reidys, C. M., 2021. Multiscale feedback loops in SARS-CoV-2 viral evolution. Journal of Computational Biology, 28(3), 248-256.

5. Bura, A.C., He, Q. and Reidys, C.M., 2021. Loop homology of bi-secondary structures. Discrete Mathematics, 344(6), p.112371.

6. Bura, A.C., He, Q. and Reidys, C., 2021. Weighted homology of bi-Structures over certain discrete valuation rings. Mathematics, 9(7), p.744.

7. Barrett, C., Bura, A.C., He, Q., Huang, F.W., Li, T.J., Waterman, M.S. and Reidys, C.M., 2021. Multiscale feedback loops in SARS-CoV-2 viral evolution. Journal of Computational Biology, 28(3), pp.248-256.

8. Dimitrova, E., He, Q., Robbiano, L. and Stigler, B., 2020. Small Gröbner fans of ideals of points. Journal of Algebra and Its Applications, 19(05), p.2050087.

9. He, Q., Huang, F.W., Barrett, C. and Reidys, C.M., 2019. Genetic robustness of let-7 miRNA sequence-structure pairs. RNA, 25(12), pp.1592-1603.

10. He, Q., Dimitrova, E.S., Stigler, B. and Zhang, A., 2019. Geometric characterization of data sets with unique reduced Gröbner bases. Bulletin of mathematical biology, 81(7), pp.2691-2705.

11. Barrett, C., He, Q., Huang, F.W. and Reidys, C.M., 2019. A Boltzmann Sampler for 1-Pairs with Double Filtration. Journal of Computational Biology, 26(3), pp.173-192.

12. Barrett, C., He, Q., Huang, F.W. and Reidys, C.M., 2018. An efficient dual sampling algorithm with Hamming distance filtration. Journal of Computational Biology, 25(11), pp.1179-1192.

13. He, Q. and Macauley, M., 2016. Stratification and enumeration of boolean functions by canalizing depth. Physica D: Nonlinear Phenomena, 314, pp.1-8.

Book chapters:

1. He, Q., Macauley, M. and Poznanović, S., 2017. Topics in mathematical biology: RNA folding. Handbook of discrete and combinatorial mathematics (pp. 1475-1482). CRC press.

2. Drellich, E., Gainer-Dewar, A., Harrington, H., He, Q., Heitsch, C.E. and Poznanović, S., 2017. Geometric combinatorics and computational molecular biology: Branching polytopes for RNA sequences. Algebraic and Geometric Methods in Applied Discrete Mathematics; Harrington, HA, Mohamed Omar, MW, Eds, pp.137-154.

3. He, Q., Macauley, M. and Davies, R., 2015. RNA secondary structures: combinatorial models and folding algorithms. In Algebraic and Discrete Mathematical Methods for Modern Biology (pp. 321-345). Academic Press.

4. He, Q., Macauley, M. and Davies, R., 2015. Dynamics of Complex Boolean Networks: Canalization, Stability, and Criticality. In Algebraic and Discrete Mathematical Methods for Modern Biology (pp. 93-119). Academic Press.

Preprints:

1. Barrett C, Bura AC, He Q, Huang FW, Li TJ, Reidys CM. Motifs in SARS-CoV-2 evolution. bioRxiv. 2023:2023-01.

2. Bura, A.C., He, Q., Motifs and dyads in sequence alignments. 2022

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Research

Research interests: Discrete, algebraic and topological methods in mathematical biology. Bioinfomatics. Statistical Inference. Simplicial and topological analysis of genomic sequence-structure data. Canalization of Boolean functions.

Current research projects:
- Genomic surveillance for SARS-CoV-2 variants.
- Combinatorics and topology of dissimilarity complexes induced by genomic sequence data.
- Homology and weighted homology.
- Mathematical analysis on plasmid data.

Service

- Co-organizer: Biocomplexity Institute Research Symposium. Virginia Tech. Blacksburg, VA. November 2017.
- Co-organizer: Beyond sequence alignment symposium. Virginia Tech. Blacksburg, VA. October 2017.
- Co-organizer (with Raina Robeva and Andy Jenkins): a three-session mini-symposium on *algebraic and discrete methods in mathematical biology* at the 8th Biomathematics and Ecology Education and Research (BEER) Symposium. Illinois State University. Normal, IL. October 2015.
- Lead organizer: 12th annual Graduate Student Combinatorics Conference at Clemson in April 2016. NSF grant pending (PI/co-PI: S. Poznanović, M. Macauley).
- Co-advising (with M. Macauley) undergraduate research student Kelly Rigsbee on the Balanced Minimum Evolution polytope, Fall 2015.
- Clemson University Math-In, Tutor, April 2015.
- Clemson University Math Help Center, Tutor, Fall 2015.

Teaching Experience

Instructor of Record, *Department of Mathematical Sciences*, Clemson University.
- Calculus of One Variable II (MATH 1080), Spring 2013, Fall 2015.
- Multivariable Calculus (MATH 2070), Spring 2015.
- Essential Mathematics for the Informed Society (MATH 1010), Fall 2012–14.
- Calculus of Several Variables (MATH 2060), Spring 2016.

Graduate Teaching Assistant, *Department of Mathematical Sciences*, Clemson University.
- Calculus of Several Variables, MATH 2060, Spring 2012.
- Calculus of One Variable II (MATH 1080) Fall 2011, Spring 2014.

Presentations

- AMS Fall Southeastern Sectional Meeting. Special Session on *Mathematics of Biomolecules: Discrete, Algebraic, and Topological*. University of Central Florida. Orlando, FL. September 2017.
- SIAM Conference on Applied Algebraic Geometry (AG17). Special Session on *Algebraic Geometry Methods for Discrete Dynamical Systems*. Georgia Institute of Technology. Atlanta, GA. July 2017.
- 12th Graduate Student Combinatorics Conference (GSCC). Clemson University, Clemson, SC. April 2016.
- 8th Biomathematics and Ecology Education and Research Symposium (BEER). Illinois State University, Normal, IL. October, 2015.
- Algebraic Geometry & Number Theory Seminar, Clemson University. Clemson, SC. August 2015.
- Virginia Bioinformatics Institute Seminar. Virginia Tech. Blacksburg, VA. July 2015.
- Annual Meeting for The Society for Mathematical Biology 2015. Georgia State University. Atlanta, GA. July 2015.
- Algebraic and Combinatorial Approaches in Systems Biology 2015. University of Connecticut. Farmington, CT. May 2015.
- 11th Graduate Student Combinatorics Conference (GSCC). University of Kentucky, Lexington, KY. March 2015.
- 46th Southeastern International Conference on Combinatorics, Graph Theory, and Computing. Florida Atlantic University. Boca Raton, FL. March 2015.
- 7th Biomathematics and Ecology Education and Research Symposium (BEER). Claremont Colleges. Claremont, CA. October, 2014.
- Algebra & Discrete Mathematics Seminar, Clemson University. Clemson, SC. September, 2014.
- 10th Graduate Student Combinatorics Conference (GSCC). Auburn University, Auburn, AL. April 2014.
- 6th Biomathematics and Ecology Education and Research Symposium (BEER). Marymount University. Arlington, VA. October, 2013.
- SIAM Conference on Applied Algebraic Geometry (AG13). Special session on *Applications to the Life and Physical Sciences*. Colorado State University. Fort Collins, CO. August, 2013.
- 9th Graduate Student Combinatorics Conference (GSCC). University of Minnesota. Minneapolis, MN. April 2013.
- Algebra & Discrete Mathematics Seminar, Clemson University. Clemson, SC. November, 2012.

Computer skills

Languages Proficient at Python, Sage, LaTeX.

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