Jianjun Paul Tian
(Jianjun Tian)
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Contact Information

121 Jones Hall
Mathematics Department
College of William and Mary
Williamsburg, VA 23187

Fax: 757-221-7400
Office phone: 757-221-2002
Email: jptian@math.wm.edu, jtian@wm.edu
Web:

Professional Positions

Aug. 2008 to present, Assistant Professor, Mathematics Department, the College of William and Mary
Sep. 2004 - Aug. 2008, postdoctoral Research Fellow in the Mathematical Biosciences Institute (MBI)

Research Interests

1. Stochastic processes and ordinary / partial differential equations, and their applications to biology; discrete mathematics including algebraic structures and their applications to biology; computational statistics.
2. Low-dimensional topology and knot theory and their applications to molecular biology.
3. Molecular population genetics and molecular evolutionary biology, particularly, coalescent theory and evolutionary modeling.
4. Tumor biology and disease ecology, particularly, mathematical study of brain tumor growth with therapies, and mathematical study of dynamics of infectious diseases.
5. Stem cell biology, particularly, mathematical study of signaling networks of intra- and extra- niche of neural stem cells, and mathematical study signal transduction of tumor stem cells.

Education

- Graduate Study in Mathematics, Ph.D. in Mathematics, June 2004, University of California, Riverside
- Graduate Study in Mathematics, Topology, June 1999, Chinese Academy of Sciences, Beijing, China
- Undergraduate Study in Mathematics, Minor in Literature and Poem, Northwestern University, China

Books or Monographs

1. **Evolution Algebras and Their Applications,** (research monograph) **Lecture Notes in Mathematics of Springer, Vol. 1921, Springer-Verlag Berlin Heidelberg 2008.**
2. Mathematical Biology and Medicine **(textbook based on my teaching lectures on the subject), in preparation.**

Published or Accepted Papers:

14. Generalized Long-Moody representations of braid groups, with S. Bigelow, appear in Communications in Contemporary Mathematics, 2008.

13. Numerical study for

a model of tumor virotherapy, with J. Wang, **Applied Mathematics and Computation, Vol. 196 (2008), Issue 1, pp 448-457.**

12. ***Classification of proteomic data with multiclass logistic partial least square algorithm*****,** ***with Z. Liu, D. Chen,*** **International Journal of Bioinformatics Research and Applications,** Vol. 4 (2008), Issue 1, pp 1-10.

11. On several types of universal invariants of framed links and 3-manifolds derived from Hopf algebras**,** **Mathematical Proceedings of the Cambridge Philosophical Society,** Vol. 142(2007), no. 01, pp 73-92.

10. On a type of 3-manifold invariants arising from finite-dimensional Hopf algebras, 20 pages, **Acta Mathematica Academiae Paedagogicae Nyiregyhaziensis, Vol. 23 (2007), No. 2, pp 177-189.**

9. ***Coalescent Random Walks on Graphs***. with Z. Liu, **Journal of Computational and Applied Mathematics,** Vol. 202(2007), no. 01, pp 144-154.

8. Continuous-time Markov processes on graphs, with X.-S. Lin, **Stochastic Analysis and Applications,** Vol. 24, no.5(2006), pp.953-972.

7. ***Glioma virotherapy: the effects of innate immune suppression and***

increased viral replication capacity, with A. Friedman, G. Fulci, E. A. Chiocca and J. Wang, **Cancer Research**, 2006, 66: 2314-2319.

6. ***Lumpability and commutativity of Markov processes***, with D. Kannan, **Stochastic Analysis and Applications,** Vol. 24, no.3 (2006), pp.685-702.

5. **Mathematical concepts of evolution algebras in non-Mendelian genetics**, with P. Vojtechovsky, **Quasigroups and related systems**, Vol.14 (2006) no.1, pp.111-122

4. ***Colored Coalescent Theory*****,** with X.-S. Lin, **Discrete and Continuous Dynamical Systems,** pp. 833-845, Aug. issue, 2005, pp.833-845.

3. ***Classification of proteomic data with logistic kernel partial least square algorithm***, with Z. Liu, and D. Chen, Proceedings of IEEE CVPR'05, Vol. 3 (2005), pp.145-150.

2. ***Coalgebraic structure of genetic inheritance***, with B.-L. Li, **Mathematical Biosciences and Engineering**, vol.1, 2. pp 243-266, 2004.

1. ***Knot theory and DNA***. with R. Ries, Spring issue of Graduate newsletter at UCR, page 7, 2002. (non-peer-reviewed)

Submitted Papers and Preprints:

1. ***Modeling the Effects of Resection, Radiation and Chemotherapy in Glioblastoma, 21 pages, with***

A. Friedman, J. Wang, E.A. Chiocca, Submitted.

2. Finite-time perturbations of dynamical systems and applications, 20 pages, submitted.

3. Mutation in colored coalescent theory, 12 pages, with X.-S. Lin, submitted.

4. A simplified mathematical model of solid tumor regrowth with therapies, 15 pages, with K. Stone, T. J. Wallin, submitted.

5. On integrals of quantum supergroup U_qGL(1|1), 20 pages, in revision.

6. A brief introduction to evolution algebras, 8 pages, preprint.

7. Case study of disease ecology: modeling of avian flu, (with S. Deckelman) 19 pages, submitted.

8. ***Algebraic structure of non-Mendelian genetics, 3*** **0 pages,** preprint **of MBI.**

9. Spin representations of Artin's braid group, preprint.

10. Evolution Algebra Theory, Ph.D. thesis, 158 pages, University of

California, Riverside, June, 2004.

Papers in preparation:

1. ***Germline stem cell competition within the niche, with T. Xie.***

2. ***Mathematical model for neural stem cell niche SVZ with two molecular signaling networks: Shh and GABA, (with A. Friedman, et al) .***

3. ***A model for emergence of high pathogenicity avian influenza virus from outbreaks with low pathogenicity avian influenza virus.***

4. ***Traveling wave solutions to a reaction diffusion equation arising from forest succession, with Y. Li and X-J. Hou.***

5. ***Dynamical analysis of virotherapy of brain tumor: tumor ecology, with D. Vasiliu.***

6. ***An evolution algebraic model for yeast DNA damage evolution, with A. Wilcox.***

7. Mathematical study of regulation of reproduction process in seasonal mice,

with P. Heideman and A. Patel.

Awards and Fellowships

2004-2007 Postdoctoral Fellow at the Mathematical Biosciences Institute
2006 Landahl Award from Society of Mathematical Biology
2004 Graduate Research Honorable Mention Award, University of California, Riverside
2003 Phi Beta Kappa International Student Award
2001-2002 Chancellor Distinguished Fellowship, University of California, Riverside
2002-2004 Graduate Student Grant, University of California, Riverside
2001-2002 Graduate Student Fellowship, University of California, Riverside
1999-2000 Graduate Student Fellowship, University of California, Riverside

Professional Services

Conferences organized or co-organized

1. Special session on "Biomathematics: Newly Developed Applied Mathematics and New Mathematics Arising from Biosciences" in the First Joint International Meeting of the AMS and Shanghai Mathematical Society, Shanghai, China, December 17-21, 2008.
2. Special session on Mathematical Modeling in Biology at AMS Spring Southeastern Meeting at Baton Rouge, LA, March 28-30, 2008, Meeting #1037.
3. International symposium on "Ecology, Evolution and Modeling of Disease Dynamics" in Eco Summit 2007, Beijing, China, May 22-27, 2007.
4. Math-Bio Lunch meeting for faculty in Mathematics Department, Biology Department and other departments in W&M, fall 2007.
5. Organizer of the MBI Postdoctoral Seminar, Spring, 2007.
6. Young Researchers Workshops in Math Biology at the MBI, March 12-15, 2007.
7. The mini-symposium on Quantitative Study of Disease Ecology in the Joint SIAM MB Conference on the Life Sciences, July 31 - August 4, 2006, North Carolina.
8. The organizer and main speaker of the graduate seminar on Quantum Group and Topology at University of California, Riverside, 2001.
9. Help Prof. X.-S. Lin to organize 92nd Southern California Topology Colloquium, University of California, Riverside, Spring 2000.

. Refereeing and Reviewing for Journals

1. Journal of Difference Equations and Applications
2. Discrete and Continuous Dynamical Systems
3. Mathematical Reviews

Committee for Honor, Master and Ph.D. students

Fall 08: Ph.D. Oral exam of Zheng Tong (Mathematics)

Spring 08: Honor thesis of Tanner Crowder

Committees for Math Department, the College, Others

1. Honors and Interdisciplinary Study Committee at W&M, August 2008 - June 2011.
2. Honors Committee of Mathematics Department, W&M, August 2008 - June 2009.
3. Library Committee of Mathematics Department at W&M, August 2008 - June 2009.
4. **Program Committee for Statistical Data Mining and Machine Learning in Cancer Epidemiology and Cancer Bioinformatics** of **The Seventh International Conference on Machine Learning and Applications (ICMLA' 08), California.**
5. Howard Hughes Medical Institute Subcommittee for Upper Division Courses and Majors in Quantitative Biology (outside of the college), July 2007 - July 2008.
6. Undergraduate Study Committee for Mathematics Department, at W&M, August 2007 - June 2008.

Invited talks in national and international conferences

1. Invited talk in the minisymposium on **Modeling of Gene Regulatory Network and Cellular Signaling** at **SIAM Conference Life Sciences**, August 4-7, 2008, Montreal, Quebec, Canada. (25 minutes)
2. Invited talk in the minisymposium on **Modeling Epidemics and Infectious Diseases: Recent Advances in Theoretical Immunology and Epidemiology** at SIAM Conference Life Sciences, August 4-7, 2008, Montreal, Quebec, Canada. (25 minutes)
3. Invited talk in the special session on Dynamical Systems in Biology and Medicine at **7th AIMS International Conference on Dynamical Systems Differential Equations and Applications**, Mary 18-21, Arlington, Texas. (30 minutes)
4. Invited talk in the special session on Nonlinear Elliptic and Parabolic PDEs with Application at **7th AIMS International Conference on Dynamical Systems Differential Equations and Applications**, Mary 18-21, Arlington, Texas. (30 minutes)
5. Seminar talk in Mathematical Biology Seminar at **the University of British Columbia**, Vancouver, Canada, March 13, 2008 (50 minutes).
6. Talk in 2008 Spring Southeastern Meeting Baton Rouge, LA, March 28-30, 2008 (25 minutes).
7. Laboratory talk in Xie's lab, **Stowers Institute for Medical Research**, December 21, 2007, Kansas City, (90 minutes).
8. Seminar talk in Mathematics Department, College of William and Mary, November 9, 2007 (50 minutes).
9. Colloquium talk in **National Institute of Health**, National Center for Biotechnology Information, November 20, 2007, Bethesda, Maryland (50 minutes).
10. Talk in the international symposium on **"Ecology, Evolution and Modeling of Disease Dynamics"** in **Eco Summit 2007**, May 22 -27, 2007, Beijing, China.
11. Colloquium talk in the Institute of Tumor Study and Hospital of Tumor Prevention of Shaanxi Provence, June 4, 2007, Xi'an, China (60 minutes).
12. Colloquium talk in the **Center for Nonlinear Studies** and Mathematics Department at **Northwest University**, June 6, 2007, Xi'an, China (60 minutes).
13. Invited talk in the College of Applied Science and College of Life Science and Bio-engineering at **Beijing University of Technology**, May 21, 2007, Beijing, China (60 minutes).
14. Invited talk in School of Sciences at **Xi'an Shiyou University**, June 1, 2007, Xi'an, China (60 minutes).
15. Recruitment talks gave during January to March 2007

The College of William and Mary, math-bio position.
Penn State University, University Park, math - bio position.
Worcester Polytechnic Institute, math position.
George Mason University, math position.
University of North Carolina, math position.
Old Dominion University, math position.
University of Texas, math position.
University of Alabama, math position.
Howard University, math position.
University of Delaware, math-bio position.

16. Invited talk in Computational and Applied Mathematics Seminar at Mathematics Department, **Iowa State University** on Nov. 7, 2006.
17. I was invited to give a talk in the Departmental Colloquium at Mathematics Department, **University of Cincinnati** on Nov. 9, 2006.
18. I was invited to give a talk in AMS 2006 Fall Central Section Meeting, Cincinnati Ohio, Oct 21-22, 2006.
19. I was invited to give a talk in Summer Seminar Series on Disease Ecology, Department of Botany and Plant Sciences at **University of California, Riverside**, August 21 - 24, 2006.
20. Talk at the mini-symposium in the **Joint SIAM-SMB conference** on the **Life Sciences,** July 31-August 4, 2006, North Carolina.
21. I was invited to give a talk in **AMS Special Session on Mathematical Biology**, April 8-9, 2006, University of Notre Dame.

22. I was invited to give a talk in the Special Session on Mathematical Biology and Epidemics at the **Joint Mathematics Meetings (AMS/MAA)** in San Antonio, TX, January 12-15, 2006

Title: **Brain tumor, oncolytic virus, innate immune cells and cyclophosphamide**

23. I was invited to give a talk in the Special Session on Quantum Invariants of Knots and 3-Manifolds at the **Joint Mathematics Meetings (AMS/MAA)** in San Antonio, TX, January 12-15, 2006

Title: **On several types of universal invariants of framed links and 3-manifolds derived from quantum groups**

24. I was invited to give a talk in the Special Session on Algebraic Statistics at the **Joint Mathematics Meetings (AMS/MAA)** in San Antonio, TX, January 12-15, 2006

Title: **Markov Chains and evolution algebras**

25. I was invited to give a talk at **Mile High International Conference on Quasigroups, Loops and Nonassociative Systems** in Denver, Colorado (July 2-9, 2005)

Title: **Introduction to Evolution Algebras**

26. I was invited to give a talk in the Special Session on Stochastic, Large-Scale and Hybrid Systems at the **Joint Mathematics Meetings (AMS/MAA)** in Atlanta, Georgia (January 4-8, 2005)

Title: **Coalescent Random Walks on Graphs**

27. I was invited to give a talk in the Special Session on Nonassociative Algebras at the **Joint Mathematics Meetings (AMS/MAA)** in Phoenix, Arizona (January 7-10, 2004)

Title: **New Algebras Inspired by Genetics and Their Applications**

28. I was invited to give a talk in **AIMS' fifth International Conference on Dynamical Systems and Differential Equations** at Pomona, California (June 16-19, 2004)

Title: **Colored Coalescent Theory**

Other Talks and lectures

29. Postdoctoral Seminar at the MBI, the Ohio State University, Feb. 10, 2005.
Title: Colored Coalescent Theory
30. Postdoctoral Seminar at the MBI, the Ohio State University, April 14, 2005.
Title: Coalgebraic Structure of Genetic Inheritance
31. Postdoctoral Seminar at the MBI, the Ohio State University, Dec. 9, 2005.
Title: Evolution Algebra Theory
32. Ecological Scaling Seminar in the Department of Botany and Plant Science at University of California, Riverside, Spring 2003.
Title: Wavelets in Investigating the Relationship between Genome Structure, Composition and Ecology in Prokaryotes
32. Prof. S.-Z. Xu' s lab seminar in the Department of Botany and Plant Science at University of California, Riverside, Summer, 2002. ***Title: The Axiomatization of Classical Genetics***

33. Bayesian Analysis Seminar in the Department of Statistics at University California, Riverside, Winter, 2002.

Subject: Accurate Restoration of DNA Sequences
34. Statistics Literature Seminar in the Department of Statistics at University of California, Riverside, Spring, 2002
Title: Statistical Models in Population Genetics
35. Mathematical Physics Seminar in the Department of Mathematics at University of California, Riverside, Winter, 2001.
Subject: Some Aspects of Einstein's Theory—Relativity
37. Topology Seminar in the Department of Mathematics at University of California, Riverside, Winter 2001.
Title: Heegaard Decomposition of 3-manifolds
38. Topology Seminar in the Department of Mathematics at University of California, Riverside, Spring 2001.
Title: The Total Curvature of Knots
39. Topology Seminar in the Department of Mathematics at University of California, Riverside, Fall 2001.
Subject: Representations of Braid Groups
40. Topology Seminar in the Department of Mathematics at University of California, Riverside, Winter 2002
Subject: Statistics of Knots, part I
41. Topology Seminar in the Department of Mathematics at University of California, Riverside, Spring 2002.
Subject: Statistics of Knots, part II

Research visits, Conferences, Workshops, Journal Clubs, Tutorials

1. Short-term visiting of Stowers Institute for Medical Research, August 18-22, 2008.
2. Short-term visiting of Department of Mathematics at University of California, Santa Barbar, May 25 - 31, 2008.
3. Short-term visiting of Stowers Institute for Medical Research, December 20 – 26, 2007.
4. Dardinger Cancer Seminar (E.A Chiocca group) every Monday from March 2005 to present, Department of Neurological Surgery, the Ohio State University.
5. MBI Workshop Cardiac Electrophysiology and Arrhythmia, September 25-29, 2006.
6. MBI Workshop Global Ecology, June 26-30, 2006.
7. MBI Workshop Uncertainty in Ecological Analysis, April 3-6, 2006.
8. Second Young Researchers Workshop in Mathematical Biology at the MBI, March 27 - 30, 2006
9. MBI Workshop Spatial Ecology, March 13-17, 2006.
10. MBI Workshop Spatial Heterogeneity in Biotic and Abiotic Environment: Effects on Species Ranges, Co-evolution, and Speciation, February 6-10, 2006
11. MBI Workshop the Problems of Phylogenetic Analysis of Large Datasets, December 1-2, 2005.
12. MBI Workshop Aspects of Self-Organization in Evolution, November 14-18, 2005.
13. MBI Workshop Phylogeography and Phylogenetics, September 26-30, 2005.
14. Tutorial Tree Reconstruction and Coalescence Theory, September 7-9 and September 12-13, 2005.
15. MBI Workshop Recombination: Hotspots and Haplotype Structure, June 13-16, 2005.
16. Tumor Dynamics Workshop in the University of Michigan, Ann Arbor, Michigan, Spring 2005.
17. Current Topics Workshop: Enzyme Dynamics and Function at the MBI, May 19-21, 2005.
18. MBI Workshop Biomarkers in HIV and Cancer Research, April 18-22, 2005.
19. First Young Researchers Workshop in Mathematical Biology at the MBI, March 29 - April 1, 2005.
20. MBI Workshop Emerging Genomic Technologies and Data Integration Problems, February 21-24, 2005
21. MBI Workshop Computational Proteomics and Mass Spectrometry, January 11-14, 2005.

22. MBI and MRI Mini-workshop Quantitative Mathematical Modeling of Gene Regulatory Networks, December 2-4, 2004.
23. MBI Workshop Regulatory Networks, November 8-12, 2004.
24. MBI Workshop Analysis of Gene Expression Data: Principles and Applications October 11-15, 2004.
25. MBI Tutorial on Microarrays, September 13-17, 2004.
26. Genetics Club in Statistics Department, the Ohio State University, Fall 2004, Winter 2005.
27. Mathematical Biology Conference at Harvey Mudd College, California, Fall 2003.
28. *"The rearrangement problem in DNA sequence analysis"* in Prof. Tao Jiang's lab in the Department of Computer Science at University of California, Riverside, Summer 2003.
29. *"The mathematical structure of genetics"* in Prof. Bai-Lian Li's lab in the Department of Botany and Plant Science, University of California, Riverside, Summer 2002.
30. *"Coalescent theory"* in Prof. Michael Clegg's lab in the Department of Botany and Plant Science at University of California, Riverside, Summer 2002.
31. *"Pedigree in quantitative genetics"* in Prof. Shizhong Xu's lab in the Department of Botany and Plant Science, University of California, Riverside (UCR), Summer, 2002.
32. AMS section conference at Nevada University, Spring 2001.
33. AMS section conference at University of California, Irvine, Fall 2001.
34. AMS section conference at University of California, Santa Barbara, Spring 2000.
35. The Southern California Topology Colloquium at Cal Tech, Fall 1999.

Teaching Activities

1. **Courses taught at W&M:**

Fall 08: Math 212, Multivariable Calculus
Math 345, An Introduction to Mathematical Biology

Spring 07: Math 212, Multivariable Calculus
Math 302, Ordinary Differential Equations

Fall 07: Math 345, An Introduction to Mathematical Biology

2. **Mentoring honor students at W&M:**

Fall 08-Spring 09: Carolyn Troha (mathematics major)
Daniel Hariprasad (biomathematics)

3. **Mentoring UBM and CSUMS students at W&M:**

Summer 08: Ankit Patel (biology major)
Andrew Wilcox (mathematics major)
Tomas John Wallin (physics major)

4. **Mellon Teaching Fellow Research Students at W&M:**

Spring 08: Kendall Stone (Economics + Mathematics)
Daniel Hariprasad (biomathematics)

5. **Committee for Honor, Master and Ph.D. Thesis:**

Fall 08: Ph.D. Oral exame of Zheng Tong (Mathematics)

Spring 08: Honor thesis of Tanner Crowder

6. **Attending Teaching/Education Related Meeting:**

1). Represented W&M to attend Howard Hughes Medical Institute "Quantitative biology curriculum planning workshop" July 21-24, 2008, Chevy Chase, MD.
2). QEP/Mellon Project Assessment Seminars, Mary 1-2, in the College.
3). Represented W&M to attend Howard Hughes Medical Institute "Quantitative biology curriculum planning workshop" July 18-20, 2007, in East Tennessee State University, Johnson City, Tennessee.

7. I tutored computer simulation for **MBI** Summer Education Program and lead a project group during July 17 --- August 4, 06.

My project is "Evolution of ranges of species". Here you can see my presentation of the project. My group has five persons. One is an ecologist, Etsuko Nonaka; she comes from the University of New Mexico. The rest four are mathematicians: Jaffar Ali Shahul-Hameed from Mississippi State University, Edgar Diaz from Arizona State University, Xiaojie Hou (assistant professor) from University of Cincinnati, Joaquin Rivera-Cruz from University of Iowa. Etsuko brought an ecological problem as to how to understand the spread of an invasive shrub from Mexico to New Mexico over the last 150 years and how to make some biologically meaningful prediction of the future spread. During the two-week-research, they have learned the communication skills between biologists and mathematicians, which is very important for their future research in the interdisciplinary areas. Two reasonable PDE models were set up to answer Etsuko's question. Here you can find their presentation. I was proud of their creativity and diligence. I think my group has a good combination of biologist and mathematicians.

8. When I was a graduate student, I taught all levels of mathematical classes from graduate classes, differential topology and real analysis, to the first year calculus and linear algebra for non-math majors. About my teaching, you can take a look at:
The following are courses that I taught:

Graduate Courses

- Real Analysis (Math 205C)
- Differential Topology (Math 209C)

Undergraduate Courses

Low-level Courses

- Math009A. First-Year Calculus
- Math009B. First-Year Calculus
- Math009C. First-Year Calculus
- Math010A. Calculus of Several Variables
- Math010B. Calculus of Several Variables
- Math023. Applied Matrix Algebra

High-level Courses

- Math113. Applied Linear Algebra
- Math133. Geometry
- Math138A. Introduction to Differential Geometry
- Math138B. Introduction to Differential Geometry
- Math149B. Probability and Mathematical Statistics
- Math149C. Probability and Mathematical Statistics
- Math146A. Ordinary and Partial Differential Equations
- Math146B. Ordinary and Partial Differential Equations
- Math146C. Ordinary and Partial Differential Equations
- Math171. Introduction to Modern Algebra

Professional Membership

American Mathematical Society
Society for Mathematical Biology
Society for Industrial and Applied Mathematics