

# Ruriko Yoshida

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<http://polytopes.net>

EDUCATION ◇ **University of California**, Davis, CA.

Ph.D. in Mathematics, June 2004.

◇ **University of California**, Berkeley, CA.

B.A. in Mathematics, May 2000.

RESEARCH ◇ Computational Biology, Phylogeny, Discrete Optimization, and Algebraic Statistics.

◇ Publications:

· Book Published:

– *Integer Points in Polyhedra* (Matthias Beck, Christian Haase, Bruce Reznick, Michele Vergne, Volkmar Welker, Ruriko Yoshida). Contemporary Mathematics. Volume 452. American Mathematical Society (6 April 2008). ISBN:978-0821841730.

· Published:

– *Computing holes in semi-groups and its applications to transportation problems* (with R. Hemmecke and A. Takemura), Contributions to Discrete Mathematics, Volume 4, Number 1, 2009, 81 - 91. Available at

<http://cdm.ucalgary.ca/index.php/cdm/article/viewPDFInterstitial/149/95>

– *A Generating Function for all Magic Squares and the Volume of the Birkhoff Polytope* (with J. De Loera and F. Liu), Journal of Algebraic Combinatorics, 30(1), 2009, 113 – 139.

Available at <http://www.springerlink.com/content/m6627810x2013373/>

– *Markov Bases for Two-way Subtable Sum Problems*, (with H. Hara and A. Takemura), J of Pure and Applied Algebra, 213(8) 2009, 1507 – 1521. Available at arXiv:0708.2312.

– *A Markov Basis for Conditional Test of Common Diagonal Effect in Quasi-Independence Model for Two-Way Contingency Tables* (with H. Hara and A. Takemura), J of Computational Statistics and Data Analysis, 53, 2009, 1006 – 1014.

– *Holes in semigroups and their applications to the two-way common diagonal effect model* (with A. Takemura and P. Thomas). In: Proceedings of the 2008 International Conference on Information Theory and Statistical Learning, ITSL 2008, CSREA Press, ISBN: 1-60132-079-5, 67 – 72.

– *Markov Chains, Quotient Ideals, and Connectivity with Positive Margins* (with Y. Chen and I. Dinwoodie), in “Algebraic and Geometric Methods in Statistics” dedicated to Professor Giovanni Pistone (P. Gibilisco, E. Riccomagno, M.-P. Rogantin, H. P. Wynn, eds.), 2008, 99 – 110.

– *A novel test for host-symbiont codivergence indicates ancient origin of fungal endophytes in grasses* (with Chris L. Schardl, Kelly D. Craven, Adam Lindstrom, Skyler Speakman, and Arnold Stromberg), Systematic Biology Volume 57, 2008, 483 – 498.

– *Geometry of Neighbor-Joining Algorithm for Small Trees* (with K. Eickmeyer), the refereed proceedings of the third international conference on Algebraic Biology, Springer LNC Series, 2008, 82 – 96.

– *On the optimality of the neighbor-joining algorithm* (with K. Eickmeyer, P. Huggins, and L. Pachter), Algorithms for Molecular Biology, Volume 3, Issue 5, 2008, <http://www.almob.org/content/3/1/5>

- *Indispensable Monomials of Toric Ideals and Markov Bases* (with Aoki and Takemura), the Journal of Symbolic Computation Volume 43, 2008, 490 – 509.
- *Saturation Points on Faces of a Rational Polyhedral Cone* (with Takemura), in Proceedings of the Joint Summer Research Conference on Integer Points in Polyhedral Geometry, Number Theory, Representation Theory, Algebra, Optimizations, Statistics. Contemporary Mathematics. Volume 452. American Mathematical Society, 2008, 147 – 162.
- *A generalization of the integer linear infeasibility problem* (with Takemura), Discrete Optimization Volume 5, Issue 1, 2008, 36 – 52.
- *On the enumeration of certain weighted graphs* (with Bóna and Ju), Discrete Applied Math Volume 155, Issue 11, 1 June 2007, 1481 – 1496.
- *Beyond Pairwise Distances: Neighbor Joining with Phylogenetic Diversity Estimates* (with Levy and Pachter), the Molecular Biology and Evolution, 2006, 23(3) 491 – 498.
- *Indispensable Monomials of Toric Ideals and Markov Bases* (with Aoki and Takemura), “the Asian Symposium on Computer Mathematics (ASCM) 2005”, edited by S. Pae, H. Park, 2005, 200 – 202, Korea Institute for Advanced Study.
- *Fairground game computations* (with P. Huggins and J. B. Kadane), Significance, Letters, Volume. 2, Issue 2, June 2005, 92.
- *Maximum Likelihood Estimation of Phylogenetic Tree and Substitution Rates via Generalized Neighbor-joining and the EM Algorithm* (with Hobolth), “Algebraic Biology 2005, Computer Algebra in Biology”, edited by H. Anai and K. Horimoto, vol. 1, 2005, 41 – 50, Universal Academy Press, INC..
- *Applications of Interval Methods to Phylogenetic Trees* (with Sainudiin), a chapter contributing to a book “Algebraic Statistics for Computational Biology” edited by Lior Pachter and Bernd Sturmfels, (2005), Cambridge University Press, 359 – 374.
- *A Computational Study of Integer Programming Algorithms Based on Barvinok’s Rational Functions* (with De Loera, Haws, Hemmecke, and Huggins), the Journal of Discrete Optimization, Vol 2, Issue 2, June 30 2005, 135 – 144.
- *Short Rational Functions and their Applications to Integer Programming* (with Woods), the newsletter of SIAM’s Activity Group on Optimization, vol. 16 no. 1–2, 2005, 15 – 19.
- *Three Kinds of Integer Programming Algorithms based on Barvinok’s Rational Functions* (with De Loera, Haws, Hemmecke, and Huggins), Integer Programming and Combinatorial Optimization: 10th International IPCO Conference, Springer, (D. Bienstock and G. Nemhauser eds.), 2004, 244 – 255.
- *Reconstructing trees from dissimilarity maps*, (with Levy and Su), RECOMB 2004 meeting abstracts, 2005, 19.
- *Effective Lattice Point Counting in Rational Convex Polytopes* (with De Loera, Hemmecke, and Tauzer), the Journal of Symbolic Computation, vol. 38 no. 4, 2004, 1273 – 1302.
- *Short Rational Functions for Toric Algebra and Applications* (with De Loera, Haws, Hemmecke, Huggins, and Sturmfels), the Journal of Symbolic Computation, vol. 38 no. 2, 2004, 959 – 973.
- *Barvinok’s Rational Functions: Algorithms and Applications to Optimization, Statistics, and Algebra*, Ph.D. Thesis, 2004, University of California, Davis.
- To Appear:
  - *Bayes estimators for phylogenetic reconstruction* (with P Huggins, W. Li, D. Haws, T. Friedrich, J. Liu), accepted conditionally in Systematic Biology. Available at <http://arxiv.org/abs/0911.0645>.
  - *Markov bases and subbases for bounded contingency tables* (with F. Rapallo), to appear in Annals of Institute of Statistical Mathematics. (Available at <http://arxiv.org/abs/0905.4841>).
  - *Book review on Markov Processes and Applications*, to appear in the journal of the American Statistical Association.
  - *Counting Tables using the Double Saddlepoint Approximation* (with J. Booth and V. Zipunnikov), to appear in the Journal of Computational and Graphical Statistics.

- *On connectivity of fibers with positive marginals in multiple logistic regression* (with H. Hara and A. Takemura), to appear in the J of Multivariate Analysis.

- Submitted:

- *Open Problems on Connectivity of Fibers with Positive Margins in Multi-dimensional Contingency Tables*, submitted to J of Algebraic Statistics.
- *Markov Bases of Population Genetic Statistics*, (with R. Sainudiin, K. Thornton, J. Booth, and M. Stillman), submitted to Bulletin of Mathematical Biology.
- *First steps toward the geometry of cophylogeny*, (with P. Huggins and M. Owen), submitted to Discrete Applied Math. Available at <http://arxiv.org/abs/0809.1908>.

- Preprint:

- *Parametric k-best alignment*, (with P. Huggins). Available at <http://arxiv.org/abs/0809.1473>.
- *Computing holes in semi-groups* (with Hemmecke and Takemura). Available at arXiv:math.CO/0607599.
- *Combinatorial algorithms for reconstructing phylogenetic trees from dissimilarity maps*, (with D. Levy and F. Su), preprint.
- *Partitioning the Sample Space on Five Taxa for the Neighbor Joining Algorithm* (with K. Eickmeyer). Preprint. Available at arXiv:math.CO/0703081.

- ◇ Thesis Advisor: Jesús De Loera, University of California, Davis, CA.

- ◇ Postdoctoral Mentor: Lior Pachter, University of California, Berkeley, CA.

- ◇ Postdoctoral Mentor: Mark Huber, Duke University, Durham, NC.

- ◇ Postdoc: David Haws.

- ◇ Former Masters student: Skyler Speakman (H. John Heinz III School of Public Policy & Management, Carnegie Mellon University).

- SOFTWARE
- ◇ **Shinrin** (with Levy and Pachter), software to reconstruct phylogenetic trees from DNA sequences via the Neighbor Joining method with subtree weights, available at URL:=<http://bio.math.berkeley.edu/mjoin>.
  - ◇ **Latte** (with De Loera, Haws, Hemmecke, Huggins, and Tauzer), software to count the number of lattice points inside a rational convex polytope via Barvinok's cone decomposition, available at URL:=<http://www.math.ucdavis.edu/~latte>.

GRANT DEVELOPEMENT ◇ Current funded

- **Source (period)**: NIH Research Project Grant Program (R01) from the Joint DMS/BIO/NIGMS Math/Bio Program. Grant number: 1R01GM086888–01. Award Document Number: RGM086888A. (July 1st, 2008 to June 30th, 2013).

**Principal Investigator**: R. Yoshida

**Role**: Principal Investigator

**Amount**: \$1,000,000 for direct cost (\$400,000 for indirect cost)

**Title**: Geometry of gene cophylogenies as relates to genome evolution and speciation

**Efforts**: one summer and one academic month.

- **Source (period)**: NSF Grant number: 0949532. (March 15th, 2010 to February 14th, 2013).

**Principal Investigator**: D. Weisrock

**Role**: co Principal Investigator

**Amount**: \$449,999 in total

**Title**: Genome-level resolution of species boundaries and phylogeny of the North American tiger salamander radiation

**Efforts**: one summer.

- ◇ Fellowship

- 2007 Summer Faculty Research Fellowship from University of Kentucky, KY.

- 2001 and 2003 Summer Research Fellowship from Graduate Studies at University of California, Davis.

SELECTED  
TALKS

- ◇ The Second CREST–SBM International Conference “Harmony of Groebner bases and the modern industrial society” Osaka, Japan, June 28th to July 2nd, 2010.
- ◇ Minisymposium on Discrete Mathematical Biology, SIAM Conference on Discrete Mathematics, June 14th to 17th, 2010 at the Hyatt Regency Austin, Austin, Texas.
- ◇ UT-ORNL-KBRIN Bioinformatics Summit 2010, March 19th to 21st, 2010 Lake Barkley State Resort Park Cadiz, KY.
- ◇ The colloquium at mathematics department in Western Michigan University, January 29th, 2010.
- ◇ Special session on “Applicable Algebraic Geometry” in the 2009 AMS Fall Central Section meeting October 16th through 18th, 2009 at Baylor University in Waco, TX.
- ◇ Seminar talk on July 30th, 2009 at POSTECH, South Korea.
- ◇ Lectures on July 28th to 29th, 2009 at KAIST, South Korea.
- ◇ Special session on “Algebra and Number Theory with Polyhedra” in the 2009 Spring Western Section Meeting of the American Mathematical Society, at the San Francisco State University on April 25 and 26, 2009, San Francisco, CA.
- ◇ Special session on “Advances in the Theory of Integer Linear Optimization and its Extensions” in the 2009 Spring Western Section Meeting of the American Mathematical Society, at the San Francisco State University on April 25 and 26, 2009, San Francisco, CA.
- ◇ Special session on “Applications of Algebraic and Geometric Combinatorics” at the Spring 2009 AMS Southeastern Sectional Meeting in Raleigh, NC, April 4th and 5th, 2009.
- ◇ A midprogram workshop of SAMSI program year on “Algebraic Methods in Systems Biology and Statistics” entitled “Algebraic Statistical Models” organized by Mathias Drton, Eva Riccomagno, and Seth Sullivant, on January 17-19, 2009, at SAMSI, NC.
- ◇ Workshop on “Algebraic Statistics” at MSRI, Berkeley, CA, on December 15th to 18th, 2008.
- ◇ Computational Algebraic Statistics, Theories and Applications (CASTA2008) in Kyoto, Japan, December 10th to 11th, 2008.
- ◇ The AMS sectional meeting “Applications of Algebraic Geometry” at the University of British Columbia in Vancouver, October 4th to 5th, 2008.
- ◇ Mixed integer programming (MIP 2008) at Columbia University, in New York City, NY on August 4th to 7th, 2008.
- ◇ Mathematical explorations in contemporary Statistics at Grande Albergo, Sestri Levante (GE) - Italy on May 19th to 20th, 2008.
- ◇ A special session on Toric Varieties at the SIAM-SEAS (Society for Applied and Industrial Mathematics-Southeastern Atlantic Section) 2008 Meeting at University of Central Florida in Orlando on March 14th and 15th, 2008.
- ◇ Future Directions in Phylogenetic Methods and Models at Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, December 17th to 21st 2007.
- ◇ AMS 2007 Fall Southeastern Meeting: Special Session on Combinatorial Enumeration, Optimization, Geometry, and Statistic. Middle Tennessee State University, Murfreesboro, TN, November 3rd to 4th, 2007.
- ◇ Tokyo daigaku, Kagaku kenkyuhi, Kenkyu shukai at Toyohashi, Japan, October 25th to 27th, 2007.
- ◇ A colloquium talk in the Department of Mathematics in University of Louisville, Oct 12th, 2007.
- ◇ Current Challenges and Problems in Phylogenetics at Isaac Newton Institute for Mathematical Sciences, Cambridge, UK on September 3rd to 7th 2007.
- ◇ The Joint Statistical Meetings in UT on July 28th to August 2nd, 2007.
- ◇ ATLANTIC COAST CONFERENCE ON MATHEMATICS IN THE LIFE AND BIOLOGICAL SCIENCES at Virginia Tech on May 3rd to 5th, 2007 (co-sponsored by VT and SAMSI/NC State).

- ◇ Institute for Mathematics and its Applications Annual Program Year Workshop, Applications in Biology, Dynamics, and Statistics at Institute for Mathematics and its Applications, Minnesota on March 5th to 9th, 2007
- ◇ Research Institute for Mathematical Sciences International Conference on Theoretical Effectivity and Practical Effectivity of Grobner Bases at Research Institute of Mathematical Sciences Kyoto University on January 22nd to 26th, 2007.
- ◇ Statistics Seminar at Oxford University, Oxford, UK on November 28th, 2006.
- ◇ Research Institute for Mathematical Sciences WORKSHOP on Development of Computational Algebraic Statistics at Research Institute of Mathematical Sciences Kyoto University on November 6th to 10th, 2006.
- ◇ Statistics Seminar, Statistics Department, Carnegie Mellon University, PA on October 11th, 2006.
- ◇ Statistics Seminar, Statistics Department, Cornell University, Ithaca, NY, on October 4th, 2006.
- ◇ Freie Universität Berlin, Germany, on July 6th, 2006.
- ◇ Otto-von-Guericke University Magdeburg, Germany, on June 29th, 2006.
- ◇ Institute of Statistical Mathematics, Tokyo, Japan on May 29th, 2006.
- ◇ Special Session on Enumerative Aspects of Polytopes American Mathematics Society 2006 Spring Western Section Meeting, in San Francisco State University, CA, on April 29th to April 30th, 2006.
- ◇ Optimization seminar, University of California Davis, CA, April 28, 2006.
- ◇ The Mathematical Colloquium at Colorado State University, CO on February 1st, 2006.
- ◇ The Computational Biology seminar at Duke University, NC on January 30th, 2006.
- ◇ Symbolic Computation Seminar at North Carolina State University, NC on January 26th, 2006.
- ◇ The Operations Research colloquium at University of North Carolina, NC, on January 25th, 2006.
- ◇ The Seminar Series at the department of statistics, University of Kentucky, Kentucky on January 20th, 2006.
- ◇ American Mathematics Society Special Session on Algebraic Statistics in San Antonio, Texas, on January 12th to 13th, 2006.
- ◇ The First International Conference Algebraic Biology (AB2005), Computer Algebra in Biology in Tokyo, Japan, on November 28th to 30th, 2005.
- ◇ Statistical and Applied Mathematical Sciences Institute Workshop on Random Graphs and Stochastic Computation on June 13th to 14th, 2005.
- ◇ Superrobust Computation Project, Tokyo University, Tokyo, Japan on May 25th, 2005.
- ◇ Morning Coffee Talks at Statistical Genetics and Bioinformatics, North Carolina State University on December 7th, 2004.
- ◇ Geometry, Algebra, and Phylogenetic trees at Harvey Mudd College Claremont, California on October 23rd, 2004.
- ◇ Symbolic Computation Seminar at North Carolina State University on September 1st, 2004.
- ◇ Computational Algebraic Statistics, December 14th to 18th, 2003 at American Institution of Mathematics, Palo Alto, CA.
- ◇ Convex Polytopes Workshop, September 15th 2003 at Mathematical Sciences Research Institution, Berkeley, CA.
- ◇ Integer points in polyhedra, Geometry, Number Theory, Algebra, Optimization. Joint summer research conferences American Mathematical Society, Institute of Mathematical Statistics, and Society for Industrial and Applied Mathematics, July 13th 2003 to July 17th 2003 at Snowbird, Utah.
- ◇ Stochastic Computation Final Workshop, June 26th 2003 to June 28th 2003, at Statistical and Applied Mathematical Sciences Institution, NC.

- ◇ Workshop on Gröbner bases and Statistics VI and the First International School on Algebraic Statistics, February 17th 2003 to February 20th 2003, at Statistique et Traitement Informatique des Données in Menton, France.
- ◇ Stochastic Computation, January 23rd 2003, at Statistical and Applied Mathematical Sciences Institution, NC.
- ◇ Workshop on Algebraic Statistics, January 14th 2003 to January 15th 2003, at University of California, Berkeley, CA.

SERVICE

- ◇ Conferences Organized
  - Program Committee, the International Conference on Algebraic and Numeric Biology, organized by RISC (Research Institute for Symbolic Computation), Johannes Kepler University of Linz, at the Castle of Hagenberg, Austria, in July 31st to August 2nd, 2010.
  - Special Session on “Advances in Algebraic Statistics” at the 2010 Spring Southeastern Sectional Meeting Lexington, KY, March 27th-28th, 2010.
  - The Transition Workshop for ALGEBRAIC METHODS IN SYSTEMS BIOLOGY AND STATISTICS at Research Triangle Park, North Carolina, June 18-20, 2009.
  - Midprogram workshop on Molecular Evolution and Phylogenetics at SAMSI, NC on April 2nd and 3rd, 2009.
  - Program Committee, the international conference on Algebraic Biology (AB’08) at RISC, Castle of Hagenberg, Austria on July 31st to August 2nd, 2008.
  - SAMSI Special Year on ALGEBRAIC METHODS IN SYSTEMS BIOLOGY AND STATISTICS at SAMSI, NC.
  - Tutorials and Opening Workshop at SAMSI, NC.
  - Co-organizer, SAMSI Special Year on ALGEBRAIC METHODS IN SYSTEMS BIOLOGY AND STATISTICS at SAMSI, NC, September, 2008 to August, 2009.
  - Organizing committee, AMS 2007 Fall Southeastern Meeting: Special Session on Combinatorial Enumeration, Optimization, Geometry, and Statistic. Middle Tennessee State University, Murfreesboro, TN, November 3rd to 4th, 2007.
  - Program Committee, the 2nd International Conference on Algebraic Biology, organized by RISC (Research Institute for Symbolic Computation), Johannes Kepler University of Linz, at the Castle of Hagenberg, Austria, in July 2nd to 4th, 2007.
  - Organizing committee, Integer Points In Polyhedra Geometry, Number Theory, Representation Theory Algebra, Optimization, Statistics on Snowbird, Utah, on June 11th to 15th, 2006.
  - Organizing and program committee, the First International Conference Algebraic Biology (AB2005), “Computer Algebra in Biology”, in Tokyo, Japan, November 28th to 30th, 2005.
- ◇ Editorial Board for Journal of Algebraic Statistics (since November 2009). <http://www.jalgststat.com/editorial-board>
- ◇ Associate Editor for the journal Frontiers in Systems Biology <http://www.frontiersin.org/systemsbiology/>
- ◇ Former Students
  - Skyler Speakman, M.S. Student, Statistics Department.
- ◇ Thesis Committee
  - Tricia Muldoon, Mathematics Department.
  - Daniel Wells, Mathematics Department.
  - Jian Zhao, Electrical and Computer Engineering Department.
  - Eric Clark, Mathematics Department.

COLLABORATORS

- ◇ Satoshi Aoki (University of Kagoshima, Japan), Matthias Beck (Sun Francisco State University, CA), Miklós Bóna (University of Florida, FL), Yuguo Chen (University of Illinois, Chicago), Jesús De Loera (UC Davis, CA), Ian Dinwoodie (Duke University, NC), Joseph

B. Kadane (Carnegie Mellon University, PA), Hyeong-Kwan Ju (Chonnam National University, Republic of Korea), Davis Haws (UC Davis, CA), Peter Huggins (Carnegie Mellon University, PA), Raymond Hemmecke (Fakultät für Mathematik, Germany), Lior Pachter (UC Berkeley, CA), Raazesh Sainudiin (University of Canterbury, NZ), Carla D Savage (NC State University, NC), Bernd Sturmfels (UC Berkeley, CA), Seth Sullivant (NC State University, NC), Akimichi Takemura (University of Tokyo, Japan), Kevin Woods (Oberlin College Oberlin, OH).

- SKILLS**
- ◇ Computing
    - Unix, Linux, and Windows.
    - Programming, C, C++, Cplex, Mathematica, Maple, Matlab. Extensive HTML Javascript Web design experience with Adobe Photoshop, Illustrator, Pagemaker. Experience with Microsoft Office.
  - ◇ Languages
    - Native speaker of Japanese. Fluent in English.
- WORK EXPERIENCE**
- ◇ **Assistant Professor** (Fall 2006 – present)  
Department of Statistics, University of Kentucky, Lexington, KY.
  - ◇ **Assistant Research Professor** (Fall 2004 – Spring 2006)  
Department of Mathematics, Duke University, Durham, NC.  
Mentor: Mark Huber.
  - ◇ **Postdoctoral Researcher** (Summer 2004)  
The Center for Pure and Applied Mathematics,  
University of California, Berkeley, CA.  
Mentor: Lior Pachter.
  - ◇ **Graduate Program in Mathematics** (Fall 2000 – June 2004)  
Department of Mathematics, University of California, Davis, CA.
  - ◇ **Associate Instructor** (Winter 2004)  
Department of Mathematics, University of California, Davis, CA.
  - ◇ **Associate Instructor** (Summer 2002)  
Department of Mathematics, University of California, Davis, CA.
  - ◇ **Research Assistant** (Fall 2001 – Winter 2002)  
Department of Mathematics, University of California, Davis, CA.  
Assisted in the stochastic network interdiction problems on graphs.
  - ◇ **Research Assistant Award from Graduate Studies** (Summer 2001)  
University of California, Davis, CA.
  - ◇ **Research Summer Internship** (Summer 1999)  
Haas Business School, Berkeley, CA.  
Supported by a National Science Foundation program called  
“Research Experience for Undergraduates.”
  - ◇ **Teaching Assistant** (January 1999 – June 1999)  
Department of Mathematics, University of California, Berkeley, CA.
- COURSES I TAUGHT**
- ◇ Algebraic Statistics for Computational Biology, Combinatorics, Linear Algebra, Integral Calculus, Differential Calculus, Phylogenetic Analysis and Molecular Evolution, Multi-Variable Calculus, Vector Calculus, Set Theory, Euclidean Geometry, Abstract Algebra, Number Theory, Numerical Analysis, Linear Programming, Stochastic Processes, Probability, Statistical Methods.
- MEMBERSHIP**
- ◇ American Statistical Association, Institution of Mathematical Statistica, and Mathematical Association of America, Society of Industrial and Applied Mathematics.