

# Bala Krishnamoorthy

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## EXPERIENCE

- ❑ Graduate instructor, University of North Carolina at Chapel Hill, August, 1999–July, 2001.
  - Sole instructor for five freshman and sophomore level classes in business calculus and management science, with class sizes up to 35 students.
- ❑ Summer project, IBM, Research Triangle Park, NC, May–August, 2000.
  - Worked with the Worldwide Quality Group of IBM to develop a C/C++ tool that uses integer programming and simulation to determine the optimal testing policy for the production of high quality personal computers while satisfying demand.
- ❑ Research assistant, University of North Carolina at Chapel Hill, August, 2001–July, 2004.
  - Supervised by Gábor Pataki: studying basis reduction and integer programming.
  - Supervised by Alex Tropsha and J. Scott Provan: studying geometry and topology of protein structure and function; graduate student member, BioGeometry (NSF-ITR program, <http://biogeometry.cs.duke.edu>).
- ❑ Faculty, Department of Mathematics, Washington State University (Pullman), August, 2004–August, 2014.
  - Assistant Professor, and then Associate Professor (since August 2011); responsibilities included research, teaching at undergraduate and graduate levels, and service.
- ❑ Consultant for Avista Corporation (Energy company in Spokane, WA), May–September, 2011.
  - Using optimization techniques to determine hydroelectric power generation schedules for multiple facilities over varied time scales.
- ❑ Visiting scientist, Departments of Orthopedics & Rehabilitation (OR) and Biochemistry & Molecular Biology (BMB), Oregon Health and Science University (OHSU), August, 2012–December, 2013.
  - Working on research with Jung Yoo, MD, and Robert Hart, MD (OR); and Ujwal Shinde (BMB), and colleagues.
- ❑ Associate Professor of Mathematics, Washington State University, Vancouver (WA), August, 2014–now.
  - Program leader for Mathematics at WSU Vancouver, August 2015–now; responsibilities include scheduling of classes, coordinating with other programs on campus and with the Department in Pullman, hiring adjunct instructors, securing internal funds to run the program, preparing annual reviews for full-time and adjunct instructors, dealing with complaints from students and faculty, and insuring the overall smooth running of the program.
  - Faculty, Department of Mathematics and Statistics, WSU (previously based only in the Pullman Campus); teaching more than 50% classes at graduate level (via videoconferencing to Pullman and in Vancouver); mentoring graduate and undergraduate students (based at Pullman and Vancouver).

## EDUCATION

- ❑ Indian Institute of Technology, Madras (Chennai), India.  
B.Tech., Mechanical Engineering (May, 1999).
- ❑ University of North Carolina at Chapel Hill, North Carolina.  
PhD in Operations Research, (August, 2004).      Dissertation Topics:
  - Pre-conditioning integer programs using column basis reduction (Advisor: Gábor Pataki).
  - Geometry and Topology of Protein Structure (Advisors: Alex Tropsha, J. Scott Provan).

**PUBLICATIONS**

Note: BK stands for Bala Krishnamoorthy

1. BK and Alex Tropsha. Development of a four-body statistical pseudo-potential to discriminate native from non-native protein conformations. *Bioinformatics*, 19, 12, 2003, 1540–1548. Preprint and code: <http://www.math.wsu.edu/faculty/bkrishna/DT/>.
2. BK, J. Scott Provan, and Alex Tropsha. A topological characterization of protein structure. In *Proceedings of Conference on Data Mining in BioMedicine*, 2004; edited by Panos M. Pardalos, Vladimir Boginski, and Alkis Vazacopoulos, Springer, 2005 (accepted), ISBN: 0-387-69318-1. Preprint: [http://www.math.wsu.edu/faculty/bkrishna/Papers/DMB\\_TopoCharProteins\\_KB.pdf](http://www.math.wsu.edu/faculty/bkrishna/Papers/DMB_TopoCharProteins_KB.pdf).
3. Christopher Deutsch and BK. Four-body scoring function for mutagenesis. *Bioinformatics*, 23, 22, 2007, 3009–3015. Preprint, dataset, and code: <http://www.math.wsu.edu/faculty/bkrishna/DT/Mutate>.
4. BK. Bounds on the size of branch-and-bound proofs for integer knapsacks. *Operations Research Letters*, 36, 1, 2008, 19–25. Preprint: [http://www.math.wsu.edu/faculty/bkrishna/Papers/ORL\\_BB.Bounds.pdf](http://www.math.wsu.edu/faculty/bkrishna/Papers/ORL_BB.Bounds.pdf).
5. BK and Gábor Pataki. Column basis reduction and decomposable knapsack problems. *Discrete Optimization*, 6, 3, 2009, 242–270. Preprint: arxiv:0807.1317.
6. Tamal Dey, Anil Hirani, and BK. Optimal homologous cycles, total unimodularity, and linear programming. In *Proceedings of 42nd ACM Annual Symposium on Theory of Computing (STOC) 2010*, 221–230. Preprint: arxiv:1001.0338.
7. Ye Tian, Christopher Deutsch, and BK. Optimized scoring function for solubility mutagenesis. *Algorithms for Molecular Biology*, 5, 33, 2010. Preprint, dataset, and code: <http://www.math.wsu.edu/faculty/bkrishna/DT/OptSolMut>.
8. Svetlana Lockwood, BK, and Ping Ye. Neighborhood properties are significant determinants of temperature sensitive mutants. *PLoS ONE*, 6, 12, e28507, 2011, [dx.plos.org/10.1371/journal.pone.0028507](http://dx.plos.org/10.1371/journal.pone.0028507).
9. Tamal Dey, Anil Hirani, and BK. Optimal homologous cycles, total unimodularity, and linear programming. In *SIAM Journal on Computing*, 40, 4, 2011, 1026–1040. This is the expanded version, with some new results, of the STOC 2010 paper listed above.
10. Bethany Suderman, BK, and Anita Vasavada. Neck muscle paths and moment arms are significantly affected by wrapping surface parameters. *Computer Methods in Biomechanics and Biomedical Engineering*, 15, 7, 735–744, 2012. 1025-5842, (DOI: 10.1080/10255842.2011.558085). Preprint: <http://www.math.wsu.edu/faculty/bkrishna/Papers/WrapSurfSensitivity.pdf>.
11. BK, William Webb, and Nathan Moyer. Lattice-based algorithms for number partitioning in the hard phase. *Discrete Optimization*, 9, 3, 2012, 159–171. Preprint: [www.optimization-online.org/DB\\_HTML/2008/10/2118.html](http://www.optimization-online.org/DB_HTML/2008/10/2118.html).
12. Johannes Elferich, Danielle Williamson, BK, and Ujwal Shinde. Propeptides of eukaryotic proteases encode histidines to exploit organelle pH for regulation. *The FASEB Journal*, 27, 8, 2013, 2939–2945.
13. Sharif Ibrahim, BK, and Kevin Vixie. Simplicial flat norm with scale. *Journal of Computational Geometry*, 4, 1, 2013, 133–159. Preprint: arxiv:1105.5104.
14. Tamal Dey, Anil Hirani, BK, and Gavin Smith. Edge contractions and simplicial homology. Submitted, 2013. Preprint: arXiv:1304.0664.
15. BK, Brian Bay, and Robert Hart. Bone mineral density and donor age are not predictive of femoral ring allograft bone mechanical strength. *Journal of Orthopaedic Research*, 32, 10, 2014, 1271–1276. Preprint: [http://www.math.wsu.edu/faculty/bkrishna/Papers/BMDAgeNotCrit2PredAllogMechStr\\_JOR.pdf](http://www.math.wsu.edu/faculty/bkrishna/Papers/BMDAgeNotCrit2PredAllogMechStr_JOR.pdf).
16. Nathan Hamlin, BK, and William Webb. A knapsack-like code using recurrence sequence representations. *Fibonacci Quarterly*, 53, 1, 2015, 24–33. Preprint: <http://www.math.wsu.edu/faculty/bkrishna/Papers/KnapCodeRecSeqRepr.pdf>.
17. Svetlana Lockwood and BK. Topological features in cancer gene expression data. In *Proceedings of the Pacific Symposium on Biocomputing*, 20, 2015, 108–119. Preprint: arXiv:1410.3198.
18. BK and Gavin Smith. Non total-unimodularity neutralized simplicial complexes. *Discrete Applied Mathematics*, published online Feb 3, 2016. DOI: 10.1016/j.dam.2016.01.004. Preprint: arxiv:1304.4985.

19. Sharif Ibrahim, BK, and Kevin Vixie. Flat Norm Decomposition of Integral Currents. *Journal of Computational Geometry*, 7, 1, 2016, 285–307. Preprint: arXiv:1411.0882.
20. BK. Thinner is not better: Cascade knapsack problems. *Operations Research Letters*, 45, 1, 77–83, 2017. Preprint, talk, and instances: [www.math.wsu.edu/faculty/bkrishna/CKP/](http://www.math.wsu.edu/faculty/bkrishna/CKP/).
21. Jung Yoo, Sabina Blizzard, BK, Matthew Shinseki, and Marcel Betsch. The magnitude of angular and translational displacement of dens fractures is dependent on the sagittal alignment of the cervical spine rather than the force of injury. *The Spine Journal*, 17, 12, 1859–1865, 2017.
22. Philip Behrend and BK. Considerations for waste gasification as an alternative to landfilling in Washington state using decision analysis and optimization. *Sustainable Production and Consumption*, 12, 170–179, 2017.
23. Dayton Opel, Benjamin Rapone, BK, Jung Yoo, and James Meeker. Race and gender influence management of humerus shaft fractures. To appear in *Journal of Orthopaedics*, accepted in 2017.
24. Marcel Betsch, Sabina Blizzard, BK, and Jung Yoo. Association between cervical spine degeneration and the presence of dens fractures. Under review, submitted in 2017.
25. Methun Kamruzzaman, Ananth Kalyanaraman, BK, and Patrick S. Schnable. Toward a scalable exploratory framework for complex high-dimensional phenomics data. Under review, submitted in 2017. Preprint: arXiv:1707.04362.
26. Ananth Kalyanaraman, Methun Kamruzzaman, and BK. Interesting paths in the Mapper. Under review, submitted in 2017. Preprint: arXiv:1712.10197.

#### **ABSTRACTS IN MEDICAL CONFERENCES**

Note: These abstracts are typically two pages long, and are peer reviewed. A small number of abstracts are elevated to oral presentations (rest are presented as e-posters).

1. BK, Brian Bay, and Robert Hart. Bone mineral density and donor age are not predictive of allograft bone mechanical strength. E-Poster in the Lumbar Spine Research Society (LSRS) Annual Meeting, 2013.
2. BK, Brian Bay, and Robert Hart. Bone mineral density and donor age are not predictive of allograft bone mechanical strength. E-Poster in the North American Spine Society (NASS) Annual Meeting, 2013.
3. Jung Yoo, Matthew Shinseki, Sabina Blizzard, Marcel Betsch, BK, and Jayme Hiratzka. Why Do Dens Fractures Occur in the Elderly and What Determines the Magnitude of Fracture Angulation and Displacement? Oral presentation in the Korean American Spine Society (KASS) Annual Meeting, 2015.
4. Jung Yoo, Sabina Blizzard, Natalie Zusman, Matthew Shinseki, Marcel Betsch, and BK. Dens Fractures Displacement Is Dependent On The Sagittal Alignment Of The Subaxial Cervical Spine Rather Than The Force Of Injury. Oral presentation in the Cervical Spine Research Society (CSRS) Annual Meeting, 2015.
5. Dayton Opel, Benjamin Rapone, BK, Jung Yoo, James Meeker. Race and Gender Influence Management of Humerus Shaft Fractures. Podium presentation at the 80th Annual Meeting of the Western Orthopaedic Association, 2016.
6. Dayton Opel, Benjamin Rapone, BK, Jung Yoo, James Meeker. Race and Gender Influence Management of Humerus Shaft Fractures. Poster at the 104th Annual Meeting of the Clinical Orthopaedic Society, 2016.

#### **POSTERS IN CONFERENCES**

Note: A short abstract is reviewed as part of the selection process. These abstracts are published as part of the proceedings of the conference.

1. Methun Kamruzzaman, Ananth Kalyanaraman, and BK. Characterizing the Role of Environment on Phenotypic Traits using Topological Data Analysis. In the 7th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM BCB 2016).
2. Gregory Dreifus, Ben Rapone, John Bowers, Xiang Chen, A. John Hart, and BK. A Framework for Tool Path Optimization in Fused Filament Fabrication. In the ACM Symposium on Computational Fabrication, June 2017.

**GRANTS**

1. *UBM: Foundation in Mathematical Biology through interdisciplinary research, training, and curriculum development*, NSF, \$905,000 (total amount), Sep 2005–Aug 2011; Co-PI.
2. *Basis Reduction and Integer Programming*, Undergraduate Research Minigrant from College of Sciences, WSU, to support the research work of Keith Clawson, \$2500, May–August 2008.
- ⇒ *Geometric Analysis for Data Reduction and Structure Discovery*, DOE Petascale grant (\$1.2mil total amount), May 2010–May, 2013; actively participating member (team members are from WSU, Duke University, University of Colorado, and University of Idaho; PI is Kevin Vixie, WSU).
3. *Collaborative Research: UBM - Institutional: UI-WSU Program in Undergraduate Mathematics and Biology*, NSF, \$700,000 (total amount; WSU portion: \$200,000), Oct 2010–Sep 2015; Co-PI.
4. *AF:Medium:Collaborative Research: Optimality in Homology - Algorithms and Applications*, NSF, total budget \$900,000 (WSU portion \$244,521), Aug 2011–Jul 2015; PI (with Tamal Dey at Ohio State University and Anil Hirani at University of Illinois as collaborative PIs).
5. REU Supplement to *AF:Medium:Collaborative Research: Optimality in Homology - Algorithms and Applications*, NSF, \$15,600 (for WSU alone), 2012–2013; PI.
6. REU Supplement to *AF:Medium:Collaborative Research: Optimality in Homology - Algorithms and Applications*, NSF, \$8,000 (for WSU alone), 2014–2015; PI.
7. REU Supplement to *AF:Medium:Collaborative Research: Optimality in Homology - Algorithms and Applications*, NSF, \$8,000 (for WSU alone), 2015–2016 (after a 1-year no-cost extension to the parent grant); PI.
8. Oregon Health and Science University (OHSU), research appointment for Benjamin Rapone, Jun–Jul, 2015, \$3000 (partially funded Ben’s work on collaborative projects).
9. WSU College of Arts and Science research assistantship for Benjamin Rapone, 2015–2016, \$29,720 (one award selected through applications from student-advisor teams from the Department of Mathematics).
10. *Student Travel Grant: International Workshop on Topological Data Analysis in Biomedicine, Seattle, October 2, 2016*, NSF, \$8,000, 2016–2017; PI.
11. *Collaborative Research: ABI Innovation: A Scalable Framework for Visual Exploration and Hypotheses Extraction of Phenomics Data using Topological Analytics*. NSF, \$1.25mil across WSU Pullman, WSU Vancouver, Iowa State University, and University of Utah (WSU Vancouver portion: \$269,091), Aug 2017–Jul 2020; Co-PI.

**SELECTED PRESENTATIONS**

Note: All presentations are **invited talks**.

1. *Decomposable knapsack problems and column basis reduction* – in the 18th International Symposium on Mathematical Programming (ISMP), Copenhagen, August 2003.
2. *Heuristics for number partitioning using basis reduction and integer programming* – seminar at IBM T.J. Watson Research Center, New York, May 5, 2008.
3. *Cascade knapsack problems* – at the Workshop on Mixed Integer Programming (MIP 2008), at Columbia University, New York, August 4–7, 2008. (Invited among 22 speakers for single-track talks over 4 days).

*Optimal homologous cycles, total unimodularity, and linear programming.*

4. Optimization Seminar at Department of Mathematics, University of Washington, Seattle, April 6, 2010.
5. Theory Seminar at Department of Computer Science, University of California, Irvine, April 16, 2010.
6. Algebra and Discrete Mathematics Seminar at Department of Mathematics, University of California, Davis, April 30, 2010.
7. Theory Seminar at Department of Computer Science, University of British Columbia, Vancouver, BC, May 10, 2010.
8. Theory seminar at Department of Computer Science, Brown University, Providence, RI, May 14, 2010.

*Optimal homologous cycles, total unimodularity, and linear programming.*

9. At IBM Research India, New Delhi, June 17, 2010.
10. At the Department of Computer Science and Engineering, Indian Institute of Technology Delhi, June 18, 2010.
11. At the Department of Computer Science and Automation, Indian Institute of Science, Bangalore, June 22, 2010.
12. At the School of Technology and Computer Science, Tata Institute of Fundamental Research, Mumbai, July 15, 2010.
13. In the Culminating Workshop of the Semester on Optimization at the Institute of Pure and Applied Mathematics (IPAM), UCLA, Dec 14, 2010.
14. *Lattice Problems and Discrete Optimization - A tutorial* (given as two seminar talks) at Department of Mathematics, University of California, Davis, April 29, 2010.

*Computational approaches for protein mutagenesis.*

15. At the TIFR Centre for Applicable Mathematics, Bangalore, June 24, 2010.
16. At the Molecular Biophysics Unit at Indian Institute of Science, Bangalore, June 25, 2010.
17. Colloquium in the Department of Mathematics and Statistics, Portland State University, October 28, 2011.

*Integer optimization and algebraic topology.*

18. In the Systems Science seminar at Portland State University, April 22, 2011.
19. Colloquium in Department of Mathematics, University of Portland, September 30, 2011.
20. *Multiscale Simplicial Flat Norm* – in the 2011 Applied Mathematics and Image Processing Summer Workshop at University of Texas-Pan American, June 1, 2011.
21. *Finding bottlenecks in tunnels* – colloquium in the Department of Mathematics and Statistics, University at Albany (SUNY), February 27, 2014.

*Non total-unimodularity neutralized simplicial complexes.*

22. In Recent Advances in Linear Optimization (RALO 2014), at Fondation Mathématiques Jacques Hadamard (FMJH), Paris, August 1, 2014.
23. In the 22nd International Symposium on Mathematical Programming (ISMP), Pittsburgh, July 2015.
24. *Flat Norm Decomposition of Integral Currents* – in the Discrete Mathematics Seminar at Department of Mathematics, Simon Fraser University, Burnaby, BC, November 25, 2014.

*Linear Programming in Geometric Measure Theory*

25. In the Applied Algebraic Topology Research Network Seminar, April 20, 2016 (online seminar of the Applied Algebraic Topology Network, which is facilitated by the NSF Institute for Mathematics and its Applications (IMA)).
26. Topology Seminar at Department of Mathematics and Statistics, University of Victoria, BC, October 14, 2016.

*Median shapes.*

27. In AMS Fall Sectional Meeting, North Carolina State University, Raleigh, NC, November 2016.
28. In the Analysis seminar of the Department of Mathematics and Statistics, Portland State University, May 19, 2017.
29. *Interesting paths in the Mapper* – at the Joint Mathematics Meetings, San Diego, CA, Jan 10, 2018.

**RESEARCH PROGRAMS AND WORKSHOPS**

1. Selected by the Institute for Mathematics and its Applications (IMA) at University of Minnesota to attend the New Directions Short Course on Applied Algebraic Topology, June 15-26, 2009 (limited to around 25 participants, selected based on application).
2. Invited by the Institute for Pure and Applied Mathematics (IPAM) at University of California, Los Angeles (UCLA) to be a *core participant* in the long program on Modern Trends in Optimization and Its Application, September 13 - December 17, 2010 (limited to around 40 core participants).
3. Invited by the Institute for Mathematics and its Applications (IMA) at University of Minnesota to attend most of the workshops (5 out of 6) held as part of the Thematic Year on Scientific and Engineering Applications of Algebraic Topology, 2013–2014.
4. Invited by the NSF Institute for Computational and Experimental Research in Mathematics (ICERM) in Brown University to participate in the workshop on Mathematics in Data Science, July 28–30, 2015.
5. Invited by the Banff International Research Station (BIRS) for Mathematical Innovation and Discovery and the Casa Mathematica de Oaxaca (CMO) to attend the workshop on Modern Techniques in Discrete Optimization: Mathematics, Algorithms and Applications, Nov 1–6, 2015. Around 35 researchers were invited, almost all of whom were faculty.

**PHD STUDENTS**

1. Ye Tian (May 2011)  
– first placement: Senior Risk Analyst at JP Morgan-Chase, Columbus, OH.
2. Gavin Smith (PhD, May 2013)  
– first placement: Senior Engineer in Intel Corporation, Hillsboro, OR.
3. Sharif Ibrahim (PhD, Summer 2014; joint with Kevin Vixie) – first placement: Developer, CogNetry (start-up, Portland, OR); Senior Engineer in Intel Corporation, Hillsboro, OR. (May 2015)
4. Yunfeng Hu (PhD, current; joint with Kevin Vixie)
5. Benjamin Rapone (PhD, current)
6. Enrique Alvarado (PhD, current; joint with Kevin Vixie)
7. Matthew Broussard (PhD, current)
8. Prashant Gupta (PhD, current)
9. Nathaniel Saul (PhD, current)

**Other PhD students who have worked substantially with me**

1. Nathan Moyer (May 2010; advisee of Bill Webb)  
– first placement: Assistant Professor in Math & CS, Whitworth University, Spokane, WA.
2. Svetlana Lockwood (PhD in Computer Science, 2016; advisee of Shira Broschat)
3. Methun Kamruzzaman (PhD in Computer Science, current; advisee of Ananth Kalyanaraman)

**MS STUDENTS**

1. John Chuba (MS, Summer 2006)
2. Andrew Fowler (MS, Summer 2006)
3. Lisa Tripp (MS, Spring 2007; PhD in Psychology, WSU, 2011)
4. Sunaina Mukherjee (MS, Summer 2007)
5. Derek Nevins (MS in Bioengineering, August 2012; joint with Anita Vasavada)
6. Didiet Anindhita (MS, August 2013)
7. Altaa Tumurbaatar (MS in Computer Science, 2015; joint with Kevin Vixie)

**OTHER GRADUATE STUDENT COMMITTEE SERVICE**

- Yuntao Zhu, PhD Committee (2007)
- Sherod Eubanks, PhD committee (2010)
- Limin Yang, PhD committee (2012)
- Ben van Dyke, PhD committee (2012)
- Pietro Paparella, PhD committee (2013)
- Leanne Whitmore, PhD committee, PhD in Biochemistry (2015)
- Bo Han, PhD committee (2016)
- Hossein Noorazar, PhD committee (current)
- Henry Riely, PhD committee (current)
- Mehrzad Mehrabipour, PhD (in Civil Engineering) committee (current)
- S.M.A. Bin Islam, PhD (in Civil Engineering) committee (current)
- Mehrdad Tajalli, PhD (in Civil Engineering) committee (current)
- Chris Kanyer, MS committee (2006)
- Jeff Noel, MS committee (2007)
- Lisa Ellison, MS committee (2008)
- Andrew Nishi, MS committee (2014)
- Andrew Miller, MS committee (2016)

**UNDERGRADUATE STUDENTS SUPERVISED**

Note: All are students from WSU Pullman. They are all supported by NSF grants, except when indicated by † (student supported by a WSU College of Science research minigrant) or ‡ (did Honors thesis research under my guidance).

1. Christopher Deutsch, Biochemistry major, *Scoring functions for protein mutagenesis* (May 2006–June 2008). Currently PhD student in Biochemistry, Portland State University, Portland, OR.
2. Kelly Stratton, Mathematics major, *Protein decoy discrimination* (May 2006–March 2007). Currently a statistical scientist at Pacific Northwest National Laboratory (PNNL), after finishing an MS in Biostatistics from University of Washington, Seattle, WA.
3. Natalie Baerlocher, Mathematics major, *Models for optimal habitat reserve management* (May 2007–June 2008). Currently working for the Energy Authority, Bellevue, WA, after finishing an MS in Operations Research, UNC Chapel Hill, NC.
4. Konstantin Stakhovich, Mathematics major, *Modeling neck muscle geometry* (May 2007–May 2008; joint with Anita Vasavada, Bioengineering).
5. Keith Clawson†, Mathematics major, *Integer programming and basis reduction* (February 2008–December 2008).
6. Svetlana Lockwood, Computer Science major, *Predicting temperature-sensitive mutations* (February 2008–August 2010; joint with Ping Ye, Molecular Biosciences at WSU, May 2009–August 2011). Currently PhD student in Computer Science, WSU, Pullman WA.
7. Derek Nevins, Bioengineering major, *Optimization in neck muscle models* (May 2009–August 2010; joint with Anita Vasavada, Bioengineering). Currently a research associate in Mechanical Engineering, WSU, after finishing MS in Bioengineering, WSU, Pullman WA.
8. Matthew Graham, Mathematics major, *effective simplicial approximations of currents* (May–September, 2012).
9. Joshua Cruz, Mathematics major, *flat norm signatures for shapes* (May 2012–June 2013). Currently, a PhD student in Mathematics, Duke University (since Fall 2013).
10. Anthony Olivos, Mathematics major, *finding patterns in surgical data* (May 2014–May 2015). Currently an analyst with Epic Systems, Madison, WI (since Jan 2016).
11. Mats Johnson, Mathematics major, *efficient algorithms for optimal homology problems* (May–August, 2015).
12. Philip Behrend‡, Mathematics major, *an optimization model for waste gasification in Washington state* (August 2015–August 2016).

**DEPARTMENTAL AND PROGRAM SERVICE**

- PhD qualifying exam committee: Spring 2005; Spring 2007; Fall 2009; Spring 2012, Spring 2014.
- PhD Evaluation Committee, 2005–06.
- Advising Undergraduate Math Club, August 2005–August 2008, August 2009–May 2011.
- Discrete math faculty search committee, 2007–2008.
- Kallaher-Mifflin retirement committee, Spring 2011.
- Administrative manager search committee, Fall 2011.
- Math-Stat merger implementation committee, Fall 2011.
- Undergraduate studies committee, August 2011–May 2012, and August 2013–May 2014.
- Post doctoral search committee, 2013–2014.
- Actively represented the department in WSU Open House and Junior Showcase events (2005–2011).
- Mentoring committee for Hongbo Dong, assistant professor (August, 2013–now).
- Mentoring committee for Shiv Karunakaran, assistant professor (2014–2017).
- Mentoring committee for Leslie New, assistant professor (2015–now).
- Member of the College of Arts and Sciences Undergraduate Research Committee in WSU Vancouver (August 2014–May 2015).
- Search committees for Mathematics instructor and Director of Quantitative Skill Center in WSU Vancouver (2014-2015).
- Program leader for Mathematics and Statistics, WSU Vancouver (August 2015–now).
  - Scheduling of classes, coordinating with other programs on campus and with the Department in Pullman, hiring adjunct instructors, securing internal funds to run the program, preparing annual reviews for full-time and adjunct instructors, dealing with complaints from students and faculty, and insuring the overall smooth running of the program.
- Graduate Studies Committee, August, 2015–now.
- Undergraduate Assessment Committee, January, 2017–now.

**INSTITUTIONAL SERVICE (AT WSU)**

- Part of Bioinformatics curriculum planning team (faculty from various departments who worked on a Bioinformatics graduate program on campus), 2006.
- Member of Bioinformatics Faculty Search Committee, School of EECS, 2006-7.
- Member of the Faculty Status Committee, 2014.
- Member of Data Sciences Faculty Search Committee, School of EECS, 2015–16 (search canceled in February 2016, after review of 115+ applications).
- Member of the Council of Faculty Representatives (CFR), WSU Vancouver, 2017–2018.

**PROFESSIONAL SERVICE (OUTSIDE WSU)**

- ❑ Editorial board member, *Journal of Advances in Applied and Computational Mathematics*, 2017–now.
- ❑ Program committee member, 8th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB), 2017.
- ❑ Organization of workshops and sessions in conferences
  - Organizer (with four others) of the Workshop on *OR and Biology*, at the INFORMS Annual Meeting, Pittsburgh, November 2006.
  - Organizer (with three others) of the workshop on *Biomedical Applications of Algebraic Topology and Abstract Algebra*, at the Pacific Symposium on Biocomputing (PSB), 2016 (selected after review of proposals).
  - Organizer of the 3rd Annual Cascade Regional Applied Interdisciplinary and Numerical (RAIN) Mathematics Meeting ([sites.google.com/site/cascaderain2016/](http://sites.google.com/site/cascaderain2016/)), April 9, 2016 at WSU Vancouver (secured \$600 in WSU funds for hosting the conference).
  - Organizer (with Bei Wang, University of Utah) of the workshop on *Topological Data Analysis in Biomedicine* at the 7th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics, ACM BCB 2016 (selected after review of proposals).
  - Chair of invited session on *OR Applications in Computational Biology* at the INFORMS Annual Meeting, San Francisco, CA, November, 2005.
  - Chair of invited session on *Optimization in Computational Biology* at the INFORMS International Meeting, Puerto Rico, July, 2007.



- Chair (with Kevin Vixie) of special session on *Analysis, geometry and data* at the Joint Mathematical Meeting, Seattle, 2016 (selected after review of proposals).
  - Chair (with Nikolay Strigul) of special session on *Data-intensive modeling in ecology* at the Joint Mathematical Meeting, Seattle, 2016 (selected after review of proposals).
  - Chair (with Henry Adams) of special session on *Recent Advances in Applied Algebraic Topology* at the AMS Spring Sectional Meeting, Pullman, WA, 2017 (selected after review of proposals).
  - Chair (with Sudipta Sinha) of special session on *Geometry and Optimization in Computer Vision* at the AMS Spring Sectional Meeting, Pullman, WA, 2017 (selected after review of proposals).
- Journal reviewer for
- Mathematical Programming, Mathematics of Operations Research, SIAM Journal of Discrete Mathematics, SIAM Journal of Optimization, INFORMS Journal of Computing, Algorithmica, Computational Geometry – Theory and Applications, SIAM Journal on Numerical Analysis, Discrete Applied Mathematics, Computational Optimization and Applications, Computers and Mathematics with Applications, Symposium on Discrete Algorithms (SODA), Linear Algebra and its Applications, PeerJ Computer Science;
  - Bioinformatics, Pacific Symposium on Biocomputing, Journal of Computational Chemistry, Journal of Theoretical Biology, BMC Genomics, *Clustering Challenges in Biological Networks* - book for DIMACS challenge.
- Review Panel Member for the NSF UBM program (2006).
- Review Panel Member for DOE-funded (NA-22) industrial project (Sep 2011).
- Panel member for the DOE Advanced Scientific Computing Research (ASCR)/Basic Energy Sciences (BES) Data Workshop, Bethesda, MD, Oct 24-25, 2011.
- External examiner for PhD dissertation of Piyashat Sripratak, Department of Mathematics, Simon Fraser University, Fall 2014.
- Virtual Review Panel Member, NSF BIGDATA program (2015).
- Reviewer for NSF BIGDATA Program, 2016–2017.
- Reviewer for NSF-Simons MathBioSys Program, 2017.

### HONORS AND AWARDS

- Placed in the top 0.2% (rank 210) among more than 100,000 candidates appearing for the Joint Entrance Examination (JEE 95) for admission to the Indian Institutes of Technology (IITs).
- Inducted into the Frank Porter Graham Graduate and Professional Student Honor Society, University of North Carolina at Chapel Hill, April, 2002.
- Selected by the Department of Operations Research at the University of North Carolina to participate in the Doctoral Colloquium at the INFORMS Annual Meeting, Atlanta, October 2003.
- Mentor for Svetlana Lockwood,
  - finalist in the Outstanding Undergraduate Researchers Award competition of Computing Research Association (CRA), 2010; and
  - winner of the Barry M. Goldwater scholarship for 2009-2010.
- Mentor for winners in the College of Sciences Undergraduate Poster Competition at WSU:
  - Chris Deutsch, first prize, 2007 and 2008.
  - Svetlana Lockwood, first prize, 2009 and 2010.
- Recognized as an *Outstanding Mentor* in 2009 by the Women and Leadership Alliance Forum, WSU.

### PROFESSIONAL AFFILIATIONS

- Mathematical Programming Society (MPS); American Mathematical Society (AMS); Society for Industrial and Applied Mathematics (SIAM); SIAM Activity Group on Algebraic Geometry; ACM Special Interest Group on Algorithms and Computation Theory (SIGACT); ACM Special Interest Group on Bioinformatics, Computational Biology, and Biomedical Informatics (SIGBio).

### COMPUTER SKILLS

- Packages: Octave/Matlab, NTL, L<sup>A</sup>T<sub>E</sub>X; extensive use of AMPL and CPLEX, including the use of CPLEX callable libraries.
- Languages: C/C++, Awk and Unix shell scripts, and some use of Python.
- Platforms: Unix/Linux, Windows.

**INSTRUCTION AND COURSE EVALUATION SCORES**

Term/year	Cr No.	Course title	# Ev/Tot	Q1	Q2	Q3	Q4
Fall 2004	566	Network Optimization	7/7	4.7	5.0	4.9	5.0
Spring 2005	364	Principles of Optimization	13/19	4.7	4.3	3.5	4.2
Fall 2005	220	Introductory Linear Algebra	49/85	4.6	4.3	4.3	4.5
Fall 2005	364	Principles of Optimization	16/17	4.6	4.4	4.3	4.4
Fall 2005	567	Integer Optimization	7/7	4.9	4.3	5.0	4.7
Spring 2006	574	Optimization in Comp. Biol.	10/14	4.6	4.4	4.6	4.5
Fall 2006	466/566	Network Optimization	10/(2,8)†	4.7	4.1	4.6	4.5
Spring 2007	464	Linear Optimization	7/10	4.7	4.7	4.9	5.0
Fall 2007	220	Introductory Linear Algebra	48/85	4.5	4.3	4.0	4.3
Fall 2007	364	Principles of Optimization	20/25	4.9	4.9	4.9	5.0
Spring 2008	574	Optimization in Comp. Biol.	8/10	4.6	4.43	4.9	5.0
Fall 2008	466/566	Network Optimization	9/(1,10)†	4.9	4.9	4.8	4.8
Fall 2008	201‡	Finite Mathematics	-/108	not evaluated			
Spring 2009	567	Integer Optimization	5/5	5.0	5.0	5.0	5.0
Spring 2009	581 §	Image and Data Analysis	9/10	4.9	4.3	4.8	4.7
Fall 2009	220	Introductory Linear Algebra	57/99	4.9	4.3	4.1	4.4
Fall 2009	364	Principles of Optimization	11/17	4.8	4.8	4.7	4.7
Spring 2010	464	Linear Optimization	13/15	4.9	4.7	4.5	4.7
Spring 2011	230	Honors Intro. Linear Algebra	21/22	4.8	3.9	4.3	4.1
Spring 2011	567	Integer Optimization	7/9	4.7	4.6	4.7	5.0
Fall 2011	364	Principles of Optimization	15/21	4.8	4.4	4.7	4.8
Spring 2012	574 ¶	Computational Topology	15/21	4.7	4.5	4.3	4.4
Fall 2013	220	Introductory Linear Algebra	59/103	4.5	3.9	4.1	4.0
Fall 2013	364	Principles of Optimization	14/21	4.6	4.5	4.3	4.6
Spring 2014	574 ¶	Computational Topology	7/7	4.9	4.7	4.6	4.9
Fall 2014 p+v	466/566¶	Network Optimization	10/(5,10)† 8/(10,0)†	4.9 4.8	4.7 3.6	4.6 3.6	4.8 3.6
Fall 2014 v	273	Calculus III	7/8	4.7	4.0	4.3	4.1
Spring 2015	567 ¶	Integer Optimization	7/8	4.9	4.7	4.6	4.7
↓ Fall 2015 p+v	581 ¶	Algebraic Topology	5/8	5.0, 5.0 (4.6, 4.4, 4.4)			
Spring 2016 v	464	Linear Optimization	12/29	5.0, 4.2 (5.0, 5.0, 5.0)			
Spring 2016 p+v	574 ¶	Computational Topology	2/10	evals not reported¶¶			
Fall 2016 p+v	466/566¶	Network Optimization	10/(4,12)† 8/(5,4)†	5.0, 4.2 (5.0, 5.0, 5.0) 4.5, 4.0 (5.0, 5.0, 5.0)			
Spring 2017 v	364	Principles of Optimization	11/18	5.0, 4.2 (5.0, 5.0, 5.0)			
Spring 2017 p+v	567 ¶	Integer Optimization	6/9 2/2	5.0, 4.5 (5.0, 5.0, 5.0) evals not reported¶¶			
Fall 2017 p+v	581 ¶	Algebraic Topology	3/9	5.0, 5.0 (5.0, 5.0, 5.0)			

Table 1: # Ev/Tot: number of students filling evaluation survey (Ev) / total enrollment (Tot). Survey questions are Q1: instructor's preparation, Q2: instructor's explanations, Q3: quality of interaction, and Q4: overall impression (scores out of 5.00). †: Undergraduate/graduate (466/566) level classes taught conjointly; material covered at graduate level, with 466 students graded on a lower curve (# students in 466/566 was 2/8 in Fall 2006). ‡: Replaced by substitute instructor after 8 weeks due to health reasons, and hence not evaluated. §: Taught jointly with two other instructors; evaluations reported separately for each instructor. ¶: Course taught via videoconferencing to remote and local locations. p/v: Pullman/Vancouver (p+v: offered concurrently in both campuses). ↓: A new online evaluation system was adapted starting in Fall 2015, with a longer survey. The overall mean/median score for the instructor and course are listed, along with scores for questions Q1–Q3. ¶¶: Results not reported if number of students taking survey is too small.

**TEACHING INNOVATIONS**

- Use of tablet PC to write on (in place of black or white board) during lectures, and capture entire lecture in video. Scribes (or lecture notes) and videos from each lecture is then made publicly available online. Sample: <http://www.math.wsu.edu/math/faculty/bkrishna/FilesMath364/S17/LecNotes/>.