

RAHUL V. KULKARNI

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EDUCATION

<i>Ph.D.</i>	The Ohio State University, Physics	March 2000
<i>M.S.</i>	Indian Institute of Technology (IIT) Kanpur, India, Physics	May 1993

PROFESSIONAL EMPLOYMENT

Professor, University of Massachusetts Boston	09/20 – present
Associate Professor, University of Massachusetts Boston	08/12 – 08/20
Assistant Professor, Virginia Polytechnic Institute & State University	08/04- 08/12
Postdoctoral Research Scientist, NEC Laboratories America, Princeton, NJ	08/02 – 08/04
Postdoctoral Researcher, Department of Physics, University of California at Davis	04/00-08/02
Research Assistant, Department of Physics, The Ohio State University	04/95-03/00
Teaching Assistant, Department of Physics, The Ohio State University	10/93-03/95

AWARDS

Ralph E. Powe Junior Faculty Enhancement Award	2005 – 2006
Virginia Tech ASPIRES Award	2005 – 2006
CSM Distinguished Institutional Service Award (UMass Boston)	2020

RESEARCH SUPPORT

Current Research Support

National Science Foundation (NSF) – Mathematical Biology (DMS) and Molecular and Cellular Biology (MCB)
Sep. 1 2019 – Aug. 31 2022

Large deviations and driven processes for stochastic models of gene expression and its regulation

Role: PI

Amount: \$309,998

Completed Research Support

National Institutes of Health (NIH) - UMB-DF/HCC U54 partnership

Nov. 1 2016 – Aug. 31 2019

Post-Transcriptional Regulation of the Tumor Suppressor Gene PTEN by Competing Endogenous RNAs

Role: PI

Amount (*direct costs*): \$750,000 (shared with PIs Zarringhalam (UMB) and Pandolfi (BIDMC))

National Science Foundation (NSF) – Mathematical Biology (DMS)

Aug. 1 2014 – Aug. 31 2018

Analytical representation of protein distributions in stochastic models of gene expression

Role: PI

Amount: \$170,000

National Science Foundation (NSF) – Physics of Living Systems (PoLS)

Sep. 1 2012 – Sep. 30 2015

Stochastic modeling of post-transcriptional regulation of gene expression in bacteria

Role: PI

Amount: \$245,359

National Institutes of Health (NIH) - UMB-DF/HCC U54 partnership

Sep. 1 2013 – Aug. 31 2015

Integrated modeling of post-transcriptional regulatory networks of the tumor suppressor gene PTEN

Role: PI

Amount (*direct costs*): \$200,000 (shared with PIs Zarringhalam (UMB) and Pandolfi (BIDMC))

University of Massachusetts Boston – Proposal Development Grant

Sep. 1 2013 – Aug. 31 2014

Quantitative modeling of post-transcriptional regulation of PTEN

Role: PI

Amount: \$10,000 (shared with PI Zarringhalam (UMB))

National Institutes of Health (NIH) - NIAID

Sep. 1 2012 – Aug. 31 2013

Defining Vibrio cholerae virulence circuitry using bioinformatics and genetics

Role: Co-PI (PI: Jun Zhu (University of Pennsylvania))

Amount: \$34,297 (subcontract amount)

National Science Foundation (NSF) – Physics of Living Systems (PoLS)

Oct. 1 2010 – Aug. 31 2012

Stochastic modeling of post-transcriptional regulation of gene expression in bacteria

Role: PI

Amount: \$106,399

National Institutes of Health (NIH) - NIAID

Sep. 1 2010 – Aug. 31 2012

Defining *Vibrio cholerae* virulence circuitry using bioinformatics and genetics

Role: Co-PI (PI: Jun Zhu (University of Pennsylvania))

Amount: \$90,667 (subcontract amount)

Carilion Research RAP5 Award Amount: \$10,000	2009-2011
Virginia Tech ICTAS Seed Grant Amount: \$31,200	2008-2009
Jeffress Memorial Trust Research Grant Amount: \$47,000	2005-2008
Virginia Tech IBPHS Seed Grant Amount: \$30,000	2007
Ralph E. Powe Junior Faculty Enhancement Award Amount: \$10,000	2005 – 2006
Virginia Tech ASPIRES Award Amount: \$46,000	2005 – 2006

TEACHING EXPERIENCE *(since joining UMB in Fall 2012)*

Graduate “Thermodynamics and Statistical Mechanics” (PHYSIC 614), Spring 2022
Undergraduate “College Physics II” (PHYSIC 108), Spring 2021
Undergraduate “Statistical Physics” (PHYSIC 350), Spring 2020
Undergraduate “College Physics II” (PHYSIC 108), Spring 2019
Undergraduate “College Physics I” (PHYSIC 107), Fall 2018
Undergraduate “College Physics II” (PHYSIC 108), Spring 2017
Undergraduate “Statistical Physics” (PHYSIC 350), Fall 2017
Undergraduate “Fundamentals of Physics II” (PHYSIC 114), Fall 2017
Undergraduate “College Physics II” (PHYSIC 108), Spring 2017
Undergraduate “Statistical Physics” (PHYSIC 350), Fall 2016
Undergraduate “Fundamentals of Physics II” (PHYSIC 114), Fall 2016
Undergraduate “College Physics II” (PHYSIC 108), Spring 2016
Undergraduate “Fundamentals of Physics II” (PHYSIC 114), Fall 2015
Graduate “Introduction to Biological Physics” (PHYSIC 697), Fall 2015
Graduate “Thermodynamics and Statistical Mechanics” (PHYSIC 614), Spring 2015

Undergraduate “Introduction to Contemporary Physics” (PHYSIC 211), Fall 2014

Undergraduate “Statistical Physics” (PHYSIC 350), Spring 2014

Graduate “Thermodynamics and Statistical Mechanics” (PHYSIC 614), Fall 2013

Undergraduate “Statistical Physics” (PHYSIC 350), Fall 2012

MENTORING

Since joining UMB in Fall 2012

Post-Doctoral Researchers Mentoring:

Niraj Kumar, Fall 2012 – Fall 2019

Swami Iyer, Fall 2013 – Fall 2014

Jordan Horowitz Fall 2014 – Spring 2015

Graduate Students Mentoring:

Jacob Adamczyk	Summer 2020 – present
Stefano Piemontese	Summer 2019 - present
Sho Inaba	Summer 2017 – present
Argenis Arriojas-Maldonado	Fall 2017 - present
Mehdi Borji	Spring 2017 – Fall 2019
Wenke Sun	Spring 2017 – Spring 2019
Alireza Zamani Dahaj	Summer 2015 – Summer 2016
Robert Barr	Summer 2015 – Fall 2018
Carl Fakhry	Summer 2015 – Spring 2018
Shilpa Chakravartula	Spring 2013 – Fall 2013

Undergraduate Students Mentoring:

Sarah True Fall 2020 - present
Thomas Wu Summer 2018 – Summer 2020
Vincent Luczkow, Spring 2014 – Spring 2016
Robert Moray, Spring 2013 – Fall 2014
Adeeba Nahrin, Summer 2013, Summer 2014
Yawou Zokoty, Summer 2015

Previous mentoring (prior to joining UMB in Fall 2012)

Ph.D. Students Mentored:

Andrew Fenley, Ph.D. (Physics), 2010

Position after leaving the group: Post-Doctoral Researcher at the University of California at San Diego (UCSD)

Barbara Xu, Ph.D. (Physics), 2010

Position after leaving the group: Post-Doctoral Researcher at Duke University

Tao Jia, Ph.D. (Physics), 2011

Position after leaving the group: Post-Doctoral Researcher at Northeastern University

Post-Doctoral Researchers Mentored:

Suman Banik, 2006 - 2008

Position after leaving the group: Post-Doctoral Researcher at Virginia Tech

Vlad Elgart, 2009 - 2010

Position after leaving the group: Post-Doctoral Researcher at Stanford University

Thierry Platini, 2010 – 2012

Position after leaving the group: Faculty member at Coventry University, UK

Undergraduate Students Mentored:

Charles Baker, 2011 - 2012

RESEARCH METRICS (*Source: Google Scholar*)

- **Citations:** 3041
- **h-index:** 23
- **i10-index:** 36

PUBLICATIONS

1. M. Smith, M. Soltani, R. Kulkarni and A. Singh, "Modulation of stochastic gene expression by nuclear export processes," 2021 60th IEEE Conference on Decision and Control (CDC), pp. 655-660, (2021).
2. Kumar, N., and Kulkarni, R. V. "Constraining the complexity of promoter dynamics using fluctuations in gene expression" *Physical biology* **17**(1), 015001 (2019).
3. Sho Inaba, Carl T. Fakhry, Rahul V. Kulkarni, and Kouros Zarringhalam. A Free Energy Based Approach for Distance Metric Learning. In *Proceedings of the 25th ACM*

SIGKDD International Conference on Knowledge Discovery & Data Mining (KDD '19). ACM, New York, NY, USA, 5-13. (2019)

4. Kumar, N., Cramer, G. M., Dahaj, S. A. Z., Sundaram, B., Celli, J. P., & Kulkarni, R. V. Stochastic modeling of phenotypic switching and chemoresistance in cancer cell populations. *Scientific Reports* **9**: 10845 (2019)
5. Kumar, N., and Kulkarni, R. V. "A stochastic model for post-transcriptional regulation of rare events in gene expression." *Physical biology* **16**(4), 045003 (2019).
6. Kumar, N., Zarringhalam, K., and Kulkarni, R. V. Stochastic Modeling of Gene Regulation by Noncoding Small RNAs in the Strong Interaction Limit. *Biophysical Journal*, **114**(11), 2530-2539, (2018).
7. Fakhry, C. T., Zarringhalam, K., & Kulkarni, R. V. (2018). Bioinformatic Approach for Prediction of CsrA/RsmA-Regulating Small RNAs in Bacteria. In *Bacterial Regulatory RNA* (pp. 47-56). Humana Press, New York, NY.
8. Carl Fakhry, Prajna Kulkarni, Ping Chen, Rahul Kulkarni and Kourosh Zarringhalam, Prediction of bacterial small RNAs in the RsmA (CsrA) and ToxT pathways: a machine learning approach. *BMC Genomics*, **18**:645, (2017).
9. K. Zarringhalam, Y. Tay, P. Kulkarni, A. Bester, P. P. Pandolfi, R. V. Kulkarni, Identification of competing endogenous RNAs (ceRNAs) of the tumor suppressor gene PTEN: A probabilistic approach. *Scientific Reports*, **10**; 7(1) 7755, (2017).
10. Jordan Horowitz and Rahul V. Kulkarni. Stochastic gene expression conditioned on large deviations. *Physical Biol.* **14**, (3) 03LT01, (2017).
11. Niraj Kumar, Tao Jia, Kourosh Zarringhalam and Rahul V. Kulkarni, Frequency modulation of stochastic gene expression bursts by strongly interacting small RNAs, *Phys Rev E*, **94** (4), 042419, (2016).
12. N. Kumar, A. Singh, R. V. Kulkarni, "Transcriptional bursting in gene expression: analytical results for general stochastic models" *PLoS Computational Biology* **11**, (e1004292) (2015)
13. Mohammad Soltani, Cesar A. Vargas-Garcia, Niraj Kumar, Rahul Kulkarni, Abhyudai Singh "Approximate statistical dynamics of a genetic feedback circuit". *Proceedings of the 2015 American Control Conference* (4424-4429) IEEE (2015).
14. A. Bandyopadhyay, A. T. Fenley, S. K. Banik, R. V. Kulkarni, "Modeling of Signal Transduction by the Quorum-Sensing Pathway in the Vibrios". In *The Physical Basis of Bacterial Quorum Communication* (pp. 7-18). (2015) (Springer New York.)
15. N. Kumar, T. Platini, R. V. Kulkarni, "Exact distributions for stochastic gene expression models with bursting and feedback". *Physical Review Letters*, **113**, 268105, (2014).

16. P. R. Kulkarni, T. Jia, S. A. Kuehne, T. M. Kerkering, E. R. Morris, M. S. Searle, S. Heeb, J. Rao, R. V. Kulkarni. "A sequence-based approach for prediction of CsrA/RsmA targets in bacteria with experimental validation in *Pseudomonas aeruginosa*." *Nucl. Acids Res.*, **42**, 6811 (2014)
17. X. Xu, N. Kumar, A. Krishnan, R. V. Kulkarni, "Stochastic Modeling of dwell-time distributions during transcriptional pausing and initiation" *Proceedings of the IEEE Conference on Decision and Control, Florence, Italy*, 4068 (2013)
18. T. Jia, R. V. Kulkarni, "On the structural properties of small-world networks with range-limited shortcut links" *Physica A*, **392**, 6118 (2013)
19. P. Kulkarni, T. Shiriasi, R.V. Kulkarni, "Cancer: tilting at windmills?" *Mol. Cancer*, **12**, 108 (2013)
20. E. Morris, G. Hall, C. Li, S. Heeb, R. V. Kulkarni, L. Lovelock, H. Silistre, M. Messina, M. Camara, J. Emsley, P. Williams, M. Searle. "Structural rearrangement in an RsmA/CsrA Ortholog of *Pseudomonas aeruginosa* creates a dimeric RNA-binding protein RsmN" *Structure*, **21**, 1659 (2013)
21. R. V. Kulkarni, "Queueing up for translation" *Biophys. Jour.*, **104**, 2329 (2013)
22. H. Pendar, T. Platini, and R. V. Kulkarni. "Exact protein distributions for stochastic models of gene expression using partitioning of Poisson processes" *Phys Rev E*, **87**, 042720 (2013)
23. C. Baker, T. Jia and R.V. Kulkarni "Stochastic modeling of regulation of gene expression by multiple competing small RNAs" *Phys. Rev. E.*, **85**, 061915 (2012)
24. T. Platini, T. Jia, and R.V. Kulkarni "Regulation by small RNAs via coupled degradation: mean-field and variational approaches" *Phys. Rev. E.*, **84**, 021928 (2011)
25. V. Elgart, T. Jia, A. T. Fenley, and R. V. Kulkarni "Connecting mRNA and protein burst distributions for stochastic models of gene expression" *Phys. Biol.*, **8**, 046001 (2011)
26. T. Jia and R.V. Kulkarni "Intrinsic noise in stochastic models of gene expression with molecular memory and bursting" *Phys. Rev. Lett.*, **106**, 058102 (2011)
27. A. T. Fenley, S. K. Banik, and R. V. Kulkarni "Computational modeling of differences in the quorum-sensing induced luminescence phenotypes of *Vibrio harveyi* and *Vibrio cholerae*" *Jour. Theor. Biol.*, **274**, 145 (2011)
28. V. Elgart, T. Jia and R. V. Kulkarni "Applications of Little's Law to stochastic models of gene expression" *Phys. Rev. E.*, **82**, 021901 (2010)

29. T. Jia and R. V. Kulkarni "Post-transcriptional regulation of noise in protein distributions during gene expression" *Phys. Rev. Lett.*, **105**, 018101 (2010)
30. V. Elgart, T. Jia, and R. V. Kulkarni "Quantifying mRNA synthesis and decay rates using small RNAs" *Biophys. J.*, **98**, 2780 (2010)
31. S. K. Banik, A. T. Fenley, and R. V. Kulkarni "A model for signal transduction during quorum-sensing in *Vibrio harveyi*" *Phys. Biol.*, **6**, 046008 (2009)
32. A. Hsiao, X. Xu, B. Kan, R.V. Kulkarni, and J. Zhu "Direct regulation by the *Vibrio cholerae* regulator ToxT to modulate colonization and anti-colonization pilus expression" *Infect Immun.*, **77**, 1383 (2009)
33. Amy M. Tsou, Tao Cai, Zhi Liu, Jun Zhu, and Rahul V. Kulkarni "Regulatory targets of quorum sensing in *Vibrio cholerae*: evidence for two distinct binding motifs" *Nucl. Acids Res.*, **37**, 2747 (2009)
34. X. Xu and R. V. Kulkarni "Modeling of processes governing subcellular localization of MinD in *Escherichia coli*" *IET Sys. Biol.*, **5**, 285 (2008)
35. R. V. Kulkarni and P. R. Kulkarni "Computational approaches for the discovery of bacterial small RNAs" *Methods*, **43**, 131 (2007)
36. P. R. Kulkarni, X. Cui, J. H. Williams, A. M. Stevens, R. V. Kulkarni, "Prediction of CsrA-regulating small RNAs in bacteria and their experimental verification in *Vibrio fischeri*" *Nucleic Acids Res.*, **34**, 3361 (2006)
37. D. H. Lenz, M. B. Miller, J. Zhu, R. V. Kulkarni and B. L. Bassler, "CsrA and three redundant small RNAs regulate quorum sensing in *Vibrio cholerae*" *Mol. Microbiol.*, **58**, 1186 (2005)
38. R. V. Kulkarni, K. C. Huang, M. Kloster and N. S. Wingreen, "Pattern formation within *E. coli*: Diffusion, Membrane Attachment, and Self-Interaction of MinD Molecules" *Phys. Rev. Lett.*, **93** 228103 (2004)
39. D. Lenz, K. Mok, B. Lilley, R. V. Kulkarni, N. Wingreen and B. Bassler, "The small RNA chaperone Hfq and multiple small RNAs control quorum sensing in *Vibrio harveyi* and *Vibrio cholerae*" *Cell*, **118**, 69 (2004)
40. E. Almaas, R. V. Kulkarni and D. Stroud, "Scaling properties of random walks on small-world networks" *Phys. Rev. E*, **68**, 056105 (2003)
41. M. Chandran and R. V. Kulkarni, "Fractionalization of a flux quantum in a one-dimensional parallel Josephson junction array with alternating π -bonds" *Phys. Rev. B*, **68**, 104505 (2003)

42. D. L. Mobley, D. L. Cox, R. R. P. Singh, R. V. Kulkarni, A. Slepoy, "Simulations of oligomeric intermediates in prion diseases" *Biophys. J.*, **85** 2213-2223 (2003)
43. R. V. Kulkarni, A. Slepoy, R. R. P. Singh, D. L. Cox and F. Pazmandi "Theoretical modeling of prion disease incubation" *Biophys. J.*, **85**, 707-718 (2003)
44. E. Almaas, R. V. Kulkarni and D. Stroud, "Characterizing the structure of small-world networks" *Phys. Rev. Lett.*, **88**, 0981011 (2002)
45. M. X. LaBute, R. V. Kulkarni, R. G. Endres and D. L. Cox "Strong electron correlations in cobalt valence tautomers" *J. Chem. Phys.*, **116**, 3681 (2002)
46. A. Slepoy, R. R. P. Singh, F. Pazmandi, R. V. Kulkarni and D. L. Cox, "Statistical mechanics of prion diseases" *Phys. Rev. Lett.*, **87**, 058101 (2001)
47. R. V. Kulkarni, E. Almaas, K. D. Fisher and D. Stroud, "Fractional vortices in the XY-model with π -bonds" *Phys. Rev. B*, **62**, 12119 (2000)
48. R. V. Kulkarni and D. Stroud, "Ab Initio molecular dynamics simulation of liquid $\text{Ga}_x\text{As}_{1-x}$ alloys" *Phys. Rev. B*, **62**, 4991 (2000)
49. R. V. Kulkarni, E. Almaas and D. Stroud, "Exact results and scaling properties of small world networks" *Phys. Rev. E*, **61**, 4268 (2000)
50. S. V. Khare, R. V. Kulkarni, D. Stroud and J. W. Wilkins, "First principles study of the energetics and STM images of Si ad-dimers on Ge(001)" *Phys. Rev. B*, **60**, 4456 (1999)
51. R. V. Kulkarni and D. Stroud, "Ab Initio molecular dynamics simulation of liquid Ga-Ge alloys" *Phys. Rev. B*, **57**, 10476 (1998)
52. R. V. Kulkarni, W. G. Aulbur, and D. Stroud, "Ab Initio molecular dynamics study of the structural and transport properties of liquid germanium" *Phys. Rev. B*, **55**, 6896 (1997)

SELECTED INVITED TALKS

"Stochastic models of post-transcriptional regulation and large deviations in gene expression" Invited Seminar at Coventry University, UK (via Zoom) Mar 17 2021

"Modeling post-transcriptional regulation and large deviations in stochastic gene expression" Invited Seminar as part of the CMB Seminar series at North Carolina State University, Raleigh, NC, Feb 20 2020.

“Modeling fluctuations and large deviations in stochastic gene expression” Invited talk in the workshop: Reverse Mathematical Methods for Reconstructing Molecular Dynamics in Single Cells, CRM Giorgi, Pisa, Italy, October 18, 2018.

"Fluctuations and rare events in stochastic models of gene expression" Invited Seminar as part of the Computational Biology and Bioinformatics Seminar series at Duke University, Durham, NC, Feb 19 2018.

“Stochastic models of fluctuations and rare events in gene expression and its regulation” Invited Seminar as part of the HIRM Seminar Series, BIDMC/Harvard Medical School, Boston MA, Nov 21 2017.

“Queues and large deviations in stochastic models of gene expression” Invited talk in the workshop Large Deviation Theory in Statistical Physics: Recent Advances and Future Challenges, ICTS TIFR, Bengaluru, India, (August 17, 2017).

“Fluctuations and large deviations in stochastic models of gene expression” Invited Seminar at the Department of Chemical Engineering, IIT Bombay, Mumbai, India, January 12, 2017.

“Modeling stochastic gene expression: exact results, queues and large deviations” Invited Seminar at NCL Pune, Pune, India, January 9, 2017.

“Modeling fluctuations in gene expression: exact results and large deviations” Invited Seminar at the Department of Physics, University of Florida, Gainesville, FL, Feb 15 2016.

“Stochastic modeling of gene expression: exact results and large deviations” Invited Seminar at the Department of Physics, Boston University, Boston, MA, April 15 2016.

“Analytical approaches for stochastic models of gene expression”, Invited Seminar at the Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, May19, 2015.

"Exact protein distributions in stochastic models of gene expression", Invited presentation at the 2014 SIAM Conference on the Life Sciences, Charlotte, NC, Aug. 7, 2014.

“Analytical approaches for modeling stochastic gene expression” Invited Seminar at the FAS Center for Systems Biology, Harvard University, Cambridge, MA, April 2, 2014

“Stochasticity in gene expression: analytical results and applications” Invited Colloquium at the Department of Physics, Emory University, Atlanta, GA, March 18, 2014

“Stochastic gene expression and queueing theory” Invited Seminar at Brandeis University, Waltham, MA, May 8, 2013

"Modeling intrinsic noise in gene expression circuits", Invited presentation at the 2012 SIAM Conference on the Life Sciences, San Diego, CA, Aug. 10, 2012.

“Stochastic gene expression and its regulation – models and analytical framework” Invited Seminar at the University of Delaware, Newark, DE, Aug. 8, 2012.

"Applications of queueing theory to stochastic modeling of gene expression", Invited presentation at the 2012 March Meeting of the American Physical Society, Boston, MA, Feb. 27 – Mar. 2, 2012.

“Stochastic gene expression and regulation by small RNAs” Invited Seminar at the Department of Physics, UMass Boston, Boston, MA, March 5 2012

“Stochasticity in gene expression and its regulation by non-coding RNAs” Invited Seminar at the Department of Physics, Georgia Tech, Atlanta, GA, Feb 22 2012

“Stochastic gene expression and regulation by non-coding RNAs” Invited Seminar as part of the ESM Seminar Series, Department of Engineering Science and Mechanics, Virginia Tech, Blacksburg, VA, Nov. 16 2011.

“The many uses of generating functions” Invited Tutorial presentation at the VT Annual Workshop on Network Science, Blacksburg, VA, Jun. 1-2, 2011.

“Regulation of gene expression: bioinformatic analysis and stochastic modeling” Invited Colloquium as part of the Frontiers in Genomics Series, Pennsylvania State University, University Park, PA, Mar. 29 2011.

“Stochastic modeling of gene expression and regulation by small RNAs” Invited Seminar at the Division of Molecular Biosciences, Imperial College, London, UK, Mar. 9 2011.

“Post-transcriptional regulation and stochastic gene expression in bacteria” Invited Seminar at the School of Molecular Medical Sciences, University of Nottingham, Nottingham, PA, UK, Mar. 7 2011.

“Stochasticity in gene expression: models, analytical framework and applications” Colloquium talk at the Department of Physics, Virginia Tech, Blacksburg, VA, Oct. 15 2010.

“Stochastic gene expression and regulation by small RNAs: models and applications” Invited Seminar at the Department of Physics, Pennsylvania State University, University Park, PA, Oct. 12 2010.

“Stochasticity in bacterial gene expression” Invited Seminar at the Department of Materials Science and Engineering, Virginia Tech, Blacksburg, VA, Oct. 30 2009.

“Stochastic modeling of regulation of gene expression in bacteria” Invited Seminar at the Department of Physics, University of Florida, Gainesville, FL, Mar 24 2009.

“On post-transcriptional regulation in global regulatory networks in bacteria” Invited Seminar as part of UCLA Biomathematics Seminar Series: Frontiers in Systems and Integrative Biology. UCLA, Los Angeles, CA, Nov. 18 2008.

“On the scaling properties of small-world networks” Invited Seminar presentation at VBI, Virginia Tech, Blacksburg, VA, March 31 2008

“Integrated analysis of bacterial quorum sensing networks” Invited presentation delivered at 72nd Annual Meeting of the Southeastern Section of the APS, Gainesville, FL, November 12 2005

“Quorum sensing and small RNA regulators in bacteria”, Invited seminar as part of The Constance Ledward Rollins Distinguished Lecture Series in Microbiology, Department of Microbiology, University of New Hampshire, NH, October 7 2005

“Computational studies of bacterial quorum-sensing networks”, Invited presentation delivered at IBM T. J. Watson Research Labs, NY, April 15 2004

“Computational studies of small RNA regulation” Colloquium talk presented at Arizona State University, Tempe, AZ, April 6 2004

“Computational studies of small RNA regulation” Colloquium talk presented at George Washington University, Washington D.C, February 24 2004

“Computational studies of small RNA regulation in bacterial quorum sensing” Colloquium talk presented at Virginia Tech, Blacksburg, VA, January 27 2004

"Computational studies of regulation of and by small RNAs in bacteria", Invited presentation delivered at the 2004 March Meeting of the American Physical Society, Montreal, CA, March 21-26, 2004

“Stochastic modeling of prion disease incubation”, Invited presentation delivered at the 2004 ICAM Workshop “Physical properties of amyloid diseases”, Boston, MA, Feb 9-11, 2004

"Statistical mechanics and stochastic modeling of prion diseases", Invited presentation delivered at the 2002 March meeting of the American Physical Society, Indianapolis, IN, March 4-8, 2002

"Fractional vortices in the XY model with antiferromagnetic bonds," Invited presentation delivered at the CLC conference 2001, Lake Tahoe, CA, February 8-11, 2001

"Fractional vortices in the XY model with π -bonds," Invited presentation delivered at the Physics by the Bay 2000 conference, Berkeley, CA, September 15, 2000

"On the properties of small-world networks," Colloquium talk presented at the Santa Fe Institute, Santa Fe, NM, September 7, 1999

"Ab Initio simulations of structural and electronic properties of liquid semiconductors," Invited presentation delivered at the 1999 Centennial meeting of the American Physical Society, Atlanta, GA, March 20-26, 1999

PRESENTATIONS

"Exact results and parameter estimation for stochastic models of miRNA-ceRNA networks" Vincent Luczkow, Kouros Zarringhalam, Rahul Kulkarni. Contributed talk at the 3rd Annual Winter q-Bio Meeting on Quantitative Biology, Maui, HI, Feb 17-20, 2015.

"Exact protein distributions for stochastic models of gene expression with bursting and feedback" Rahul Kulkarni, Niraj Kumar and Thierry Platini. Poster presentation at the 2015 Gordon Research Conference on Stochastic Physics in Biology, Ventura, CA, Jan 11-16, 2015

"Stochastic modeling of regulation of gene expression by non-coding RNAs" Rahul Kulkarni, Niraj Kumar, Tao Jia, Kouros Zarringhalam. Poster presentation at the Cell Symposia: Regulatory RNAs conference, Berkeley, CA, Oct. 19-21 2014.

"Exact distributions for stochastic models of gene expression with bursting and feedback" Rahul Kulkarni, Niraj Kumar and Thierry Platini. Contributed Plenary Session talk at the 2nd Annual Winter q-Bio Meeting on Quantitative Biology, Hawaii, HI, Feb 17-20, 2014.

"Bioinformatic analysis and stochastic modeling of gene expression and post-transcriptional regulation" Rahul Kulkarni. Invited short talk at the 2013 DF/HCC Brief updates series: What's up in Biostatistics and Computational Biology, Boston, MA, Dec. 18, 2013.

"Stochastic modeling of dwell-time distributions during transcriptional pausing and initiation" Rahul Kulkarni, Xiaohua Xu, Niraj Kumar, Arjun Krishnan. Contributed talk at the 52nd IEEE Conference on Decision and Control, Florence, Italy, December 9-12 2013.

"Exact protein distributions for stochastic models of gene expression" Rahul Kulkarni, Hodjat Pendar and Thierry Platini. Contributed talk at the 2013 APS March Meeting, Baltimore, MD, March 18-22, 2013.

"Exact protein distributions in stochastic models of gene expression" Rahul Kulkarni, Hodjat Pendar and Thierry Platini. Contributed talk at the 1st Annual Winter q-Bio Meeting on Quantitative Biology, Honolulu, HI Feb 18-22 2013

"Analytical representation of protein distributions in stochastic models of gene expression" Rahul Kulkarni, Hodjat Pendar and Thierry Platini. Poster presentation at the 2013 Gordon Research Conference on 'Stochastic Physics in Biology', Ventura, CA Jan 13-18 2013

“Analytical representation of protein distributions in stochastic models of gene expression” Rahul Kulkarni, Hodjat Pendar and Thierry Platini. Contributed presentation at the 14th Annual GBASM meeting, Brandeis University, Waltham MA, Oct. 6 2012.

“Analytical representation of protein distributions in stochastic models of gene expression” Rahul Kulkarni, Hodjat Pendar and Thierry Platini. Contributed talk at the 2013 Greater Boston Area Statistical Mechanics Meeting, Waltham, MA Oct. 6 2012

“Stochastic gene expression and regulation by small RNAs” Rahul Kulkarni, Tao Jia, Vlad Elgart and Andrew Fenley. Poster presentation at the 2011 MBI Workshop on ‘Stochastic Processes in Cell and Population Biology’, Ohio State University, Columbus, OH, Sep. 24-28 2011.

“Intrinsic noise in stochastic models of gene expression with molecular memory, bursting and post-transcriptional regulation” Rahul Kulkarni, Tao Jia, Vlad Elgart and Andrew Fenley. Poster presentation at the 2011 Gordon Research Conference on ‘Stochastic Physics in Biology’, Ventura, CA Jan 23-28 2011

“Bioinformatic and experimental approaches to virulence regulation by RsmA” Rahul Kulkarni, VT-Carilion Collaborative Infectious Diseases Research Conference, Blacksburg, VA, July 16 2010

“Stochastic gene expression and post-transcriptional regulation in bacteria” Invited Lecture/Research Presentation in the Problem Solving in GBCB Course, Spring 2009, Virginia Tech

Invited participant at the MBI workshop “Network Biology: Understanding metabolic and protein interactions” Ohio State University, Columbus, OH, (September 14-18, 2009)

“Modeling of processes governing subcellular protein localization in E. coli” Complexity in Materials Far from Equilibrium, Blacksburg, VA, May 14-16 2008

“Computational analysis of regulation by the quorum-sensing and CsrA pathways in the Vibrios” 42nd Annual US-Japan meeting on Cholera and other Bacterial Enteric Infections, Austin, TX, December 5-7 2007

“Computational prediction of bacterial small RNAs controlling the global regulatory protein CsrA” 2007 CSHL meeting on: Systems Biology: Global Regulation of Gene Expression, Cold Spring Harbor, NY, March 29 – April 1 2007

“Subcellular protein localization in E.coli: diffusion and membrane attachment of MinD molecules” 2005 March Meeting of American Physical Society, Los Angeles, CA, March 21-25, 2005

"Theoretical modeling of prion disease incubation" Keystone Symposia meeting on Prion Diseases, Breckenridge, CO, April 2-6, 2003

Invited participant in the ICAM conference "Physical principles of amyloid aggregation" University of California at San Francisco, San Francisco, CA, November 29-December 01, 2001

"Ab Initio study of Co complexes exhibiting valence tautomerism" 2001 March meeting of the American Physical Society, Seattle, Washington, March 12-16, 2001

"Fractional vortices in the XY model with pi-bonds," 2000 March Meeting of the American Physical Society, Minneapolis, MN, March 20-24, 2000

"Polarization Density Functional theory and the dielectric properties of semiconductors," ES98 (Electronic Structure '98) conference, Philadelphia, PA, May 29-June 1, 1998

"Comments on the geometric phase approach to macroscopic polarization of insulators," 1998 March Meeting of the American Physical Society, Los Angeles, CA, March 16-20, 1998

"Ab Initio molecular dynamics simulation of liquid Ga-Ge alloys," 1998 March Meeting of the American Physical Society, Los Angeles, CA, March 16-20, 1998

"Ab Initio study of neural defects on GaAs(110) surfaces," 1997 March Meeting of the American Physical Society, Kansas City, MO, March 18-22, 1997

"Diffusion in liquid Germanium using ab initio molecular dynamics," 1996 March Meeting of the American Physical Society, St. Louis, MO, March 18-22, 1996

SELECTED PRESENTATIONS BY STUDENTS/POSTDOCS/COLLABORATORS

Argenis Arriojas, Jacob Adamczyk, Stas Tiomkin, Rahul Kulkarni, "Closed-form analytical results for maximum entropy reinforcement learning using large deviation theory". Contributed talk at the 2022 APS March Meeting, Chicago, IL March 14-19 2022.

Jacob Adamczyk, Argenis Arriojas, Stas Tiomkin, Rahul Kulkarni, "Novel approaches and bounds for maximum entropy reinforcement learning using non-equilibrium statistical mechanics". Contributed talk at the 2022 APS March Meeting, Chicago, IL March 14-19 2022.

Sho Inaba, Carl T. Fakhry, Rahul V. Kulkarni, and Kouros Zarringhalam. "A Free Energy Based Approach for Distance Metric Learning". KDD 2019 Conference, August 4-8, Anchorage, AK

Arriojas, A., Inaba, S., & Kulkarni, R.V. "Quantifying noise in general stochastic models of post-transcriptional regulation of gene expression." q-Bio 2018 Conference, June 26- 29, Houston, TX

Kumar, N., Zarringhalam, K., & Kulkarni, R. V. "Stochastic modeling of post-transcriptional regulation of gene expression by non-coding RNAs." q-Bio 2018 Conference, June 26- 29, Houston, TX

Sho Inaba, Rahul V. Kulkarni "Dynamical phase transitions for stochastic models of gene expressions conditioned on large deviations" Contributed presentation at the GBASM 2017 conference, Oct 21, 2017, Boston, MA

"Quantitative models of target recognition by miRNAs: applications to the PTEN ceRNA network" Kouros Zarringhalam, Prajna Kulkarni, Rahul Kulkarni. Contributed talk at the 3rd Annual Winter q-Bio Meeting on Quantitative Biology, Maui, HI, Feb 17-20, 2015.

"Transcriptional bursting in general models of stochastic gene expression: analytical results for moments and determination of burst parameters" Niraj Kumar, Abhyudai Singh, Rahul Kulkarni. Poster presentation at the Gordon Research Conference on Stochastic Physics in Biology, Ventura, CA, Jan 11-16, 2015

"Estimation of parameters for stochastic models of ceRNA networks" Vincent Luczkow, Kouros Zarringhalam, Rahul Kulkarni. Contributed presentation at the 16th Annual GBASM meeting, Brandeis University, Waltham MA, Nov. 8 2014.

"Large-scale identification of ceRNA network of tumor suppressor genes by co-expression analysis" Kouros Zarringhalam, Swami Iyer, Robert Moray and Rahul Kulkarni. Contributed talk at the 2nd Annual Winter q-Bio Meeting on Quantitative Biology, Hawaii, HI, Feb 17-20, 2014.

"A machine learning approach for identifying the PTEN non-coding ceRNA network" Swami Iyer, Robert Moray, Prajna Kulkarni, Rahul Kulkarni, Kouros Zarringhalam. Contributed talk at the 2nd Annual Winter q-Bio Meeting on Quantitative Biology, Hawaii, HI, Feb 17-20, 2014.

"Determination of burst parameters in stochastic models of gene expression" Niraj Kumar, Rahul Kulkarni. Poster presentation at the 2nd Annual Winter q-Bio Meeting on Quantitative Biology, Hawaii, HI, Feb 17-20, 2014.

"Determination of burst parameters in gene expression models" Niraj Kumar, Rahul Kulkarni. Contributed presentation at the 15th Annual GBASM meeting, Brandeis University, Waltham MA, Oct. 12 2013.

"Exact solutions for models of gene expression with bursting and feedback" Niraj Kumar, Thierry Platini, Rahul Kulkarni. Contributed presentation at the 15th Annual GBASM meeting, Brandeis University, Waltham MA, Oct. 12 2013.

"Protocols for discriminating sources of intrinsic noise in gene expression" Niraj Kumar and Rahul Kulkarni. Contributed talk at the 2013 APS March Meeting, Baltimore, MD March 18-22 2013.

“Stochastic gene expression in networks of post-transcriptional regulators” Charles Baker, Tao Jia, Hodjat Pendar, and Rahul Kulkarni. Talk presented at the 2012 APS March Meeting, Boston, MA, Feb. 27- Mar. 2 2012.

“Accurate analytical distributions for stochastic gene expression” Hodjat Pendar and Rahul Kulkarni. Talk presented at the 2012 APS March Meeting, Boston, MA, Feb. 27- Mar. 2 2012.

“Stochastic gene expression with bursting and positive feedback” Thierry Platini, Hodjat Pendar, and Rahul Kulkarni. Talk presented at the 2012 APS March Meeting, Boston, MA, Feb. 27- Mar. 2 2012.

“Intrinsic noise in stochastic models of gene expression with molecular memory and bursting” Tao Jia and Rahul Kulkarni. Talk presented at the GSNP Student Speaker Award session at the 2011 APS March Meeting, Dallas, TX, Mar 21-25 2011.

“Stochastic modeling of regulation of gene expression by multiple competing small RNAs” Charles Baker, Tao Jia, and Rahul Kulkarni. Talk presented at the 2011 APS March Meeting, Dallas, TX, Mar 21-25 2011.

“Regulation of gene expression by small RNAs via coupled stoichiometric degradation: a variational approach” Thierry Platini, Tao Jia, and Rahul Kulkarni. Talk presented at the 2011 APS March Meeting, Dallas, TX, Mar 21-25 2011.

“Intrinsic noise in stochastic models of gene expression with molecular memory and bursting” Tao Jia and Rahul Kulkarni. Complex Driven Systems Symposium, Blacksburg, VA, Oct 1-3, 2010.

“Stochastic modeling of gene regulation by small RNAs” Vlad Elgart, Tao Jia, Andrew Fenley, and Rahul Kulkarni. Talk presented at the 2009 APS March Meeting, Pittsburgh, PA, Mar 18 2009.

“Stochastic modeling of protein-based post-transcriptional regulation” Tao Jia, and Rahul Kulkarni. Talk presented at the 2009 APS March Meeting, Pittsburgh, PA, and Mar 18 2009.

“Stochastic modeling of post-transcriptional regulation” Tao Jia and Rahul Kulkarni, Contributed talk at the Mini-workshop on Nonequilibrium Statistical Mechanics: A Bridge from Physics to Biology, Blacksburg, VA, Dec. 11 2008.

“Defining the CsrA regulon in *Vibrio fischeri* and its interactions with the quorum-sensing network” Joshua Williams, Tao Jia, Prajna Kulkarni, Rahul Kulkarni, and Ann Stevens. Poster presentation at the Gordon Research Conference on Microbial Stress Responses, Mt. Holyoke, Hadley, MA July 2008.

“Computational modeling of small RNA-based regulation during quorum sensing in *Vibrio harveyi* and *Vibrio cholerae*” Andrew Fenley, Suman Banik and Rahul Kulkarni. Poster presentation at the 3rd ASM Conference on Cell-Cell Communication, Austin, TX, August 2007.

“Modeling of protein subcellular localization in E. coli” Xiaohua Xu and Rahul Kulkarni. Poster presentation at the 1st Q-bio Conference on Cellular Information Processing, Santa Fe, NM, August 2007.

“Structural Properties of Short-Range Small-World Networks” Tao Jia and Rahul Kulkarni. Poster presentation at the NetSci 2007 Meeting, New York, NY, March 2007.

“Computational modeling of the quorum-sensing network in bacteria” Andrew Fenley, Suman Banik and Rahul Kulkarni. Talk presented at the 2007 March Meeting of the American Physical Society, Denver, CO, March 5-9, 2007.

“Modeling of signal transduction in bacterial quorum sensing” Andrew Fenley, Suman Banik, and Rahul Kulkarni. Talk presented at the 2006 March Meeting of the American Physical Society, Baltimore, MD, March 13-17, 2006.

“Analysis of the structure of small-world networks” Tao Jia and Rahul Kulkarni. Talk presented at the 2006 March Meeting of the American Physical Society, Baltimore, MD, March 13-17, 2006.

“Modeling of protein subcellular localization in bacteria” Xiaohua Xu and Rahul Kulkarni. Talk presented at the 2006 March Meeting of the American Physical Society, Baltimore, MD, March 13-17, 2006.

SERVICE *(Since joining UMB in Fall 2012)*

Department

- Chair Sep 2020 - present
- Interim Chair Feb 2020 - Aug 2020
- Department of Physics DPC, Committee Chair, Sep 2017 – Aug 2019
- Faculty Advisor for the Society of Physics Students (SPS) Sep 2012 – May 2019
- Faculty Search Committee, Committee Member Dec 2013 – June 2014
- Faculty Search Committee, Committee Member Dec 2015 – June 2016
- Faculty Search Committee, Committee Member Dec 2016 – June 2017
- Physics PhD program Committee, Committee Member Sep 2013 - June 2014
- PhD Admissions Committee, Committee Member March 2015 – May 2017

- Departmental Curriculum Development
- Undergraduate Program Assessment Spring 2015

College

- Ad Hoc Tenure and Promotion Committee, Committee Member, (October 2021 – February 2022)
- Ad Hoc Tenure and Promotion Committee, Committee Member, (October 2020 – February 2021)
- CSM Strategic Management Task Force, Committee Member, (September 2020 – present)
- CSM Faculty Senate representative for the Department of Physics, (Sep 2015 – Aug 2019)
- CSM Scholarships Review Committee, Committee Member, (Sep 2015 - Mar 2018)
- CPCT Faculty Search Committee, Committee Member (Feb 2014 - Feb 2015)
- Computational Sciences PhD Program Committee, Committee Member, (Jun 2016 – Present)
- PhD in Computational Science Committee, Committee Member (Sep 2012 – May 2016)

University

- Engineering Chair Search Committee, Committee Chair, (Mar 2022 – present)
- CSM Dean's Search Committee, Committee Member (October 2018 - May 2019)
- Goldwater Scholarship Program Committee, Committee Chair (May 2014 – May 2019)

- Campus Faculty Representative, Goldwater Scholarship Program, (May 2014 – present)
- Honors College Ad Hoc Personnel Committee, Committee Chair, 2016 – 2019
- Fellowships Committee, Committee Member, (Sep 2015 – May 2017)
- Healey Awards Review Committee, Committee Member, May 2018 - Jun 2018

Professional

- NSF Review Panel, Member, Jan 2021
- NSF Jumpstart on 'Integrating Biology', Invited participant, Dec 2019
- NSF Review Panel, Member, April 2017
- NSF Review Panel, Member, April 2015
- External reviewer for proposal submitted to the Leverhulme Trust
- Reviewer for multiple articles for leading journals including: PNAS (USA), Physical Review Letters, Nature Communications, Physical Review E, PLoS Computational Biology, PLoS One, Biophysical Journal, Physical Biology, Journal of Theoretical Biology, Nucleic Acids Research, IEEE Conference Proceedings.

PROFESSIONAL AFFILIATIONS

American Physical Society	06/95 - present
Associate Member – Dana Farber/Harvard Cancer Center	09/13 - present