

# Abhyudai Singh

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RESEARCH INTERESTS Dynamics and Control of Biomolecular Circuits; Systems/Synthetic Biology; Stochastic Processes in Biology; Computational Neuroscience; Theoretical Ecology; Hybrid Systems.

EXPERIENCE

- ◇ **Associate Professor**, September 2017–Present  
Electrical & Computer Engineering  
Biomedical Engineering  
Mathematical Sciences  
Center for Applications of Mathematics in Medicine  
Center for Bioinformatics and Computational Biology  
University of Delaware, Newark, DE.
- ◇ **Visiting Professor**, April 2018–July 2018  
University of Turin, Turin, Italy.
- ◇ **Assistant Professor**, September 2011–August 2017  
University of Delaware, Newark, DE.
- ◇ **Postdoctoral Scholar**, October 2008–August 2011  
Chemistry & Biochemistry  
University of California, San Diego, CA.

EDUCATION

- ◇ **Ph.D. in Electrical and Computer Engineering**, September 2004–September 2008  
University of California, Santa Barbara, CA.  
Advisor: João P. Hespanha.  
Thesis: *Stochastic modeling of chemical reactions and gene regulatory networks.*
- ◇ **M.A. in Ecology, Evolution and Marine Biology**, September 2006–December 2007  
University of California, Santa Barbara, CA.  
Advisor: Roger M. Nisbet.  
Thesis: *Semi-discrete host parasitoid modeling.*
- ◇ **M.S. in Electrical and Computer Engineering**, August 2003–August 2004  
Michigan State University, East Lansing, MI.  
Advisor: Hassan K. Khalil.  
Thesis: *Regulation of nonlinear systems using conditional integrators.*
- ◇ **M.S. in Mechanical Engineering**, August 2002–December 2006  
Michigan State University, East Lansing, MI.  
Advisor: Ranjan Mukherjee.  
Thesis: *A mechanistic approach to tuning of MEMS resonators.*
- ◇ **B. Tech. in Mechanical Engineering**, August 1998–May 2002  
Indian Institute of Technology, Kanpur, India.

SUMMER SCHOOL

- ◇ **The q-bio Summer School on Cellular Information Processing**,  
July 2008–August 2008, Center for Nonlinear Studies, Los Alamos National Laboratory, NM.

- ◇ **Molecular Biology and Protein Purification Graduate Laboratory**,  
July 2007–August 2007, University of California, Santa Barbara, CA.

AWARDS AND  
HONORS

IET Premium Award 2018.  
ORAU Ralph E. Powe Junior Faculty Enhancement Award.  
University of Delaware Research Foundation Award.  
Best PhD Thesis Award, University of California, Santa Barbara.  
Best presentation award at the IEEE American Control Conference in 2006, 2009 and 2013.  
Michigan State University Graduate Fellowship for Fall 2002.  
Best Senior Project Award in 2002 at the Indian Institute of Technology, Kanpur, India.

GRANT  
SUPPORT

*Consequences and control of randomness in timing of intracellular events*, NIH, PI, September 1, 2017 - August 31, 2021, \$920,000.  
*Stochastic hybrid systems approach to elucidate a cellular counting and sizing mechanism*, NIH, PI, September 1, 2017 - August 31, 2020, \$675,000.  
*Stochastic inference and control of complex biological networks*, National Science Foundation, PI, September 1, 2017 - August 31, 2020, \$255,000.  
*A plasticity and reprogramming paradigm for therapy resistance at the single cell level*, NIH, Co-PI, September 1, 2018 - August 31, 2023, \$300,000 (UD's component).  
*Stochastic modeling and inference of gene networks*, Division of Mathematical Sciences, National Science Foundation, PI, August 15, 2013 - July 31, 2017, \$221,065.  
*Stochastic modeling and inference of gene networks*, NSF Research Experiences for Undergraduates (REU), PI, August 15, 2016 - July 31, 2017, \$8,1000.  
*Stochastic modeling and inference of gene networks*, NSF Research Experiences for Undergraduates (REU), PI, August 15, 2014 - July 31, 2015, \$4,500.  
*Stochastic modeling and inference of gene networks*, Oak Ridge Associated Universities, PI, September 1, 2013 - May 31, 2014, \$10,000.  
*Reverse engineering cellular networks from single-cell gene expression data*, University of Delaware Research Foundation, PI, September 1, 2013 - May 31, 2015, \$38,500.

PUBLICATIONS

**105 peer-reviewed papers** collectively cited more than 2,300 times with an h-index of 26  
**Google Scholar Profile:** <http://scholar.google.com/citations?user=MPmrKXsAAAAJ&hl=en>  
Supervised graduate students are underlined

Supervised undergraduate students are double-underlined

**Journal Papers**

- 1) S Keskin, GS Devakanmalai, SB Kwon, HT Vu, Q Hong, YiY Lee, M Soltani, **A Singh**, A Ay and EM Ozbudak. *Noise in the vertebrate segmentation clock is boosted by time delays but tamed by notch signaling*. Cell Reports, 7, 2175–2185, 2018.
- 2) P Bokes, YT Lin and **A Singh**. *High cooperativity in negative feedback can amplify noisy gene expression*. Bulletin of Mathematical Biology, DOI: 10.1007/s11538-018-0438-y, 2018.
- 3) CA Vargas-Garcia, K Ghusinga and **A Singh**. *Cell size control and gene expression homeostasis in single-cells*. Current Opinion in Systems Biology, 8, 109–116, 2018.
- 4) A Lamperski, K Ghusinga and **A Singh**. *Analysis and control of stochastic systems using semidefinite programming over moments*. IEEE Transactions on Automatic Control, DOI: 10.1109/TAC.2018.2872274, 2018.
- 5) CA Vargas-Garcia, R Zurakowski and **A Singh**. *Synaptic transmission may provide an evolutionary benefit to HIV through modulation of latency*. Journal of Theoretical Biology, 455, 261-268, 2018.

- 6) A Kakrana, A Yang, D Anand, D Djordjevic, D Ramachandruni, **A Singh**, H Huang, J Ho, SA Lachke. *iSyTE 2.0: A database for expression-based gene discovery in the eye*. Nucleic Acids Research, 46, D875–D885, 2018.
- 7) DO Robinson, JE Coate, **A Singh**, L Hong, M Bush, JJ Doyle, A Roeder. *Ploidy and Size at Multiple Scales in the Arabidopsis Sepal*. The Plant Cell, 30, 2308–2329, 2018.
- 8) Y Wu, B Han, T Gauvin, J Smith, **A Singh** and E Griffin. *Single molecule dynamics of the P granule scaffold MEG-3 in the C. elegans zygote*. Molecular Biology of the Cell, to appear, 2018.
- 9) A Hubbard, X Zhang, S Jastrebski, SJ Lamont, **A Singh** and CJ Schmidt. *Identifying mechanisms of regulation to model carbon flux during heat stress and generate testable hypotheses*. PLOS One, 13, e0205824, 2018.
- 10) S Shaffer, M Dunagin, S Torborg, E Torre, B Emert, C Krepler, M Beqiri, K Sproesser, P Brafford, M Xiao, E Egan, I Anastopoulos, K Nathanson, CA Vargas-Garcia, **A Singh**, M Herlyn and A Raj. *Rare cell variability and drug-induced reprogramming as a mode of cancer drug resistance*. Nature, 546, 431–435, 2017.
- 11) K Ghusinga, JJ Dennehy and **A Singh**. *First-passage time approach to controlling noise in the timing of intracellular events*. Proceedings of the National Academy of Sciences, 114, 693–698, 2017.
- 12) S Modi, CA Vargas-Garcia, K Ghusinga and **A Singh**. *Analysis of noise mechanisms in cell size control*. Biophysical Journal, 112, 2408–2418, 2017.
- 13) P Bokes and **A Singh**. *Gene expression noise is affected differentially by feedback in burst frequency and burst size*. Journal of Mathematical Biology, 74, 1483–1509, 2017.
- 14) A Mena, DA Medina, J Garcia-Martinez, V Begley, **A Singh**, S Chavez, MC Munoz-Centeno and JE Perez-Ortin. *Asymmetric cell division requires specific mechanisms for adjusting global transcription*. Nucleic Acids Research, 45, 12401–12412, 2017.
- 15) K Ghusinga, CA Vargas-Garcia, A Lamperski and **A Singh**. *Exact lower and upper bounds on stationary moments in stochastic biochemical systems*. Physical Biology, 14, 04LT01, 2017.
- 16) M Soltani and **A Singh**. *Moment-based analysis of stochastic hybrid systems with renewal transitions*. Automatica, 84, 6269, 2017.
- 17) CA Vargas-Garcia, M Soltani and **A Singh**. *Conditions for cell size homeostasis: A stochastic hybrid systems approach*. IEEE Life Science Letters, 2, 47–50, 2016.
- 18) M Soltani and **A Singh**. *Effects of cell-cycle-dependent expression on random fluctuations in protein levels*. Royal Society Open Science, 3, 2016. DOI: 10.1098/rsos.160578.
- 19) K Ghusinga, CA Vargas-Garcia and **A Singh**. *A mechanistic stochastic framework for regulating bacterial cell division*. Nature: Scientific Reports, 6, 30229, 2016.
- 20) M Soltani, CA Vargas-Garcia, D Antunes and **A Singh**. *Intercellular variability in protein levels from stochastic expression and noisy cell cycle processes*. PLOS Computational Biology, 12, e1004972, 2016.
- 21) R Dar, S Schaffer, **A Singh**, B Razooky, M Simpson, A Raj and LS Weinberger. *Transcriptional bursting explains the noise-versus-mean relationship in mRNA and protein levels*. PLOS One, 11, e0158298, 2016.
- 22) A Borri, P Palumbo and **A Singh**. *The impact of negative feedback in metabolic noise propagation*. IET Systems Biology, 10, 179–186, 2016.
- 23) B Emerick and **A Singh**. *Host-feeding enhances stability of discrete-time host-parasitoid population dynamic models*. Mathematical Bioscience, 272, 54–63, 2016.
- 24) E Sontag and **A Singh**. *Exact moment dynamics for feedforward nonlinear chemical reaction networks*. IEEE Life Sciences Letters, 1, 26–29, 2015.

- 25) P Kulkarni, N Rangarajan, Z Fox, **A Singh** and G Rangarajan. *State switching and cancer: The role of Myc, an intrinsically disordered protein*. Journal of Theoretical Biology, 386, 105–114, 2015.
- 26) N. Kumar, **A Singh** and R. Kulkarni. *Transcriptional bursting in gene expression: analytical results for general stochastic models*. PLOS Computational Biology, 11, e1004292, 2015.
- 27) M Soltani, CA Vargas-Garcia and **A Singh**. *Conditional Moment Closure Schemes for Studying Stochastic Dynamics of Genetic Circuits*. IEEE Transactions on Biomedical Systems and Circuits, 9, 518–526, 2015.
- 28) M Soltani, P Bokes, Z Fox and **A Singh**. *Nonspecific transcription factor binding can reduce noise in the expression of downstream proteins*. Physical Biology, 12, 055002, 2015.
- 29) SA Agrawal, D Anand, AD Siddam, A Kakrana, DA Scheiblin, CA Dang, AM Terrell, SM Waters, **A Singh**, H Motohashi and SA Lachke. *Compound mouse mutants of bZIP transcription factors MafG and MafK reveal a network of non-crystallin genes in cataractogenesis*. Human Genetics, 134, 717-735, 2015.
- 30) O Padovan-Merhar, G Nair, A Biaesch, A Mayer, S Scarfone, S Foley, A Wu, L Churchman, **A Singh** and A Raj. *Single mammalian cells compensate for differences in cellular volume and DNA copy number through independent global transcriptional mechanisms*. Molecular Cell, 58, 339-352, 2015.
- 31) P Bokes and **A Singh**. *Protein copy number distributions for a self-regulating gene in the presence of decoy binding sites*. PLOS One, 10, e0120555, 2015.
- 32) B Daigle, M Soltani, L Petzold and **A Singh**. *Inferring single-cell gene expression mechanisms using stochastic simulation*. Bioinformatics, 31, 1428-1435, 2015.
- 33) D Antunes and **A Singh**. *Quantifying gene expression variability arising from randomness in cell division times*. Journal of Mathematical Biology, 71, 437-463, 2015.
- 34) **A Singh**. *Transient changes in intercellular protein variability identify sources of noise in gene expression*. Biophysical Journal, 107, 2214-2220, 2014.
- 35) **A Singh** and JJ Dennehy. *Stochastic holin expression can account for lysis time variation in the bacteriophage  $\lambda$* . Journal of the Royal Society Interface, 11, 20140140, 2014.
- 36) **A Singh** and M Soltani. *Quantifying intrinsic and extrinsic variability in stochastic gene-expression models*. PLOS One, 8, e84301, 2013.
- 37) **A Singh** and P Bokes. *Consequences of mRNA transport on stochastic variability in protein levels*. Biophysical Journal, 103, 1087-1096, 2012.
- 38) **A Singh**, B Razooky, RD Dar and LS Weinberger. *Dynamics of protein noise can distinguish between alternate sources of gene-expression variability*. Molecular Systems Biology, 8, 607, 2012.
- 39) RD Dar, B Razooky, **A Singh**, T Trimeloni, J McCollum, CD Cox, LS Weinberger and ML Simpson. *Transcriptional burst frequency and burst size are equally modulated across the human genome*. Proceedings of the National Academy of Sciences, 109, 17454 -17459, 2012.
- 40) **A Singh**. *Negative feedback through mRNA provides the best control of gene-expression noise*. IEEE Transactions on NanoBioscience, 11, 194-200, 2011.
- 41) K Franz, **A Singh** and L. S. Weinberger. *Lentiviral vectors to study stochastic noise in gene expression*. Methods in Enzymology, 497, 603-622, 2011.
- 42) **A Singh** and JP Hespanha. *Approximate moment dynamics for chemically reacting systems*. IEEE Transactions on Automatic Control, 56, 414-418, 2011.
- 43) **A Singh** and JP Hespanha. *Using stochastic hybrid systems for studying biochemical processes*. Philosophical Transactions A of the Royal Society, 368, 4995-5011, 2010.

- 44) **A Singh**, B Razooky, CD Cox, ML Simpson and LS Weinberger. *Transcriptional bursting in HIV-1 promoter creates high variability in proteins levels*. Biophysical Journal, 98, L32-L34, 2010.
- 45) **A Singh** and JP Hespanha. *Evolution of gene auto-regulation in the presence of noise*. IET Systems Biology, 3, 368-378, 2009.
- 46) **A Singh** and LS Weinberger. *Noise in viral gene expression as a molecular switch for viral latency*. Current Opinion in Microbiology, 12, 460-466, 2009.
- 47) **A Singh**, WW Murdoch and RM Nisbet. *Skewed attacks, stability and host suppression*. Ecology, 90, 1679-1686, 2009.
- 48) **A Singh** and JP Hespanha. *Optimal feedback strength for noise suppression in auto-regulatory gene networks*. Biophysical Journal, 96, 4013-4023, 2009.
- 49) **A Singh** and RM Nisbet. *Variation in risk in single-species models*. Mathematical Bioscience and Engineering, 5, 859-875, 2008.
- 50) **A Singh** and JP Hespanha. *A derivative-matching approach to moment closure for the stochastic logistic model*. Bulletin of Mathematical Biology, 69, 1909-1925, 2007.
- 51) **A Singh** and RM Nisbet. *Semi-discrete host-parasitoid models*. Journal of Theoretical Biology, 247, 733-742, 2007.
- 52) JP Hespanha and **A Singh**. *Stochastic models for chemically reacting systems using polynomial stochastic hybrid systems*. International Journal of Robust and Nonlinear Control, 15, 669-689, 2005.
- 53) **A Singh** and HK Khalil. *Regulation of nonlinear systems using conditional integrators*. International Journal of Robust and Nonlinear Control, 15, 339-362, 2005.
- 54) **A Singh**, R Mukherjee, K Turner and S Shaw. *MEMS implementation of axial and follower end forces*. Journal of Sound and Vibration, 286, 637-644, 2005.

**Peer-reviewed Conference Papers**

6-8 pages in two-column format with 2-5 reviewers

- 55) A Borri, P Palumbo and **A Singh**. *Noise propagation in feedback coupling between cell growth and metabolic activity*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 56) CA Vargas-Garcia and **A Singh**. *Elucidating cell size control mechanisms with stochastic hybrid systems*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 57) M Soltani and **A Singh**. *Control design and analysis of a stochastic event-driven system*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 58) S Modi and **A Singh**. *Optimal feedback mechanisms for regulating cell numbers*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 59) M Soltani, Z Xu and **A Singh**. *Exact statistical moments of multi-mode stochastic hybrid systems with renewal transitions*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 60) S Mukherjee, A Carignano, **A Singh** and G Seelig. *Extrinsic noise suppression in microRNA mediated incoherent feedforward loops*. IEEE Conference on Decision and Control, Miami, FL, 2018.
- 61) C Demir, M Soltani and **A Singh**. *Prediction of projectile impact point using approximate statistical moments*. American Control Conference, Milwaukee, WI, 2018.
- 62) S Modi, M Soltani and **A Singh**. *Linear noise approximation for a class of piecewise deterministic markov processes*. American Control Conference, Milwaukee, WI, 2018.
- 63) M Soltani and **A Singh**. *Linear piecewise-deterministic markov processes with families of random discrete events*. European Control Conference, Limassol, Cyprus, 2018.

- 64) K Ghusinga, A Lamperski and **A Singh**. *Estimating stationary characteristic functions of stochastic systems via semidefinite programming*. European Control Conference, Limassol, Cyprus, 2018.
- 65) P. Bokes and **A Singh**. *Buffering gene expression noise by microRNA based feedforward regulation*. 16th conference on Computational Methods in Systems Biology, Brno, Czech Republic, 2018.
- 66) A Borri, P Palumbo and **A Singh**. *Noise propagation in a class of metabolic networks*. IEEE Conference on Decision and Control, Melbourne, Australia, 2017.
- 67) J Blotnick, CA Vargas-Garcia, JJ Dennehy, R Zurakowski and **A Singh**. *The effect of multiplicity of infection on the temperateness of a bacteriophage: Implications for viral fitness*. IEEE Conference on Decision and Control, Melbourne, Australia, 2017.
- 68) **A Singh**. *Modeling noise mechanisms in neuronal synaptic transmission*. IEEE Conference on Decision and Control, Melbourne, Australia, 2017.
- 69) X Chen, M Ogura, K Ghusinga, **A Singh**, VM Preciado. *Semidefinite bounds for moment dynamics: Application to epidemics on networks*. IEEE Conference on Decision and Control, Melbourne, Australia, 2017.
- 70) K Ghusinga, M Soltani, A Lamperski, S Dhople and **A Singh**. *Approximate moment dynamics for polynomial and trigonometric stochastic systems*. IEEE Conference on Decision and Control, Melbourne, Australia, 2017.
- 71) M Soltani and **A Singh**. *Stochastic analysis of linear time-invariant systems with renewal transitions*. American Control Conference, Seattle, WA, 2017.
- 72) CA Vargas-Garcia, C Agemabiese and **A Singh**. *Optimal adsorption rate: Implications of the shielding effect*. American Control Conference, Seattle, WA, 2017.
- 73) K Ghusinga and **A Singh**. *Effect of gene-expression bursts on stochastic timing of cellular events*. American Control Conference, Seattle, WA, 2017.
- 74) A Borri, P Palumbo and **A Singh**. *Noise reduction for enzymatic reactions: a case study for stochastic product clearance*. IEEE Conference on Decision and Control, Las Vegas, NV, 2016.
- 75) CA Vargas-Garcia and **A Singh**. *Hybrid systems approach to modeling stochastic dynamics of cell size*. IEEE Conference on Decision and Control, Las Vegas, NV, 2016.
- 76) A Lamperski, K Ghusinga and **A Singh**. *Stochastic optimal control using semidefinite programming for moment dynamics*. IEEE Conference on Decision and Control, Las Vegas, NV, 2016.
- 77) M Soltani and **A Singh**. *Moment dynamics for a class of time-triggered stochastic hybrid systems*. IEEE Conference on Decision and Control, Las Vegas, NV, 2016.
- 78) J Conway, JJ Dennehy and **A Singh**. *Optimizing phage  $\lambda$  survival in a changing environment: stochastic model predictions*. IEEE Conference on Decision and Control, Las Vegas, NV, 2016.
- 79) K Ghusinga and **A Singh**. *Optimal regulation of protein degradation to schedule cellular events with precision*. American Control Conference, Boston, MA, 2016.
- 80) M Soltani, T Platini and **A Singh**. *Stochastic analysis of an incoherent feedforward genetic motif*. American Control Conference, Boston, MA, 2016.
- 81) A Borri, P Palumbo and **A Singh**. *Metabolic noise reduction for enzymatic reactions: the role of a negative feedback*. IEEE Conference on Decision and Control, Osaka, Japan, 2015.
- 82) K Ghusinga and **A Singh**. *First-passage time for a gene expression model with bursts and decay*. IEEE Conference on Decision and Control, Osaka, Japan, 2015.
- 83) K Ghusinga and **A Singh**. *Optimal auto-regulation to minimize first-passage time variability in protein level*. American Control Conference, Chicago, IL, 2015.

- 84) M Soltani, CA Vargas-Garcia, N Kumar, R Kulkarni and **A Singh**. *Approximate statistical dynamics of a genetic feedback circuit*. American Control Conference, Chicago, IL, 2015.
- 85) K Ghusinga and **A Singh**. *Optimal first-passage time in gene regulatory networks*. IEEE Conference on Decision and Control, Los Angeles, CA, 2014.
- 86) Z Fox and **A Singh**. *Stochastic analysis of protein-mediated and microRNA-mediated feedback circuits in HIV*. 19th IFAC World Congress, Cape Town, South Africa, 2014.
- 87) CA Vargas-Garcia, L Cannon, **A Singh** and R Zurakowski. *Optimal multi-drug approaches for reduction of the latent pool in HIV*. 19th IFAC World Congress, Cape Town, South Africa, 2014.
- 88) **A Singh**, CA Vargas-Garcia and R Karmakar. *Stochastic analysis of genetic promoter architectures with memory*. IEEE Conference on Decision and Control, Florence, Italy, 2013.
- 89) CA Vargas-Garcia, R Zurakowski and **A Singh**. *Conditions for invasion of synapse-forming HIV variants*. IEEE Conference on Decision and Control, Florence, Italy, 2013.
- 90) D Antunes and **A Singh**. *Computing mRNA and protein statistical moments for a renewal model of stochastic gene-expression*. IEEE Conference on Decision and Control, Florence, Italy, 2013.
- 91) **A Singh**, CA Vargas-Garcia and R Karmakar. *Stochastic analysis and inference of a two-state genetic promoter model*. American Control Conference, Washington, DC, 2013.
- 92) **A Singh**. *Quantifying stochasticity in gene-expression models with extrinsic parameter fluctuations*. IEEE Conference on Decision and Control, Maui, HI, 2012.
- 93) **A Singh**. *Stochastic analysis of genetic feedback circuit controlling cell-fate decision in HIV*. IEEE Conference on Decision and Control, Maui, HI, 2012.
- 94) **A Singh**. *Genetic negative feedback circuits for filtering stochasticity in gene expression*. IEEE Conference on Decision and Control, Orlando, FL, 2011.
- 95) **A Singh** and JP Hespanha. *Reducing noise through translational control in an auto-regulatory gene network*. American Control Conference, St. Louis, MO, 2009.
- 96) **A Singh** and JP Hespanha. *Noise suppression in auto-regulatory gene networks*. IEEE Conference on Decision and Control, Cancun, Mexico, 2008.
- 97) **A Singh** and JP Hespanha. *Scaling of stochasticity in gene cascades*. American Control Conference, Seattle, WA, 2008.
- 98) **A Singh** and JP Hespanha. *Stochastic analysis of gene regulatory networks using moment closure*. American Control Conference, New York, NY, 2007.
- 99) **A Singh** and JP Hespanha. *Lognormal moment closures for bio-chemical reactions*. IEEE Conference on Decision and Control, San Diego, CA, 2006.
- 100) **A Singh** and JP Hespanha. *Moment closure techniques for stochastic models in population biology*. American Control Conference, Minneapolis, MN, 2006.
- 101) **A Singh** and JP Hespanha. *Stochastic modeling of biochemical reactions*. 25th Army Science Conference, Orlando, FL, 2006.
- 102) **A Singh** and JP Hespanha. *Models for multi-specie chemical reactions using polynomial stochastic hybrid systems*. IEEE Conference on Decision and Control, Seville, Spain, 2005.
- 103) **A Singh** and JP Hespanha. *Modeling chemical reactions with single reactant specie*. In Proc. of the Workshop on Modeling and Control of Complex Systems, Cyprus, 2005.
- 104) **A Singh** and HK Khalil. *State feedback regulation of nonlinear systems using conditional integrators*. IEEE Conference on Decision and Control, Bahamas, 2004.

Book Chapters

- 105) **A Singh** and R Grima. *Quantitative Biology: Theory, Computational Methods and Examples of Models*. Editors: Bill Hlavacek, Brian Munsky and Lev Tsimring, MIT Press, 2018

**Selected Conference Abstracts**

*Stochastic Dynamics and Control of Biological Circuits*. AMS Sectional Meeting, University of Delaware, Newark, DE, 2018.

*Noise Analysis in Biochemical Complex Formation*. Annual q-bio Conference, Rice University, Houston, TX, 2018.

*Exact lower and upper bounds on moments of biochemical systems*. European Conference on Mathematical and Theoretical Biology, Lisbon, Portugal, 2018.

*Dependency of Bacteriophage  $\lambda$  Lysis Time on the Host's Growth Rate*. Annual q-bio Conference, New Brunswick, NJ, 2017.

*Properties of Intragenic microRNA-Based Gene Regulation in Single Cells and Population Measurements*. AIChE Annual Meeting, San Francisco, CA, 2016.

*First passage time approach to modeling timing phenomena in single-cells*. Annual Meeting of the Society for Mathematical Biology, Nottingham, UK, 2016.

*Modeling timing phenomena in single-cells: From phage-induced lysis to cell-division events*. International Chemical Congress of Pacific Basin Societies (Pacifichem), Honolulu, HI 2015.

*Modeling bacteriophage lambda lysis time through first-passage time calculations*. Annual Meeting of the Society for Mathematical Biology, Atlanta, GA, 2015.

*Stochastic analysis of genetic feedback circuit controlling HIV latency*. Annual Meeting of the Society for Mathematical Biology, Atlanta, GA, 2015.

*Effects of molecular sequestration on stochastic gene expression*. Q-bio conference, Santa Fe, NM, 2014.

*Integration of temporal lens gene expression datasets to expand the gene discovery tool iSyTE*. ARVO Annual Meeting, Orlando, FL, 2014.

*Characterization of lens defects in mouse mutants of bZIP transcription factors MafG and MafK*. ARVO Annual Meeting, Orlando, FL, 2014.

*First-passage time calculations for gene networks: Implications for phage lambda lysis time*. SIAM Conference on the Life Sciences, Charlotte, NC, 2014.

*First-passage time stochasticity in a gene network with feedback regulation*. Northeast Bioengineering Conference, Boston, MA, 2014.

*Determination of burst parameters in stochastic models of gene expression*. Winter Q-bio Meeting, Waikoloa, HI, 2014.

*Modeling Tat-protein feedback network in HIV: microRNA influence on HIV latency*. 16th Annual Undergraduate Research Symposium in the Chemical and Biological Sciences, UMBC, Baltimore, MD, 2013. Zachary Fox received second-place prize for his research.

*Conditions for invasion of synapse-forming HIV variants*. International Conference on Computational Cell Biology, Blacksburg, VA, 2013.

*Identification of small MAF family transcription factors MafG and MafK associated with cataract*. ARVO Annual Meeting, Seattle, WA, 2013.

*Transcriptional bursting in HIV-1 promoter creates high variability in proteins levels*. Conference on Stochastic Systems Biology, Switzerland, 2011.

PRESS  
COVERAGE

The article "Noise in the vertebrate segmentation clock is boosted by time delays but tamed by notch signaling" was reported in:

<https://www.sciencedaily.com/releases/2018/05/180515113759.htm>



The article “Rare cell variability and drug-induced reprogramming as a mode of cancer drug resistance” was reported in:  
<http://ecancer.org/news/11752-cancer-cell-variability-epigenetic-reprogramming-and-drug-resistance.php>  
<http://www.udel.edu/udaily/2017/june/nature-random-variations-cancer-drug-resistance/>

The article “iSyTE 2.0: A database for expression-based gene discovery in the eye” was reported in:  
<https://www.udel.edu/udaily/2017/december/eye-genome-database/>

The article “First-passage time approach to controlling noise in the timing of intracellular events” was reported in:  
<http://www.udel.edu/udaily/2017/january/timing-of-key-intracellular-events/>  
<https://m.phys.org/news/2017-01-mathematical-key-intracellular-events.html>

The article “Compound mouse mutants of bZIP transcription factors MafG and MafK reveal a network of non-crystallin genes in cataractogenesis” was reported in:  
<http://www.sciencedaily.com/releases/2015/06/150618122111.htm>

The article “Single mammalian cells compensate for differences in cellular volume and DNA copy number through independent global transcriptional mechanisms” was reported in:  
<http://phys.org/news/2015-06-cells-biochemical-bigger.html>

The article “Dynamics of protein noise can distinguish between alternate sources of gene-expression variability” was reported in:  
<http://phys.org/news/2012-09-paper-method-sources-noise-gene-expression.html>

The article “Transcriptional burst frequency and burst size are equally modulated across the human genome” was reported in:  
<http://gladstoneinstitutes.org/pressrelease/2012-10-08/gladstone-scientists-discover-gene-bursting-plays-key-role-in-protein-product>

UDaily article on Best PhD Thesis Award:  
<http://www.udel.edu/udaily/2012/dec/singh-ccdc-award-121411.html>

The article “Transcriptional bursting in HIV-1 promoter creates high variability in proteins levels” was reported in:  
<http://www.sciencedaily.com/releases/2010/04/100420132828.htm>  
<http://www.medicalnewstoday.com/articles/186129.php>  
<http://www.physorg.com/news190985130.html>

STUDENTS &  
POSTDOCS

Dola Sengupta, Postdoctoral Scholar, Arriving January 2019  
Supravat Dey, Postdoctoral Scholar, Spring 2018 – Present  
Sherin Kannoly, Postdoctoral Scholar, Spring 2018 – Present  
Zikai Xu, Ph.D. Student, Fall 2017– Present  
Mike Saint-Antoine, Ph.D. Student, Fall 2018– Present  
Zahra Vahdat, Ph.D. Student, Fall 2018 – Present  
Madeline Smith, Undergraduate researcher, Summer 2018 – Present  
Djordje Vukojevic, Undergraduate researcher, Summer 2018 – Present

Rohan Kanchana, High school student, Summer 2018 – Present

LAB ALUMINI Cesar Augusto Vargas-Garcia, Ph.D. Student, Fall 2012 – Fall 2017, Currently Assistant Professor at Fundacin Universitaria Konrad Lorenz, Bogota, Colombia.

Mohammad Soltani, Ph.D. Student, Fall 2012 – Spring 2018, Currently Data Scientist at Johnson & Johnson.

Khem Ghusinga, Ph.D. Student, Fall 2013 – Summer 2018, Currently Postdoctoral Scholar at the University of North Carolina, Chapel Hill.

Saurabh Modi, Ph.D. Student, Fall 2015 – Spring 2018, Currently Ph.D. student in Biomedical Engineering at the University of Delaware.

Cenk Demir, M.S. Student, Fall 2015 – Spring 18, Currently Ph.D. student at the University of California, San Diego.

Hetty Nie, M.S. Student, Fall 2014 – Fall 2016, Currently Staff Scientist at QPS.

Joshua Boltnick, Undergraduate researcher, Spring 2016 – Spring 2018, Currently Ph.D. student at the University of Colorado, Boulder.

Zach Fox, Undergraduate researcher from Spring 2013 – Summer 2014, Currently Ph.D. student at Colorado State University.

Kyle Davis, Undergraduate researcher from Spring 2014 – Spring 2015, Currently Ph.D. student at Columbia University.

Daniel Charytonowicz, Undergraduate researcher from Spring 2015 – Spring 2016, Currently MD/PhD student at Icahn School of Medicine at Mount Sinai.

TEACHING EXPERIENCE Introduction to Data Analysis, University of Turin, Turin, Italy, Summer 2018

ELEG 418: Digital Control Systems, UD, Fall 2016, Spring 2019.

ELEG 801: Advanced Topics in Biomedical Engineering, UD, Spring 2014

ELEG 697: Computational Systems Biology, UD, Fall 2012 – 2015, 2018

BMEG 330: Biomedical Instrumentation, UD, Spring 2012 – 2015, Fall 2015 – 2016, 2018

ELEG 664: Biomedical Engineering Seminar, Fall 2012 – 2018.

ELEG 305: Signals and Systems, UD, Spring 2013 – 2016 (one guest lecture)

MATH 460: Introduction to Systems Biology, UD, Fall 2011 (one guest lecture)

CHEM 220: Regulatory Circuits in Cells, UCSD, Spring 2011 (three guest lectures)

INVITED TALKS Department of Mathematics, New Jersey Institute of Technology, Newark, NJ 2018

Institute of Functional Epigenetics, Helmholtz Zentrum Munchen, Munich, Germany 2018

Department of Electrical Engineering, Polytechnic of Milan, Milan, Italy 2018

Institute for Integrative Systems Biology, Valencia, Spain 2018

Institute of Fundamental Technological Research, Warsaw, Poland 2018

Department of Information Engineering, University of Padova, Padova, Italy 2018

Institute of Electronics, Information and Telecommunications Engineering, Turin, Italy 2018

FIRC Institute of Molecular Oncology, Milan, Italy 2018

Molecular Biotechnology Center, University of Turin, Turin, Italy 2018

Department of Biomedical Engineering, Boston University, Boston, MA 2018

Department of Biological Sciences, Wright State University, Fairborn, OH 2018

Walter and Eliza Hall Institute of Medical Research, Melbourne, Australia, 2017

Department of Biology, Williams College, Williamstown, MA 2017

*Abhyudai Singh*

Electrical and Computer Engineering, Worcester Polytechnic Institute, Worcester, MA 2017  
Systems Biology Program, Bose Institute, Kolkata, India 2017  
National Institute of Immunology, New Delhi, India 2017  
Chemical & Biological Engineering, Colorado State University, Fort Collins, CO 2017  
Department of Applied Mathematics, University of Colorado, Boulder, CO 2017  
Computational Biology Program, Worcester Polytechnic Institute, Worcester, MA 2017  
Center for Theoretical Biological Physics, Rice University, Houston, TX 2017  
Department of Physics, Williams College, Williamstown, MA 2017  
Quantitative Biology, University of California, San Diego, CA 2016  
Department of Bioengineering, University of Texas, Dallas, TX 2016  
Department of Biomedical Engineering, Rensselaer Polytechnic Institute, Troy, NY 2016  
Department of Biological Sciences, University of Delaware, Newark, DE 2016  
Department of Mathematics, University of Arizona, Tucson, AZ 2016  
Department of Mathematics, Arizona State University, Phoenix, AZ 2016  
QBiC Quantitative Biology Center RIKEN, Osaka, Japan 2015  
Department of Chemical Engineering, Colorado State University, Fort Collins, CO 2015  
Bioinformatics Program, Boston University, Boston, MA 2015  
Department of Mathematics, Northeastern University, Boston, MA 2015  
Department of Mathematics, Penn State University, University Park, PA 2015  
Department of Electrical Engineering, Indian Institute of Technology Delhi, India 2014  
Department of Mathematics, Rutgers University, New Brunswick, NJ 2014  
Department of Biology, Queens College, City University of New York, NY 2013  
Department of Chemical Engineering, Indian Institute of Technology, Bombay, India 2013  
Department of Applied Mathematics, University of Waterloo, Waterloo, ON, Canada 2013  
Department of Physics, University of Massachusetts, Boston, MA 2013  
Department of Electrical Engineering, University of California, Santa Barbara, CA 2013  
University of Connecticut Health Center, Farmington, CT, 2012  
Thomas Jefferson University, Philadelphia, PA, 2012  
Department of Mathematics, University of Arizona, Tucson, AZ, 2011  
Department of Electrical Engineering, University of Connecticut, Storrs, CT, 2011  
Center for Systems Biology, University of California, San Francisco, CA, 2011  
Department of Biomedical Engineering, University of Buffalo, NY, 2011  
Center for AIDS research, University of California, San Diego, CA, 2010  
Center for Nonlinear Studies, Los Alamos National Lab, Los Alamos, NM, 2008

PROFESSIONAL SERVICE Program Committee, 17th conference on Computational Methods in Systems Biology, Trieste, Italy, 2019.

Program Committee, 16th IEEE International Conference on Computational Intelligence in Bioinformatics and Computational Biology, Siena, Italy, 2019.

Co-organizer of invited session on “Stochastic Processes in Mathematical Biology” at the AMS Fall Sectional Meeting at the University of Delaware, 2018.

Academic Editor, PLOS ONE, July 2018 – Present.

Program Committee, 6th International Workshop on Hybrid Systems and Biology, Prague, Czech Republic, 2019.

Co-chair of session on “Biomolecular Systems” at the IEEE Conference on Decision and Control, Miami, FL, 2018.

Co-chair of session on “Systems Biology” at the IEEE Conference on Decision and Control, Miami, FL, 2018.

Program Committee, 16th conference on Computational Methods in Systems Biology, Brno, Czech Republic, 2018.

Chair of sessions on “Biological Systems” and “Stochastic Systems” at the American Control Conference, Seattle, WA, 2017.

Co-organizer of invited session on “Stochastic Analysis and Design Methods in Biological Systems” at the IEEE Conference on Decision and Control, Las Vegas, NV, 2016.

Served on review panels for Division of Mathematical Sciences, National Science Foundation in 2015 and 2016.

External reviewer for Swiss National Science Foundation in 2017.

Program Committee, Fifth International Workshop on Hybrid Systems and Biology, Grenoble, France, 2016.

Chair of session on “Cellular Dynamics” at the American Control Conference, Boston, MA, 2016.

Gave two invited lectures (75 mins each) on “Moment Dynamics for Stochastic Systems” at the 2015 q-bio Summer School held in Fort Collins, CO.

Co-organizer of the symposium “Stochastic Dynamics in Single-Cells” at the City University of New York (CUNY) on May 26th 2015. Symposium brought together over 60 participants from institutes in and around NYC.

Program Committee, Fourth International Workshop on Hybrid Systems and Biology, Madrid, Spain 2015.

Session Chair at the International Conference on Computational Cell Biology, Blacksburg, VA, 2013.

Chair of session on “Cellular Dynamics” at the IEEE Conference on Decision and Control, Florence, Italy, 2013.

Co-organizer of post conference workshop “Identification, Analysis and Design of Biological Networks” at the IEEE Conference on Decision and Control, Maui, HI, 2012.

Chair and co-organizer of invited session on “Stochastic Analysis and Inference of Biochemical Processes” at the IEEE Conference on Decision and Control, Maui, HI, 2012.

Chair and co-organizer of invited session on “Modeling and Control of Disease” at the IEEE Conference on Decision and Control, Maui, HI, 2012.

Chair of session on “Gene Regulatory Systems” at the IEEE Conference on Decision and Control, Orlando, FL, 2011.

Member of SIAM, Biophysical Society, IEEE Control Systems Society, and the Society for Mathematical Biology.

Reviewer for Cell Systems, PNAS, Complexity, Royal Society Open Science, Frontiers in Cell and Developmental Biology, Nature Communications, IEEE Transaction on Biomedical Circuits and Systems, Automatica, IEEE Transactions on Automatic Control, Scientific Reports, SIAM Journal on Applied Dynamical Systems, European Journal of Control, Critical Reviews in Microbiology, Heliyon, Journal of the Royal Society Interface, PLoS Computational Biology, ACS Synthetic Biology, Biochemical Society Transactions, Biophysical Journal, Proceedings of the Royal Society B: Biological Sciences, Journal of Chemical Physics, Journal of Mathematical Biology, Systems and Synthetic Biology, Journal of Theoretical

Biology, PLoS One, Gene, ACM Transactions on Modeling and Computer Simulation, IET Systems Biology, Theoretical Biology and Medical Modeling, IEEE Conference on Decision and Control, International Symposium on Mathematical Theory of Networks and Systems, American Control Conference, IFAC Symposium on System Identification, International Conference on Hybrid Systems: Computation and Control.

UNIVERSITY  
SERVICE

Group leader, Signal Processing, Communication and Control (SPCC) group, Department of Electrical & Computer Engineering.

P&T Committee, Department of Biomedical Engineering.

Academic advisor, Bioelectrical Engineering Minor, Department of Electrical & Computer Engineering.

Member, Steering Committee, Center of Bioinformatics and Computational Biology.

Member, Academic Program Committee, IGERT Program in Systems Biology of Cells in Engineered Environments.

Advisor, Indian Graduate Student Association, University of Delaware.

Academic advisor to 15 Biomedical engineering undergraduate students.

Served on the PhD Dissertation Committee of 7 students.

Served on three Faculty Search Committees.

Undergraduate Committee, Department of Biomedical Engineering.

Member, Preliminary Exam Committee, PhD Program in Bioinformatics and Systems Biology, Center of Bioinformatics and Computational Biology.

Member, Junior Faculty Advisory Council, College of Engineering.