Jae Kyoung Kim

Contact Information

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Education

University of Michigan, Ann Arbor, Michigan, USA

Ph.D. Applied and Interdisciplinary Mathematics, 2008–2013

- Committee: **Daniel Forger**, **Victoria Booth**, Trachette Jackson, Lei Yin, Marisa Eisenberg
- Dissertation: Mathematical Modeling and Analysis of Cellular Clocks (Sumner B. Myers Prize)

Seoul National University, Seoul, Republic of Korea

Bachelor of Mathematics Education, 2001 – 2005 (Summa Cum Laude)

Academic Appointment

Department of Mathematical Science, KAIST, Daejeon, Korea

Assistant Professor. 2015-Present

Mathematical Biosciences Institute, The Ohio State University, Columbus, OH, USA

Postdoctoral Fellow. 2013-2015

Research Interests

Nonlinear dynamics, Stochastic process, Singular perturbation, Parameter estimation
Systems biology, Synthetic biology, Biochemical networks, Circadian rhythms, p53 rhythms

Publications

$^{+}$: co-corresponding author, *: co-1st author

DAlessandro M*, Beesley S*, **Kim JK***, Jones Z, Chen R, Vera D, Kyle K, Pagano M, Nowakowski R, Lee C, Stability of the circadian system requires a robust degradation of PERIOD, *Current Biology* (2017)

Kim JK^{+}, Rempla G^{+}, Kang H^{+}, Reduction for stochastic reaction network with multi-scale conservation, *SIAM Multiscale Model Simul* ((2017)

Kim JK^{+}, Sontag E^{+}, Reduction of Multiscale Stochastic Biochemical Reaction Networks using Exact Moment Derivation, *PLoS Comput. Biol* (2017)

Gotoh T*, **Kim JK***$^{+}$, Liu J, Vila-Caballer M, Stauffer PE, Tyson JJ, Finkielstein C^{+}, A systems-driven experimental approach reveals the complex regulatory distribution of p53 by circadian factors, *PNAS* (2016)

Kim JK, Protein sequestration versus Hill-type repression in circadian clock models, *IET Systems Biology* (2016)

DAlessandro M, Beesley S, **Kim JK**, Chen R, Abich E, Cheng W, Yi P, Takahashi JS, Lee C, A tunable artificial circadian clock in clock-defective mice, *Nature Communication* 6:9587 (2015)

Kim JK^{+}, Josić K^{+}, Bennett MR^{+}, The relationship between deterministic and stochastic quasi-steady state approximation, *BMC Syst Biol* 9:87(2015)

Zhou M*, **Kim JK***, Ling Eng GW, Forger DB, Virshup DM, A Period2 Phosphoswitch Regulates and Temperature Compensates Circadian Period *Molecular Cell* 60 (2015)

Chen Y*, **Kim JK***, Hirning A, Josić K, Bennett MR, Emergent genetic oscillations in a synthetic microbial consortium. *Science* 349.6251 (2015): 986-989

Kim JK, Josić K, Bennett MR, The Validity of Quasi-Steady-State Approximations in Discrete Stochastic Simulations, *Biophy J.* 107 (2014)

Kim JK^{+}, Kilpatrick Z, Bennett MR, Josić K^{+}, Molecular mechanisms that regulate the coupled period of the mammalian circadian clock, *Biophy J.* 106 (2014) (*Featured article of journal*)

Goriki A, Hatanaka F, Myung J, **Kim JK** Yoritaka T, Tanoue S, Abe T, et. al.. A novel protein, CHRONO, functions as a core component of the mammalian circadian clock, *PLoS Biol.* (2014)

Kim JK, Forger DB, Marconi M, Wood D, Doran A, Wager TT, Chang C Walton K, Modeling and validating chronic pharmacological manipulation of circadian rhythms, *CPT:Pharmacometrics & Systems Pharmacology (Nature Publishing Group)*, 2 (2013)

Kim JK Jackson T, Mechanisms that enhance sustainability of p53 pulses, *PLoS ONE*, (2013)

Kim JK Forger DB, A mechanism for robust circadian timekeeping via stoichiometric balance, *Molecular Systems Biology (Nature Publishing Group)*, 8 (2012) (*Recommended reading by F1000*)

Kim JK Forger DB, On the Existence and Uniqueness of Biological Clock Models Matching Experimental Data, *SIAM J. APPL. MATH.*, 72 (2012)

In Preparation

Nguyen C, **Kim JK** , Han SK, Robust and Tunable Toggle Switches with Interlocked Positive Feedback Loops (*In revision* for Physical Review E)

Choi B, Rempla G, **Kim JK**, Beyond Michaelis-Menten: Accurate and efficient estimation of enzyme kinetic parameters (*In revision for Scientific Report*)

Jo H, Kim Y, **Kim JK**, Foo M, Somers DE, Kim P, Waveforms of Molecular Oscillations Reveal Circadian Timekeeping Mechanisms (*In revision for Physical Review Letter*)

Bellman J*, **Kim JK***, Lim S, Hong C, Systematic modeling reveals light-dependent degradation of WC-1 as a novel molecular mechanism to reset the Neurospora circadian clock (*Submitted*)

Research Support

Research Grant

2017–2020 Human Frontier Science Program Young Investigator Award (Co-PI) ($1,350,000)
- The molecular circadian clock as a causal mediator of sleep-regulated neurophysiology and cognition

2017–2019 Ewon Fellowship (PI) ($60,000)
- The reverse engineering algorithm based on covergence mapping and machine learning.

2016–2021 Korea National Research Foundation Young Investigator Grant (PI) ($500,000)
- Investigation of circadian clocks and their interactions with cancer by the development of theory for reduction of stochastic systems and mathematical modeling

2016–2019 Pfizer Inc, Boston (PI) ($100,000)
- Matheamtical modeling for a new drug development regulating circadian rhythms

2016–2018 TJ Park Science Fellowship (PI) ($70,000)
- Simplification and mathematical modeling of stochastic biochemical networks

2015–2016 National Institute of Mathematical Sciences (collaborator) ($350,000)
- KAIST Industrial Mathematics Ignition Program

Honors and Awards

2017 1st KSIAM Young Researcher Award	Korea Society of Industrial & Applied Math
2017 Best Teaching Award	College of Natural Sciences, KAIST
2017 EWon Assistant Professorship for Outstanding Junior Faculty	KAIST
2016 30 Young Leading Scientists of Korea	POSTEC & Dong-A Daily News
2015 Sangsan Young Mathematician Award	The Korean Mathematical Society
2015 TJ Park Science Fellowship	POSCO TJ Park Foundation
2013 Sumner B. Myers Prize for the best math Ph.D. thesis	University of Michigan
2012 Department of Mathematics Outstanding Teaching Award	University of Michigan
2011 Best Poster Presenter	System Biology Symposium
2010 Rackham International Student Fellowship	University of Michigan
2009 Mathematics Department Summer Fellowship	University of Michigan
2006 The Air Force Chief of Staff's Award, Pedagogic Method Announcement Contest	ROKAF
2005 Dean's Citation for Excellent Learning	Seoul National University
2004 The Special Prize, Korean College Students Mathematical Competition	Korea Math Society
2004 Full Tuition Scholarship	Seoul National University
2001–2003 Full Tuition Scholarship	Chunjae Education Incorporation

Teaching Experience

Applied Analysis (Fall 2015), Nonlinear Dynamics (Spring 2016), Mathematical Biology (Fall 2016)
Instructor KAIST, Daejeon, Korea

MBI-CAMBAM-NIMbios Graduate Summer Program (Summer 2014)
Project mentor The Ohio State University, Columbus, OH, USA
– Mentored three graduate group projects on circadian rhythms, cell cycle and neural rhythms.

Calculus for Biological Sciences (Fall 2013)
Project mentor The Ohio State University, Columbus, OH, USA
– Mentored a undergraduate group project on parameter sensitivity analysis for five weeks.

Precalculus (Fall 2009), Calculus I (Winter 2010), Calculus II (Fall 2010/2011)
Sessional Lecturer University of Michigan, MI, USA
– Received 4.92/4.97/4.95/4.82 student evaluations of four courses (on a 1 to 5 scale).
– Received 2012 The Department of Mathematics Outstanding Teaching Award bestowed on one graduate student in Math Department.

Calculus (2005-2008)
Mathematics Instructor Air Force Aviation Science High School, Jinju, Korea
– Prepared and implemented lectures 12 hours weekly. Developed a curriculum of calculus.
– Received 2006 Best Instructor Award bestowed on one instructor in Air Force Academy.

Invited Talks

2018 18th World Congress of Basic and Clinical Pharmacology (July)	Kyoto, Japan
2018 Asian Sleep Society Conference (Jan)	Seoul, Korea
2018 International Workshop on Mathematical Biology (Jan)	Cebu, Phillipine
2017 International SYMCYP workshop (Dec)	Busan, Korea
2017 Korean society for clinical pharmacology and therapeutics conference (Nov)	Seoul, Korea
2017 Osaka Univ Biological Sciences Seminar (Oct)	Osaka, Japan
2017 Asian Pharmacometric Conference (Oct)	Kyoto, Japan
2017 KoreaBIOplus (Oct)	Seoul, Korea
2017 International Conference on Mathematical Biology (Oct)	Taipei, Taiwan
2017 Handong Univ Biology Seminar	Pohang, Korea
2017 Korea Research Institute of Bioscience and Biotechnology	Daejeon, Korea
2017 IMA Innovative Statistics and Machine Learning in Precision Medicine	Minneapolis, USA
2017 CMC conference: Nonlinear dynamics of many-body systems	Seoul, Korea
2017 18th International Conference on Systems Biology (Plenary Lecture)	Blacksburg, USA
2017 4th Industry Revolution Forum of the National Congress	Seoul, Korea
2017 Korean Sleep Research Society Conference	Seoul, Korea
2017 International Conference on Random Dynamical Systems	Wuhan, China
2017 Pharmacology Seminar, Chungnam University	Daejeon, Korea
2017 SIAM Conference on Applied Dynamics	Salt Lake City, USA
2017 Department of Chemistry Seminar, Chungang University	Seoul, Korea
2017 A3-NIMS Mathematical Biology Workshop	Daejeon, Korea
2017 Korea Mathematical Society Annual Meeting Public Lecture	Gwangju, Korea
2017 DIGIST Brain & Cognitive Science Seminar	Daegu, Korea
2017 Department of Mathematics Seminar, Busan University	Busan, Korea
2017 Korea University Medical School Seminar	Seoul, Korea
2017 World Brain Awareness Week Public Lecture	Daejeon, Korea
2017 Humanity and Social Science Colloquium, KAIST	Daejeon, Korea
2017 Inje University Medical School Seminar	Busan, Korea
2017 Computational Neuroscience Winter School	Pohang, Korea
2017 Network Seminar, U of Houston	Houston, USA
2016 APCTP Workshop on Frontiers of Physics	Pohang, Korea
2016 System Synthetic Agricultural Engineering Workshop	Jinju, Korea
2016 Mathematics Colloquium, UNIST	Ulsan, Korea
2016 APCTP-ICTP joint workshop: quantitative life sciences	Pohang, Korea
2016 Brain & Cognitive Engineering Seminar, KAIST	Daejeon, Korea
2016 29th Conference of the International Society for Chronobiology	Suzhou, China
2016 International Conference for the 70th Anniversary of Korean Math Society	Seoul, Korea
2016 A3 Pharmacometrics Syposium	Daejeon, Korea
2016 Mathematics Colloquium, POSTEC	Pohang, Korea
2016 Mathematics Colloquium, Yeonsei Univ	Seoul, Korea
2016 Signature Seminar, DUKE-NUS Medical school	Singapore

2016 International Conference: Patterns and Waves	Hokkaido, Japan
2016 World Conference of Scientist and Engineers	Seoul, Korea
2016 Annual Computational Neuroscience Meeting (Featured oral)	Jeju, Korea
2016 Mathematics Colloquium, Chungnam Univ	Daejeon, Korea
2016 Biological Sciences Seminar, KAIST	Daejeon, Korea
2016 National Science Museum public lecture	Daejeon, Korea
2016 Industrial & Systems Engineering Colloquium, KAIST	Daejeon, Korea
2016 A3 Workshop on Interdisciplinary Research Connecting Math and Biology	Beijing, China
2016 Mathematics Colloquium, Ajou Univ	Suwan, Korea
2016 Mathematics Colloquium, Seoul Nat. Univ	Seoul, Korea
2016 Workshop for Mathematical Biology: Recent Topics and Vision (Plenary talk)	Jeju, Korea
2016 MBI workshop, Interplay of stochastic and deterministic dynamics	Columbus, OH
2016 Applied Mathematics Seminar, Ohio State Univ	Columbus, OH
2015 Sleep Seminar, Asan Medical Center	Seoul, Korea
2015 Inverse problem conference	Daejeon, Korea
2015 Young Computational Neuroscience Workshop	Seoul, Korea
2015 Joint workshop of China-Japan-Korea A3 Foresight Program	Xiamen, China
2015 Industrial & Applied Mathematics Seminar, Konkuk Univ	Seoul, Korea
2015 KSIAM Annual Meeting	Pusan, Korea
2015 Bioinfo 2015	Seoul, Korea
2015 Mathematics Colloquium, Inha University	Incheon, Korea
2015 APTCP seminar, Asia Pacific Center for Theoretical Physics	Pohang, Korea
2015 NIMS Colloquium, National Institute for Mathematical Sciences	Daejeon, Korea
2015 National Cancer Center Seminar	Ilsan, Korea
2015 Joint Meeting of JSMB and CJK Colloquium on Mathematical Biology	Kyoto, Japan
2015 Lorentz Center workshop: Human Circadian Rhythms	Leiden, Netherlands
2015 Society of Mathematical Biology Annual Meeting	Atlanta, GA, USA
2015 U of Utah Mathematics Colloquium	Salt Lake City, UT
2014 Boston Univ. Dynamical Systems Seminar Seminar	Boston, MT
2014 U of Utah Biological Mathematics Seminar	Salt Lake City, UT
2014 Florida State U. Biological Mathematics Seminar	Tallahassee, FL
2014 UNIST Mathematics Colloquium	Ulsan, Korea
2014 KAIST Applied Mathematics Seminar	Daejeon, Korea
2014 Konkuk U. Mathematical Biolgoy Seminar	Seoul, Korea
2014 U of Michigan Mathematics Colloquium (Sumner B. Myers Prize Talk)	Ann Arbor, MI
2014 Ohio State U. Undergraduate Mathematical Biology Seminar	Columbus, OH
2014 Virginia Tech. Genetics Bioinformatics Computational Biology Seminar	Blacksburg, VA
2013 Rutgers U. Mathematical Physics Seminar	New Brunswick, NJ
2012 Complex Systems Advanced Academic Workshop	Ann Arbor, MI
2012 12th Experimental Chaos and Complexity Conference	Ann Arbor, MI
2012 RIKEN QBiC Seminar	Kobe, Japan

Other presentation	2017 Winter Q-bio conference	Contributed Talk, Hawaii, USA
	2016 International Conference on Systems Biology	Contributed Talk, Barcelona, Spain
	2016 Korean Society for Mathematical Biology Annual Meeting	Minisymposium Talk, Jeju, Korea
	2016 Society for Research on Biological Rhythms Meeting	Contributed Talk, Tampa, FL
	2016 KSIAM Annual Meeting	Contributed Talk, Daejeon, Korea
	2015 Q-bio conference	Poster Spotlight, Blacksburg, VA, USA
	2015 IMA workshop: Reflected Brownian Motions, ...	Poster, Minneapolis, MN, USA
	2014 International Congress of Mathematicians	Contributed Talk, Seoul, Korea
	2014 SIAM Annual Meeting	Contributed Talk, Chicago, IL
	2014 Society for Research on Biological Rhythms Meeting	Contributed Talk, Big Sky, MT
	2013 MBI Postdoctoral Seminar	Seminar Talk, Columbus, OH
	2013 International Conference on Computational Cell Biology	Award Talk, Blacksburg, VA
	2013 Gordon Conference on Chronobiology	Poster, New Port, RI
	2012 MBI Workshop for Young Researchers in Mathematical Biology	Talk, Columbus, OH
	2012 SIAM Conference on Life Sciences	Poster, San Diego, CA
	2012 The SMB Annual Meeting and Conferences	Contributed Talk, Knoxville, TN
	2012 KSBMB Annual Meeting	Poster, Seoul, Korea
	2012 Society for Research on Biological Rhythms Meeting	Poster, Destine, FL
	2011 Biological Rhythm Data Annual Meeting	Talk, Ann Arbor, MI
	2011 Biological Rhythms Seminar	Seminar Talk, Ann Arbor, MI
	2011 MBI Workshop for Young Researchers in Mathematical Biology	Poster, Columbus, OH
	2011 3rd World Congress of Chronobiology	Poster, Puebla, Mexico
	2011 System Biology Symposium	Poster, Ann Arbor, MI
	2010 NIDDK workshop: Circadian Rhythms and Metabolic Diseases	Poster, Bethesda, MD
Editorial Work	Editorial Board Member of JSM Mathematics and Statistics	2014–present
	Guest Associate Editor of PLoS Computational Biology	2014-2015

Refereeing Work PNAS; Cell Reports; NPJ Systems Biology; Scientific Reports; Physical Review Letters; Physical Review E; Physica D; J of Theo Biol; PLoS Comp Biol; Biophys J; BMC Syst Biol; J of Biol Phys; IEEE Trans. Biomed. Circuits Syst

Organization

2018 A3-NIMS Joint Workshop on Mathematical Biology in Hiroshima, Japan (Co-organizing with Zhang (Pecking) and Masakazu (Kyushu))

2017 A3-NIMS Joint Workshop on Mathematical Biology in Daejeon, Korea (Co-organizing with Zhang (Pecking) and Masakazu (Kyushu))

2016 A3 Workshop on Interdisciplinary Research Connecting Mathematics and Biology in Pecking, China (Co-organizing with Zhang (Pecking) and Tanaka (Tokyo))

2015 Society of Mathematical Biology Annual Meeting Mini-symposium (Approximation and simulation of multiscale stochastic system)

Membership	Board member of Korea Society of Bioinformatics	2017–present
	Board member of Population Approach Group in Korea	2016–present
	Member of Organization for Computational Neurosciences	2015–present
	Board Member of Korea SIAM	2015–present
	Member of Korean Mathematical Society	2015–present
	Member of Society of Mathematical Biology	2014–present
	Member of Biophysical Society	2013–present

Member of Society for Research on Biological Rhythms	2012–present
Member of Society for Industrial and Applied Mathematics	2009–present
Member of American Mathematical Society	2009–present

Research References

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Assistant Professor of Biochemistry and Cell biology
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