

Hyunjoong Kim

Simons Postdoctoral Fellow in Mathematical Biology
Department of Mathematics, University of Pennsylvania
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Research Interest

Applied Mathematics

Stochastic Processes, Differential Equations, Optimization, Dynamical Systems

Mathematical Biology

Cell Biology, Developmental Biology, Biophysics, Social Foraging

Employment

University of Pennsylvania, Philadelphia, PA
Simons Postdoctoral Fellow in Mathematical Biology
Advisors: Yoichiro Mori and Joshua Plotkin

2020 -
present

Education

University of Utah, Salt Lake City, UT
Ph.D. in Mathematics
Advisor: Paul C. Bressloff
Thesis: "Mathematical models of cytoneme-based morphogenesis"

2020

Yonsei University, Seoul, South Korea
M.Sc. in Applied Mathematics
Advisors: Jeehyun Lee and Hee-Dae Kwon
Thesis: "Parameter estimation in epidemic models using Kalman filter"

2016

B.Sc. in Mathematics

2014

Publications & Preprints

H. Kim, Y. Mori, and J. Plotkin, "Optimality of bee foraging for multiple resources under competition," *In progress*, 2022.

- [8] **H. Kim**, Y. Mori, and J. Plotkin, "Optimality of intercellular signaling: Direct transport versus diffusion," *Physical Review E*, **106** 054411, 2022. [[arXiv](#)] [[DOI](#)]
- [7] S. Park*, **H. Kim***, Y. Wang, D.S. Eom, and J. Allard, "Zebrafish airinemes optimize between ballistic search and diffusive search," *eLife*, **11** e75690, 2022. [[bioRxiv](#)] [[DOI](#)] *Equal contribution
- [6] M.-J. Muñoz-López, **H. Kim**, and Y. Mori, "A reduced 1D stochastic model of bleb-driven cell migration," *Biophysical Journal*, 2022. [[DOI](#)]
- [5] **H. Kim** and P.C. Bressloff, "Stochastic Turing pattern formation in a model with active and passive transport," *Bulletin of Mathematical Biology*, **82** 144, 2020. [[DOI](#)]
- [4] **H. Kim** and P.C. Bressloff, "Impulsive signaling model of cytoneme-based morphogen gradient formation," *Physical Biology*, **16** 056005, 2019. [[DOI](#)]
- [3] P.C. Bressloff and **H. Kim**, "Search-and-capture model of cytoneme-mediated morphogen gradient formation," *Physical Review E*, **99** 052401, 2019. [[DOI](#)]
- [2] **H. Kim** and P.C. Bressloff, "Direct vs. synaptic coupling in a mathematical model of cytoneme-based morphogen gradient formation," *SIAM Journal on Applied Mathematics*, **78** 2323-2347, 2018. [[DOI](#)]
- [1] P.C. Bressloff and **H. Kim**, "Bidirectional transport model of morphogen gradient formation via cytonemes," *Physical Biology*, **15** 026101, 2018. [[DOI](#)]

Honors & Funding	Department Good Teaching Awards University of Pennsylvania	2021
	BioFire Scholar Award BioFire Diagnostics, Approximately two awards are given in an academic year	2020
	Mathematics Department Summer Research Fellowship University of Utah, Approximately four awards are given in an academic year	2019
	Brain Korea 21 Scholarship for Leading Universities and Students National Research Foundation of Korea	2014 - 2016
	Honors Student Yonsei University, Top 10% GPA of the students are given in the college of science in a semester	2012
	Distinguished Honors Student Yonsei University, Approximately two honors are given in the college of science in a semester	2007
	National Science and Technology Scholarship Korea Student Aid Foundation, Top 2% Korea SAT of the students are awarded for 8 semesters	2007
Teaching	Department of Mathematics, University of Pennsylvania	
	AMCS 603: Algebraic Techniques for Applied Mathematics and Computational Science II	2023 Spring
	AMCS 602: Algebraic Techniques for Applied Mathematics and Computational Science I	2021 Fall
	Department Good Teaching Awards	
	Department of Mathematics, University of Utah	
	MATH 1320: Engineering Calculus II	2019 Fall
	MATH 1210: Calculus I	2019 Fall
	MATH 1030: Introduction to Quantitative Reasoning	2019 Spring
	MATH 1030: Introduction to Quantitative Reasoning	2018 Fall
	MATH 1310: Engineering Calculus I (Lab)	2018 Spring
MATH 1210: Calculus I (Lab)	2017 Fall	
MATH 1210: Calculus I (Lab)	2017 Spring	
MATH 2250: Differential Equations and Linear Algebra (Lab)	2016 Fall	
Department of Computational Science and Engineering, Yonsei University		
CSE 5810: Numerical Analysis (Grader)	2015 Spring and Fall 2014 Fall	
Advising	Ya Grace Gao Co-advised Penn graduate student on analyzing traveling waves in random networks	2022 Summer
	María-Jesús Muñoz-López Co-advised Penn graduate student on stochastic modeling on bleb-driven cell migration	2020 - 2021
Academic Visit	Institute for Basic Science Biomedical Mathematics Group Daejeon, South Korea, Jun. 13 ~ Jun. 17 (1 week) Chief Investigator: <i>Jae Kyoung Kim</i>	2022
	NSF-Simons Center for Multiscale Cell Fate Research University of California, Irvine, CA, Jul. 1 ~ Aug. 9 (6 weeks) Collaborated with <i>Jun Allard</i> and an experimentalist <i>Dae Seok Eom</i>	2019
Presentations	Optimal search processes in biology: zebrafish airinemes and bee foraging Networks Seminar, University of Houston, Houston, TX	2022
	A simple stochastic model of bleb-driven cell migration SIAM Conference on the Life Sciences, Pittsburgh, PA (Hybrid)	2022

	Optimality of Stochastic Directional Search Processes SIAM Annual Meeting, Pittsburgh, PA (Hybrid)	2022
	Optimized persistent random walk in zebrafish airineme search process Biomedical Mathematics Seminar, Institute for Basic Science, Daejeon, South Korea	2022
	Effect of intrinsic noise on dynamical systems: a stochastic model of bleb-driven cell migration Applied Mathematics Seminar, University of Georgia, Athens, GA	2022
	Intercellular communication by direct contact: is it better than diffusion? Mathematical Biology Seminar, New Jersey Institute of Technology, Newark, NJ	2021
	Direct contact vs. diffusion in the efficiency of intercellular transport University of Houston, Houston, TX	2021
	Stochastic Turing pattern formation in a model with active and passive transport SIAM Conference on Applications Dynamical Systems (Virtual)	2021
	Communication by touch: modeling perspectives Mathematical Biology Seminar, University of Pennsylvania, Philadelphia, PA	2020
	Do cytonemes form a morphogen gradient via a random search? Annual Symposium on Multiscale Cell Fate, Irvine, CA (Poster) Symposium Travel Award	2019
	Do developmental cells really communicate via diffusing particles? Applied Mathematics Seminar, California State University, Northridge, CA	2019
	Stochastic processes in cytoneme-mediated cell development SIAM Wasatch Student Chapters Conference, Logan, UT	2019
	Mathematical models of cytoneme-based morphogen gradient formation SIAM Conference on the Life Sciences, Minneapolis, MN (Poster)	2018
	Estimation of the reproduction number of pandemic influenza A (H1N1) in Korea 2009 Korean Mathematical Society Annual Meeting, Seoul, South Korea	2015
	Estimating parameters in mathematical epidemic model by using Kalman filter Korean SIAM Annual Meeting, Seogwipo, South Korea (Poster) Best Poster Prize	2014
Service	<i>Co-organizer</i> , AMS Western Sectional Meeting Together with Daniel Cooney and Daniel Gomez. Held at University of Utah, Salt Lake City, UT	2022
	<i>Member</i> , Preliminary Exam Committee Department of Mathematics, University of Pennsylvania, Philadelphia, PA	2021 - 2022
	<i>Organizer</i> , Mathematical Biology Seminar University of Pennsylvania, Philadelphia, PA	2021
	<i>Student Representative</i> , Applied Mathematics Graduate Student Group Yonsei University, Seoul, South Korea	2015
	<i>President</i> , Mathematics Honors Student Group Yonsei University, Seoul, South Korea	2013
	<i>Sergeant</i> , Signal Intelligence Specialist Republic of Korea Air Force, Mandatory	2009 - 2010
	<i>Student Representative</i> , Science Undergraduate Students' Class 3 Yonsei University, Seoul, South Korea	2008
Proficiency	Computer Skills MATLAB, LaTeX, Adobe Illustrator, Mathematica, Maple, XPPAUT, R, C++, Fortran.	

Language
Professional proficiency in English
Native proficiency in Korean

Referees

Paul C. Bressloff
Professor
Department of Mathematics
University of Utah
bressloff@math.utah.edu

Joshua B. Plotkin
Annenberg Professor of the Natural Sciences
Department of Mathematics and Biology
University of Pennsylvania
jplotkin@sas.upenn.edu

Sean D. Lawley
Associate Professor
Department of Mathematics
University of Utah
lawley@math.utah.edu

Yoichiro Mori
Calabi-Simons Professor in Mathematics and
Biology
Department of Mathematics and Biology
University of Pennsylvania
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Jun F. Allard
Associate Professor
Department of Mathematics and Physics
University of California, Irvine
jun.allard@uci.edu

William H. Nesse
Associate Professor (Lecturer)
Department of Mathematics
University of Utah
nesse@math.utah.edu