
CONTACT INFORMATION	Biomedical Mathematics Group Institute for Basic Science (IBS) 55 Expo-ro Yuseong-gu Daejeon 34126, South Korea	<i>E-mail:</i> hyukpyo.hong13@gmail.com <i>Web:</i> https://hyukpyohong.github.io
APPOINTMENTS	Institute for Basic Science (IBS) , Daejeon, South Korea Visiting Research Fellow, Biomedical Mathematics Group	May 2026–present
	University of Wisconsin–Madison , Madison, Wisconsin, USA Van Vleck Assistant Professor, Department of Mathematics	Aug. 2023–May 2026
EDUCATION	KAIST , Daejeon, South Korea Ph.D. in Mathematical Sciences Advisor: Jae Kyoung Kim Thesis: Development of stochastic model reduction framework for analysis and inference of biochemical reaction networks B.S. in Mathematical Sciences	Feb. 2018–Aug. 2023 Mar. 2013–Feb. 2018
RESEARCH INTERESTS	Fields: Mathematical biology, ODEs, Stochastic processes, Bayesian statistics, Digital medicine Topics: Steady states of ODEs, stationary distributions of CTMCs, Koopman operator theory, MCMC methods, parameter estimation for non-Markovian stochastic models, metabolic control analysis, homeostasis and adaptation in biological systems, neurodegenerative disease-related alteration of human motor activity	
PAPERS	†: (co-)1st author, *: (co-)corresponding author. Note: Where no author is designated as the first author (†), names are listed in alphabetical order by last name, as is standard practice in mathematical journals. In preparation or preprint: <ol style="list-style-type: none"> 18. Ella Buelling†, Wolfram Liebermeister*, Hyukpyo Hong*, Connections between structural sensitivity analysis and metabolic control analysis, <i>in preparation</i> 17. Hyukpyo Hong, Seewoo Lee, Necessary and sufficient conditions of the existence of a finite dimensional invariant subspace for polynomial ODEs, <i>in preparation</i> 16. Geonhee Ryu†, Hyukpyo Hong*, Daewook Kim*, Non-autonomous dynamics learning via Koopman-based Neural Networks, <i>in preparation</i> 15. Seewoo Lee†, Byung-Hak Hwang†, Hyojae Lim, Jihoon Hyun, Ilkyoo Choi, Yeachan Park, Jineon Baek, Hyukpyo Hong, Keewoo Lee, Jaeseong Heo, Hyungryul Baik, Chul-hee Lee*, Kyu-Hwan Lee, LEAN-GAP: A Dataset of Formalized Graduate Algebra Problems, <i>Submitted</i>; [arXiv] 14. Hyukpyo Hong†, Qin Li, Matthew Colbrook, Hanbaek Lyu*, Finding Koopman Invariant Subspaces via Personalized PageRank, <i>Submitted</i>; [arXiv] 13. Hyukpyo Hong†*, Diego Rojas La Luz†, Gheorghe Craciun*, Ubiquitous asymptotic robustness in biochemical systems, <i>Under review</i>; [arXiv] Published or accepted: <ol style="list-style-type: none"> 12. Dongju Lim†, Kyeong Tae Ko†, Hyukpyo Hong, Hyojung Lee, Boseung Choi, Won Chang, Sunhwa Choi*, Jae Kyoung Kim*, A history-dependent approach for accurate initial condition estimation in epidemic models, <i>PLoS Computational Biology</i>, 2025; [journal] 	

11. **Hyukpyo Hong**†, Seokhwan Moon†, Yuji Hirono†*, Jae Kyoung Kim*, Topological criterion for robust perfect adaptation of reaction fluxes in biological networks, *iScience*, 2025; [[arXiv](#)]; [[journal](#)]
10. **Hyukpyo Hong**†, Eunjin Eom†, Hyojung Lee, Sunhwa Choi*, Boseung Choi*, Jae Kyoung Kim*, Overcoming bias in estimating epidemiological parameters with realistic history-dependent disease spread dynamics, *Nature Communications*, 2024; [[journal](#)]
9. Hyeontae Jo†, **Hyukpyo Hong**†, Hyung Ju Hwang, Won Chang, Jae Kyoung Kim*, Density physics-informed neural networks reveal sources of cell heterogeneity in signal transduction, *Patterns*, 2023; [[bioRxiv](#)]; [[journal](#)]
8. **Hyukpyo Hong**†, Mark Jayson Cortez, Yu-Yu Cheng, Hang J. Kim, Boseung Choi*, Krešimir Josić*, Jae Kyoung Kim*, Inferring delays in partially observed gene regulation processes, *Bioinformatics*, 2023; [[bioRxiv](#)]; [[journal](#)]
7. **Hyukpyo Hong**, Bryan S. Hernandez, Jinsu Kim, Jae Kyoung Kim*, Computational translation framework identifies biochemical reaction networks with special topologies and their long-term dynamics, *SIAM Journal on Applied Mathematics*, 2023; [[arXiv](#)]; [[journal](#)]
6. **Hyukpyo Hong**†, Ji Yun Noh†, Hyojung Lee, Sunhwa Choi, Boseung Choi, Jae Kyoung Kim*, Eui-Cheol Shin*, Modeling incorporating the severity-reducing long-term immunity: higher viral transmission paradoxically reduces severe COVID-19 during endemic transition, *Immune Network*, 2022; [[medRxiv](#)]; [[journal](#)]
5. Dae Wook Kim†, **Hyukpyo Hong**†, Jae Kyoung Kim*, Systematic inference identifies a major source of heterogeneity in cell signaling dynamics: the rate-limiting step number, *Science Advances*, 2022; [[journal](#)]
4. Jaehyung Hong†, Su Jung Choi†, Se Ho Park, **Hyukpyo Hong**, Victoria Booth, Eun Yeon Joo*, Jae Kyoung Kim*, Personalized sleep-wake patterns aligned with circadian rhythm relieve daytime sleepiness, *iScience*, 2021; [[bioRxiv](#)]; [[journal](#)]
3. Yun Min Song†, **Hyukpyo Hong**†, Jae Kyoung Kim*, Universally valid reduction of multiscale stochastic biochemical systems with simple non-elementary propensities, *PLoS Computational Biology*, 2021; [[bioRxiv](#)]; [[journal](#)]
2. Mark Jayson Cortez†, **Hyukpyo Hong**, Boseung Choi*, Jae Kyoung Kim*, Krešimir Josić*, Hierarchical Bayesian models for inference in biochemical reactions with delays, *Bioinformatics*, 2021; [[bioRxiv](#)]; [[journal](#)]
1. **Hyukpyo Hong**†, Jinsu Kim†, M. Ali Al-Radhawi, Eduardo D. Sontag, Jae Kyoung Kim*, Derivation of stationary distributions of biochemical reaction networks via structure transformation, *Communications Biology*, 2021; [[bioRxiv](#)]; [[journal](#)]

BOOK CHAPTERS

1. **Hyukpyo Hong**, Boseung Choi, Jae Kyoung Kim*, Beyond the Michaelis-Menten: Bayesian inference for enzyme kinetic analysis, *Computational Methods for Estimating the Kinetics Parameters of Biological Systems*, *Methods in Molecular Biology*; [[journal](#)]; [[link](#)]

RESEARCH GRANTS

2019–2023 National Research Foundation of Korea (NRF), NRF-2019-Fostering Core Leaders of the Future Basic Science Program/Global Ph.D. Fellowship Program, 2019H1A2A1075303, **PI** (120000)
 Title: *Development of Stochastic Model Reduction Methodology and its Application to an Optogenetic System*

HONORS AND AWARDS

2025 Postdoctoral Excellence in Teaching Award, UW-Madison
 2025 Excellent Dissertation Award, Korean Mathematical Society
 2024 KSIAM Next Generation Researcher Award, Korean Society for Industrial and Applied Mathematics
 2022 SIAM Student Travel Award, Society for Industrial and Applied Mathematics
 2022 Blood Donor Hall of Fame (100 donations), Korean Red Cross

Global Ph.D. Fellowship (Full Tuition), National Research Foundation of Korea
 2017 36th National Undergraduate Mathematics Competition Silver Award, Korean Mathematical Society
 2016 Mirae Asset Global Exchange Scholarship, Mirae Asset Park Hyeon Joo Foundation
 2014 33rd National Undergraduate Mathematics Competition Silver Award, Korean Mathematical Society
 2014 Dean's List Award College of Natural Sciences, KAIST
 2013 32nd National Undergraduate Mathematics Competition Silver Award, Korean Mathematical Society
 National Scholarship for Science and Engineering (Full Tuition), Korea Student Aid Foundation

TEACHING

UW–Madison

- Spring 2026: [Instructor] MATH331: Introductory Probability
- Fall 2025: [Instructor] MATH331: Introductory Probability
- Spring 2025: [Instructor] MATH331: Introductory Probability
- Fall 2024: [Instructor] MATH340: Elementary Matrix and Linear Algebra
- Spring 2024: [Instructor] MATH320: Linear Algebra and Differential Equations
- Fall 2023: [Instructor] MATH320: Linear Algebra and Differential Equations

KAIST

- Spring 2019: [Teaching Assistant] MAS201: Differential Equations and Applications
- Fall 2018: [Teaching Assistant] MAS201: Differential Equations and Applications, MAS480: Introduction to Mathematical Biology
- Spring 2018: [Teaching Assistant] MAS109: Introduction to Linear Algebra, MAS212: Linear Algebra

MENTORING

UW–Madison

- Jun. 2024 – present: Ella Buelling, Junior student, Edgewood High School
Working on connections between the hypergraph representation of biochemical reaction networks and metabolic control analysis.

KAIST

- Jun. 2023 – Mar. 2025: Seokhwan Moon, Undergraduate, Department of Mathematics, POSTECH
Investigated structural conditions under which ODE steady-state solutions remain independent of system parameters. Published in *iScience*.
- Spring 2019: Minyoo Kim, Undergraduate, Department of Mathematics, KAIST
Investigated the total quasi-steady-state approximation for a competitive system. Won a poster prize at the 2019 KSIAM Spring Conference and a prize in the URP final evaluation.

INVITED TALKS

2026-04-28, Online, **Formal reaction kinetics and related questions**
Ubiquitous Asymptotic Robustness in Biochemical Systems [\[video\]](#)
 2026-02-26, Online, **Mathematics of Reaction Networks (MoRN) Seminar**
Ubiquitous Asymptotic Robustness in Biochemical Systems [\[video\]](#)
 2025-11-21, Durham, NC, USA, **Duke University Math Bio Seminar**
Identifying major sources of heterogeneity in antibiotic cell responses via Bayesian inference and Physics-informed neural networks

2025-11-20, Durham, NC, USA, **NC State Univ. TPB Cluster**
Bridging Mathematical Theory and Biological Challenges: From intracellular networks to human-scale dynamics

2025-11-19, Durham, NC, USA, **NC State Univ. Dept. of Mathematics**
Leveraging Koopman Operator Theory and Graph Representation for Deeper Insight into Complex Dynamical Systems

2025-11-13, Seoul, Korea, **Seminar at Seoul National University**
Finite-Dimensional Representations of the Koopman Operator: Equation- and Data-Driven Approaches

2025-10-31, Madison, WI, USA, **UW–Madison Applied and Computational Mathematics Seminar**
Finite-Dimensional Representations of the Koopman Operator: Equation- and Data-Driven Approaches

2025-10-28, Online, **Midwest Mathematical Biology Seminar**
Ubiquitous Asymptotic Robustness in Biochemical Systems

2025-10-01, Seoul, Korea, **Seminar at Korea University**
Leveraging Koopman Operator Theory and Graph Representation for Deeper Insight into Complex Dynamical Systems

2025-09-27, Chicago, IL, USA, **2025 GLSIAM Meeting**
Digital biomarker of cognitive impairment: fractal patterns of human activity data

2025-07-17, Edmonton, Canada, **SMB Annual Meeting**
Inferring delay distributions in partially observed biological processes

2025-07-08, Madison, WI, USA, **SIAM Conference on Applied Algebraic Geometry**
Ubiquitous Asymptotic Robustness in Biochemical Systems

2025-06-20, Busan, Korea, **Pusan National University Math Seminar**
Parameter inference in Markovian and non-Markovian models

2025-06-04, Daejeon, Korea, **KAIST Brain & Cognitive Sciences Seminar**
Digital biomarker of cognitive impairment: fractal patterns of human activity data

2025-06-02, Seoul, Korea, **Konkuk University Math Seminar**
Parameter inference in Markovian and non-Markovian models

2025-05-17, Seoul, Korea, **KSIAM Spring Conference**
KSIAM Next Generation Researcher Award speech

2025-05-15, Denver, CO, USA, **SIAM Conference on Applied Dynamical Systems**
Network Translation of a Stochastic Reaction Network to Reveal Stationary Distributions

2025-03-03, Online, **Computational and Applied Math / Data Science Seminar, Arizona State University**
Koopman representation: Linear representation of nonlinear dynamics

2024-10-25, Cincinnati, OH, USA, **Applied Math Seminar at the University of Cincinnati**
Koopman representation: Linear representation of nonlinear dynamics

2024-10-07, Online, **Seminar at the University of the Philippines Diliman**
Accurate epidemiological parameters estimation with realistic history-dependent disease spread dynamics

2024-08-01, Busan, Korea, **Seminar at Pusan National University**
Analysis of dynamical systems using “easier” representations

2024-07-31, Daejeon, Korea, **Biomedical Mathematics Seminar at Institute for Basic Science**
Koopman representation: Linear representation–not an approximation–of nonlinear dynamics

2024-07-04, Seoul, Korea, **SMB Annual Meeting**
Density-PINNs reveal that multiple pathways reduce cell-to-cell heterogeneity in antibiotic responses

2024-07-02, Seoul, Korea, **SMB Annual Meeting**
Inferring delays in partially observed gene regulation processes

2024-06-04, Sejong, Korea, **Data Computational Sciences Special Lecture at Korea University, Sejong Campus**
How to sample random numbers from a target distribution

2024-06-03, Seoul, Korea, **Data Science Seminar at Sogang University**
Analysis of dynamical systems using “easier” representations

2024-05-23, Pohang, Korea, **CM2LA Seminar at POSTECH**
Analysis of dynamical systems using “easier” representations

2024-04-25, Champaign, IL, USA, **Mathematical Biology Seminar at UIUC**
Analyzing long-term behavior of dynamical systems using “easy-to-handle” representations

2023-08-17, Daejeon, Korea, **ICIAM 2023 Satellite Workshop: Stochastic Modeling and Data Analysis for Biological Systems**
Network translation allows for revealing long-term dynamics of stochastic reaction networks

2023-07-17, Columbus, OH, USA, **SMB Annual Meeting**
Network translation allows for revealing long-term dynamics of stochastic reaction networks

2023-06-27, Jeju, Korea, **The 8th CIJK International Conference on Mathematical and Theoretical Biology**
Things we have been overlooking in infectious disease modeling

2023-05-19, Pyeongchang, Korea, **KSIAM Spring Conference, Special session**
Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition

2022-12-19, Daejeon, Korea, **Mini-workshop on Recent Trends in Pure and Applied Mathematics**
Inferring delays in partially observed gene regulatory networks

2022-11-21, Seoul, Korea, **Population Approach Group Korea Annual Meeting**
Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition

2022-10-19, Seoul, Korea, **Global KMS International Conference**
Systematic inference identifies a major source of heterogeneity in non-Markovian cell signaling dynamics

2022-06-25, Yeosu, Korea, **KSMB Annual Meeting**
Increasing viral transmission paradoxically reduces severe COVID-19 during endemic transition

2022-06-22, Online, **BRIC Webinar**
Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability

2022-05-28, Daejeon, Korea, **KSIAM Spring Conference**
Systematic inference for cell signalling pathways identifies a key determinant of cell-to-cell variability

2021-08-27, Online, Korea, **KSMB Annual Meeting**
Inference of stochastic dynamics in biochemical reaction networks

2021-06-16, Online, **SMB Annual Meeting**
Inference of stochastic dynamics in biochemical reaction networks

2021-05-27, Online, **SIAM Conference on Applications of Dynamical Systems**
Derivation of stationary distributions of stochastic chemical reaction networks via network translation

2021-05-13, Online, **Seminar on the Mathematics of Reaction Networks**
Derivation of stationary distributions of stochastic chemical reaction networks via network translation [video]

2020-10-24, Online, **KMS Annual Meeting, Minisymposium**
Derivation of stationary distributions of biochemical reaction networks via structure transformation

ACADEMIC SERVICE **2021-06: Support Staff, SMB Annual Meeting**
Hosted Zoom sessions for the Asia time zone.

PEER REVIEW PLoS Computational Biology, Acta Biotheoretica, Stat, PCI Math Comp Biol, Frontiers in Public Health

OUTREACH **2026-05-26: Alumni Career Talk**, KAIST Department of Mathematical Sciences
Preparing for a Postdoc Abroad: A Three-Year Retrospective [slides]
Slides are available but written in Korean.

2023-06-20: KAIST Math Graduate Student Seminar, KAIST Department of Mathematical Sciences
Preparation for Postdoc Positions

2022-09-16: Science Slam-D Public Lecture, Yongsan High School, Daejeon, Korea
Mathematics Meets Biology: Discovering the Optimal Sleep Pattern through Mathematical Modeling
Hosted by NST, IBS, Daejeon MBC (TV network), and Hello DD (Press). Delivered for high school students.

2021-04-27: Mobile Science Classroom, National Research Foundation of Korea
Mathematical Biology: Bridging Mathematics and the Life Sciences
Delivered for middle school students.