Jakob Ruess

InBio Project Team
Inria Paris
2 Rue Simone Iff,
75012 Paris, France

Email: jakob.ruess@inria.fr

InBio Unit
Institut Pasteur
25-28 Rue du Dr Roux
75015 Paris, France

Email: jakob.ruess@pasteur.fr

EDUCATION

Inria Paris/Institut Pasteur: Researcher Scientist (2019-...)

Topic: Stochastic Systems Biology

InBio Project Team (Inria) and InBio Unit (Pasteur)

Inria Saclay/Institut Pasteur: Researcher Scientist (2016-2019)

Topic: Stochastic Systems Biology

Lifeware Project Team (Inria) and InBio Unit (Pasteur)

IST Austria: Postdoctoral research fellow (2014-2016)

Topic: Stochastic Systems Biology

Group 1: Tom Henzinger (Computer Science), *Concurrent and Embedded Systems*

Group 2: Gasper Tkacik (Biophysics), *Information Processing in Biological Networks*

ETH Zurich: PhD studies at the Automatic Control Laboratory (2010-2014)

PhD thesis: *Moment-based methods for the analysis and identification of stochastic models of biochemical reaction networks*

Graduate School: Life Science Zurich Graduate School (Systems Biology)

Advisor: Prof. John Lygeros

University of Heidelberg: Diploma studies in Mathematics (2004-2010)

Diploma thesis: *Nonparametric estimation of linear functionals in the convolution problem with unknown error distribution*

Advisors: Prof. Jan Johannes & Prof. Rainer Dahlhaus

AWARDS

2018 Inria PEDR junior (prime d'encadrement doctoral et de recherche 2018-2022)

2015 ETH Medal (special award for the most outstanding (approx. top 8 %) doctoral theses at ETH Zurich).

2014 Selected for the ISTFELLOW program and fellowship, IST Austria.

2012 Swiss Institute of Bioinformatics 2012 Best Graduate Paper Award *(including a 5000 CHF (5600 USD) cash award).*

RESEARCH GRANTS

2019-2022 Coordinator of CyberCiruits - Cybergenetic circuits to test composability of gene networks, ANR-FWF French-Austrian collaboration with Calin Guet (IST Austria). 296k euro (553k euro in total), https://anr.fr/Project-ANR-18-CE91-0002

2018-2021 Member of SYMBIONT, ANR-DFG, https://anr.fr/Projet-ANR-17-CE40-0036

TEACHING

2016-...	*Computational Biology* - Master Approches Interdisciplinaires du Vivant (CRI)
2019	*Optimally learning dynamical models from data*, Advanced Lecture Course on Computational Systems Biology, Aussois, France
2016-2018	*Modelling and Engineering of Biological Systems* - Predoctoral School of ITI (PSL)
2012-2014	*Signals and Systems II*, Student Assistant - Control Engineering, ETH Zurich
2008	*Statistics*, Student Assistant - Mathematics, University of Heidelberg
2006-2007	*Introduction to Probability Theory*, Student Assistant - Mathematics, University of Heidelberg

LIST OF PUBLICATIONS

Peer Reviewed Journal Articles

C. Aditya, F. Bertaux, G. Batt*, and J. Ruess* "A light tunable differentiation system for the creation and control of consortia in yeast," *Nature Communications*, vol. 12, 175829, 2021.

D. Lunz, G. Batt, J. Ruess*, and JF Bonnans* "Beyond the chemical master equation: stochastic chemical kinetics coupled with auxiliary processes," *PLoS Computational Biology*, vol. 17, no. 7, e1009214, 2021.

D. Lunz, G. Batt, and J. Ruess, "To quarantine, or not to quarantine: A theoretical framework for disease control via contact tracing," *Epidemics*, vol. 34, 100428, 2021.

F. Bertaux, J. Ruess, and G. Batt "External control of microbial populations for bioproduction: A modeling and optimization viewpoint," *Current Opinion in Systems Biology*, 100394, 2021.

S. Cepeda-Humerez, J. Ruess, and G. Tkacik, "Estimating information in time-varying signals," *PLoS Computational Biology*, vol. 15, no. 9, pp. e1007290, 2019.

J. Ruess, M. Pleska, C. Guet, and G. Tkacik, "Molecular noise of innate immunity shapes bacteria-phage ecologies," *PLoS Computational Biology*, vol. 15, no. 7, pp. e1007168, 2019.

R. Chait*, J. Ruess*, T. Bergmiller. G. Tkačik, and C. Guet, "Shaping bacterial population behavior through computer-interfaced control of individual cells," *Nature Communications*, vol. 8, no. 1, pp. 1535, 2017.

J. Ruess*, H. Koeppl, and C. Zechner*, "Sensitivity estimation for stochastic models of biochemical reaction networks in the presence of extrinsic variability," *The Journal of Chemical Physics*, vol. 146, no. 12, pp. 124122, 2017.

C. Schilling, S. Bogomolov, T.A. Henzinger, A. Podelski, and J. Ruess, "Adaptive moment closure for parameter inference of biochemical reaction networks," *BioSystems*, vol. 149, pp. 15-25, 2016.

J. Ruess, "Minimal moment equations for stochastic models of biochemical reaction networks with partially finite state space," *The Journal of Chemical Physics*, vol. 143, no. 24, pp. 244103, 2015.

J. Ruess*, F. Parise*, A. Milias-Argeitis, M. Khammash and J. Lygeros, "Iterative experiment design guides the characterization of a light-inducible gene expression circuit," *Proceedings of the National Academy of Sciences of the USA*, vol. 112, no. 26, pp. 8148-8153, 2015.

F. Parise*, J. Lygeros and J. Ruess* "Bayesian inference for stochastic individual-based models of ecological systems: a pest control simulation study," *Frontiers in Environmental Science*, vol. 3, pp. 42, 2015.

J. Ruess and J. Lygeros, "Moment-based methods for parameter inference and experiment design for stochastic biochemical reaction networks," *ACM Transactions on Modeling and Computer Simulation*, vol. 25, no. 2, art. 8, 2015.

J. Ruess, A. Milias-Argeitis and J. Lygeros, "Designing experiments to understand the variability in biochemical reaction networks," *Journal of the Royal Society Interface*, vol. 10, no. 88, pp. 20130588, 2013.

C. Zechner*, J. Ruess*, P. Krenn, S. Pelet, M. Peter, J. Lygeros and H. Koeppl, "Moment-based inference predicts bimodality in transient gene expression," *Proceedings of the National Academy of Sciences of the USA*, vol. 109, pp. 8340-8345, 2012.

J. Ruess, A. Milias-Argeitis, S. Summers and J. Lygeros, "Moment estimation for chemically reacting systems by extended Kalman filtering," *The Journal of Chemical Physics*, vol. 135, pp. 165102, 2011.

* contributed equally

Preprints currently under review

C. Aditya, F. Bertaux, G. Batt, and J. Ruess, "Using single-cell models to predict the functionality of synthetic circuits at the population scale," *under review at Proceedings of the National Academy of Sciences of the USA*, https://doi.org/10.1101/2021.08.03.454887 , 2021.

A. Davidovic, R. Chait, G. Batt, and J. Ruess, "Parameter inference for stochastic biochemical models from perturbation experiments parallelised at the single cell level," *under review at PLoS Computational Biology*, https://doi.org/10.1101/2021.08.24.457516, 2021.

D. Lunz, JF. Bonnans, and J. Ruess, "Optimal control of bioproduction in the presence of population heterogeneity," *HAL-Inria*, https://hal.inria.fr/hal-03445175, 2021.

Z. Fox, S. Fletcher, A. Fraisse, C. Aditya, S. Sosa-Carrillo, S. Gilles, F. Bertaux, J. Ruess, and G. Batt, "MicroMator: Open and Flexible Software for Reactive Microscopy," *under review at Nature Communications*, https://doi.org/10.1101/2021.03.12.435206, 2021.

Peer Reviewed Conference Publications

E. Weill, V. Andreani, C. Aditya, P. Martinon, J. Ruess, G. Batt, and F. Bonnans, "Optimal control of an artificial microbial differentiation system for protein bioproduction," *European Control Conference (ECC)*, 25-28 June, Naples, 2019.

M. Kryukov, A. Carcano, G. Batt, and J. Ruess, "Can optimal experimental design serve as a tool to characterize highly non-linear synthetic circuits?," *European Control Conference (ECC)*, 25-28 June, Naples, 2019.

S. Bogomolov, T.A. Henzinger, A. Podelski, J. Ruess, and C. Schilling# "Adaptive moment closure for parameter inference of biochemical reaction networks," in *Computational Methods in Systems Biology*, Nantes, France, September 16-18, 2015.

F. Parise, J. Ruess, and J. Lygeros, "Grey-box techniques for the identification of a controlled gene expression model," in *European Control Conference*, Strasbourg, France, June 24-27, 2014.

J. Ruess and J. Lygeros, "Identifying stochastic biochemical networks from single-cell population experiments: a comparison of approaches based on the Fisher information," in *IEEE Conference on Decision and Control*, Florence, Italy, December 10-13, 2013.

A. Hjartarson, J. Ruess, and J. Lygeros, "Approximating the solution of the chemical master equation by combining finite state projection and stochastic simulation," in *IEEE Conference on Decision and Control*, Florence, Italy, December 10-13, 2013.

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Book Chapters

J. Ruess and J. Lygeros, "On the use of the moment equations for parameter inference, control and

experimental design in stochastic biochemical reaction networks," in *Computational Methods in Systems Biology* (A. Gupta and T. Henzinger, eds.), vol. 8130 of *LNBI*, Heidelberg: Springer-Verlag, 2013.