BENCE MÉLYKÚTI
CURRICULUM VITÆ

I am a mathematician with a PhD, with expertise in stochastic processes, dynamical systems and control theory, chemical reaction network theory, chemical reaction kinetics and molecular systems biology. I have diverse research and personal interests and aim to apply my skills in interdisciplinary work. My research goal is to bring transformational insights into biochemical, systems biological and medical research by mathematical modelling.
Web: `http://research.melykuti.be` | Twitter: `@BMelykuti`

APPOINTMENTS

Sep. 2014–Apr. 2017 AXA Research Fund Postdoctoral Fellow
University of Freiburg (Germany), Centre for Biological Systems Analysis (ZBSA). Funded by the AXA Research Fund.

- My academic host is Peter Pfaffelhuber (Dept. of Mathematical Stochastics).

Jan.–Jun. 2016 Visiting fellow
Isaac Newton Institute for Mathematical Sciences (Cambridge, UK), participant of the *Stochastic dynamical systems in biology: numerical methods and applications* programme.

Apr. 2012–Mar. 2014 Humboldt Postdoctoral Research Fellow
University of Freiburg (Germany), Centre for Biological Systems Analysis (ZBSA) and Department of Mathematical Stochastics. Funded by the Alexander von Humboldt Foundation.

- My academic host was Peter Pfaffelhuber (Dept. of Mathematical Stochastics).

Nov. 2010–Nov. 2011 Postdoctoral scholar (before graduation: assistant specialist)
University of California, Santa Barbara (USA), Department of Mechanical Engineering.

- My mentors were Mustafa Khammash (Dept. of Mechanical Engineering) and João P. Hespanha (Dept. of Electrical and Computer Engineering).

EDUCATION

Dec. 2011–Mar. 2012 Intensive German language course at the C1.2 level
Goethe Institute (Freiburg, Germany).

2006–2011 Doctor of Philosophy (DPhil, PhD)
University of Oxford (UK), Life Sciences Interface Doctoral Training Centre and Department of Statistics. I was a member of Keble College.

- I was supervised by Alison M. Etheridge (Dept. of Statistics) and Antonis Papachristodoulou (Control Group, Dept. of Engineering Science).
- The title of my thesis: *Theoretical advances in the modelling and interrogation of biochemical reaction systems: alternative formulations of the chemical Langevin equation and optimal experiment design for model discrimination*. I was modelling the effects of stochastic fluctuations of molecular concentrations on chemical kinetics in molecular biology (systems biology) arising from the low copy numbers of interacting molecules. The main mathematical tools I used were Itô stochastic differential equations. The thesis can be downloaded from my website or from here.
  In the first part of the thesis I proved that there are new, alternative formulations of the chemical Langevin equation which all give the same distributions of variables. These new formulations give insight into the geometrical structure of trajectories, and they can accelerate the numerical simulation of the equation. The second part of the thesis expanded on the project described in the next bullet point.

- As part of my lab rotation, I did an eight-week-long control theory project supervised by Antonis Papachristodoulou (2007). The title of my project report: *A control theoretical approach to designing optimal experiments in systems biology*. The report can be downloaded from my website.
  In this mathematical study I was investigating what kind of external stimulus profile (input function shape) yields the maximal difference between predicted measurement values from two alternative ordinary differential equation models of a (biological) system, in order to get real world measurements from the so designed experiment that are most likely to invalidate the incorrect one of the two models.
- As part of my lab rotation, I did an eight-week-long statistical project supervised by Gil McVean (Dept. of Statistics, 2007). The title of my project report: *Prediction of hematopoietic cell transplantation success from HLA matching*. The report can be downloaded from my website.
  In this statistical meta-analysis I was comparing the negative effect of mismatches at six HLA genes between donor and recipient on recipients' survival time.
- This is a 1+3-year graduate programme. My 2006/2007 academic year was devoted to courses in computational biology, bioinformatics, bio-medical image and signal analysis, and bionanotechnology. The curriculum also included wetlab experimentation, e.g. the sequencing of own mitochondrial DNA.
- Recipient of an Engineering and Physical Sciences Research Council (EPSRC) doctoral studentship (fees and subsistence).
- I was the second from my class of twenty students at the Doctoral Training Centre to submit a thesis and second to complete the doctoral studies.

2001–2006 MSc in mathematics

Eötvös Loránd University [ELTE] (Budapest, Hungary), Faculty of Science.

- In the last two years I studied:
  - Stochastic processes
  - Stochastic analysis
  - Stochastic modelling
  - Control theory
  - Continuous optimisation
  - Mathematical physics
  - Universal algebra
  - Set theory
- The title of my dissertation: *The mixing rate of Markov chain Monte Carlo methods and some applications of MCMC simulation in bioinformatics*. My advisor was István Miklós. The dissertation can be downloaded from my website.
  This project explored analytical tools and applied some of them to study the mixing rate of two discrete state space Markov chain Monte Carlo methods that were rooted in bioinformatics questions. We addressed the fundamental question analytically for how long an MCMC needs to be run to reach the required proximity of the target distribution.
- As part of my coursework, I did a stochastic optimisation project for an operations research course taught by András Prékopa (2005).
  In the project I modelled a daily business decision of the leading Hungarian newspaper distributor as a stochastic optimisation problem. I developed a solution starting by interviewing a manager through formulating a mathematical model to finding the theoretic and algorithmic solution of the mathematical problem.
- Among my professors there were five members of the Hungarian Academy of Sciences, including Wolf Prize laureate László Lovász.

1995–2001 Toldy Ferenc Secondary School (Budapest, Hungary)

- The faculty awarded me the prize of the *Toldy Ferenc Foundation* for my outstanding academic performance, social activity, and exemplary conduct throughout the six years of study.

PUBLICATIONS[1]

5. Bence Mélykúti, Peter Pfaffelhuber. The stationary distribution of a Markov jump process glued together from two state spaces at two vertices.
   Stochastic Models, **31**(4), 525–553, 2015. arXiv:1401.6400 [math.PR], 2015.

4. Bence Mélykúti, João P. Hespanha, Mustafa Khammash. Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks.
   Journal of the Royal Society Interface, **11**(97), 20140054, 2014.

3. Bence Mélykúti, Kevin Burrage, Konstantinos C. Zygalakis. Fast stochastic simulation of biochemical reaction systems by alternative formulations of the chemical Langevin equation.
   Journal of Chemical Physics, **132**, 164109, 2010.
   Selected for inclusion in the 1st May 2010 issue of the Virtual Journal of Biological Physics Research (volume 19, issue 9).[2]

2. Bence Mélykúti, Elias August, Antonis Papachristodoulou, Hana El-Samad. Discriminating between rival biochemical network models: three approaches to optimal experiment design.
   BMC Systems Biology, **4**:38, 2010.
   Achieved 'Highly accessed' *designation on the BMC Systems Biology website.*

1. István Miklós, Bence Mélykúti, Krister Swenson. The metropolized Partial Importance Sampling MCMC mixes slowly on minimum reversal rearrangement paths.
   IEEE/ACM Transactions on Computational Biology and Bioinformatics, **7**(4), 763–767, 2010.

PREPRINTS

6. Felix Beck, Bence Mélykúti. Parameter estimation in a subcritical percolation model with colouring.
   arXiv:1604.08908 [math.ST], 2016.

SUPERVISION

- Felix Beck, MSc dissertation in mathematics, Oct. 2014–Oct. 2015
  Title: *Parameter estimation in a percolation model with coloring*

- Bernadette (Benny) Lies, MSc dissertation (Diplomarbeit) in mathematics, May 2012–Jan. 2014
  Title: *The global attractor conjecture in the chemical reaction network theory*

CONFERENCE PRESENTATIONS

◎ World Congress in Probability and Statistics (WCPS 2016), *11th–15th July 2016, Fields Institute, Toronto, Canada.*
Talk: Parameter estimation in a percolation model with colouring

[1] Citation data is available by Google Scholar Citations at
`http://scholar.google.com/citations?user=5HGcq_gAAAAJ`.

[2] The Virtual Journal, which was published by the American Physical Society and the American Institute of Physics in cooperation with numerous other societies and publishers, was an edited compilation of links to articles from participating publishers, covering a focused area of frontier research.

- Information, Probability and Inference in Systems Biology Conference (IPISB 2016), *18th–20th May 2016, Institute of Science and Technology Austria, Klosterneuburg, Austria.*
  Poster: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks
- Advances in numerical and analytic approaches for the study of non-spatial stochastic dynamical systems in molecular biology, *4th–8th April 2016, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK.*
  Poster: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks
- Multiscale methods for stochastic dynamical systems in biology, *29th February–4th March 2016, International Centre for Mathematical Sciences, Edinburgh, UK.*
  Poster: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks
- Chemical Reaction Network Theory (CRNT) Portsmouth 2014, *23rd–25th June 2014, University of Portsmouth, UK.*
  Talk: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks
- 11th German Probability and Statistics Days (GPSD), *4th–7th March 2014, Ulm, Germany.*
  Talk: The stationary distribution of a Markov jump process on a state space glued together from two state spaces at two vertices

◎ 14th International Conference on Systems Biology (ICSB 2013), *30th August–3rd September 2013, Copenhagen, Denmark.*
Talk: A mathematical comparison of transcription factor-facilitated mechanisms of gene regulation

◎ 36th Conference on Stochastic Processes and their Applications (SPA 2013), *29th July–2nd August 2013, University of Colorado, Boulder, CO, USA.*
Talk: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks

- German–Polish Joint Conference on Probability and Mathematical Statistics (GPPS), *6th–9th June 2013, Toruń, Poland.*
  Talk: Equilibrium distributions of simple biochemical reaction systems for time-scale separation in stochastic reaction networks
- 9th German Open Conference on Probability and Statistics (GOCPS), *2nd–5th March 2010, Leipzig, Germany.*
  Talk: A diffusion process model for chemical reaction kinetics: the chemical Langevin equation
- RoSBNet Synthetic Biology Workshop, *14th–16th September 2009, Oxford, UK.*
  Poster: Faster stochastic simulation — Alternative formulations of the chemical Langevin equation

◎ 33rd Conference on Stochastic Processes and their Applications (SPA 2009), *27th–31st July 2009, Berlin, Germany.*
Talk: Alternative formulations of the chemical Langevin equation

- Probability at Warwick Young Researchers Workshop, *20th–24th July 2009, Department of Statistics, University of Warwick, UK.*
  Talk: Alternative formulations of the chemical Langevin equation
- StoMP 2009. Noisy Bugs: modelling and microbiology, *13th–16th July 2009, e-Science Institute, Edinburgh, UK.*
  Poster: Faster stochastic simulation — Alternative formulations of the chemical Langevin equation

CONFERENCES ATTENDED

- Spatially distributed stochastic dynamical systems in biology, *20th–24th June 2016, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK.*
- Opening workshop of the *Stochastic dynamical systems in biology: numerical methods and applications* programme, *18th–22nd January 2016, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK.*
- 38th Conference on Stochastic Processes and their Applications (SPA 2015), *13th–17th July 2015, Oxford, UK.*
- Workshop on Mathematical Trends in Reaction Network Theory, *1st–3rd July 2015, University of Copenhagen, Denmark.*
- 29th European Meeting of Statisticians (EMS 2013), *20th–25th July 2013, Budapest, Hungary.*
- Ars Conjectandi — A celebration of 300 years of stochastics, *21st–24th May 2013, Freiburg, Germany and Basel, Switzerland.*
- 35th Conference on Stochastic Processes and their Applications (SPA 2011), *19th–24th June 2011, Oaxaca, Mexico.*
- Southern California Systems Biology Conference, *29th–30th January 2011, University of California, Irvine, CA, USA.*
- 2010 Southern California Probability Symposium, *4th December 2010, University of California, Los Angeles, CA, USA.*
- 11th International Conference on Systems Biology, *10th–14th October 2010*, and workshop on Evolutionary Systems Biology, *15th October 2010, Edinburgh, UK.*
- Probability at Warwick Young Researchers Workshop, *19th–23rd July 2010, Department of Statistics, University of Warwick, UK.*
- RoSBNet Synthetic Biology Workshop, *12th–14th July 2010, Oxford, UK.*
- 1st FORSYS Symposium (BMBF Initiative for Systems Biology), *19th–20th June 2008, Berlin, Germany.*
- IMA Hot Topics Workshop: Stochastic Models for Intracellular Reaction Networks, *11th–13th May 2008, Institute for Mathematics and its Applications, University of Minnesota, Minneapolis, MN, USA.*
- Oxford Centre for Integrative Systems Biology Launch Meeting, *10th–11th January 2008, Oxford, UK.*

PROFESSIONAL SERVICE

- Reviewer for the Journal of Chemical Physics, Bulletin of Mathematical Biology, Stochastic Environmental Research and Risk Assessment, IEEE Transactions on Automatic Control (twice), International Journal of Robust and Nonlinear Control, Molecular Systems Biology, BMC Systems Biology.
- Proposed and organised a contributed session titled *Stochastic processes in molecular systems biology* at the 29th European Meeting of Statisticians (EMS 2013), *20th–25th July 2013, Budapest, Hungary.*

TEACHING EXPERIENCE

- I gave a standalone lecture (in 2012) and the corresponding practical class (in 2012 and 2013) on chemical reaction network theory for an MSc course, Freiburg.
- Teaching assistant for the third-year mathematics undergraduate Applied probability course, Michaelmas Term 2008, Oxford.
- Demonstrator for statistics courses at the Doctoral Training Centre on three occasions.

LANGUAGES

Hungarian First language.

English Fluent. TOEFL CBT score: 280 out of 300 (essay rating: 5.5 out of 6) in 2005.

German Fluent, advanced level. Goethe-Zertifikat C1 score: 94%, 'very good' grade in 2012.

OTHER SKILLS

- Computing skills
  - Proficiency in Matlab, Mathematica
  - Experience with Python, C++, Javascript, R, Maple
  - LaTeX
  - Microsoft Office softwares
  - HTML editing
- Driving licence. Driving experience with both left-hand-drive and right-hand-drive cars, in right-hand traffic and in left-hand traffic, respectively, and with up to 17-seater minibuses (in the UK).

ACTIVITIES OUTSIDE ACADEMIA

- I publish essays about science, technology and society on my blog at `http://blog.melykuti.be`.
- On 24th April 2010, I published a 2000-word topical article in a major Hungarian newspaper, the Népszabadság. The article is available on my website.
- In the 2008/2009 academic year I was the vice-president of the graduate student representative body (Middle Common Room) of Keble College.
  My duties included ensuring that the provisions of our constitution and standing orders were followed, chairing our general meetings, representing the 240 graduate students on certain college committees, liaison between students and college authorities and occasionally the organisation of events.
- From April 2007 to June 2010 I was the president of the university club Oxford Hungarian Society.
  I organised socials and excursions and tried to link Hungarian students and academics in Oxford with each other.
- In 2005, at the age of 22, together with one of my classmates, I organised a reunion for our kindergarten class.

LEISURE ACTIVITIES

Reading Newspapers and news portals (political, financial, business, technology news and analysis; investment and startup advice).

Photography My favourite subjects are people; atmospheric places; action photography (photography of moving things); night photography; railway photography; and minimalist compositions. I use an analogue SLR camera with slide film or a digital SLR camera.

Sports Running, volleyball, tennis.

Railing Travelling by train when others would fly. Sightseeing.

Car enthusiasm Member of the Jaguar Association Germany (JAG) e.V., a club for the owners and lovers of Jaguar cars in Germany.

PERSONAL DETAILS

FORENAME	**Bence**	PLACE OF RESIDENCE	Freiburg i. Br., Germany
SURNAME	**Mélykúti**	EMAIL	melykuti@stochastik.uni-freiburg.de
GENDER	Male	HOMEPAGE	http://melykuti.be
YEAR OF BIRTH	1983	TWITTER	@BMelykuti
CITIZENSHIP	Hungarian	PHONE	...

This CV was most recently updated on 19th January 2017.