# Michael Hartmann Baym

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Department of Biomedical Informatics
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## Academic Appointments

*Harvard Medical School*

**Assistant Professor** of Biomedical Informatics — 2017 – present
**Member** of the Laboratory of Systems Pharmacology — 2017 – present
**Research Fellow** in Systems Biology, Kishony Lab — 2009 – 2017

*Massachusetts Institute of Technology*

**Research Affiliate** in Mathematics — 2010 – 2017
**Visiting Scholar** in Mathematics — 2009 – 2010

## Education

*Massachusetts Institute of Technology*

**Ph.D. in Mathematics** (Applied) — 2009
Advisor: Bonnie Berger
Thesis title: "Large, Noisy, and Incomplete: Mathematics for Modern Biology"

*University of Illinois at Urbana-Champaign (UIUC)*

**A.M. in Mathematics** — 2003
**B.S. in Mathematics** with Highest Distinction — 2002
Senior Theses in Mathematics and Chemical Biology

## Prizes, Awards, and Honors

**Roche Postdoctoral Fellowship** — 2016 – 2017
Fellowship for "scientific leadership for creation of innovative healthcare products and solutions."

**NSF Mathematical Sciences Postdoctoral Research Fellowship** — 2009 – 2012
National fellowship "to support future leaders in mathematics and statistics."

**Hertz Foundation Graduate Fellowship** — 2004 – 2009
National fellowship for graduate students in applied sciences

**ASEE-NDSEG Graduate Fellowship** — 2004 – 2007
Biosciences Division, national graduate fellowship

**NSF VIGRE Graduate Fellowship (UIUC)** — 2002 – 2003
Department of Mathematics, awarded to top incoming graduate students

**Undergraduate Mathematics Major Award (UIUC)** 2002
For the "most outstanding undergraduate student" in mathematics at UIUC

**Greenwood-Trijinsky Prize (UIUC)** 2001, 2002
Annual Undergraduate Mathematics Research Award (2nd 2001, 1st 2002)

**Colgate-Palmolive Undergraduate Research Fellowship (UIUC)** 2001 – 2002
UIUC-wide award for "outstanding research in the biological sciences"

**Chancellor's Scholar (UIUC)** 1999 – 2002
Campus-wide honors program

## Publications

### Articles

1. I. A. Anzai, L. Shaket, O. Adesina, **M. Baym**, B. Barstow, *Knockout Sudoku, a method for rapidly curating gene disruption collections*, Nature Protocols, *to appear*
Preprint: `https://peerj.com/preprints/2294/`

2. D.T. Riglar, T.W. Giessen, **M. Baym**, S.J. Kerns, M.J. Niederhuber, R.T. Bronson, J.W. Kotula, G.K. Gerber, J.C. Way, P.A. Silver, *Synthetic biological circuits that demonstrate long-term genetic and functional stability in the mammalian gut* , Nature Biotechnology, *to appear*
Preprint: `http://biorxiv.org/content/early/2016/09/14/075051`

3. C. Myhrvold, **M. Baym**, N. Hanikel, L.L. Ong, J.S. Gootenberg, P. Yin, *Barcode Extension for Analysis and Reconstruction of Structures*, Nature Communications, **8**, 14698 (2017)

4. **M. Baym***, L. Shaket, I.A. Anzai, O. Adesina, B. Barstow*, *Rapid Construction of a Whole-genome Transposon Insertion Collection for* Shewanella oneidensis *by Knockout Sudoku*, Nature Communications, **7**, 13270 (2016)

5. L.K. Stone, **M. Baym**, T.D. Lieberman, R. Chait, J. Clardy, R. Kishony, *Compounds that select against the tetracycline resistance efflux pump*, Nature Chemical Biology, **12**, 902–904 (2016)

6. **M. Baym**, T.D. Lieberman, E.D. Kelsic, R. Chait, R. Gross, I. Yelin, R. Kishony, *Spatiotemporal microbial evolution on antibiotic landscapes*, Science, **353**, 1147–1151 (2016)
**Media attention including:** PBS News Hour, CNN, NPR, The Atlantic, Haaretz, The Scientist, Smithsonian, Vox, Vice Motherboard, Wired, Gizmodo, Slate

7. **M. Baym***, L.K. Stone*, R. Kishony, *Multidrug evolutionary strategies to reverse antibiotic resistance*, Science, **351**, 6268 (2016), *review*

8. A. Palmer*, E. Toprak*, **M. Baym**, S. Kim, A. Veres, S. Bershtein, R. Kishony, *Delayed commitment to evolutionary fate in antibiotic resistance fitness landscapes*, Nature Communications, **6**, 7385 (2015)

9. **M. Baym***, S. Kryazhimskiy*, T.D. Lieberman*, H. Chung*, M.M. Desai, R. Kishony, *Inexpensive Multiplexed Library Preparation for Megabase-Sized Genomes*, PLoS ONE, **10**, e0128036 (2015)

10. D.J. Klein, **M. Baym**, and P. Eckhoff, *The Separatrix Algorithm for Synthesis and Analysis of Stochastic Simulations with Applications in Disease Modeling*, PLoS ONE **9**, e103467 (2014)

11. N.M. Daniels, A. Gallant, J. Peng, L.J. Cowen, **M. Baym**, and B. Berger, *Compressive genomics for protein databases*, Bioinformatics **29:13** i283–i290 (2013)

12. **M. Baym** and D.B. West, *Bounds on the* k*-dimension of Products of Special Posets*, Order **30** 779–796 (2013)

13. P.-R. Loh*, **M. Baym***†, and B. Berger†, *Compressive Genomics*, Nature Biotechnology **30** 627–630 (2012)
    **Selected for Highlights Track at RECOMB 2013 and ISMB 2013**

14. D. Park, R. Singh, **M. Baym**, C. Liao, and B. Berger, *IsoBase: A Database of Functionally Related Proteins across PPI Networks*, Nucleic Acids Research, **39** D295–300 (2011)

15. D.S. Lun, G. Rockwell, N.J. Guido, **M. Baym**, J.A. Kelner, B. Berger, J.E. Galagan, and G.M. Church,*Large-scale identification of genetic design strategies using local search*, Molecular Systems Biology **5:296** (2009)

16. C.-S.Liao, K. Lu, **M. Baym**, R. Singh, and B. Berger, *IsoRankN: Spectral methods for global alignment of multiple protein networks*, Bioinformatics, **25(12)**: i253–258 (2009)

17. **M. Baym***, C. Bakal*, N. Perrimon and B. Berger, *High-Resolution Modeling of Cellular Signaling Networks.*, Proceedings of the 12th Annual International Conference on Research in Computational Molecular Biology (RECOMB) LNBI **4955**: 257–271 (2008)

18. **M. Baym** and A.W. Hübler, *Conserved quantities and adaptation to the edge of chaos*, Phys. Rev. E. **73**, 056210 (2006)

## In Review

19. Y. J. Jiao*, **M. Baym***, A. Veres, R. Kishony, *Population diversity can jeopardize the efficacy of antibiotic cycling*, in review
    Preprint: `http://www.biorxiv.org/content/early/2016/10/20/082107`

*Authors contributed equally. †Corresponding author.

## Issued Patents

1. *Devices, systems, and methods for automated data collection*, US Patent #9,589,106
2. *Mining drill with gradient sensing and method of using same*, US Patent #9,587,482
3. *Kinetic penetrator with a retrieval tether*, US Patent #9,562,396
4. *Systems, methods, and devices for assessing microbiota of skin*, US Patent #9,557,331
5. *Devices and methods for sampling and profiling microbiota of skin*, US Patent #9,549,703
6. *Devices and methods for profiling microbiota of skin*, US Patent #9,526,480
7. *Devices and methods for profiling microbiota of skin*, US Patent #9,526,450
8. *Radiofrequency particle separator*, US Patent #9,480,991
9. *Acoustic source fragmentation system for breaking ground material*, US Patent #9,468,932

10. *Oral implant system for releasing encapsulated food additives by exposure to energy*, US Patent #9,462,822
11. *Devices, systems, and methods for automated data collection*, US Patent #9,460,264
12. *Systems, methods, and devices for assessing microbiota of skin*, US Patent #9,456,777
13. *Apparatus, system, and method for controlling movement of an orthopedic joint prosthesis in a mammalian subject*, US Patent #9,439,797
14. *Devices and methods for competency training and use authorization for dispensing an agent*, US Patent #9,390,457
15. *Systems, methods, and devices for assessing microbiota of skin*, US Patent #9,390,312
16. *Actively released food additives*, US Patent #9,357,865
17. *Devices, systems, and methods for automated data collection*, US Patent #9,317,662
18. *Focusing electromagnetic radiation within a turbid medium using ultrasonic modulation*, US Patent #9,232,896
19. *Systems and devices for sampling and profiling microbiota of skin*, US Patent #9,186,278
20. *Systems, devices, and method for determining treatment compliance including tracking, registering, etc. of medical staff, patients, instrumentation, events, etc. according to a treatment staging plan*, US Patent #9,008,385
21. *Determining a next value of a system-simulation parameter in response to a representation of a plots having the parameter as a dimension*, US Patent #8,949,084
22. *Determining a next value of a system-simulation parameter in response to representations of plots having the parameter as a dimension*, US Patent #8,938,374
23. *Focusing electromagnetic radiation within a turbid medium using ultrasonic modulation*, US Patent #8,917,442
24. *Mining drill with gradient sensing*, US Patent #8,857,539
25. *Determining a next value of a parameter for system simulation*, US Patent #8,855,973
26. *Material, system, and method that provide indication of a breach*, US Patent #8,845,969
27. *Systems, devices, admixtures, and methods including transponders for indication of food attributes*, US Patent #8,746,576
28. *Material, system, and method that provide indication of a breach*, US Patent #8,715,576
29. *Systems and methods for dynamic drug therapy response to blood pressure incidents*, US Patent #8,702,683
30. *Inflatable cuff with built-in drug delivery device for dynamic drug therapy response to blood pressure incidents*, US Patent #8,702,614
31. *Systems, devices, admixtures, and methods including transponders for indication of food attributes*, US Patent #8,695,884

## Work and Teaching Experience

**Institute for Disease Modeling at Intellectual Ventures**
Research Consultant in Epidemiological Modeling and Biomedical Technologies 2009 – 2014

**MIT Teaching Assistant in Mathematics**
Group Theory with Applications to Physics (Graduate) 2004
Principles of Applied Mathematics (Undergraduate) 2003

**Santa Fe Institute (SFI)** 2003
*Visiting Researcher* in Chaos Theory and Theoretical Biology
Advisors: Alfred Hübler and Stuart Kauffman

**UIUC Department of Chemistry** 2001, 2002
*Research Assistant* in Computational Chemical Biology
Advisor: Zaida Luthey-Schulten

**UIUC Department of Mathematics** 2001
*UNIX Consultant*

**Sigma Digital Designs** 1996 – 1998
*Co-founder and web content designer*

## Invited Talks

**Physical approaches for growing and evolving populations workshop (Tokyo, Japan)** 2017

**Harvard Medical School** Talks @12 2016
Video: `https://www.youtube.com/watch?v=JZ8usjcKW9g`

**Microsoft Research New England** Computational Biology Seminar 2016

**Harvard Medical School** Biomedical Informatics & Biostatistics Big Data Seminar 2016

**Genome Science Conference (Liverpool, England)** Keynote 2016

**Fannie and John Hertz Foundation Fellowship** Summer Workshop 2016

**Princeton University** Ecology and Evolutionary Biology Colloquium 2016

**Harvard School of Public Health** Evolutionary Epidemiology of Infectious Diseases 2015

**University of Texas El Paso** Undergraduate Research Summer Symposium Keynote 2015

**MIT Mathematics** Computational Biology Seminar 2015

**Caltech** New Frontiers in Biological Engineering Symposium 2015

**Harvard School of Public Health** Infectious Disease Epidemiology Seminar 2014

**Harvard University Systems Biology** Bauer Forum 2014

**Science Hack Day Boston** 2013

**MIT Mathematics** Computational Research in Boston and Beyond (CRIBB) Seminar 2011

**McGill University Computer Science** Montreal Bioinformatics Users Group (Mon-BUG) Seminar 2011

**Tufts University Computer Science** Colloquium 2009

**Princeton University, Lewis-Sigler Institute** Seminar 2009

**UC Berkeley Mathematics** Mathematical and Computational Biology Seminar 2009

## Campus Service

**MIT Applied Mathematics Graduate Student Seminar (SPAMS)** 2007 – 2008
Organizer

**UIUC Mathematics Department** 2000 – 2001
Undergraduate Advisory Committee

**UIUC Illini Tae Kwon Do Club** 1999 – 2003
Instructor, 4$^{th}$ Degree Black Belt

**UIUC Undergraduate Mathematics Society** 2001 – 2002
Founder, President