

# DANIEL IAN SCHOLES ROSENBLOOM

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## EDUCATION

### Harvard University, Cambridge, MA

Ph.D. in Organismic and Evolutionary Biology, May 2013

Dissertation: Dynamics of infection, mutation, and eradication in HIV and other evolving populations

Advisor: Martin A. Nowak

### Harvard University, Cambridge, MA

A.B. *cum laude* with honors in Mathematics & Philosophy, 2005

## RESEARCH EXPERIENCE

### Columbia Univ. Med. Ctr. Dept. of Biomedical Informatics, New York, NY

Postdoctoral Research Scientist

Advisor: Raul Rabadan

Feb. 2014 – present

### Harvard University Program for Evolutionary Dynamics, Cambridge, MA

Johns Hopkins University School of Medicine, Baltimore, MD (joint affiliation)

Postdoctoral Fellow

Advisors: Martin A. Nowak (Harvard), Robert F. Siliciano (Hopkins)

June 2013 – Jan. 2014

### Johns Hopkins University School of Medicine, Baltimore, MD

Laboratory Trainee (BSL-3) and Visiting Student

Advisor: Robert F. Siliciano

Jan. 2011 – May 2013

### Harvard University Program for Evolutionary Dynamics, Cambridge, MA

Ph.D. Student

Thesis Advisor: Martin A. Nowak

Sept. 2008 – May 2013

### Santa Fe Institute Complex Systems Summer School in Beijing

Participant

Summer 2005

### New England Complex Systems Institute

Undergraduate Researcher

Advisor: Yaneer Bar-Yam

2002 – 2005

## RESEARCH AND TEACHING INTERESTS

Mathematical biology for medicine & public health: virus evolution, drug resistance, epidemiology

HIV treatment, adherence, and latent reservoir dynamics

Computational and topological methods in human and viral genomics

Evolutionary dynamics, bioinformatics, statistics, and population genetics

Modeling mutation rates and recombination rates, hypermutation and recombination hotspots

Cultural evolution and imitation dynamics

**FELLOWSHIPS, GRANTS, AND AWARDS**

<b>Gates Foundation Grand Challenges Explorations Grant</b> Funding to develop a gene therapy to eradicate the latent reservoir in HIV infection Co-awardees: Hill AL, Rabi SA, Laird G	2012 – 2013
<b>National Science Foundation Graduate Research Fellowship</b> Stipend & tuition for three years of Ph.D. study	2009 – 2012
<b>Harvard University Certificate of Distinction in Teaching (awarded twice)</b> For teaching of Mathematical Biology & Evolutionary Dynamics	2009 & 2011

**TEACHING / EDUCATION EXPERIENCE**

<b>Columbia University</b> Guest Lecturer, Computational Aspects of Infectious Diseases (two 3-hour talks)	Spring 2014
<b>Harvard University</b> Advised three undergraduate theses in HIV population genetics, HIV treatment, and dynamical systems of viral infections	Fall 2011 – Spring 2013
Course Assistant, Evolutionary Dynamics graduate seminar (22 enrolled)	Spring 2012
Course Assistant, Mathematical Biology undergraduate course 2011: Average rating 4.7 / 5.0 (32 enrolled) 2009: Average rating 4.8 / 5.0 (21 enrolled)	Fall 2009, Fall 2011
Guest Lecturer, Mathematical Biology (eight 90-minute talks)	2009 - 2012
<b>Xidian University, Xi'an, China</b> Guest Speaker, hour-long seminar on graduate study in the U.S.	October 2009
<b>Harvard-MIT Mathematics Tournament, Cambridge, MA</b> Director of undergraduate-run math competition for high school students	May 2002 – April 2004
<b>Fresh Pond Enrichment Program, Alewife, MA</b> First- and Second-grade science enrichment teacher	Fall 2001

**OTHER PROFESSIONAL EXPERIENCE**

<b>Private Hedge Fund</b> Mathematical Modeler & Analyst (part-time)	2008 – 2010
<ul style="list-style-type: none"> <li>Designed algorithm to predict asset price changes, translating owner's strategies into program specifications</li> <li>Supervised programmers' implementation of algorithm</li> </ul>	
<b>Fair Isaac Co. (NYSE: FICO)</b> Business Strategy Analyst & Consultant	2005 – 2008
<ul style="list-style-type: none"> <li>Implemented randomized controlled trial for measuring profitability of marketing campaigns</li> <li>Designed and delivered training in use of graph-theoretic analytics software to identify "baskets" of products that customers often purchase together</li> <li>Programmed and presented customer profitability analysis, based on billions of transactions</li> </ul>	

## PEER-REVIEWED PUBLICATIONS

\* Denotes equal author contributions

Hill AL\*, **Rosenbloom DIS\***, Fu F, Nowak MA, Siliciano RF (2014, in press). Predicting the outcomes of treatment to eradicate the latent reservoir for HIV-1. **PNAS**.

**Rosenbloom DIS**, Allen B (2014). Frequency-dependent selection can lead to evolution of high mutation rates. **American Naturalist** 183(5): 131 – 153.

Whitney JB, Hill AL, Sanisetty S, Penaloza-MacMaster P, Liu J, Shetty M, Parenteau L, Cabral C, Shields J, Blackmore S, Smith JY, Brinkman AL, Peter LE, Mathew SI, Smith KM, Borducchi EN, **Rosenbloom DIS**, Lewis MG, Hattersley J, Li B, Hesselgesser J, Geleziunas R, Robb ML, Kim JH, Michael NL, Barouch DH (2014, in press). Rapid seeding of the viral reservoir prior to SIV viremia in rhesus monkeys. **Nature**.

Ho Y-C, Shan L, Hosmane N, Wang J, Laskey SB, **Rosenbloom DIS**, Lai J, Blankson JN, Siliciano JD, Siliciano RF (2013). Replication-competent noninduced proviruses in the latent reservoir increase barrier to HIV-1 cure. **Cell** 155(3): 540 – 551.

**Rosenbloom DIS\***, Hill AL\*, Rabi SA\*, Siliciano RF, Nowak MA (2012). Antiretroviral dynamics determines HIV evolution and predicts therapy outcome. **Nature Medicine** 18: 1378 – 1385.

Allen B, **Rosenbloom DIS** (2012). Mutation rate evolution in replicator dynamics. **Bulletin of Mathematical Biology** 74(11): 2650 – 2675.

Hill AL, **Rosenbloom DIS**, Nowak MA (2012). Evolutionary dynamics of HIV at multiple spatial and temporal scales. **Journal of Molecular Medicine** 90: 543 – 561.

Fu F\*, **Rosenbloom DI\***, Wang L, Nowak MA (2011). Imitation dynamics of vaccination behaviour on social networks. **Proceedings of the Royal Society B** 278: 42 – 49.

## UNDER REVISION / SUBMISSION

Camara PG, **Rosenbloom DIS**, Emmett KJ, Levine AJ, Rabadan R. Fine-scale resolution of human recombination using topological data analysis.

Moreno-Gamez S, Hill AL, **Rosenbloom DIS**, Petrov DA, Nowak MA, Pennings P. Imperfect drug penetration leads to rapid evolution of multi-drug resistance.

## RESEARCH TOOLS & EDUCATIONAL RESOURCES

Evolutionary dynamics & mathematical biology teaching – online educational resource ([www.danielrosenbloom.com/math153](http://www.danielrosenbloom.com/math153)), featured in the Drexel University Math Forum

*reboundtimes* – program for estimating time to viral rebound after interruption of HIV antiretroviral therapy ([www.danielrosenbloom.com/reboundtimes](http://www.danielrosenbloom.com/reboundtimes))

*IUPMStats* – program for computing infection frequencies from limiting dilution assays ([www.danielrosenbloom.com/iupmstats](http://www.danielrosenbloom.com/iupmstats))

## PRESENTATIONS & CONFERENCE PROCEEDINGS

- International Conference on Machine Learning**, Beijing, June 2014. Parametric inference using persistence diagrams: a case study in population genetics. Co-author of conference paper.
- Univ. of Delaware Series on Bioinformatics & Computational Biology**, Newark, DE, March 2014. Predicting the outcomes of treatment to eradicate the latent reservoir for HIV-1. Invited speaker.
- Workshop on Topological Structures in Computational Biology, Inst. for Mathematics and its Applications**, Minneapolis, MN, December 2013. Persistent homology estimators of evolutionary history. Poster presentation.
- XIV Congress of the European Society for Evolutionary Biology**, Lisbon, Portugal, August 2013. The role of drug penetration in the evolution of multi-drug resistance. Co-author of published abstract.
- 8th International Conference on HIV Treatment and Prevention Adherence**, Miami, FL, June 2013. Modeling treatment outcomes using rich adherence data & antiretroviral pharmacometrics. Oral presentation.
- 20th International Workshop on HIV Dynamics & Evolution**, Utrecht, Netherlands, May 2013. Predicting outcomes of treatments to eradicate the latent reservoir. Oral presentation.
- 20th International Workshop on HIV Dynamics & Evolution**, Utrecht, Netherlands, May 2013. Discordant drug penetration promotes the evolution of multi-drug resistance. Co-author of published abstract.
- 20th International Workshop on HIV Dynamics & Evolution**, Utrecht, Netherlands, May 2013. Estimating the efficacy of latency reversing agents from residual viremia measurements. Co-author of published abstract.
- 20th Conference on Retroviruses and Opportunistic Infections (CROI)**, Atlanta, GA, March 2013. Predicting outcomes of treatments to eradicate the HIV latent reservoir. Co-author of published abstract.
- 19th International Workshop on HIV Dynamics & Evolution**, Asheville, NC, April 2012. Antiretroviral dynamics determines HIV evolution and predicts therapy outcome. Oral presentation.
- Harvard University Organismic & Evolutionary Biology Department Seminar**, Cambridge, MA October 2012. Dynamics of HIV treatment, resistance, and the latent reservoir. Oral presentation.
- Harvard University Microbial Evolution Seminar**, Cambridge, MA June 2011. Predicting HIV treatment success, failure, and drug resistance. Oral presentation.
- Harvard University Organismic & Evolutionary Biology Department Retreat**, Petersham, MA, February 2011. Modeling HIV evolution and drug resistance. Oral presentation.
- Harvard University Organismic & Evolutionary Biology Department Retreat**, Petersham, MA, February 2010. Games and the evolution of high mutation rates. Oral presentation.
- Conference on Evolutionary Dynamics, Peking University**, Beijing, October 2009. Imitation dynamics of vaccination. Invited speaker.
- Santa Fe Institute Complex Systems Summer School**, Beijing, August 2005. Nonsyntactic human communication. Oral presentation of working paper.

## REVIEWER FOR

PLoS Computational Biology, PLoS ONE, Journal of Theoretical Biology, IEEE Transactions on Biomedical Engineering, Poznan Studies in Contemporary Linguistics, Journal of Applied Mathematics