PERSONAL INFORMATION

Jeremy D Harris

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⌗ Jeremy-D-Harris

WORK EXPERIENCE

June 2020 – present

Postdoctoral Fellow Researcher in Weitz Group

Department of Biological Sciences, Georgia Tech

- Advisor: Joshua Weitz, PhD, Associate Professor
- Aim: We aim to develop and analyze mathematical models of virus-host dynamics. Current projects include: epidemic modeling of asymptomatic transmission; introducing heterogeneity in susceptibility and transmissibility in compartmental models; modeling virus-microbe dynamics (e.g., latency of lytically infected bacteria); modeling coalition formation in the context of multiple lysogens and their phages.

August 2017 – May 2020

Postdoctoral Fellow Researcher in Koelle Research Group

Department of Biology, Emory University

- Advisor: Katia Koelle, PhD, Associate Professor
- Developed mathematical models of influenza virus. In collaboration with experimental virologists, we studied the effects of multiplicity of infection (MOI) on influenza viral infection outcomes in cell culture. We also modeled a serial passage study in which varying MOIs of wild-type and defective interfering particles gave rise to cycling dynamics.

EDUCATION

2017

Ph.D. in Mathematics

University of Pittsburgh, Pittsburgh, PA
Advisor: Bard Ermentrout, PhD, Distinguished University Professor

- Thesis: "Analysis of a spatially-distributed Wilson-Cowan model of cortex"

2011

B.S. in Mathematics, minor in Bioengineering

University of Pittsburgh, Pittsburgh, PA

- Honors College, Graduated Summa Cum Laude

PUBLICATIONS

In Preparation.

- Harris, J.D., Park, S.W., Dushoff, J., Weitz J.S. "How time-scale differences in asymptomatic and symptomatic transmission shape SARS-CoV-2 outbreak dynamics." (submitted to Epidemics: July 2022; working on revisions) medRxiv 2022
- Dominguez Mirazo, M., Harris, J.D., Demory, D., Weitz, J.S. "The impacts of latent period variability on virus-host dynamics." (in preparation, anticipated date of submission: Dec 2022)
- Harris, J.D.*, Martin, B.E*., Koelle, K.V., and Brooke, C.B. "Influenza virus population cycles emerge from collections of variably responding cells." *authors contributed equally. (in preparation, anticipated date of submission: Nov 2022)
- Harris, J.D., Gallmeier, E., Weitz J.S. "Correlations between individual variation in susceptibility and transmissibility impact the speed, strength, and final outbreak size of epidemics." (in preparation, anticipated date of submission: Jan 2023)

Published.
- Martin, B.E.*, Harris, J.D.* et al. (2020). "Cellular co-infection can modulate the efficiency of influenza A virus production and shape the interferon response." PLoS pathogens 16.10: e1008974. *authors contributed equally
- Harris, J.D. and Ermentrout, G.B. (2018). "Traveling waves in a spatially-distributed Wilson-Cowan model of cortex: From fronts to pulses." Physica D: Nonlinear Phenomena , 369, 30-46.

- Ali, R., Harris, J.D.*, and Ermentrout, G.B. (2016). "Pattern formation in oscillatory media without lateral inhibition." Physical Review E, 94(1), 012412. *corresponding author

- Harris, J.D. and Ermentrout, G.B. (2015). "Bifurcations in the Wilson–Cowan equations with nonsmooth firing rate." SIAM Journal on Applied Dynamical Systems, 14(1), 43-72.

Ongoing Projects.
- Coalition formation in phage-microbe dynamics: The life cycle of phage viruses can involve both lytic and lysogenic modes of infection. In this project, we examine the impact of these different modes of infection on phage virulence, lysogen invasion, and conditions for maintenance of multiple lysogens.
- Model framework for multiple infections: The lysis-lysogeny decision-switch in phage-host systems can be modulated by the number of viruses that infect the cell, termed the cellular multiplicity of infection (MOI). Here, we propose a model framework that explicitly accounts for cellular MOI variation in infected cells to examine the phage-host dynamics with both lytic and lysogenic modes of infection.
- Modeling de novo variation in growing populations: The immediate goal of this work is to develop a likelihood framework for the number of subclonal and clonal variants arising the in recipient host of a acute infection (e.g., influenza or SARS-CoV-2). In this project, we use differential master equations of a stochastic birth-death process with stochastic neutral mutations to obtain the steady-state distribution for the number of subclonal and clonal variants. The analytic and computational results may apply more broadly, as many biological processes involve natural variation during population expansion (e.g., cancer cell growth, resistance in bacterial populations).

PRESENTATIONS

2014 – present

Talks & Posters (external)

While in Weitz lab:

- Invited speaker – "Individual-level differences in symptomatic and asymptomatic transmission shape population-level dynamics of SARS-CoV-2 outbreaks." Virtual talk for University of Pennsylvania Math Bio seminar (Feb. 1, 2022)
- 2-minute Rapid Talk (poster) – "Modeling asymptomatic transmission in COVID-19." MIDAS 2021 (May 10-13)
- Invited speaker – "Modeling asymptomatic transmission in COVID-19." Virtual talk for University of Florida Math Bio seminar (Feb. 4, 2021)
- Poster presentation – "Modeling asymptomatic transmission in COVID-19." Student Conference on COVID-19 modeling (May 28-29, 2021)
- Invited speaker – "Modeling asymptomatic transmission in COVID-19." Virtual talk for University of Pittsburgh Math Bio seminar (Nov. 19, 2020)

While in Koelle lab:

- Conference talk – "Estimating transmission bottleneck sizes from viral variants unique to recipient hosts." Epidemics Conference 2019 (Dec. 3-6, 2019)
- Invited speaker – "Cellular co-infection increases viral production but the constituents of the output depend on frequencies of the input." Kennesaw State University, Applied Math seminar (Nov. 15, 2019)
- Invited speaker – "How do defective interfering particles impact influenza virus dynamics?" University of Pittsburgh, Center for Vaccine Research (April 16, 2019)
- Discussion moderator – summarized conference talks/posters and facilitated "Big picture" discussion on the future of quantitative biology. A TMLS-sponsored conference at Emory (Jan. 16-18, 2019)
- Poster presentation – "Complex viral dynamics emerge in vitro from collections of heterogeneously-responding infected cells." Evolution of Complex Life at Georgia Tech (May 15-17, 2019)

While in graduate school:

- Conference talk – "Traveling waves in a (nonsmooth) neural firing rate model." SIAM 2017 Annual Meeting (Pittsburgh, PA, July 10-14, 2017)
- Conference talk – "Patterns and waves in a spatially-extended neural field model." SIAM 2017 Conference on Applications of Dynamical Systems (Snowbird, Utah, May 21-25, 2017)
- Conference talk – "Travelling fronts and pulses in a nonsmooth neural mass model." SIAM 2015 Conference on Applications of Dynamical Systems (Snowbird, Utah, May 17-21, 2015)
- Conference talk – "The Wilson-Cowan equations with nonsmooth firing rate." (George Mason University, March 20-21, 2015)
- Conference talk – "Bifurcation analysis of the Wilson-Cowan equations with nonsmooth firing rate function." IEEE International Meeting on Analysis and Applications of Nonsmooth Systems (Como, Italy, August 10-12, 2014)

2011 – present   ## Seminar Presentations (internal)

- Presented, "Modeling asymptomatic transmission in COVID-19." Complex microbial dynamics and infections seminar (Oct. 9, 2020)
- Presented, "Data literacy in the sciences." Academic Learning Community on data literacy, Emory (March 31, 2020)
- Presented Rubin et al., "Revealing neural correlates of behavior without behavioral measurements." BioRxiv (2019). Theoretical Biophysics seminar, Emory (Oct. 21, 2019)
- Presented Shoval et al., "Evolutionary Trade-Offs, Pareto Optimality, and the Geometry of Phenotype Space." Science (2012). Theoretical Biophysics seminar, Emory (Feb. 18, 2019)
- Presented on current methods of estimating transmission bottlenecks. Koelle lab meeting, Emory (Feb. 11, 2019)
- Presented Allesina and Levine, "A competitive network theory of species diversity." PNAS (2011). Theoretical Biophysics seminar, Emory (Oct. 2017)
- Presented "The community ecology of influenza A defective interfering particles." Ecology and Evolution seminar, Emory (Oct. 2017)
- Presented "Pattern formation in the Wilson-Cowan equations." Applied Math seminar, Pitt (September 25, 2015)
- Presented on "Bifurcations of piecewise smooth flows." Colombo et al., Physica D: Nonlinear Phenomena (2012). Math Bio seminar, Pitt (Sept. 12 & 17, 2015)
- Presented an introduction to rigidity in the tensegrity model – In preparation for the guest speaker, R. Connelly, as part of a themed semester on networks. Math Bio seminar, Pitt (Sept. 17, 2014)
- Presented on "Iterated Prisoner's Dilemma contains strategies that dominate any evolutionary opponent." Press and Dyson, PNAS (2012). Math Bio seminar, Pitt (March 6, 2014)
- Presented "Processes taking place on networks." Math Bio seminar, Pitt (Feb. 5, 2013)
- Presented an existence proof of travelling waves in a shape-space model of antigenic variation in Trypanosomes. Applied Math seminar, Pitt (April 5, 2013)
- Presented on modelling antigenic variation in Trypanosome infections. Math Bio seminar, Pitt (Dec. 9, 2011 & Oct. 29, 2012.)

TEACHING EXPERIENCE

2021 – Present Teaching & Mentoring – GA Tech

- Serrapilheira ICTP-SAIFR - This training program was focused on topics in quantitative biology and ecology. I taught two modules in organismal behavior to (about 30) graduate-level students from various Latin American countries: Mexico, Colombia, Argentina, Brazil.
- Foundations in Quantitative Biology (Fall 2021, Fall 2022) – This course is for first-year QBioS program PhD students; the small class sizes (10-12 students) allowed for close interactions that grew over the semester. The class is intense for both students and instructors with two lectures, a computational lab, and a homework assignment each week, culminating in a final project. I had the opportunity to lecture for four of the weeks on organismal behavior, excitability, and movement. I also helped several students who did final projects on topics related to these.
- Undergraduate Mentoring – During the fall and spring semesters of 2021, I mentored a senior undergraduate student on a research project modeling variation in susceptibility and transmissibility in epidemic models. We are writing our results to publish a manuscript. In this experience, I contributed to a letter of support for their graduate school applications; they are currently in a PhD program in applied mathematics at Cornell University.
- Graduate Mentoring – I have been working with a graduate student in the Quantitative Biosciences program. We are developing a model framework for latency of viral infections.
- Entering Mentoring training – Workshop offered by Offices of Undergraduate Education and Graduate Education & Faculty Development
- KITP Quantitative biology summer research course – Held hands-on labs (using Matlab, R, and Python) to go though the exercises on eco-evolutionary models of viral dynamics (August 9-13, 2021)
- Quantitative Biosciences Workshop 2021: Epidemics – Ran a hands-on breakout session using Matlab to go though the exercises; see material (May 17-18, 2021)
- Undergraduate Research Symposium – volunteered to serve as a judge of 5-minute talks (April 22, 2021)

2015 – 2017 Teaching – Pitt

- Graduate Linear Algebra – Teaching Assistant
- Intro to Finite and Discrete Mathematics – Instructor
- Intro to Real Analysis – Teaching Assistant
- Intro to College Algebra – Instructor
- Calculus I (2 sections) – Instructor
- Intro to College Algebra (2 sections) – Instructor
- Intro to College Algebra – Instructor
- Calculus III – Teaching Assistant

2015 – 2016 Teaching Assistant Workshops – Pitt

- Topics include: developing a teaching philosophy, syllabus construction, encouraging participation, teaching with Powerpoint, navigating difficult situations

SERVICE

2015 – present Journal manuscript reviews

- Kähne, M., Rüdiger, S., Kihara, A. H., and Lindner, B. (2019). Gap junctions set the speed and nucleation rate of stage I retinal waves. PLoS computational biology, 15(4), e1006355.
- Nielsen, B. F. (2017). "Regularization of Ill-posed point neuron models." The Journal of Mathematical Neuroscience, 7(1), 6.
- Ji, Y., Zhang, X., Liang, M., Hua, T., and Wang, Y. (2015). "Dynamical analysis of periodic bursting in piece-wise linear planar neuron model." Cognitive Neurodynamics, 9(6), 573-579.

2018 – Spring 2020   Emory

- Data Literacy Academic Learning Community – six 1.5 hour discussions on data literacy, with a focus on interdisciplinary educational approaches, skill-building in data literacy; deliverables include a package on data literacy for lessons and curriculum to support undergraduate education
- Data Science for Scientists ATL – monthly meetings and special sessions on all things data (e.g. Jupyter notebook demos, version control with git, visualization with R)
- Software carpentry workshop – hosted by Data Science for Scientists ATL (Nov. 23-24, 2019) – to learn and help others learn basic shell commands, version control with git, and to use jupyter notebooks and some basic python code
- Datafest at Emory – undergraduates analyze a large dataset as part of the quantitative theory and methods initiative (April 2019)
- Graduate Research Symposium – helped with judging of research talks/posters (2018-2020)
- Volunteer for Atlanta Bike Emory: participating in Emory Cares International Service Day (Saturday Nov. 9, 2019)
- Committee on Environment – We discuss, review, and make recommendations on campus projects and initiatives that have an environmental impact on campus (committee website) (2019-2020)

2018 – Spring 2020   Pitt

- Representative from the math department in general body meetings; planned and organized graduate student events, including socials and the new student teaching orientation (2013 – 2017)
- Organized for graduate students as an opportunity to practice presenting their work (2014 – 2015)
- Volunteer at Pitt's Integration Bees – Helped with the undergraduate bee (2014 & 2015); high school bee (2015 & 2016)

April 2020 – present   Hearts to Nourish Hope Food Bank

- Volunteer through Hands on Atlanta – monthly, from April-August 2020

2018 – 2019   Human Rights Campaign (HRC)

- Volunteer for HRC Atlanta Pride Brunch (Oct. 13, 2019)

2013 – 2014   Volunteer for Neighborhood Learning Alliance (NLA)

- Helped high school students complete online coursework to obtain equivalent credit for a failed or incomplete course-requirement, Pittsburgh, PA (July and August of 2013 & 2014).

GROUPS & ORGANIZATIONS

2019 – Fall 2020   Emory, UGA, GA Tech

- CoS Research Faculty Advisory Council (member since Feb. 1, 2022) - the mission of the council is to support and advocate for postdocs and research scientists by disseminating information on resources and policies, being liaisons to the administration, and building community by hosting events, like townhalls.
- Emory-UGA-GATech SARS-CoV-2 journal club (co-organizer) – to collect, organize, and share information on high output of COVID-19 papers. We read papers anywhere from epidemiological data analysis to vaccine efficacy studies. We meet weekly, and the google doc is kept up-to-date – first meeting April 20; updated August 14.
- Postdoctoral Science Magazine (editor) – to highlight research being done at Emory University and other research institutions in Atlanta; develop skills in communicating science; blog post (Emory PDA) on working remotely – March 25, 2020; last updated December 2020

2017 – Spring 2020	**Emory University**

- Biology Postdoctoral Cohort – created to build social and professional connections amongst postdocs in biology and related areas
- Theory and Modeling of Living Systems (TMLS) Initiative
- EmoRy R & coding club – to learn R studio, R markdown, version control with git
- Data Science for Scientists ATL – to engage with the data science community at Emory, both learning and helping with events (meetings, workshops, etc.)
- Data Literacy Academic Learning Community – seeks to provide a space for discussion and exploration of data literacy, with a focus on interdisciplinary educational approaches, skill-building in data literacy (6 meetings during spring semester 2020); one of our main goals is to develop a data literacy package that includes lessons and curriculum to support undergraduate education

CURRENT PROFESSIONAL MEMBERSHIPS

National/international Organizations

- Society for Industrial and Applied Mathematics (SIAM)
- Society for Mathematical Biology (SMB)
- American Mathematical Society (AMS)
- Models of infectious disease agent study (MIDAS)

AWARDS & FELLOWSHIPS

2011 – 2013	**NSF-RTG, Complex Biological Systems Group**

- Complex biological systems across multiple space and time scales
  Award number 0739261
- Funding for the first two years of graduate school

April 2011	**Culver Award for undergraduate research, Department of Mathematics**

- For work on modeling antigenic variation in Trypanosome infections

2010 – 2011	**NSF-RTG, Complex Biological Systems Group**

- Complex biological systems across multiple space and time scales
  Award number 0739261
- Undergraduate research experience: summer (2010) & spring/summer (2011)

2007 – 2011	**University of Pittsburgh scholarships**

- University of Pittsburgh, 2007-2011
- Swanson School of Engineering, 2007-2009

FUNDING ACKNOWLEDGMENTS

August 2017 – present	**DARPA INTERCEPT W911NF-17-2-0034**

Principal Investigator: Chris B. Brooke, PhD, Assistant Professor
- Funding source of my postdoctoral fellowship
- As part of the INTERCEPT program, our research team has aimed to investigate the potential for defective interfering particles to be used as a novel therapeutic against viral infections by understanding their basic evolutionary consequences within- and between-hosts.

2013 – 2014	**NSF DMS 1219753**

Principal Investigator: G. Bard Ermentrout, PhD, Distinguished University Professor
- Interactions between Stimuli and Spatiotemporal Activity
- Working with an undergraduate REU student (summer 2014), we published our results in PRE (2016). (see publications section)

REFERENCES

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