CURRICULUM VITAE

Andreas Handel, Ph.D.
Department of Epidemiology and Biostatistics, College of Public Health
The University of Georgia
124 B.S. Miller Hall, Health Sciences Campus
Athens, GA 30602
ahandel@uga.edu
http://handelgroup.uga.edu

Academic History

Present rank: Assistant Professor
Tenure status: Tenure-track
Graduate faculty status: Active
Academic Appointment: 9 month

- Current (2012/13 – present): 50% Instruction, 45% Research, 5% Service
- Previous (2009/2010 – 2011/2012): 25% Instruction, 75% Research

EDUCATION

- Ph.D. in Physics with minor in Mathematics, Center for Nonlinear Sciences and School of Physics, Georgia Institute of Technology. Thesis Topic: "Limits of localized control in extended nonlinear systems," Advisor: Dr. Roman Grigoriev (2004)
- B.S. (German equivalent) in Physics, Department of Physics, University of Stuttgart, Germany (1999)

POSITIONS

- Assistant Professor, Department of Epidemiology and Biostatistics, College of Public Health, University of Georgia (2009 – present)
- Faculty, Institute of Bioinformatics, University of Georgia (2009 – present)
- Member, Faculty of Infectious Diseases, University of Georgia (2009 – present)
- Adjunct Assistant Professor, Department of Infectious Diseases, College of Veterinary Medicine, University of Georgia (2010 – present)
- Adjunct Assistant Professor, Department of Epidemiology, Rollins School of Public Health, Emory University (2011 – present)
- Postdoctoral Fellow, Department of Biology, Emory University (2004 – 2008)
- Graduate Research Assistant, School of Physics, Georgia Institute of Technology (2000 – 2004)

Teaching Activity

CLASSES TAUGHT AT THE UNIVERSITY OF GEORGIA

Academic Year 2013/2014 (50% teaching appt., 12 teaching credits required, 11.4 produced*)

* Teaching credits are computed per UGA rules as 1 credit per regular class and 20 credits = 1 regular credit for research/mentoring courses. Courses marked with ^ do not count toward teaching load credits.
Were available and applicable, ratings for each course are given.

Summer 2014:

- EPID 8560 Analysis of Infectious Disease Data, 3 credit course, 10 students, ^
- PBHL 7560 (internship), 6 total credit hours, 1 student

Spring 2014:

- EPID 7010 Introduction to Epidemiology, 3 credit course, 14 students, 4.3/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 37 students, 4.54/5

Fall 2013:

- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 30 students, 4.21/5
- EPID/ECOL/IDIS 8515 Modeling Infectious Diseases, 4 credit course, 7 students, 4.43/5
- PBHL 7800 (MPH capstone), 3 total credit hours, 1 student
- BINF 7300 (masters research), 4 total credit hours, 1 student
- BINF 9000 (doctoral research), 5 total credit hours, 1 student
- BINF 9300 (doctoral research), 30 total credit hours, 2 students

Academic Year 2012/2013 (50% teaching appt., 12 credits required, 17.9 produced)

Summer 2013:

- BINF 9300 (doctoral research), 36 total credit hours, 2 students
- PBHL 7560 (internship), 18 total credit hours, 3 students
- EPID 7005 (TA), 3 credit hours, 1 student

Spring 2013:

- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 19 students, 4.78/5
- PBHL 7560 (internship), 24 total credit hours, 4 students
- PBHL 7800 (MPH capstone), 9 total credit hours, 3 students
- BINF 9300 (doctoral research), 29 total credit hours, 2 students
- BINF 9000 (doctoral research), 5 total credit hours, 1 students
- BINF 7300 (masters research), 4 total credit hours, 1 student
- EPID 7005 (TA), 9 total credit hours, 1 student
- FYOS 1001 Computer Simulations of Infectious Diseases, 1 credit course, 12 students ^

Fall 2012:

- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 34 students, 4.51/5
- EPID 7010 Introduction to Epidemiology, 3 credit course, 47 students, 3.6/5
- EPID/ECOL/IDIS 8515 Modeling Infectious Diseases, 4 credit course, 13 students, 3.73/5
- BINF 9300 (doctoral research), 31 total credit hours, 2 students
- BINF 7300 (masters research), 4 total credit hours, 1 student

- PBHL 7560 (internship), 6 total credit hours, 1 student

Academic Year 2011/2012 (25% teaching appt., 6 credits required, 16.4 produced)

[+] While I was instructor of record for this course, most lectures were delivered by 2 of our DrPH students to allow them to gain teaching experience. I was responsible for everything else.

Summer 2012:

- BINF 9000 (doctoral research), 39 total credit hours, 3 students
- BINF 9300 (doctoral research), 9 total credit hours, 1 student

Spring 2012:

- EPID 4070 Fundamentals of Epidemiology, 3 credit course, 61 students [+]
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 28 students, 4.33/5
- EPID 8910 (directed study), 3 total credit hours, 1 student
- BINF 9000 (doctoral research), 51 total credit hours, 3 students

Fall 2011:

- EPID/ECOL/IDIS 8515 Modeling Infectious Diseases, 4 credit course, 11 students, 4.34/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 33 students, 4.49/5
- FYOS 1001 Computer Simulations of Infectious Diseases, 1 credit course, 10 students ^
- PBHL 7800 (MPH capstone), 4 total credit hours, 1 student
- BINF 9000 (doctoral research), 42 total credit hours, 4 students

Academic Year 2010/2011 (25% teaching appt., 6 credits required, 14.3 produced)

Summer 2011:

- BINF 9000 (doctoral research), 47 total credit hours, 4 students

Spring 2011:

- EPID 4070 Fundamentals of Epidemiology, 3 credit course, 64 students, 4.14/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 39 students, 4.28/5
- EPID 3900 Special Topics in Epidemiology (study abroad 12/15/10 – 1/5/11), 3 credits, 32 students^
- EPID 8900 Special Topics in Epidemiology (study abroad 12/15/10 – 1/5/11), 3 credits, 6 students ^
- PBHL 7800 (MPH capstone), 3 total credit hours, 1 student
- PBHL 7560 (internship), 12 total credit hours, 2 students
- BINF 9000 (doctoral research), 22 total credit hours, 3 students

Fall 2010:

- EPID/ECOL/IDIS 8515 Modeling Infectious Diseases, 4 credit course, 9 students, 4.75/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 29 students, 4.49/5
- BINF 9000 (doctoral research), 22 total credit hours, 3 students

Academic Year 2009/2010 (25% teaching appt., 6 credits required, 10.7 produced)

Summer 2010:

- BINF 9000 (doctoral research), 40 total credit hours, 4 students
- PBHL 7560 (internship), 12 total credit hours, 2 students

Spring 2010:

- EPID 4070 Fundamentals of Epidemiology, 3 credit course, 102 students, 4.00/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 8 students, 3.87/5
- EPID 7005 (graduate student seminar), 1 course credit hour, 3 total credits, 1 student
- BINF 7000 (masters research), 5 total credits, 1 student
- BINF 9300 (doctoral research), 7 total credits, 1 student

Fall 2009:

- EPID/ECOL/IDIS 8515 Modeling Infectious Diseases, 4 credits, co-taught with Dr. Park, 7 students, 4.58/5
- EPID 7100 Current Topics in Epidemiology, 1 credit seminar series, 18 students, 4.48/5
- BINF 7000 (masters research), 5 total credit hours, 1 student
- BINF 9000 (doctoral research), 2 total credit hours, 1 student

CLASSES TAUGHT AT OTHER INSTITUTIONS

- Infectious Disease Dynamics (EPI 590R), 2 credit short-term, intensive course, January 2013, Emory University Rollins School of Public Health, 33 students
- An Introduction to Infectious Disease Modeling (EPI 590R), 2 credit short-term, intensive course, January 2012, Emory University Rollins School of Public Health, 21 students

WORKSHOPS TAUGHT

- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 6th Summer Institute in Statistics and Modeling in Infectious Diseases, 7/9 – 7/11/2014, University of Washington, 28 students
- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 5th Summer Institute in Statistics and Modeling in Infectious Diseases, 7/10 – 7/12/2013, University of Washington, 21 students
- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 4th Summer Institute in Statistics and Modeling in Infectious Diseases, 7/9 – 7/11/2012, University of Washington, 27 students
- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 3rd Summer Institute in Statistics and Modeling in Infectious Diseases, 6/13 – 6/15/2011, University of Washington, 31 students
- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 2nd Summer Institute in Statistics and Modeling in Infectious Diseases, 6/16 – 6/18/2010, University of Washington, 18 students
- Workshop on "Infectious Diseases, Immunology and Within-Host Models,", 1st Summer Institute in Statistics and Modeling in Infectious Diseases (SISMID), 6/14-6/16/2009, University of Washington, 7 students

GUEST LECTURES

- "Introduction to the Likelihood" for EPID 8010 (8/2013)
- "Introduction to within-host Infectious Disease modeling" for ECOL/BIOL 4150/6150 (3 times, spring 2010-2012)
- "Descriptive Epidemiology" for EPID 7010 (1/2012)
- "Introduction to Infectious Disease Modeling" for FRES 1010 (2/2010)
- "Introduction to Infectious Disease Modeling" for EPID 8500 (10/2009)

Scholarly Activity

Areas in which research is done

My research focuses on modeling and analysis of infectious diseases at the individual and population levels. My main areas of study are currently study influenza, tuberculosis and norovirus. I am interested in obtaining a better basic understanding of the dynamic processes that occur during an individual infection as well as during spread of an infectious disease in a population. The ultimate goal is to use these new insights to design better intervention and control strategies against infectious diseases, both for individual patients and on the population level.

Publications

PEER-REVIEWED JOURNAL ARTICLES
(30 published, 4 in review. * indicates a student or postdoc mentee)

- Nicola Bird, Aeron Hurt, Christine Oshansky, Oh Ding, Patrick Reading, Matthew Olson, Yilun Sun, Li Tang, **Andreas Handel**, Stephen Turner, Paul Thomas, Katherine Kedzierska. Oseltamivir prophylaxis reduces inflammation-induced morbidity while facilitates establishment of cross-strain protective CD8+ T cell memory to influenza viruses. (Under review at Nature Medicine).
- Theresa Devasia*, Benjamin Lopman, Juan Leon, **Andreas Handel.** Association of host, agent and environment characteristics and the duration of incubation and symptomatic periods of norovirus gastroenteritis. (Under review at Epidemiology & Infection)
- Juliet Sekandi, Justin List, Nibiao Zheng*, **Andreas Handel**, Christopher Whalen. Undetected Seronegative Cases May be 'Hidden' Drivers of the Tuberculosis Epidemic in an Urban African Setting with High HIV Prevalence. (Under review at International Epidemiology)
- Nibiao Zheng*, Christopher Whalen, **Andreas Handel.** Modeling the potential impact of host population survival on the evolution of M. tuberculosis latency. (Under review at PLoS One).

1. **Andreas Handel**, Camille Barbenchon, Justin Brown, David Stallknecht, Pejman Rohani (2014). Trade-offs between and within scales: Environmental persistence and in-host fitness of avian influenza viruses. Proc Royal Soc B 281, 20133051.
2. Thi H. O. Nguyen, Louise C. Rowntree, Daniel G. Pellicci, Nicola L. Bird, **Andreas Handel**, Lars Kjer-Nielsen, Katherine Kedzierska, Tom C. Kotsimbos and Nicole A. Mifsud (2014). Recognition of distinct cross-reactive virus-specific CD8+ T cells reveals a unique TCR signature in a clinical setting. Journal of Immunology, doi:10.4049/jimmunol.1303147.
3. Yan Li***, Andreas Handel** (2014). Modeling inoculum dose dependent patterns of acute virus infections. Journal of Theoretical Biology 347, 63–73
4. Tania Cukalac, Jesseka Chadderton, **Andreas Handel**, Peter Doherty, Stephen Turner, Paul Thomas, Nicole La Gruta (2014). Reproducible selection of high avidity CD8+ T-cell clones following secondary acute virus infection. Proceedings of the National Academy of Sciences 111 (4), 1485–1490
5. **Andreas Handel,** Victoria Akin***,** Sergei S. Pilyugin, Veronika Zarnitsyna, Rustom Antia (2014). How sticky should a virus be? The impact of virus binding and release on transmission fitness using influenza as an example. Journal of the Royal Society Interface 11: 20131083.
6. **Andreas Handel,** Justin Brown, David Stallknecht, Pejman Rohani (2013). A multi-scale analysis of influenza A virus fitness trade-offs due to temperature-dependent virus persistence. PLoS Computational Biology 9(3): e1002989
7. Paul Thomas, **Andreas Handel**, Peter Doherty, Nicole La Gruta (2013). Ecological analysis of antigen-specific CTL repertoires defines the relationship between naive and immune T-cell populations. Proceedings of the National Academy of Sciences, PMID: 23319654
8. Mark Jackwood, David Hall**, Andreas Handel** (2012). Molecular evolution and emergence of avian gammacoronaviruses. Infection, Genetics and Evolution 12, 1305–1311
9. Rishi Desai, Christal Hembree*, **Andreas Handel**, et al. (2012). Severe outcomes are associated with

genogroup 2 genotype 4 norovirus outbreaks: A systematic literature review. Clinical Infectious Diseases, 10.1093/cid/cis372

10. Isaac Fung*, Rustom Antia, **Andreas Handel** (2012). How to minimize the attack rate during multiple influenza outbreaks in a heterogeneous population. PLoS ONE 7(6): e36573
11. Catherine Beauchemin and **Andreas Handel** (2011). A review of mathematical models of influenza A infections within a host or cell culture: Lessons learned and challenges ahead. BMC Public Health 11:S7
12. Jessica Moffat, **Andreas Handel**, Peter Doherty, Stephen Turner, Paul Thomas, Nicole La Gruta (2010). Influenza Epitope-Specific CD8+ T Cell Avidity, but Not Cytokine Polyfunctionality, Can Be Determined by TCRβ Clonotype. Journal of Immunology 185, 6850-6856
13. **Andreas Handel**, Ira M. Longini Jr., Rustom Antia (2010). Towards a quantitative understanding of the within-host dynamics of influenza A infections. Journal of the Royal Society Interface 7, 35-47. PMID: 19474085.
14. **Andreas Handel**, Ira M. Longini Jr., Rustom Antia (2009). Intervention strategies for an influenza pandemic taking into account secondary bacterial infections. Epidemics 1, 185-195
15. **Andreas Handel** and Daniel E. Rozen (2009). The impact of population size on the evolution of asexual microbes on smooth versus rugged fitness landscapes. BMC Evolutionary Biology 9:236
16. **Andreas Handel**, Andrew Yates, Sergei S. Pilyugin, Rustom Antia (2009). Sharing the burden: Antigen transport and firebreaks in immune responses. Journal of the Royal Society Interface 6, 447-454. PMCID: PMC2659692.
17. **Andreas Handel**, Elisa Margolis, Bruce R Levin (2009). Exploring the role of the immune response in preventing antibiotic resistance. Journal of Theoretical Biology 256 (4), 655-662. PMID: 19056402.
18. **Andreas Handel**, Ira M. Longini Jr., Rustom Antia (2009). Antiviral resistance and the control of pandemic influenza: The roles of stochasticity, evolution and model details. Journal of Theoretical Biology 256 (1), 117-125. PMCID: PMC2624577.
19. **Andreas Handel** and Matthew Bennett (2008). Surviving the bottleneck: Transmission mutants and the evolution of microbial populations. Genetics 180 (4), 2193–2200. PMCID: PMC2600951.
20. **Andreas Handel** and Rustom Antia (2008). A Simple Mathematical Model Helps To Explain the Immunodominance of CD8 T Cells in Influenza A Virus Infections. Journal of Virology 82 (16), 7768-7772. PMCID: PMC2519595.
21. Daniel E. Rozen, Michelle G. J. L. Habets, **Andreas Handel**, J. Arjan G. M. de Visser (2008). Heterogeneous Adaptive Trajectories of Small Populations on Complex Fitness Landscapes. PLoS One 3 (3): e1715
22. **Andreas Handel**, Andrew Yates, Sergei S. Pilyugin, Rustom Antia (2007). Gap junction-mediated antigen transport in immune responses. Trends in Immunology 28, No. 11, 463-466. PMID: 17951108
23. **Andreas Handel**, Ira M. Longini Jr., Rustom Antia (2007). Neuraminidase Inhibitor Resistance in Influenza: Assessing the Danger of its Generation and Spread. PLoS Computational Biology 3 (12): e240. PMCID: PMC2134965.
24. **Andreas Handel**, Ira M. Longini Jr., Rustom Antia (2007). What is the best control strategy for multiple infectious disease outbreaks? Proceedings of the Royal Society B 274, 833-837. PMCID: PMC2093965
25. Cecile Viboud, Theresa Tam, Douglas Fleming, **Andreas Handel**, Mark A. Miller, Lone Simonsen (2006). Transmissibility and mortality impact of epidemic and pandemic influenza, with emphasis on the unusually deadly 1951 epidemic. Vaccine 24, 6701. PMID: 16806596.
26. **Andreas Handel**, Roland R. Regoes, Rustom Antia (2006). The Role of Compensatory Mutations in the Emergence of Drug Resistance. PLoS Computational Biology 2(10): e137. PMCID: PMC1599768.
27. **Andreas Handel** and Roman O. Grigoriev (2006). Transient dynamics and nonlinear stability of spatially extended systems. Physical Review E 74, 036302
28. **Andreas Handel** and Roman O. Grigoriev (2005). Pattern selection and control via localized feedback. Physical Review E 72, 066208
29. Roman O. Grigoriev and **Andreas Handel** (2002). Spectral theory for the failure of linear control in a nonlinear stochastic system. Physical Review E 66, 065301(R)
30. Roman O. Grigoriev and **Andreas Handel** (2002). Non-normality and the localized control of extended systems. Physical Review E 66, 067201

BOOK CHAPTERS

- Roman O. Grigoriev and **Andreas Handel** (2007). Localized Control of Spatiotemporal Chaos. Handbook of Chaos Control, Chapter 8, Wiley-VCH

OTHER PUBLICATIONS

- **Andreas Handel** (2004). Limits of localized control in extended nonlinear systems. Ph. D. Thesis, School of Physics, Georgia Institute of Technology

Creative contributions other than formal publications

ORAL PRESENTATIONS (* indicates invited presentations)

- "A TB Model for post 2015 WHO Interventions in South Africa", 6/2/2014, Gates Foundation, Seattle, WA*
- "Flu in Ducks and Water: A Multiscale Modeling Study", 4/9/2014, Mathematical Biosciences Institute, Columbus, Ohio*
- "Introduction to Mechanistic Modeling", 2/25/2014, CDC, Atlanta, GA*
- "Modeling the role of inoculum dose on infection dynamics", 2/11/2014, Georgia Tech, Atlanta, GA*
- "Inference for infectious disease modeling", 2/7/2014, CDC, Atlanta, GA*
- "Flu in Ducks and Water: A Multiscale Modeling Study", 11/14/2013, OneHealth Talk, UGA, Athens, GA*
- "A mathematical model shows that prolonged latency can improve population-level survival of Mycobacterium tuberculosis", 10/11/2013, USC Beaufort, Beaufort, SC*
- "How to further improve our influenza models - some thoughts" (keynote address), 7/15/2013, Frankfurt, Germany*
- "How Sticky should a virus be? The impact of binding and detachment on virus fitness using influenza as an example", 6/21/2013, St. Jude, Memphis, TN*
- "A multi-scale analysis of influenza A virus fitness trade-offs due to temperature-dependent virus persistence", 4/3/2013, Ecology Department, UGA, Athens, GA
- "A multi-scale analysis of influenza A virus fitness trade-offs due to temperature-dependent virus persistence", 3/11/2013, USC Beaufort, Beaufort, SC*
- "Parallel Computation using the R software platform", UGA, 5/2/2012
- "Modeling the impact of drug-based intervention strategies for pandemic influenza", CDC, 2/8/2012, Atlanta, GA*
- "Introduction to Infectious Disease Modeling", 10/27/2011, Emory University, Atlanta, GA*
- "Model fitting and model selection", Evolution of Infectious Diseases: Integrating Empirical Data and Modeling Approaches, NESCent Catalysis Meeting, 3/23/2011, Raleigh, NC*
- "Influenza & Immunity", RAPIDD workshop on Generation and Maintenance of Immune Memory, 3/8/2011, Seattle, WA*
- "Mathematical and computational modeling of infectious disease dynamics", 10/ 20/2010, Institute of Bioinformatics, University of Georgia, Athens, GA*
- "How sticky should a virus be? The impact of attachment and detachment rates on virus fitness using influenza as example", 8/30/2010, Viral Dynamics Workshop, Santa Fe, NM*
- "How sticky should a virus be? The impact of attachment and detachment rates on virus fitness using influenza as example", 7/20/2010, Fields Institute Workshop on the Mathematics of Drug Resistance in Infectious Diseases, Toronto, Canada*
- "Modeling influenza infection in vivo", 1/13/2010, Los Alamos National Laboratory, Los Alamos, NM*
- "How sticky should a virus be? Optimal Infection Strategies and the Balance Between Hemagglutinin and Neuraminidase for Influenza A Virus" 10/12/2009, Department of Infectious Diseases, University of Georgia, GA*
- "Modeling Influenza infection in vivo", 7/28/2009, Conference on Immunobiology of Influenza Virus

Infection, Athens, GA*

- "Within-host ecology: Virus spread, gap-junctions and firebreaks", 3/6/2009, Ecology of Infectious Diseases Seminar Series, University of Georgia, Athens, GA*
- "Mathematical Modeling of Immunodominance in influenza infections", 2/13/2009, Institute of Bioinformatics, University of Georgia, Athens, GA*
- "Mathematical Modeling of Infections: CD8 T Cell Dynamics During Influenza Infections as an Example", 11/11/2008, Department of Cell Biology, University of Georgia, Athens, GA*
- "Within-host dynamics of Influenza infections: When details matter", 6th Annual Conference on Ecology and Evolution of Infectious Diseases, 6/05/2008, Fort Collins, CO*
- "The dynamics of drug resistance emergence", 10/05/2007, Center for Interdisciplinary Applied Mathematics, University of North Carolina, Chapel Hill, NC*
- "Influenza resistant to neuraminidase inhibitors: the danger of its generation and spread", Immunobiology of Influenza Virus Infection: Approaches for an Emerging Zoonotic Disease, 7/31/2007, Athens, GA
- "Mathematical models of drug resistance emergence", 1/24/2007, Department of Mathematics, Georgia Institute of Technology, Atlanta, GA*
- "Two stochastic strolls through pathogen land", 11/17/2006, Seminar in Population Biology and Evolutionary Ecology, Emory University, Atlanta, GA*
- "The Role of Compensatory Mutations for the Emergence of Drug Resistance", 4th Annual Conference on Ecology and Evolution of Infectious Diseases, 5/18 - 5/20/2006, State College, PA

POSTER PRESENTATIONS

- "A multi-scale analysis of influenza A virus fitness trade-offs due to temperature-dependent virus persistence", 5/21/2013, 11th Annual Conference on Ecology and Evolution of Infectious Diseases, State College, PA
- "Cooperation and competition determine CD8 T-cell immunodominance hierarchies", Swine Origin H1N1 Virus: The First Pandemic of the 21st Century, 4/18 - 4/20/2010, Atlanta, GA
- "Cooperation and competition determine CD8 T-cell immunodominance hierarchies", 1st International Workshop in Systems Approaches in Immunology, 1/10 – 1/12/2010, Santa Fe, NM
- "A simple mathematical model helps explain immunodominance of CD8 T-cells in influenza A infections", Conference on Theoretical Biology and Biomathematics, 6/22 – 6/27/2008, Barga, Italy
- "Influenza resistant to neuraminidase inhibitors: the danger of its generation and spread", Viral Paradigms: Molecules, Populations, Ecosystems and Infectious Disease, 1/14-1/16/2008, Atlanta, GA
- "Influenza resistant to neuraminidase inhibitors: the danger of its generation and spread", Conference on Immunobiology of Influenza Virus Infection: Approaches for an Emerging Zoonotic Disease, 7/29/2007 - 7/31/2007, Athens, GA

Grant Activity

GRANTS - FUNDED

- 7/2014 – 6/2019 “Research Coordination Network - Infectious Disease Evolution Across Scales“, NSF $500K, PI Graham, Princeton. My role: Network Member.
- 7/2012 – 6/2015 “REU Site - Population Biology of Infectious Diseases”. NSF, $283K, PI Drake, UGA. My role: Senior Personnel.
- 7/2012 – 7/2017 "Georgia Veterinary Scholar Summer Research program". NIH T35, $259K, PI Sanchez, UGA. My role: Mentor.
- 9/2011 – 8/2013 “Quantifying and modeling influenza viral dynamics and host responses”. NIH R56, $648K, PI Thomas, St. Jude. My role: PI on UGA sub-contract, $266K.
- 7/2011 – 6/2012 “Developing an agent-based model to study tuberculosis transmission and vaccination”. UGA Faculty Research Grant, $11K. My role: PI.
- 5/2007 – 4/2012 “Quantitative studies of CD8 T-cell dynamics”. NIH K25, $358K. My role: PI.

GRANTS - PENDING

- 7/2014 “Computational and Molecular Epidemiology Training in TB and HIV in Uganda”. NIH D43, $1.4M. My role: Co-I.
- 7/2014 “Dynamics and evolution of immune responses to influenza”. NIH U19, $8.7M. My role: PI on UGA sub-contract, $592K.

GRANTS - UNFUNDED

1. 2/2014 “Network based TB transmission model as decision tool for TB vaccine trials“. NIH R01, $2.9M. My role: PI.
2. 2/2014 “Studying the impact of inoculum dose on immune response, morbidity and mortality”, UGA Faculty Research Grant, $8K. My role: PI.
3. 11/2013 “Evolution of an RNA virus in its natural host”. NSF/NIH EEID, $1.7M, PI Jackwood, UGA. My role: Co-I.
4. 10/2013 “Mechanistic models of cooperation to study CD8 T-cell immunodominance”. NIH R03, $149K, PI.
5. 8/2013, “Improving Self-Care and Triage of Acute Respiratory Tract Infections in Adults” (PCORI, Co-I, $)
6. 7/2013 “Understanding And Controlling Influenza Dynamics, Spread, And Disease Severity” (NIH U01, Co-I, $3.9M)
7. 6/2013 “Quantifying Norovirus incubation and symptomatic periods and transmissibility” (NIH R03, PI, $148K)
8. 12/2012, “Evolution of an RNA virus in its natural host” (NIH EEID Co-I, $1.7M)
9. 11/2012, “Improving Self-Care for Acute Respiratory Tract Infections in Adults” (PCORI, Co-I, $1.4M)
10. 10/2012 “Modeling the impact of inoculum dose on pathogen and immune responses dynamics” (NIH R01, PI, $1.8M).
11. 8/2012 “Estimating the impact of ecological covariates on the transmissibility of norovirus”, (UGA-CDC, co-PI, $100K)
12. 3/2012 “Host cell responses to influenza virus infection”, (NIH R01, PI on UGA sub-contract, 5y, $2.8M, resubmission)
13. 1/2012, “Evolutionary dynamics of an RNA virus in its natural animal host”, NSF (4y, $400K, Co-I).
14. 11/2011 “The Interplay Between Animal Health And Salmonella Transmission In Poultry” (USDA, Co-I, $2.5M)
15. 10/2011 “Analysis And Modeling of Norovirus Outbreak Dynamics And Intervention Strategies” (NIH R01, PI, $1.7M)
16. 8/2011 "REU Site: Population Biology of Infectious Diseases" (NSF REU, Co-I, $495K)
17. 7/2011 “Evolutionary dynamics of an RNA virus in its natural host” (NSF, Co-I, $592K)
18. 6/2011 “Host cell responses to influenza virus infection” (NIH R01, PI on UGA sub-contract, $3.4M)
19. 2/2011 “Disentangling the mechanisms of CD8 T-cell immunodominance” (NIH R01, PI, $2.9M)

20. 11/2010 “Mathematical Modeling of Tuberculosis Vaccine Trials” (NIH R03, Co-I, $148K, resubmission).
21. 11/2010 “Quantifying and modeling influenza viral dynamics and host responses” (NIH R01, PI on UGA sub-contract, $3.3M, resubmission).
22. 11/2010 “Evolutionary dynamics of an RNA virus in its natural host” (NIH R01, Co-I, $2.5M, resubmission)
23. 8/2010 "REU Site: Population Biology of Infectious Diseases" (NSF REU, Co-I, $524K)
24. 8/2010 “Modeling transmission of Norovirus in community and healthcare outbreaks” (UGA-CDC, Co-PI, $99K)
25. 6/2010 “Modeling CD8 T-cell immunodominance after influenza A virus infections” (NIH R21, PI, $371K).
26. 3/2010 “Quantitative methods for global infectious diseases” (NIH R24, Co-I, $250K)
27. 2/2010 “Multiscale modeling of fitness trade-offs in influenza A virus dynamics” (NIH R21, PI, $297K)
28. 2/2010 “Mathematical Modeling of Tuberculosis Vaccine Trials” (NIH R03, Co-I, $148K)
29. 2/2010 “Evolutionary dynamics of an RNA virus in its natural host” (NIH R01, Co-I, $2.8M)
30. 2/2010 “Quantifying and modeling influenza viral dynamics and host responses” (NIH R01, PI on UGA sub-contract, $3.3M)
31. 12/2009 "What factors drive biogeographic patterns among Salmonella serovars and can these explain distinct patterns in human disease trends?” (NSF EEID, Co-I, $2.4M)
32. 11/2009 "Real-time surveillance and control of infectious disease outbreaks" (Gates Foundation, PI, $100K)
33. 11/2009 "Designing clinical trials for TB using agent-based mathematical models" (Gates Foundation, Co-I, $100K)
34. 8/2009 "REU Site: Population Biology of Infectious Diseases" (NSF REU, Co-I, $820K)
35. 7/2009 “Empirical and Mathematical Network Models of TB Transmission” (NIH U01, co-I, $3.2M)
36. 7/2009 “A quantitative, multi-scale study of influenza A virus infections” (Searle Foundation, UGA-internal nomination, PI, $300K)
37. 4/2009 “Computational Methods to Address Health Disparities in TB” (NIH Challenge grant, Co-I, $806K)
38. 4/2009 “Quantitative studies of CD8 T-cell dynamics” (supplement to existing NIH K25 grant, PI, $77K)
39. 3/2009 “Modeling within-host infectious disease dynamics: A multi-scale study of influenza A virus infections” (James S. McDonnell Foundation, PI, $450K)
40. 1/2009 “Spatial simulation of influenza A infection dynamics” (UGA-FID, PI, $24K)
41. 10/2008 “Quantifying the in vitro infection dynamics of influenza A viruses” (UGA-CDC, Co-PI, $80K)
42. 4/2008 “A quantitative, multi-scale study of influenza A virus dynamics” (BWF, PI, $500K)

Research supervision and mentoring

POSTDOCTORAL FELLOWS

Isaac Fung 8/2009 – 8/2011

- Research topic: Modeling control efforts during an influenza pandemic
- Currently an Assistant Professor at Georgia Southern University

MAIN GRADUATE STUDENTS (MAJOR ADVISOR)

Yan Li, Ph.D. in Bioinformatics 8/2009 – 12/2013

- Research Topic: Modeling the impact of inoculum dose on within-host virus dynamics, immune response, and disease
- Currently a bioinformatician, Center for Research Informatics, University of Chicago

Nibiao Zheng, Ph.D. in Bioinformatics 8/2009 – 12/2013

- Research Topic: Mathematical Studies of Persistence and Cost Effectiveness of Active Case Finding of Tuberculosis

Scott Russell, M.S. in Bioinformatics 8/2009 – 12/2013

- Research Topic: Modeling within-host norovirus infection dynamics

UNDERGRADUATE STUDENTS

Theresa Devasia 8/2012 – present
- Research Project: Statistical analysis of incubation and symptomatic periods of norovirus infections

Victoria Akin 5/2009 – 7/2012
- Research Project: Modeling the impact of virus binding and release on influenza fitness
- Currently in the Mathematics Ph.D. program at the University of Chicago

NON-UGA STUDENTS

Alexander Becker 5/2013 – 7/2013 (NSF REU summer program)
- Research Project: Modeling multi-drug treatment regimens for TB infections
- Currently an undergraduate student at NYU

SHORT-TERM GRADUATE STUDENTS

Stephanie Cooke, Ph.D. candidate in Bioinformatics	10/2009 - 12/2009 (rotation student)
Valerie Flint, Ph.D. candidate in Bioinformatics	10/2010 – 12/2011 (rotation student)
Zhen Yan, Ph.D. candidate in Statistics	1/2012 – 5/2012 (short-term project)
Allison Roebling, DVM student	4/2012 (Vet Med externship)
Christal Hembree, MPH student	1/2011 – 5/2011 (capstone project)

OTHER STUDENT MENTORING
- Academic mentoring of 20 Masters of Public Health (MPH) students
- Mentoring of 2 undergraduate students through UGA's honors program
- Nominated for the 2012 Graduate School Outstanding Mentoring Award

Editorship or editorial board member

- Guest Editor for Research Topic "Computational Model Development of Within-Host Respiratory Tract Infections" in Frontiers in Microbiology, 2013 - present

Public service

PROFESSIONAL AFFILIATIONS
- American Society for Microbiology

INTERNATIONAL PROGRAMS
- Study abroad Australia, taught EPID 3900/8900 (Special Topics in Epidemiology – Global Health) during winter break 2011/12 to 38 students.

MEDIA ENGAGEMENT
- Quoted in an article about controversial H5N1 influenza research, Athens Banner Herald, 7/2/2012.
- Public Health Impact TV Show on TB and modeling. Aired 1/2013.
- Prepared multimedia materials for colleague's (Dr. Whalen's) TED talk, 3/2013

OTHER SERVICE & OUTREACH ACTIVITIES
- Judge, 61st Georgia Science and Engineering Fair, 4/09, Athens, GA
- Judge, High School Science Fair, 1/2009, Centennial High School, Roswell, GA
- Judge, Intel International Science and Engineering Fair, 5/2008, Atlanta, GA

REVIEWER FOR THESE JOURNALS
- American Journal of Epidemiology, American Naturalist, Antiviral Therapy, BMC Public Health, Chaos, Ecology Letters, Journal of the Royal Society Interface, Journal of Theoretical Biology, Journal of Virology, Nature, Nonlinear Analysis: Modelling and Control, PLoS Computational Biology, PLoS Medicine, PLoS One, PLoS Pathogens, Proceedings of the Royal Society B, Risk Analysis, Science, Technology and Innovation, Theoretical Population Biology, The Lancet, Trends in Immunology, WIRE Systems Biology and Medicine
- Approximately 5-10 reviews per year

REVIEWER FOR BOOK MANUSCRIPTS
- Book proposal review for Springer Science (1/2012)
- Book proposal review for Cambridge University Press (9/2013)

REVIEWER FOR THESE GRANT ORGANIZATIONS
- Medical Research Council (MRC, United Kingdom)
- National Science Foundation (NSF)
- Biotechnology and Biological Sciences Research Council (BBSRC, United Kingdom)
- University of Georgia (internal grants)

CONFERENCE SERVICE
- Chair of session on "Computational tools and theoretical aspects", 1st Workshop on Virus Dynamics, 7/15 – 7/16/2013, Frankfurt, Germany
- Scientific Program Committee, One Health Symposium, University of Georgia, 3/21-23/2013
- Chair of session on "Modeling infectious disease " at the American Society of Microbiology Southeastern Branch Meeting "Ecology of Infectious Disease", 10/25-10/27/2012, Athens, GA
- Scientific Program Committee for Computational Immunology, Immunoinformatics, Theoretical Immunology, & Systems Immunology, 11th International Conference on Artificial Immune Systems, 8/28-8/31/2012, Taormina, Italy
- Scientific Program Committee, 2012 Spring Symposium & Workshop "Solving important biological problems through modeling", 4/2/2012, Institute of Bioinformatics, University of Georgia

Other services

SERVICE AT UGA – DEPARTMENT LEVEL
- Chair of departmental search committee to hire a new business manager, Summer 2013
- 3 departmental search committees for hires of Zhang, Ezeamama and Wagner
- Currently on search committee for joint hire with the college of engineering
- MPH Curriculum Committee, 2010 – present
- MPH Admission Committee, 2010 – present

SERVICE AT UGA – COLLEGE LEVEL
- College of Public Health DrPH Committee, Fall 2013 – present

SERVICE AT UGA – UNIVERSITY LEVEL
- UGA Graduate Council, 8/2011 – 5/2014
- UGA Graduate Council, Admission and Retention Committee, 8/2011 – 7/2012
- UGA Graduate Council, Program Review Committee, 8/2012 – 5/2014
- UGA Graduate Council, Admission and Retention Committee, ad hoc member, 8/2012 – present
- Institute of Bioinformatics, Development Committee, 8/2011 – 7/2012
- Analysis of UGA Health Center data to help plan for the 2009 H1N1 pandemic, Winter 2009
- Co-founder and core participant of the Computational Ecology & Epidemiology Study Group, UGA, 8/2009 – present
- Administrator of the webpage of the Computational Ecology and Epidemiology Study Group, UGA, 8/2009 – 8/2013
- Administrator of the Computational Ecology and Epidemiology Study Group mailing list, UGA, 8/2009 – present
- Administrator of "flulist", an email list that connects researchers interested in influenza at UGA and surrounding institutes, 8/2009 – present

OTHER ACTIVITIES
- UGA Faculty Learning Community "Globalizing the Curriculum", 8/2010 – 5/2011
- Taught Freshmen Odyssey seminar, Fall 2011, Spring 2013

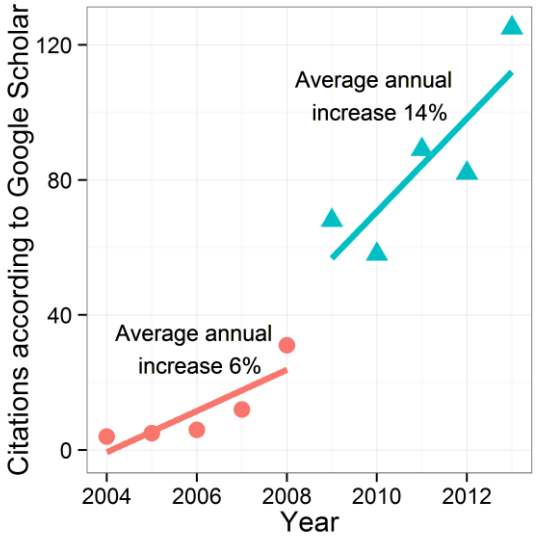
Summary of Major Accomplishments

High research productivity and visibility

I have so far published 30 peer-reviewed papers, 18 since I started at UGA in 2009. All of them were published in high quality journals. The table summarizes the 18 publications and quality of journals (as measured by the 5-year impact factor (IF), Journal Citation Reports 2012).

Journal	# of Publications	5-year IF
Proceedings of the National Academy of Science (PNAS)	2	10.6
Clinical Infectious Diseases	1	9.0
PLoS Computational Biology	1	5.9
Proceedings of the Royal Society B	1	5.8
Journal of Immunology	2	5.7
Journal of the Royal Society Interface	3	5.2
BMC Evolutionary Biology	1	4.4
PLoS One	1	4.2
Infection, Genetics and Evolution	1	3.0
BMC Public Health	1	2.6
Journal of Theoretical Biology	3	2.5
Epidemics	1	2.3

My work is regularly recognized in the field. According to Google Scholar (accessed 7/28/2014), my current total number of citations, h-index and i10-index are 601, 14 and 15, respectively, with those numbers since 2009 being 533, 14 and 15. As seen in the figure, my visibility has markedly increased as my career has progressed. The red data and trend-line show annual citations from the year I received my PhD to the end of my postdoctoral career. The blue data and trend-line show annual citations since I started at UGA in 2009 until the end of 2013. Not only did the annual citation counts increase, but the increase itself has been accelerating.



Successful research mentoring

Since starting at UGA, I have (in addition to several minor mentoring roles) been the main mentor/advisor for a postdoctoral fellow, 2 PhD graduate students and 1 masters graduate student, as well as 2 undergraduate students. Each of my mentees successfully produced at least one publication (some already published, some under review, some about to be submitted). My mentees are also proceeding well in their careers. The postdoctoral fellow (Dr. Isaac Fung) secured a prestigious Prevention Effectiveness Fellowship at the CDC and started in 2013 as assistant professor of Epidemiology at the Jiann-Ping Hsu College of Public Health, Georgia Southern University. All 3 graduate students successfully completed their degree in December of 2013. One of them now works as a bioinformatician at the Center for Research Informatics at the University of Chicago, the other two are currently looking for new opportunities in their careers. One of the undergraduate students is now a graduate student in mathematics at the University of Chicago. The other undergraduate student is still working with me.

Successful teaching at UGA and beyond

I have been teaching courses at UGA ranging from undergraduate to advanced graduate level. For many of my courses, the material is complex and not easy to grasp. A regular lecture-style delivery would not achieve adequate learning. I therefore regularly use computer labs integrated into the lectures, and other active learning tools to ensure students learn well. Despite being initially unfamiliar with a fair amount of material I ended up teaching (see next section), I have consistently received student ratings indicating a high quality experience in my courses. In addition to my teaching at UGA, I have taught at other institutions. Every year since 2009, I have taught a summer short course at the University of Washington. This course on "Infectious Diseases, Immunology and Within-Host Models" is team-taught with my colleague and collaborator Dr. Paul Thomas at St. Jude Children's Research Hospital. The course teaches participants how to combine mathematical and statistical methods with biological data to answer important questions in immunology, virology and microbiology. The course is part of a summer institute on statistics and modeling of infectious diseases. Our course has consistently received some of the best student ratings among all courses. In January 2012 and 2013 I also taught short-term, intensive courses at Emory University. These week long, 2-credit hour courses introduced MPH and Ph.D. students at Emory's School of Public Health to infectious disease dynamics and modeling. Student feedback for these courses has been very positive and I anticipate offering these or similar courses again in the near future. Overall, I consider my major accomplishments in teaching the ability to deliver consistently high quality in my courses and my ability to teach material that is often complex and difficult in an effective manner. More details on these various teaching activities are provided in the achievements section of this document.

Continuing expansion of my knowledge

One area that is harder to quantify is my ongoing willingness and ability to learn new material and to expand my knowledge. My undergraduate and graduate training are in physics. During my time as a postdoc, I was awarded an NIH K25 Mentored Quantitative Research Career Development Award. The purpose of this award is to support investigators with a quantitative background as they make a transition to biomedical health research. This transition started during my postdoc training, where, in a short amount of time, I learned a fair amount of evolutionary biology, immunology, virology and microbiology – enough to have meaningful conversations and collaborations with people trained in these fields. The transition continued as I joined the department of Epidemiology & Biostatistics at UGA. Much of the material comprising epidemiology and (bio)statistics was new to me. I have since been able to acquire the knowledge to comfortably teach courses not only relating to my area of research but also fundamental epidemiology courses to both undergraduate and graduate students. Both in my teaching and research, I am increasingly incorporating concepts and tools from epidemiology and biostatistics, while retaining the methods and approaches I learned in my physics training. I have also started to work on infectious diseases such as TB and norovirus that I had not worked on before. To properly communicate and collaborate with my colleagues on those projects required learning a fair amount about each pathogen. Overall, over the last 5 years I believe I have become a teacher and researcher who comfortably and expertly operates within the realm of epidemiology and public health, while also making use of and teaching cutting edge research methodology such as dynamical modeling and advanced data analysis methods. I consider this expansion of my knowledge a major accomplishment. I am looking forward to continuing to widen my knowledge to allow for further high impact, creative, and cross-disciplinary research and teaching, all with the goal of remaining a highly innovative teacher and researcher.

ACHIEVEMENTS

Achievements in Teaching

Overview
Since joining UGA, I have been teaching a diverse range of courses, from undergraduate to advanced graduate levels, as well as several special courses such as the Freshmen Odyssey seminar, a study abroad course and our departmental seminar series.

I came to UGA with a NIH K25 Mentored Quantitative Research Career Development Award, which I held until the end of April 2012. The NIH stipulates that a holder of such an award must commit at least 75% of their full time effort to research. Therefore, my appointment at UGA while I held that grant (academic years 2009/10 – 2011/12) was for 75% research and 25% allocated to teaching. Since then, my appointment for academic years 2012/13 and 2013/14 has been 50% teaching, 45% research and 5% service. As evidenced from the information provided in the CV, my teaching commitment has generally been above the level required by my appointment, sometimes by a large amount. For the years 2009/10, 2010/11 and 2011/12, my teaching commitment amounted to 10.7, 14.3 and 16.4 credits, compared to the 6 credits required by my appointment. For the years 2012/13 and 2013/14, my teaching commitment amounted to 17.9 and 11.1 credits, compared to the 12 credits required by my appointment. Overall, my teaching commitment since I've been at UGA was 168% of my required teaching load. A detailed listing of all courses per semester, credit hours, enrollment, and ratings are shown in the CV.

In addition to my teaching at UGA, I have been teaching an annual course at the University of Washington and classes at Emory University. I describe and highlight some of my teaching activity in the following sections.

Undergraduate level courses
I have successfully taught several core epidemiology classes. The first epidemiology class I taught was a large undergraduate class, EPID 4070, Fundamentals of Epidemiology. I taught this class twice, in spring 2010 and spring 2011. (I was instructor of record for the class in spring 2012, however almost all lectures were given by 2 of our DrPH students to allow them to gain teaching experience. I was responsible for all other aspects of the class. Since I only delivered a few of the lectures, I will not further discuss this semester as part of my teaching here).
The size of EPID 4070 was rather large, with 102 and 64 students enrolled, respectively. This made it hard to use my preferred style of teaching, which is to interact with students, regularly ask questions, solicit their opinions and stimulate discussion.
Given that the material one needs to cover in such an introductory class is very broad and can at times feel dry, especially when delivered only through lectures, I used various approaches to help make the material come to life and be more engaging. In class, whenever possible I incorporated short video clips covering public health topics and showed case studies as examples for specific concepts covered in class. As homework, I regularly assigned reading of simple overview papers written by public health practitioners. A final project required students to do their own small epidemiological analysis.
Despite the fact that the material was new to me and the large lecture teaching style is not my natural strength, I believe I was able to challenge the students, show them how the material applies to many important aspects of everyday life beyond the classroom, and provide students with a solid learning experience. Comments from students, provided on the official evaluation form, seem to confirm my impression. A few select comments for the course are:

- *"It was very well organized; I always knew what I could expect from the following lecture and how it would be used in assessments. Also, the course is designed to be a great overview of the field--significantly better than most other intro courses I've taken, actually--and, as a student beginning graduate work in Epidemiology in the fall, I especially valued this aspect."*

- *"This course did a great job introducing the topic and applying it to the "real world" opportunities available in the field. The instructor is very pleasant and approachable."*
- *"This course encouraged me to look outside the box in investigating illness and relationships between cause and event."*
- *"Clearly laid out and explained all that goes into epidemiology from calculating ratios and proportions to analyzing tables and statistics."*
- *"The case studies helped me to understand the material a little better. They allowed me to see the material is applicable in life."*
- *"The project was great!"*
- *"I see epidemiology everywhere now."*

Student ratings from this course were 4.0/5 for the first time I taught it and improved to 4.2/5 the second time.

Core graduate level courses

After having taught the undergraduate level introduction to epidemiology course several times, I moved on to our main introductory class in Epidemiology for MPH students, EPID 7010 "Introduction to Epidemiology I." I offered this class first in fall 2012. On reflection, the first time I offered it I was too ambitious in what I wanted to achieve as learning outcomes for the students. This led to some frustrations among students, and the course rating reflected this, with an overall student rating of 3.6/5. While this is not a terrible rating, I am not satisfied with any course rating below at the lowest a 4/5. As a consequence, when I taught this course again in spring 2014, I made several adjustments to find a good balance between setting high expectations and providing a rigorous course without overtaxing and thereby frustrating the students. Improved student ratings for this class of 4.3/5 seem to confirm that I have made the right adjustments. I plan to keep teaching this course in the future and to continue improving on how I teach the material. For the near future I will include some teaching tools that have been shown to work well, such as a flipped classroom whereby students review the material (e.g. by reading the textbook and watching a pre-recorded lecture) at home and then use the class time for interactive exercises, discussions, etc. I have been using such interactive and hands-on teaching approaches in my advanced classes to great effect (see below) and I plan to implement such approaches for this class.

Advanced graduate level courses

The year I arrived at UGA, I developed an advanced graduate level course, EPID/ECOL/IDIS 8515, "Modeling Infectious Diseases," which is closely related to my research interests. I taught the course 5 times so far, every year since I started at UGA. The first year I co-taught this course with my colleague and fellow infectious disease modeler, Dr. Andrew Park from Ecology. Since then, I have been the sole teacher. The students enrolled in this course always have very diverse backgrounds, with students from many different colleges and departments (e.g. Vet School, Ecology, Geography, Microbiology, Bioinformatics) taking the class. The course content relies heavily on using the computer to build and analyze models. Instead of a lecture style course with additional computer labs, I designed the course such that lectures and labs are integrated. In each class, I usually lecture for a few minutes on a specific topic, then the students are given a computer exercise to try and implement the topic. This hands-on approach of teaching has been successful (average rating for this class is 4.37). It allows students to much better grasp rather complicated methods and topics and by doing it themselves, they get a much more applied experience than a pure lecture-based course would afford. Some of the students' comments reflect this:

- *"This course was a very well-organized and comprehensive review of modeling methodology. I would venture to say that this is the most helpful and directly applicable course I have taken so far."*
- *"Dr. Handel has done an EXCELLENT job preparing material for this class. I can't imagine the effort involved in all of the partially completed scripts he gave us to help our learning and provide us resources for our future research. Really, really GREAT!! Also, I appreciated the very well planned lectures and the homework assignments. I think those (instead of exams) were the absolute best way to assess our progress and make us "get our hands dirty" in the modeling world."*

- *"This course has sparked my interest in disease modeling, and I am now planning on including a modeling component in my dissertation research. Dr. Handel is a great resource to UGA in that he understands and knows how to come up with this stuff."*
- *"I cannot think of any improvements; it was a very well-taught class!"*

As part of our departmental procedures, I also had Dr. Robert Galen, our former Senior Associate Dean, visit one of my lectures to perform an evaluation. Dr. Galen rated my teaching performance as outstanding (5/5). I want to highlight one paragraph from his evaluation letter: *"....Our College is indeed fortunate to have Andreas on our faculty as a researcher as well as an instructor. Our students are very fortunate to have Dr. Handel as their instructor. When he does lecture, he is very enthusiastic and has a very "easy" way about his presentation style which is clearly a function of his expert knowledge, experience, and his delightful personality…"*.

Departmental Seminar

Noticing upon arrival at UGA that our department did not have a departmental seminar series, I set out to establish one (EPID 7100). The main target audience for this seminar series are our MPH Epidemiology students. The seminars are also public and open to PhD students, faculty and anyone interested in attending the presentations. I have organized this seminar 10 times so far, every semester since fall 2009. With about 10-15 speakers per semester, over 100 speakers have presented at the seminar so far. At least 70% of the speakers come from outside UGA, with a large portion of those outside speakers from the CDC. These seminars are a vital part of our department. They expose our MPH students (who have to take the seminar twice) to a vast range of topics in public health. The topics presented each week range from research talks to talks describing career opportunities. I know of several specific connections facilitated through the seminar that lead to opportunities. Based on recommendation by a colleague, I invited Dr. Lopman from the CDC to come and give a talk. Since then, we have been collaborating on several norovirus projects. I also know of at least 2 students who got an MPH internship directly through following up with one of the seminar speakers. I am sure there are many more such opportunities for our students that arose out of a speaker visiting the seminar that I'm not personally aware of. In addition, inviting external speakers has increased the visibility of our department and college outside UGA. By having external speakers meet our students, it facilitates connections within the larger Epidemiology/Public Health Community in the region, most notably the CDC. As such, I consider the seminars a vital aspect of our department. Ratings for the seminar (EPID7100) are high (average rating of 4.38/5), indicating that it is well received by the students. Comments such as these from students also reflect the value provided by the seminars:

- *"Great variety of speakers and lectures. I enjoyed it a lot."*
- *"This course was very good in networking and seeing what opportunities are out there in the field of Epi."*
- *"It was great hearing from different people in the field of epidemiology. The lectures gave me insight of possible career choices in my field."*
- *"The selected topics were good and helped me appreciate other aspects of epidemiology outside of the classroom. Most of the speakers were outstanding and it was good to learn from their experience."*
- *"This seminar had wonderful speakers from the CDC. My future goal is to work for the CDC."*
- *"This class has reiterated my passion for epidemiologic research."*

Special courses

In addition to the main courses described above, I developed and taught a few others. During the 2011 Winter break, I designed and offered a class on Global Health (EPID 3900/8900) as part of a UGA study abroad program. This class used an unconventional format of topical modules, and combined field experiences with lectures to integrate the study abroad experience with the learning objectives of the class. While no official student feedback is available from this class, informal feedback I received suggests that the students learned a fair amount of public health, while at the same time enjoying themselves in Australia. Two of the undergraduate students who took this study abroad course contacted me a few semesters later and told me that as result of this course, they had gotten interested in public health (their undergraduate major was biochemistry). They asked if I would write letters of

recommendation for graduate school MPH programs, which I gladly did. They have since both started an MPH program at Emory University.
I also twice taught the 1st year odyssey seminar (FYOS 1001), the only pre-tenure faculty in the department to do so. I decided to offer a seminar on "Computer Modeling of Infectious Diseases." Similar to my other infectious disease modeling classes, I used an approach combining short lectures and discussions with interactive computer-exercises to expose students to the idea of infectious disease modeling. In contrast to the more advanced modeling courses, I used a less powerful but more user friendly computer simulation software. This did not require students to do any computer programming, but instead allowed them to interactively explore infectious disease dynamics and thereby learn important concepts of infectious diseases.

Development of new courses
While I plan to continue offering the courses described above, I am also eager to develop and offer new courses to our students. I recently designed a new advanced graduate class, EPID 8560 "Analysis of Infectious Disease Data," which was offered for the first time in summer 2014 with 10 students enrolled. This course will had a similar format to my infectious disease modeling class, namely lectures and computer exercises tightly integrated. The idea is to teach students how to best analyze their data using various modern analysis approaches. The course covered a variety of advanced analysis methods, as well as teaching students how to properly analyze "real world" datasets, including steps such as coming up with a hypothesis, obtaining and cleaning data, performing preliminary analyses, final analysis, presentation of outcomes and reproducible research. In my opinion, this course went very well (student ratings are still pending) and I plan to offer this course as a regular semester course in the future.

Annual Summer Course at the University of Washington
Every year since its inception in 2009, I have been invited to teach a short course "Infectious Diseases, Immunology and Within-Host Models" at the Summer Institute of Statistics and Modeling of Infectious Diseases (SISMID, http://depts.washington.edu/sismid/) at the University of Washington. 2014 will by my 6th year teaching this course. I teach this course together with my colleague and collaborator, Dr. Paul Thomas at St. Jude Children's Research Hospital. Paul is virologist/immunologist and covers the biological aspects of the material, I focus on the modeling aspects. As such, this is a truly interdisciplinary course that teaches participants how to tightly integrate mathematical and statistical methods with biological data. The audience for this course is rather diverse, ranging from undergraduates to professors and from bench scientists to mathematicians and statisticians. This course has grown to be one of the largest of the approximately 15 courses offered at SISMID and constantly receives some of the best student feedback and highest rating among all courses. This is evidenced by some of the student's comments:

- *"I thought our instructors were very responsive and adaptive to our needs into the course. They were obviously invested in giving a useful training and they amount of time they had prepared was very evident in the courses materials. They also conveyed a real enthusiasm for some often very dry material, which was helpful for me. "*
- *"Excellent course. The links between the lectures on immunology and the computer exercises were particularly interesting and well-planned."*
- *"I had no knowledge about modeling in infectious diseases before taking this course. This course has introduced me to some really good and new concepts which will help me grow in my career as an infectious diseases epidemiologist."*
- *"The modeling exercises and R code were excellent. The R code documentation was superb. I especially appreciated that the modeling exercises were largely inspired by published studies and real-world data."*
- *"Superb job by the instructors. Thorough, clear, and engaging."*
- *"You are both fantastic teachers and presented interesting information in an exciting way. Thanks!"*

Teaching at Emory University

In 2011, based on a request from several PhD students in the epidemiology department at Emory University, I was asked if I wanted to teach a course "Introduction to Infectious Disease Modeling." I developed a short but intensive course (EPI 590R, 2 credit course, 21 students) that I taught in several full-day sessions over a week in January 2012 (Emory's equivalent to UGA's Maymester). I was asked to teach another course in January 2013 ("Infectious disease dynamics," EPI 590R, 2 credit course, 33 students), this one focused on the population dynamics of infectious diseases, using mathematical models as tools but not requiring model building by the students. Feedback from both courses has been very positive, and I anticipate teaching one of these courses or a similar one again at Emory in the future. As part of teaching this experience, I was also invited to become an Adjunct Faculty in the Department of Epidemiology at Emory. I want to highlight feedback I received from Dr. Vaccarino, the chair of the Epidemiology department at Emory, for the course I taught in January 2012. She sent me a short email stating: *"Your course was extremely well received by the students. I wanted to personally congratulate you and thank you for your outstanding contributions to the educational mission of the Epi department. I also wanted to share with you a comment I received by Dick Levinson [Associate Dean for Academic Affairs at Emory Rollins School of Public Health] about your course evaluations: "Overall, the teaching program is strong in the eyes of students. Evaluations of […] Handel (590R) […] stand out from the rest as well-taught."*

Development and use of innovative teaching tools

For all courses I have taught, I include a final project as part of the coursework. This helps students to practice the course material, synthesize and apply the skills they learned, and practice presenting their results both in oral and written form. I also frequently include in my classes suitable material available freely online, for instance TED talks by Hans Rosling, Ben Goldacre and others on relevant public health topics.

For some of my introductory courses on infectious diseases, I often use the NetLogo software. This is user-friendly software allows students to analyze complex simulations in an interactive manner, by changing settings graphically through buttons, sliders, etc. I have found that exploring the complex dynamics of infectious diseases in this way makes intuitive sense even for 1st year undergraduate students. It is thus possible to teach a complex subject at the appropriate level. Also, the interactive, hands-on aspect of this approach tends to lead to more thorough understanding by the students. I have written at least 20 NetLogo programs for various infectious disease scenarios, which I regularly use in class as teaching tools.

The advanced graduate courses I teach, as well as the courses offered at Emory University and the University of Washington, all require students to write and use advanced computer programs. Quite often, students do not have previous computer programming experience. It is challenging to teach both subject matter and programming skill in a single semester course, let alone in the short intense courses I teach at the University of Washington or Emory. I developed several tools and resources to help students successfully learn the material and master the programming aspects of these classes. One resource I wrote is a short tutorial for R – the programming language I use in most courses. This resource is freely available on my webpage and students are asked to work through it in the first few weeks of class (or, for an intense short course, before the course starts). Since it is freely available to everyone, I have also received feedback from individuals that did not take any of my classes telling me that they found this tutorial useful. Further, I often write the computer code the students need to use for the in-class exercises in advance, and only leave a few crucial lines of code out. This helps students not to spend too much time trying to write code, while at the same time forces them to understand the problem deeply enough to successfully add the few missing lines of code and make it work. I have for my different classes written over 50 such computer programs that help students learn various aspects of infectious disease modeling.

Student Mentoring

In addition to research mentoring (see below), I have been the main advisor for 20 MPH students. I was the Capstone (Mini-Thesis) advisor for 7 of those students. One of the capstone projects led to a publication (Christal Hembree). I have also mentored several undergraduate students, both in research (see below) and general academic mentoring through the Honors program. Overall, mentoring is a significant part of my academic work.

Achievements in Research, Scholarship and Other Creative Activities

Overview

My career has been truly interdisciplinary. I completed my B.S. (or what could be considered the German equivalent) at the University of Stuttgart in Germany and my Ph.D. from the Georgia Institute of Technology both in physics. During my Ph.D., I worked on a problem in theoretical physics that combined physics, engineering and mathematics. After my Ph.D. I decided to apply the tools and methods I had learned to a different set of topics, namely to biological questions. I did a postdoctoral fellowship at Emory University in the group of Dr. Rustom Antia. During that time, I started to focus on infectious diseases. I embarked on several projects that had to do with understanding the dynamics of pathogens, both on the within-host level during individual infections and the between-host, population level. I worked on topics as varied as immunology, evolutionary biology and epidemiology. In 2009, I joined the Department of Epidemiology and Biostatistics in the College of Public Health at the University of Georgia as an Assistant Professor. As a faculty, I have continued to study infectious diseases through mathematical, statistical and computational approaches. The following sections describe my major research achievements so far.

Innovative Interdisciplinary Research

My research encompasses work on multiple infectious diseases (currently mainly influenza, TB and norovirus). Always using a theoretical approach, I work for each pathogen simultaneously on multiple scales: The within-host level (immunology, virology, microbiology) as well as the between-host level (epidemiology, ecology). It is my contention that one needs to understand both scales to fully understand the dynamics of infectious diseases. The scientific questions I address range from questions about the fundamental dynamics of the immune response following infection to the evolutionary dynamics of diseases to applied topics such as optimal control strategies for infectious disease outbreaks. Like the scientific questions, the approaches I use are interdisciplinary, combining aspects of mathematics, statistics, and computational modeling, often in conjunction with data generating experiments or field studies done by my collaborators. I believe that this truly interdisciplinary approach to research, which bridges scales both with regard to scientific questions as well as methodology, is one of my unique strengths as a scientist and researcher. The broad and interdisciplinary nature of my research can be seen by the breadth of journals I publish in (see CV). My inherent interest in learning new ideas, and trying to apply the best tools and approaches available to solve important scientific questions, keeps me motivated to extend my knowledge and skills. Over the last few years I have extended both my work to new infectious diseases, such as TB and norovirus, as well as new analysis approaches, making increasingly more use of advanced statistical methods. This widening of my areas of expertise will further help me increase the already very solid research productivity and impact of my work.

Multiple successful local, national and international research collaborations

Almost all my research is done in collaboration with others. At UGA, I have worked with Dr. Christopher Whalen in my department on questions of TB transmission and control. Across campus, I have worked with Dr. David Stallknecht in the Vet School on avian influenza and Dr. Mark Jackwood, also in the Vet School, on coronavirus (infectious bronchitis virus) evolution. A recent started collaboration with Dr. Andrew Park in Ecology deals with aspects of Chagas disease control. Nationally, I am collaborating with Dr. Paul Thomas at St. Jude Children's Research Hospital in Memphis on understanding influenza infection dynamics, with Dr. Ben Lopman at the CDC on norovirus epidemiology and with Dr. Stephanie Karst at the University of Florida on characterization of murine norovirus infection dynamics. Internationally, I work with Dr. Nicole La Gruta and Dr. Peter Doherty in Melbourne, Australia, on characterizing influenza infection dynamics and T-cell immune responses upon infection. Another collaborator on influenza modeling is Dr. Catherine Beauchemin at Ryerson University in Toronto. As evidenced by the list of coauthors on my publications, I have in addition to the ones mentioned here many other successful collaborations with a diverse range of scientists, both fellow modelers and

experimentalists. For most of those collaborations, I am an equal or lead contributor, as evidenced by the first or last (=senior) authorship position on many of my publications.

High research productivity

I have so far published 30 peer reviewed papers in my research career, 18 of them since 2009. Several others are currently under review or close to submission. On most of these publications, I am either the first or last (= senior) and corresponding author. Reflecting my diverse research interests and collaborations, the range of journals in which I publish is broad, including basic science journals such as The Journal of Immunology, Journal of Virology and the Proceedings of the National Academy of Sciences, more mathematical and computationally oriented journals such the Journal of the Royal Society Interface, PLoS Computational Biology, and Journal of Theoretical Biology, as well as more applied journals such as Clinical Infectious Diseases and BMC Public Health. One commonality of all of these journals is that they are all considered to be in the top tier in their respective areas; most of them are in the top 5 or top 10 of their field as measured my various metrics such as impact factor, eigenfactor, article influence score, etc. A table with some metrics indicating the quality of the journals that I published in over the last 5 years is shown in the major accomplishments section.

High research impact and visibility in the field

My work is regularly recognized in the field. My publications are cited frequently, and the increase in citations (and also the increase of that increase) – as outlined in the major accomplishments section – shows that my work is being well recognized.

I have also presented my work at various conferences and workshops (see CV for details). I give several invited talks each year, both on the regional and national, as well as international level. A few highlights showing the impact of my work are as follows:

- Invited to give a talk to the class of CDC EIS officers on mechanistic modeling, 2/2014.
- Invited to give one of the keynote addresses at a conference on virus dynamics in Frankfurt, Germany, 7/2013.
- Invited to give a talk to influenza experts at the CDC on some of my research regarding intervention strategies for pandemic influenza, 2/2012.
- Invited to give a talk on "Model fitting and model selection" at a National Evolutionary Synthesis Center Catalysis Meeting, Duke University, 3/2011.
- Invited to give a talk on some of my influenza modeling work at the Fields Institute Workshop on the Mathematics of Drug Resistance in Infectious Diseases in Toronto, Canada, 7/2010.

Success in securing extramural funding

To support my research endeavor and to support graduate students and postdocs, I have vigorously pursued funding opportunities. I have been externally funded since my start at UGA until Fall 2013, first through an NIH K25 grant ($365K), followed by an NIH R56 grant ($266K). I also successfully obtained a UGA internal seed grant ($11K). Through this funding I have supplied 75% of my salary through external funding from 2009-2012, and 50% in 2012-2013. In addition, these funds paid salary for my students that have since graduated.

I am also part of 3 different training and outreach grants: An NSF Research Experience for Undergraduates (REU) training program (John Drake in Ecology at UGA is the PI), an NIH T35 summer training program for veterinary students (Susan Sanchez in the Vet School at UGA is the PI) and an NSF Research Coordination Network grant (Andrea Graham at Princeton is the PI). In addition to these successful grant applications, I have also since 2009 submitted – either as PI or collaborator – 40 grant applications (including resubmissions), demonstrating my strong commitment to continue to seek extramural funding, even in today's difficult funding climate.

Pioneering work on influenza infection modeling

One of my areas of expertise is influenza modeling. I have worked both on the between-host and within-host scales. I have to date published 15 studies on this topic, 6 of them have been cited 20 times or more (as of 7/28/2014, Google Scholar data). In recognition of my expert knowledge on within-host modeling if influenza, I was invited to write a review paper on that topic. Together with my colleague Catherine Beauchemin, we wrote a review for BMC Public Health. This review is currently one of the two most authoritative reviews on this research area and has since its publication in 2011 already been cited 33 times (as of 7/28/2014). The review has been cited by virtually every study on that topic that has since been published. I have also widely presented my influenza modeling research at conferences and by giving invited talks regionally, national and internationally.

Successful research mentoring

Since I started at UGA, I have mentored a postdoctoral fellow, two PhD graduate students, 1 MS graduate student and 2 undergraduate students (with some further students working with me for shorter times, e.g. rotation students). All of them have successfully produced at least one publication, some are already published, some under review or about to be submitted (see the publication section in the CV for student authors). My mentees are also well on their way to have successful careers, as described in the major accomplishment section.

Achievements in Service to Society, the University and the Profession

Service to the Profession

Since starting my career at UGA, I have regularly reviewed manuscripts for the top journals in my field. I estimate that I review on average 5-10 papers per year. I receive about 3 times as many requests for review, I limit the reviews I do those that I consider interesting and potentially adding important new insights to the research endeavor. In recent years, I have taken on additional responsibilities. I have served as ad-hoc reviewer for several grants from external funding agencies (NSF, MRC, BBSRC) as well as UGA internal grants. I have also recently reviewed 2 book proposals, chaired several sessions and was part of the program committee for several conferences, and currently serve as one of three guest editors for a special topic issue for Frontiers in Microbiology. I expect that as my career advances, I will be called to provide further service to the profession, such as serving on an NIH study section. I am fully prepared to serve the profession in various capacities, as I consider this to be a vital part of a well-functioning scientific research enterprise.

Service at UGA

I have and continue to serve UGA on the departmental, college and university level. At the departmental level, I was a member of 4 faculty search committees, with one search ongoing. I also chaired a search committee to hire our current business manager. I have been on the curriculum and admissions committee for our MPH program since 2010. I have also served in other informal roles, such as helping with PhD admissions in 2013 and 2014.

At the level of the college of public health, I am serving since 2013 on the DrPH committee. As such, I have been involved in interviewing candidates and planning the future direction of the program.

At the university level, I have served on the graduate council from 2011 to 2014. For the first year I was part of the council's admission and retention committee, the following 2 years I served on the program review committee, with ad hoc participation in the admission and retention committee. I have also served a year term in 2011-2012 on the development committee of the Institute of Bioinformatics.

During the winter 2009 influenza pandemic, I was involved with helping the University Health Center anticipate the number of cases/workload that might occur as the flu season progressed.

I am also a co-founder and core participant of the Computational Ecology & Epidemiology Study Group (CEESG) at UGA. This group, which we started in fall 2009, combines faculty and their groups from multiple colleges who have a shared research interest on mathematical, statistical and computational approaches to ecology and epidemiology. I maintained the group webpage until 2013 and still manage the email list. I have also regularly given tutorials during our weekly group meetings.

Service to the Society

First and foremost, I believe that my research serves the society. By better understanding how to control infectious diseases in individual patients and in populations, my research has an impact on society in the state of Georgia, the country and the world. In addition to this service through research, I have also participated in several specific outreach activities.

I have given several non-technical talks to introduce non-expert decision makers to aspects of my research. One recent example is an introductory, recent non-technical presentation on "Mechanistic Modeling" I gave to the current class of CDC Epidemic Intelligence Service (EIS) officers in February 2014. The CDC administered a survey to the attendees of this talk. Initially, EIS officers rated themselves a 1.3 with regard to understanding of the subject matter (0 = no knowledge, 5 = expert), after my talk this self-assessment increased to 2.9. The overall quality of my talk received a rating of 4.2/5. Some comments from EIS officers were:

- *"Dr. Handel was a fantastic presenter and I felt like he gave us very useful information about how these kinds of models work and how they can be appropriately used."*
- *"Would love to see more sessions like this."*
- *"Great seminar. The interactive parts were really useful and Dr. Handel was an engaging speaker."*

Both the comments and numerical evaluation indicate that my presentation achieved its goal of teaching a useful methodology to an important non-expert audience. I have given other such talks to non-experts (see CV), and while none of these talks had a formal survey to gather feedback, informal responses I have gotten from attendees have been similarly positive.

I have also participated in our college-sponsored and produced TV show "Public Health Impact". I was featured on an episode discussing the topic of "Global Health and the Infectious Disease Impact of Tuberculosis" (http://youtu.be/QzG1fp8dMPw). I explained how mathematical and computational models can be used to help in the study and eventual control of infectious diseases such as TB.

Some other outreach activities include participating as judge in several science fairs, writing some computer animations for my colleague Dr. Whalen for a TED talk, and providing expert commentary on controversial H5N1 influenza research in an article published in the local newspaper. I expect that this kind of outreach will increase dramatically as I embark on the next chapter of my career.

As part of my service to both the profession and society, I maintain a webpage for my research group that showcases our work. In addition to describing our research and providing publications of our work to the public, I also regularly post tools, such as computer programs I developed, to this webpage (http://handelgroup.uga.edu/resources.htm). This allows others to take advantage of these freely available tools and use them for their purposes.