Nina H. Fefferman
http://www.math.princeton.edu/~feferman/

Positions and Employment:

2007-cont.	Research Assistant Professor, The Center for Discrete Mathematics and Theoretical Computer Science, Rutgers Univ.
2007-cont.	Adjunct Assistant Professor, Tufts Univ. School of Medicine, Dept. of Public Health and Family Medicine
2005-cont.	Co-Director, Tufts University Initiative for the Forecasting and Modeling of Infectious Disease (InForMID)
2005-2007	Visiting Research Associate, Rutgers Univ., Center for Discrete Math and Theoretical Computer Science (DIMACS)
2005, 2006 summers	Research Experience Leader, DIMACS Bio-Math Connect Institute for High School Teachers
2005	Short Term Visitor, School of Natural Sciences, Institute for Advanced Study
2005-2007	Research Assistant Professor, Tufts Univ. School of Medicine, Dept. of Public Health and Family Medicine – Including responsibility for designing and teaching introductory biostatistics courses for Masters of Public Health and M.D. students
2003-2004	Research Consultant, Tufts Univ. School of Medicine

Education:

Ph.D., Biology, Tufts University, 2004, "Applications of mathematical models to resolving questions in animal behavior, ecology and epidemiology"

M.S., Mathematics, Rutgers University, 2001, "Maker-Breaker versions of infinite dimensional Ramsey games"

A.B., Mathematics, Princeton University, 1999, "A proposal for a traceable authenticated anonymous exchange protocol"

Professional Memberships:

DyDAN (The Center for Dynamic Data Analysis – Dept. of Homeland Security CoE)

DIMACS (The Center for Discrete Mathematics and Theoretical Computer Science)
Society for Mathematical Biology
Wildlife Disease Association
International Union for the Study of Social Insects
Society for Industrial and Applied Mathematics
The International Environmetrics Society
Association for Women in Mathematics

Invited Talks:

Fefferman, N.H. 2007. Fantastic Problems in Mathematical Ecology. DIMACS Bio-Math ConnectionField Testers Workshop, Rutgers Univ.

Fefferman, N.H. 2007. Does Securing Infrastructure Against Workforce-Depletion Depend on Whether the Risk is Environmental or Infectious? DIMACS Workshop on Mathematical Modeling of Infectious Diseases in Africa, Univ. of Stellenbosch, South Africa

Fefferman, N.H. 2007. Social interaction and disease dynamics. Analysis of Time Series Data in Epidemiology, Tufts Univ. School of Medicine, Boston, MA

Fefferman, N.H. 2007. The Behaviors of Individuals and Populations. Working Group on Spatio-Temporal and Network Modeling of Diseases, ICMS, Edinburgh, Scotland

Fefferman, N.H. 2007. The Evolution of Complexity in Already Social Groups. Dept. of Ecology and Evolutionary Biology, Princeton Univ.

Fefferman, N.H. 2007. Disease as a Selective Pressure and the Evolution of Social Complexity. Applied Biomathematics, Stony Brook

Fefferman, N.H. 2007. Vital Rate Sensitivity Analysis: A new method for population viability analysis - Two examples of its use. Applied Biomathematics, Stony Brook.

Fefferman, N.H. 2007. Disease as a Selective Pressure and the Evolution of Social Complexity. Dept. of Ecology, Evolution and Natural Resources, Rutgers Univ.

Fefferman, N.H. 2006. The Role of Individual Choice in the Evolution of Social Complexity and its Implications Towards the Emergence of Zoonotic Infections. DIMACS Computational and Mathematical Epidemiology Seminar, Rutgers Univ.

Fefferman, N.H. 2006. Preparing Societal Infrastructure Against Disease-Related Workforce Depletion. DIMACS Workshop on Facing the Challenge of Infectious Diseases in Africa, University of the Witswatersrand, South Africa

Fefferman, N.H. 2006. Fantastic Problems in Mathematical Ecology. DIMACS Bio-Math Connect Institute for High School Teachers, Denver, CO

Fefferman, N.H. 2006. Societal Bio-defense - How Can we Accomplish Safety, Stability and Efficiency? SIAM Annual Meeting, Boston, MA

Fefferman, N.H. 2006. When females should stop supporting lazy males: mathematics and honey bees. DIMACS REU Seminar Series, Rutgers Univ.

Fefferman, N.H. 2006. Selected Problems in Epidemiology. DIMACS Tutorial on Data Mining and Epidemiology.

Fefferman, N.H. 2006. How Would Termites Prepare for Pandemic Bird Flu and What Should We Learn From Them? Joint Dept. of Entomology and Center for Infectious Disease Dynamics Seminar, Penn State Univ.

Fefferman, N.H. 2006. Different Scales of BioDefense - Can societies be both safe and efficient? DIMACS Computational and Mathematical Epidemiology Seminar, Rutgers Univ.

Fefferman, N.H. 2005. Termites in the Nation′s Service. DIMACS Computational and Mathematical Epidemiology Seminar, Rutgers Univ.

Fefferman, N.H. 2005. Applications of Self-Organizing Systems to Epidemiology. DIMACS Mixer Series, Rutgers Univ.

Fefferman, N.H. 2005. Disease Signatures: A New Combinatorial Method for Epidemiology. DIMACS Computational and Mathematical Epidemiology Seminar, Rutgers Univ.

Fefferman, N.H. 2005. Fantastic Problems in Mathematical Ecology. DIMACS Bio-Math Connect Institute for High School Teachers, Rutgers Univ.

Fefferman, N.H. 2005. How Complex Systems Can Simplify a Complex Problem: What Epidemiologists Can Learn From Insects. Institute for Advanced Study, Center for Systems Biology Seminar Series

Fefferman, N.H. 2004. Incorporating Behavior and Social Structure into Pathogen Defense Strategies. Conference on Innate Immunity for Biodefense, National Defense University's Center for Technology and National Security Policy (CTNSP) & the Department of Defense

Fefferman, N.H. 2004. Social Insects, Immunocompetence and Epidemiology: A Model System for Systems Modelers. **Keynote Address** - Vanderbilt Medical School, Dept. of Microbiology and Immunology Annual Retreat

Fefferman, N.H. and J.F.A. Traniello. 2004. Disease and Immunocompetence in Group-Living Animals: Implications for Human Epidemiology. DARPA/DSO Workshop on Endogenous Defense

Presentations:

Fefferman, N.H. and J.M. Reed. 2006. A Vital Rate Sensitivity Analysis (VRSA) for Non-stable Age Distributions and Short-term Planning. North American Ornithological Conference

Fefferman, N.H. and P.T.B. Starks. 2004. A Mathematical Analysis of Reproductive Fission. North American Section of the International Union for the Study of Social Insects (with published abstract)

Fefferman, N.H., J. Jagai and E.N. Naumova. 2004. Two-stage Wavelet Analysis Assessment of Dependencies in Time Series of Disease Incidence. The 2004 Conference of the International Environmetrics Society (with published abstract)

Fefferman, N.H., R.B. Rosengaus, D.V. Calleri and J.F.A. Traniello. 2004. Mathematical Modeling of Behavior and Ecology in Social Insects: Social mechanisms of pathogen control in termite colonies. Departmental Research Seminar, Tufts Univ.

Fefferman, N.H. and E.N. Naumova. 2003. Modeling Waterborne Infectious Outbreaks: When, where and how bad will they be. The 2003 Conference of the International Environmetrics Society (with published abstract)

Fefferman, N.H., R.B. Rosengaus, D.V Calleri and J.F.A. Traniello. 2003. Modeling Disease Resistance through Social Interactions in Termites. The 2nd Conference on the Mathematics and Algorithms of Social Insects (with published abstract)

Fefferman, N.H. 2001. The Mathematics of Privacy, Graduate Research Seminar, Rutgers Univ.

Fefferman, N.H. 2000. The Mathematics of Real World Security. Graduate Research Seminar, Rutgers Univ.

Fefferman, N.H. 2000. The Use of Boolean Functions in Cryptographic Protocols. CORE, Rutgers Univ.

Fefferman, N.H. 2000. Zero Knowledge Proofs and Graph Theoretic Games You Can Play With Them. Graduate Research Seminar, Rutgers Univ.

Fefferman, N.H. and C. Nevill-Manning. 2000 A Proof That Greedy Really is Good When it Comes to Data Compression. VIGRE Research Seminar, Rutgers Univ.

Fefferman, N.H. 1999. A Presentation of the Hilbert Syzygy Theorem. Graduate Seminar on Commutative Algebras, Rutgers Univ.

Fefferman, N.H. 1998. Elliptic Curves and their uses in Cryptography. Graduate Research Seminar, Princeton Univ.

Other Experience:

2007	Invited Participant, Symposium on The science of thinking: Europe's next challenge – Computational Thinking, Royal Academy of Science, Humanities and Fine Arts, Brussels, Belgium
2007	Mentor of two teams of researchers for Department of Homeland Security funded Research Experience for those at Minority Serving Institutions
2006-cont.	Advisory/Editorial Board Member for the journal *Annales Zoologici Fennici*

2006 & 2007	Research Advisor for Rutgers Univ. DIMACS REU
2006	Research Advisor for Tufts Univ. Summer Scholars Program
2004-cont.	Referee of papers for *Behavioral Ecology and Sociobiology, Mathematical Biosciences*, *Journal of Insect Science*, *Bulletin for Mathematical Biology*, *Annales Zoologici Fennici, Journal of Medical Internet Research, Journal of Biological Dynamics*
2004	Subject Matter Expert on Innate Immunity and Biodefense, National Defense University
2004	Research Consultant, DARPA (via Strategic Analysis, INC.)
2003	Developed algorithm for Managing Endangered Species Habitat in Hawaii - MESHH software package (Reed, J.M., N.H. Fefferman, C.S. Elphick, and M. Silbernagle. 2004)
2000-2002	Technical Editor (Cryptography) to MacMillan Press
1999	Invited Reviewer of AES submission to the National Institute of Standards and Technology, later published as The Twofish Encryption Algorithm, Schneier, et al, 1999, John Wiley & Sons Inc.

Press Coverage:

Television/Online Video Broadcasts:
BBC World News, CBS News, Canada Television (CTV), AT&T Tech Channel

Radio Broadcasts:
BBC UK News, National Public Radio, AM900 CHML

Print/Online Media:
ABC News, TIME, Forbes, Reuters, Canadian Press (via CBC), Fox News, The Economist, New Scientist

Publications:

1. **Fefferman**, N.H. and K.L. Ng. Can Disease Models on Static Graphs Approximate Epidemics in Shifting Social Networks? (In Press, *Physical Review E*)
2. Lofgren, E. and N.H. **Fefferman**. 2007. The Untapped Potential of Virtual Game Worlds to Shed Light on Real World Epidemics. *The Lancet Infectious Diseases.* 7:625–629.
3. Lofgren, E., N.H. **Fefferman**, Y.N. Naumov, J. Gorski and E.N. Naumova. 2007. Influenza Seasonality: Underlying Causes and Modeling Theories. *Journal of Virology*, 81(11):5429-5436.

4. Lofgren, E., N.H. **Fefferman**, M. Doshi and E.N. Naumova. 2007. Assessing Seasonal Variation in Multisource Surveillance Data: Annual Harmonic Regression. *Lecture Notes in Computer Science.* BioSurveillance 2007. eds D. Zeng et al. 4506:114-123.

5. **Fefferman**, N.H. and K.L Ng. 2007. The role of individual choice in the evolution of social complexity. *Annales Zoologici Fennici*, 44:58-69.

6. **Fefferman**, N.H., J.F.A. Traniello, R.B. Rosengaus and D.V. Calleri. 2007. Disease Prevention and Resistance in Social Insects: Modeling the Survival Consequences of Immunity, Hygienic Behavior and Colony Organization. *Behavioral Ecology and Sociobiology*, 61:565-577.

7. Starks, P.T.B. and N.H. **Fefferman**. 2006. Polistes Nest Founding Behavior: a Model for the Selective Maintenance of Alternative Behavioral Phenotypes. *Annales Zoologici Fennici*, 43:456-467.

8. **Fefferman**, N.H., and E.N. Naumova. 2006. Combinatorial Decomposition of an Outbreak Signature. *Mathematical Biosciences*, 202(2):269-287.

9. **Fefferman**, N.H. and J.M. Reed. 2006. A Vital Rate Sensitivity Analysis that is Valid for Non-Stable Age Distributions and for Short-Term Planning. *The Journal of Wildlife Management*, 70(3):649-656.

10. **Fefferman**, N.H., and P.T.B. Starks. 2006. A Modeling Approach to Swarming in Honey Bees. *Insectes Sociaux*, 53(1):37-45.

11. **Fefferman**, N.H., E.A. O′Neil, and E.N. Naumova. 2005. Confidentiality vs Confidence: The aggravation of aggregation as a remedy in public health. *Journal of Public Health Policy,* 26(4):430-449.

12. **Fefferman**, N.H., J. Jagai, and E.N. Naumova. 2004. Two - Stage Wavelet Analysis Assessment of Dependencies in Time Series of Disease Incidence. *Proceedings of the 2004 Conference of the International Environmetrics Society*

13. **Fefferman**, N.H. 2004. Applications of Mathematical Models to Resolving Questions in Animal Behavior, Ecology and Epidemiology. (Doctoral Dissertation)

14. MacLeod, N., N. Ortiz, N.H. **Fefferman**, W. Clyde, C. Schulter, and J. MacLean. 2002. Phenotypic Response of Foraminifera to episodes of global environmental change. *in* Biotic Response to Global Change. eds S.J. Culver and P. Rawson. Cambridge University Press

15. **Fefferman**, N.H. and J.F.A. Traniello. (2007) Social Insects as Models in Epidemiology: Establishing the Foundation for an Interdisciplinary Approach to Disease and Sociality. (Forthcoming) *in* Organization of Insect Societies: From Genome to Sociocomplexity eds J. Gadau and J. Fewell. Harvard University Press

16. Starks, P.T., M. Spivak, and N.H. **Fefferman**. (2009) Review of behavioral defenses against diseases in insect societies with a special focus on hygienic behavior in honey bees. *Annual Review of Entomology* (Forthcoming)

17. **Fefferman**, N.H. (Ed.) (2007) Simulation Modeling in Biology and Medicine. *Annales Zoologici Fennici* 44(6) (Forthcoming)

18. **Fefferman**, N.H. and L.M. Fefferman. (2008) Mathematical Macrobiology: An Unexploited Opportunity in High School Education. DIMACS Series Publications – Biomathematics in High School Education (Forthcoming)
19. **Fefferman**, N.H., and E.N. Naumova. The role of social interactions among etiologically distinct subpopulations in the seasonality of infectious disease incidence (Submitted)
20. **Fefferman**, N.H. and K.L. Ng. Species-specific Behavior Affects Disease Spread Throughout an Ecosystem. (Submitted)
21. **Fefferman**, N.H. and L.M. Romero. How physiological stress alters population persistence: a model with conservation implications (Submitted)
22. Phan, L., D. Brugge and N.H. **Fefferman**. Built environment and health-related crimes: A retrospective study in Boston Chinatown. (Submitted)
23. Gurley, K., D.C. Baisly, N.H. **Fefferman**, B.A. Kravets, A.E. Libert, A.J. Siegel and P.T. Starks. The increasing thermoregulatory value of honey bee heat-sheilders. (Submitted)
24. Ji, S., A. Chaovalitwongse, N.H. **Fefferman**, W. Yoo, and J.E. Perez-Ortin. How to Avoid Type I and Type II Errors in Interpreting DNA Microarray Data. In Clustering Techniques in Biological Systems. ed. A. Chaovalitwongse (Submitted)
25. Reed, J.M., N.H. **Fefferman**, R.C. Averil-Murray. Vital Rate Sensitivity Analysis and Management Implications for Desert Tortoise. (In Preparation)
26. **Fefferman**, N.H. Worker Task Allocation in Social Insect Colonies: Should the strategy depend on disease presence? (In Preparation)
27. Senese, M., J. Rogers and N.H. **Fefferman**. Balancing Public Health Risks Against Educational Goals in the Public School System. (In Preparation)
28. **Fefferman**, N.H. and P.T.B. Starks. Drone Tenure in Honey Bee Colonies: A Game Theoretic Approach. (In Preparation)
29. **Fefferman**, N.H. and P.T.B. Starks. A Game Theoretic Comparison of Differential Investment in Reproductive Offspring in Honey Bees. (In Preparation)
30. **Fefferman**, N.H. and J. Evans. A Theoretical Model of the Intra-Hive Distribution of American Foulbrood in Nurse Bees as Infective Agents. (In Preparation)

Technical Reports:

1. Fefferman, N.H. 1999. Proposed Protocol for Blocking a Web-Scripting Attack. LockStar Inc.
2. Fefferman, N.H. 1999. RedMapping and the Math Behind It. LockStar Inc.
3. Fefferman, N.H. 1998. SynCrypt Trust Classification Model. SynData Inc.
4. Fefferman, N.H. 1998. Proposed Systems for Key Recovery for use with SynCrypt Encryption. SynData Inc.

Funding/Support:

2007 Department of Homeland Security, MSI support for summer research (**Fefferman PI** – called "Mentor" by funding agency)

2006 Received Tufts Summer Scholars Award supporting supervisory position of undergraduate research

2004-cont. Supported by National Institute of Allergy and Infectious Diseases Grant - Portrayal T-cell Memory: Robustness and Complexity - as part of an NIH Center Grant - Robust T-cell Immunity to Influenza in Human Populations - 5U19 AI062627

2003-2004 Supported by NIH Supplemental Funding for Researchers with Disabilities Grant R01 HD038327-S1

2003-2004 Received Tufts Univ. Tufts Institute of the Environment grant for work on Hawaiian wetland optimization algorithms

2003 Received MASI Travel Grant to attend conference in Atlanta, GA, USA

2003 Received NSF Travel Grant to attend TIES conference in South Africa

1999-2001 Participated in two major NSF-VIGRE supported projects while a graduate student at Rutgers:

1) Research which eventually became a master's thesis: Working on combinatorial games with an eye towards proving explicit strategies in the Maker/Breaker version of a number of different Ramsey games.

2) Participated as a Mentor/Advisor to an Undergraduate Student as part of an REU (research experience for undergraduates) run by DIMACS, which led to both a talk and a published research summary by the student.

Past and Current Research Advisees:

Undergraduates: Ashley Crump, Anne Eaton, Eric Lofgren, Luke Postle, Jeremiah Rogers, Nicole Scholtz, Margaret Senese, Barry Walker, Johanna Tam, Barton Willage, Nakeya Williams

Graduate Students: *(advised funded research projects – was not primary graduate advisor)* Devroy McFarlane, Anthony Ogbuka, Paul Raff, Alex Thorn

Post-Doctoral Researchers: Dr. Kah Loon Ng