NICHOLAS G. COGAN
Florida University
Department of Mathematics

Curriculum Vitae

Contact Information

Department of Mathematics
Florida State University
208 Love Building
Tallahassee, FL 32306-4510

email: cogan@math.fsu.edu
Phone: (850) 644-2202
Fax: (850) 644 - 6043
http://www.math.fsu.edu/~cogan

Education

- *Ph.D.*, University of Utah, Mathematics, May, 2003.
  Dissertation: A Model of Biofilm Growth and Structural Development
  Chair: James P. Keener
- *M.S.*, Montana State University, Mathematics, May, 1996.
- *B.A.*, Texas Tech University, Mathematics, May, 1994.

Experience

- *Associate Professor*, Department of Mathematics, Florida State University, September 2011 - present
- *Assistant Professor*, Department of Mathematics, Florida State University, January 2006 - August 2011.
- *Visiting Scholar*, Department of Mathematics, University of Cincinnati, August 2009 - December 2009.
- *Visiting Assistant Professor*, Department of Computational and Applied Mathematics, Rice University, July 2005 - December 2005.
- *Postdoctoral Fellow*, Department of Mathematics, Tulane University, July 2004 - July 2005.
- *Postdoctoral Fellow*, Center for Computational Science, Tulane University, July 2003-July 2004.
- *Postdoctoral Fellow*, Department of Mathematics, Tulane University, January 2002-July 2003.

Research Interests

- Mathematical Biology
- Fluid/Structure Interactions
- Optimal Control
- Microfiltration
- Biofilm Dynamics
- Immunology

External Funding

- 2015-2018: NSF-CBET #1122378 (**PI**, Environmental Engineering, $169,945.00) *Collaborative Research: Optimizing Microfilter Productivity During Water Treatment: Modeling and Experimental Verification*
- 2011-2014: NSF-DMS #1122378 (**PI**, Mathematical Biology, $283,799.00) *Collaborative Research: Investigating the development and treatment of plant diseases caused by the bacterium* Xylella fastidiosa *using theoretical and experimental methods*
- 2007-2009: NSF-DMS # 0724273 SCREMS (**Co-PI**, $114,687)) *High Performance Computing and Visualization*
- 2005 - 2007: NSF - DMS # 0548511(**PI**, Mathematical Biology, $34,600.00)*Modeling Biofilms: Fluid Dynamics, Reaction/Diffusion/Advection and Biomass Redistribution*

Refereed Publications

1. *A two dimensional multiphase model of biofilm formation in microfluidic chambers*
   M. Whidden, **N.G. Cogan**, M. Donahue, F. Navarrete, L. De La Fuente, Bulletin of Mathematical Biology (Accepted).
2. *Shocks and rarefactions arise in a two-phase model with logistic growth*
   D. Ekrut, and **N. G. Cogan**, Applied Mathematics Letters 52 (2016).
3. *Modelling mechanical and chemical treatment of biofilms with two phenotypic resistance mechanisms*
   N. G. Cogan and B. Szomolay, Environmental Microbiology, 17(6) (2015).
4. *Mathematical Model for Alopecia Areata*
   A. Dobreva, R. Paus, and **N. G. Cogan**, Journal of Theoretical Biology, 13 (2015).
5. *A Particular Solutions for a Two-Phase Model with a Sharp Interface*
   D. Ekrut and **N. G. Cogan**, Biomath, 4(1) (2015).
6. *Modelling the interaction between the host immune response, bacterial dynamics and inflammatory damage in comparison with immunomodulation and vaccination experiments*
   A. Jarrett, **N. G. Cogan** and M.E. Shirtliff, Mathematical Medicine and Biology, 22 doi:10.1093/imammb/dqu008. (2014).
   Winner of 2015 Best Paper Prize
7. *A method for determining the optimal back-washing frequency and duration for dead-end microfiltration*
   N. G. Cogan and S. Chellam, Journal of Mathematical Biology, Online First (2014).
8. *Global Sensitivity Analysis Used to Interpret Biological Experimental Results*
   A. Jarrett, **N. G. Cogan**, Y. Liu, and M. Y. Hussaini, Journal of Mathematical Biology, 71(1), 151-170 (2014).
9. *Concepts in Bacterial Disinfection*
   N. G. Cogan, Mathematical Biosciences, 245(2), 111-125 (2013).

10. *Pattern Formation Exhibited by Biofilm Formation within Microfluidic Chambers*
N. G. Cogan, M. Donahue, M. Whidden, and L. De La Fuente, Biophysical Journal, 104(9), 1867-1874 (2013).

11. *Effect of Periodic Disinfection on Persisters in a One-Dimensional Biofilm Model*
N. G. Cogan, B. Szomolay, and M. Dindos, Bulletin of Mathematical Biology, 75(1), 94-123 (2013).

12. *Marginal Stability and Traveling Fronts in Two-Phase Mixtures*
N. G. Cogan, M. Donahue, and M. Whidden, Physical Review E, 86(5) (2012).

13. *Optimal Control Strategies for Disinfection of Bacterial Populations with Persister and Susceptible Dynamics*
N. G. Cogan, J. Brown, K. Darres, and K. Petty, Antimicrobial Agents and Chemotherapy, 56(9), 4816-4826 (2012).

14. *Colloidal and bacterial fouling during constant flux microfiltration: Comparison of classical blocking laws with a unified model combining pore blocking and EPS secretion*
Shankararaman Chellam and **N. G. Cogan**, Journal of Membrane Science, 382(1), 148-157 (2011).

15. *Computational exploration of disinfection of bacterial biofilms in partially blocked channels*
N. G. Cogan, International Journal for Numerical Methods in Biomedical Engineering, 27(12), 1982-1995 (2011).

16. *Biofilms and Infectious diseases: Biology to mathematics and back again*
N. G. Cogan, J. S. Gunn and D. J. Wozniak, FEMS Microbiology Letters, 322(1) pp: 1-7 (2011)

17. *Two dimensional patterns in bacterial veils arise from self-generated, three-dimensional fluid flows,*
N. G. Cogan and C. W. Wolgemuth, Bulletin of Mathematical Biology 73 pp: 212-229 (2011)

18. *An extension of the boundary integral method applied to periodic disinfection of a dynamic biofilm,*
N. G. Cogan, SIAM Journal on Applied Mathematics, 70(7) pp: 2281-2307 (2010)

19. *Perspectives: Multiphase flow models of biogels from crawling cells to bacterial biofilms,*
N. G. Cogan and Robert D. Guy, HFSP Journal 4(1) pp: 11-25 (2010)

20. *Incorporating pore blocking, cake filtration, and EPS production in a model for constant pressure bacterial fouling during dead-end microfiltration,*
N. G. Cogan and Shankar Chellam, Journal of Membrane Science 345(1-2) pp: 81-89 (2009)

21. *Failure of antibiotic treatment in microbial populations,*
Patrick De Leenheer and **N. G. Cogan**, Journal of Mathematical Biology 59(4) pp: 563-579 (2009)

22. *Regularized Stokeslets Solution for 2-D Flow in Dead-end Microfiltration: Application to Bacterial Deposition and Fouling*
N. G. Cogan and Shankar Chellum, Journal of Membrane Science 318(1-2) pp: 379-386 (2008)

23. *Phase-Field Models for Biofilm. I. Theory and 1-D Simulations*
Tianyu Zhang, **N. G. Cogan** and Qi Wang, SIAM J. Appl. Math. Volume 69, Issue 3, pp. 641-669 (2008)

24. *Field-Phase Models for Biofilms. II. 2-D Numerical Simulations of Biofilm-Flow Interaction*
Tianyu Zhang, **N. G. Cogan** and Qi Wang, Communications in Computational Physics, 4(1) pp: 72-101 (2008)

25. *A Two-Fluid Model of Biofilm Disinfection*
N.G. Cogan, Bulletin of Mathematical Biology,, Bulletin of Mathematical Biology, 70(3) pp. 800-819 (2008)

26. *Hybrid Numerical Treatment of Two Fluid Problems with Passive Interfaces*
N.G. Cogan, Comm. App. Math. and Comp. Sci. Vol 2., No. 1, pp. 117-133 (2007).

27. *Incorporating Toxin Hypothesis into a Mathematical Model of Persister Formation and Dynamics*
N.G. Cogan, Journal of Theoretical Biology 248 (2007): 340-349.

28. *Effects of Persister Formation on Bacterial Response to Dosing*
N.G. Cogan, Journal of Theoretical Biology 238(3): 694-703 (2006) .

29. *Channel Formation in Gels*
N.G. Cogan and James P. Keener, SIAM J. Appl. Math. 65 (6): 1839-1854 (2005).

30. *Pattern Formation by Bacteria-driven Flow*
N. G. Cogan and C.W. Wolgemuth, Biophysical Journal 88 (4): 2525-2529 (2005).

31. *Modeling Physiological Resistance in Bacterial Biofilms*
N.G. Cogan, Ricardo Cortez and Lisa J. Fauci, Bulletin of Mathematical Biology 67 (4): 831-853 (2005).

32. *The Role of the Biofilm Matrix in Structural Development*
N.G. Cogan and James P. Keener, Mathematical Medicine and Biology 21(2),147-166 (2004)

Proceedings

- *Pattern Formation of the Causative Agent of Pierce's Disease within Microfluidic Chambers*
N.G. Cogan and L. De La Fuente, Biomath Communications (2013).

- *Microbial Biofilms: Persisters, Tolerance and Dosing*
N.G. Cogan, International Symposium on Interdisciplinary Science, American Institute of Physics Conference Proceedings (2005).

- *Biofilm Control by Antimicrobial Agents*
  P.S. Stewart, S. Sanderson, X. Xu, J. Raquepas, and N. Cogan, In Biofilms II: Process Analysis and Applications, 2nd edition, J. D. Bryers, ed. New York: John Wiley & Sons (2000).

- *Boundary Element Analysis of Intracardiac Electrogram Sensing*
  John Alford, Nick Cogan, Charles Miller, Seth Patinkin, Bradford E.Peercy, and Noah A. Rosenberg, IMA Preprint Series # 1589 (1999).

Selected Presentations

- **Plenary** *Aspects of tolerance in biofilm colonies*, Models for bacterial biofilms formation : mathematical, physical and biological perspectives, LJAD, University of Nice, Nice, France. '14

- **Plenary** *Pattern Formation of the Causative Agent of Pierce's Disease within Microfluidic Chambers*, BIOMATH, Sofia, Bulgaria, '13

- *Pattern Formation Exhibited by Biofilm Formation within Microfluidic Chamber*, Colloquium, Department of Physics, University of Arizona, '13

- *Dynamics of Persister Formation: Dosing and Fluid Effects*, ICIAM 2011, Vancouver, CA July '11

- *Dynamics of Persister Formation: Dosing and Fluid Interactions*, SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May '11

- *Biofilm Modeling* (sequence of six talks), University of Cincinnati, Fall Quarter 09

- *An Application of the Boundary Integral Method to Biofilm Disinfection*, University of Kentucky, Applied Mathematics Seminar, Fall '09

- *Persister Distribution in a Moving Biofilm*, Spring Topology and Dynamics Conference Ulam Centennial Conference, University of Florida, Spring '09

- *A Model of Persister Formation and Dynamics*, SIAM Annual Meeting. Denver, CO, Summer 2009

- *Extending Boundary Integral Methods to Biofilm Dynamics*, University of California-Davis, Mathematical Biology Seminar, Spring '08.

- *Simulating Biofilm Growth and Dynamics in a Flowing Environment*, University of Cincinnati Mathematics Department Colloquium, Spring '08.

- *A Model of Persister Formation and Dynamics*, Conference on Mathematical Tools and Multiscale behavior in Biological Processes, Montana State University Summer '08.

- *Boundary Integral Methods for Two-Fluid Systems*, Mathematics Departmental Colloquium, Duke University, Durham, North Carolina, October 2005.

Ph.D. Thesis Advisor for:

- Mark Whidden, July 2013 (Graduated), Numerical Methods for Multiphase Systems with Applications to Biology
- Matt Donahue, July 2014 (Graduated), Modeling the Effect of Biofilm Production in the Development of Plant Diseases
- Angela Jarrett, 2016 (Expected), Immuno-modulation, Uncertainty and Sensitivity Analysis
- David Ekrut, 2016 (Expected), Symmetry Analysis for Multiphase Systems
- Jian Li, 2017 (Expected), Parabolic Stability Equations for Multiphase Systems
- Atanaska Dobreva, 2017 (Expected), Immunological Models of Alopecia Areata
- Sepideh Ebadi, 2018 (Expected), Experimental and Mathematical Exploration of Persister Cell Dynamics
- Nihan Acar, 2018 (Expected), Optimal Control Studies of Bacterial Disinfection
- Manu Aggarwal, 2019 (Expected), Sensitivity and Uncertainty for Biological Systems
- Deniz Ozturk, 2019 (Expected), Biofilm Dynamics

Professional Service and Outreach

- Landau Chair, Society for Mathematical Biology
- Judge for Moody's Mega Math Challenge 2006-2013
- Mentor for Siemen's High School Science Competition 2015
- Co-instructor for a short course in mathematical biology for undergraduates, Summer 2009.
- Visiting Scholar-University of Cincinnati, Fall Quarter 2009.
- Selected reviewer for: Communications on Pure and Applied Analysis,Computational and Applied Math Quarterly, Cell Biochem. Biophys., Math and Computer Modeling, Mathematical Biosciences, Boundary Value Problems, Bulletin of Mathematical Biology; Water Research; Physics of Fluids; SIAM Journal on Multiscale Modeling and Simulation; Mathematical Medicine and Biology; SIAM Journal on Applied Mathematics; Biophysical Journal; Journal of Theoretical Biology; Biotechnology and Bioengineering; NSF Proposal MSPA-interdisciplinary; NSF Proposal RIG-interdisciplinary, MITACS

Professional Affiliation

- SIAM (Society for Industrial and Applied Mathematics)
- SMB (Society for Mathematical Biology)