Education

Ph.D.	**Applied Mathematics** *University of Arizona* *Tucson, Arizona*	**1990-1994**
B.Sc. Honors (1st Class)	**Computational Physics** *Heriot-Watt University* *Edinburgh, Scotland*	**1987-1990**

Academic Appointments

Associate Dean for Faculty Affairs and Research **2010-Present**
Franklin W. Olin College of Engineering
Needham MA USA

Professor of Mathematics **2008-Present**
Franklin W. Olin College of Engineering
Needham MA USA

Visiting Research Fellow **2009-Present**
Institute for Complex Systems and Mathematical Biology
University of Aberdeen, Aberdeen Scotland

Associate Professor of Mathematics **2003-2008**
Franklin W. Olin College of Engineering
Needham MA USA

Assistant Professor of Mathematics **1998-2003**
Department of Mathematics and Statistics
University of New Hampshire, Durham NH USA

Assistant Professor of Mathematics **1996-1998**
Ramapo College of New Jersey, Mahwah NJ USA

Lecturer **1995-1996**
Ramapo College of New Jersey, Mahwah NJ USA

Awards

Outstanding Teaching Award **2000**
University of New Hampshire, Durham NH USA

SIAM Travel Award **1999**

Scholar-in-Residence **1997**
New York University, New York NY USA

Watt-Club Medal for Excellence in Physics **1990**
Heriot-Watt University, Edinburgh Scotland

Third-Year Physics Prize **1989**
Heriot-Watt University, Edinburgh Scotland

Courses Taught

2003- **Franklin W. Olin College of Engineering**

Modeling and Simulation of the Physical World I & II
Single-variable Calculus
Multi-variable Calculus
Linear Algebra
Ordinary Differential Equations
Nonlinear Dynamics and Chaos
6 Theorems That Changed The World
Transport in Biological Systems
Numerical Methods and Scientific Computing

1998-2003 **University of New Hampshire**

Numerical Analysis
Scientific Computing
Linearity I & II
Ordinary Differential Equations
Partial Differential Equations
Multi-variable Calculus
Single-variable Calculus
Linear Algebra
Applied Complex Analysis

1996-1998 **Ramapo College of New Jersey**

Chaos and Fractals
Developmental Mathematics
Energy and Society
Basic Mathematics
Elementary Algebra
College Algebra
Mathematics with Applications for Business Majors

Current Support

NIH 1 R15 HL106648-01
A mathematical model of microvascular remodeling: Endothelial dysfunction in obesity, diabetes, and hypertension
Role: PI

Changes in blood vessel remodeling that occur in prevalent diseases such as obesity, diabetes, and hypertension are thought to cause some of the morbidity associated with these diseases including organ damage and tissue ischemia. The proposed work aims to use experimentally-motivated, mathematical models of vessel remodeling to gain understanding of this process that would be difficult to obtain experimentally. Increasing our knowledge about the remodeling process will ultimately lead to more effective clinical interventions.

The Davis Educational Foundation
Faculty Development Modules
Role: PI

We propose to create and deliver a series of faculty development modules in which faculty at Olin College of Engineering deliver short, intensive courses for other faculty during the winter and summer breaks. This program would contribute to the intellectual vitality of faculty members and create new opportunities in teaching, student learning, and faculty research.

Prior Support

NSF 0636528 Davis (PI)
Long-Term Undergraduate Research Experience.
Role: Senior Personnel

The Long-term Undergraduate Research Experience (LURE) model for the mathematical sciences is a collaboration between the mathematics faculty at Central Michigan University, Coppin State University, Olin College, and the University of Richmond. The LURE model emphasizes the early recruitment of undergraduates to mathematical research and the cultivation of interest in the mathematical sciences. It builds upon the success of the apprentice model often used in the physical and life sciences, wherein scientists routinely engage first- and second-year undergraduates in research and then continue to mentor these students until they are prepared to pursue graduate degrees. Specifically, LURE recruits students early in their undergraduate careers and pairs them with faculty who serve as mentors throughout a two-year research experience in the mathematical sciences. Through closely supervised research and independent study activities spanning two summers (ten weeks each) and two academic years, students experience all steps in a research project, from background reading to the professional presentation of results. This allows undergraduates to be involved with mathematics research experiences that are more sophisticated than possible with traditional single-summer research experiences.

NIH/NHLBI 1 R01 HL067789-01 Carr (PI)
Nonlinear dynamics in microvascular networks.
Role: Mathematician.

Temporal fluctuations in the microcirculation have long been considered the result of active biological control. The project focuses on computer simulations which indicate that the microvascular networks can exhibit spontaneous nonlinear oscillations in the absence of biological control. The simulations are based on well established blood rheological properties; the Fahraeus-Lindqvist effect and plasma skimming. Realistic network geometries based on in vivo observations of rat mesentery are used in the simulations.

NSF/DUE 9752650 Black (PI)
Linearity I and II.
Role: Consultant.

A year-long integrated course of study organized around the fundamental concept of linearity and the process of linearization is being developed at the University of New Hampshire (UNH). The goals of this sequence are: 1) to unify the learning of the core ideas and techniques normally studied in a separate fashion in ordinary differential equations, linear algebra, and multivariable calculus, by captitalizing on the rich interconnections among the three subject areas, and 2) to maximize student opportunities to engage in contextual learning of these key concepts.

NSF/DMS 9704911 Short (PI)
Nonlinear dynamic forecasting for signal processing applications.
Role: Consultant

The goal of this project was to develop signal processing techniques based on nonlinear dynamic (NLD) forecasting. Traditional signal processing approaches have generally relied upon the assumption that systems are either periodic/quasi-periodic or random. The NLD forecasting approach attempts to bridge the gap between these approaches by assuming that there may be a deterministic component which is responsible for the observed complex behavior. The developed techniques have been successfully employed on seismic data from nuclear tests and data from a chaotic erbium-doped fiber ring laser.

Published Papers

0. John B. Geddes, Russell T. Carr, Fan Wu, Yingyi Lao, Meaghan Maher
Blood flow in microvascular networks: A study in nonlinear biology
Chaos 20, 045123 (2010).

1. John B. Geddes, Brian D. Storey, David Gardner, and Russell T. Carr
Bistability in a simple fluid network due to viscosity contrast
Physical Review E 81, 046316 (2010).

2. Kelly Black and John B. Geddes
Noise-Induced Oscillations in an Actively Mode-Locked Laser
Computers and Mathematics with Applications 60, 1-13 (2010).

3. Ilari Shafer, Morgan Boes, Rachel Nancollas, John B. Geddes, and Alisha L. Sieminski
Stability of a microvessel subject to structural adaptation of diameter and wall thickness
Mathematical Medicine and Biology (2010).

4. David Gardner, Yiyang Li, Benjamin Small, John B. Geddes, and Russell T. Carr
Multiple Equilibrium States in a Micro-vascular Network
Mathematical Biosciences 227, 117-124 (2010)

5. Jonathan Stolk, Robert Martello, Mark Somerville, and John Geddes
Engineering Students' Definitions of and Responses to Self-Directed Learning
International Journal of Engineering Education 26, 900-913 (2010)

6. John B. Geddes, Russell T. Carr, Nathaniel J. Karst, and Fan Wu
The Onset of Oscillations in Microvascular Blood Flow
SIAM Journal on Applied Dynamical Systems 6, (2007), pp. 694—727.

7. Kelly Black and John B. Geddes
Complex Valued Spectral Hermite Approximations for the Actively Mode-Locked Laser
Journal of Scientific Computing 32, (2007), pp. 427—448.

8. John B. Geddes and Kelly Black
The Dynamic Force Table
PRIMUS 18, (2007), pp. 221—246.

9. Russell T. Carr, John B. Geddes, and Fan Wu
Oscillations in a simple microvascular network
Annals of Biomedical Engineering 33, (2005), pp. 764-771.

10. John B. Geddes, Willie J. Firth and Kelly Black
Pulse dynamics in an actively mode-locked laser
SIAM Journal on Applied Dynamical Systems 2, (2003), pp. 647-671.

11. Kelly Black and John B. Geddes
Spectral Hermite approximations for the actively mode-locked laser
Journal of Scientific Computing 16, (2001), pp. 81–120.

12. John B. Geddes, Kevin M. Short, and Kelly Black
Extraction of signals from chaotic laser data
Physical Review Letters 83 (1999), pp. 5389–5392.

13. J. B. Geddes, R. A. Indik, J. V. Moloney and W. J. Firth
Hexagons and squares in a passive nonlinear optical system
Physical Review A 50, (1994), pp. 3471–3485.

14. J. B. Geddes, J. V. Moloney, E. M. Wright and W. J. Firth
Polarization patterns in a nonlinear cavity
Optics Communications 111, (1994), pp. 623–631.

15. J. B. Geddes, J. Lega, J. V. Moloney, R. A. Indik, E. M. Wright and W. J. Firth
Pattern selection in passive and active nonlinear optical systems
Chaos, Solitons and Fractals 4, (1994), pp. 1261–1274.

16. G. K. Harkness, W. J Firth, J. B. Geddes, E. M. Wright and J. V. Moloney
Boundary effects in large-aspect-ratio lasers
Physical Review A 50, (1994), pp. 4310–4317.

17. J. B. Geddes, J. V. Moloney and R. Indik
Spontaneous transverse spatial pattern formation due to stimulated Brillouin scattering of counterpropagating optical beams
Optics Communications 90, (1992), pp. 117–122.

Presentations

1. Russell T. Carr and John B. Geddes
Nonlinear Dynamics and Microvascular Blood Flow
Workshop on State-Dependent Delay Equations, Max Planck Institute for the Physics of Complex Systems, Dresden Germany, October 2009 (Invited).

2. John B. Geddes
Nonlinear Dynamics in Microvascular Blood Flow
Dynamics in Systems Biology, University of Aberdeen UK, September 2009 (Invited).

3. John B. Geddes
Nonlinear Dynamics in Microvascular Blood Flow
University of Aberdeen Physics Seminar, Aberdeen UK, July 2009 (Invited).

4. John B. Geddes, Ben Small, and Rachel Nancollas
Nonlinear Dynamics in Microvascular Networks
Workshop on Applications of Complex Networks, University of Strathclyde, Glasgow UK, May 2009 (Paper).

5. John B. Geddes
Modeling, Simulation, and Analysis at Olin College of Engineering
SIAM Minisymposium on Education and Applied Mathematics, Joint Mathematics Meetings, San Diego CA, January 2008 (Paper).

6. John B. Geddes
Oscillations in MIcrovascular Blood Flow
University of Dundee Mathematics Seminar, Dundee UK, November 2007 (Invited).

7. John B. Geddes and Russell T. Carr
Oscillations in Microvascular Blood Flow
University of Nottingham Mathematics Seminar, Nottingham UK, November 2007 (Invited).

8. John B. Geddes
Oscillations in Microvascular Bloodflow
Union College Mathematics Seminar, Schenectady NY, November 2007 (Invited).

9. Jonathan Stolk, Robert Martello, and John Geddes
Building autonomous students: Modeling curricular approaches for lifelong learning
Frontiers in Education Conference, Milwaukee WI, October 2007 (Paper).

10. Mark Somerville, Benjamin Linder, Ozgur Eris, John B. Geddes, and Jonathan Stolk
Applying user-oriented techniques to curriculum design
Active Learning in Engineering, Toulouse, France, June 2007 (Activity).

11. John B. Geddes
Spontaneous oscillations in micro-vascular blood flow
Blood Flow in the Microcirculation Workshop, Mathematical Biosciences Institute, Columbus OH, January 2007 (Poster).

12. John B. Geddes, Russell T. Carr, Fan Wu, and Nathaniel J. Karst
Spontaneous oscil lations in micro-vascular blood flow, Dynamics Days 2007, Boston MA, January 2007 (Poster).

13. Mark Somerville, John B. Geddes, Benjamin Linder, Ozgur Eris, and Jonathan Stolk
Incorporating values: A user-oriented approach to curriculum design
Frontiers in Education Conference, San Diego CA, October 2006 (Activity).

14. Jonathan Stolk, Mark Somerville, John B. Geddes, and Robert Martello
Understanding discomfort: student response to self-direction
Frontiers in Education Conference, San Diego CA, October 2006 (Paper).

15. John B. Geddes and Russell T. Carr
A state dependent delay equation for microvascular bloodflow
Society for Industrial and Applied Mathematics Annual Meeting, Boston MA, July 2006 (Poster).

16. Kelly Black and John B. Geddes
Complex Hermite-Gaussian Approximation to the Mode-Locked Laser
Society for Industrial and Applied Mathematics Annual Meeting, Boston MA, July 2006 (Paper).

17. Russell T. Carr, John B. Geddes and Nathaniel J. Karst
Multiple Steady States in Microvascular Blood Flow
Microcirculation 2005, Durham NH, September 2005 (Poster).

18. Fan Wu, Russell T. Carr, John B. Geddes, and Yingyi Lao
Stability analysis of blood flow in three node microvascular networks
Microcirculation 2005, Durham NH, September 2005 (Poster).

19. Mark Somerville and John B. Geddes
Along the Spectrum of Inquiry: A Project-Based Approach to the First Year Experience
Frontiers in Education Conference, Indianapolis IN, October 2005 (Paper).

20. Mark Somerville and John B. Geddes
Early Exploration: A Project-based Approach
Active Learning in Engineering Education, Netherlands June 2005 (Paper).

21. Mark Somerville, John B. Geddes, and Benjamin Linder
Imaginary Students
Active Learning in Engineering Education, Netherlands June 2005 (Activity).

22. Y. Lao, R.T. Carr, J.B. Geddes, and F. Wu
Dynamics of blood flow in a simple microvascular network (including spontaneous flow reversal)
Experimental Biology, San Diego CA, April 2005 (Poster).

23. F. Wu, R.T Carr, J.B. Geddes, and Y. Lao
Stability Analysis of Blood Flow in Microvascular Networks
Experimental Biology, San Diego CA, April 2005 (Poster).

24. Kelly Black, John B. Geddes, and Willie J. Firth
High-order approximation and pulse dynamics of a mode-locked laser
International Conference On Spectral and High Order Methods, Providence RI, June 2004 (Paper).

25. Mark Somerville and John Geddes
Developing Competencies through Early Exploration: A Project-Based Approach
Active Learning in Engineering Education, France June 2004 (Poster).

26. John B. Geddes
Oscillations in microvascular bloodflow
College of the Holy Cross, MA, November 2003 (Invited).

27. K. Black, and J. B. Geddes, and Willie Firth
Spectral/Hermite Approximations and Transient Growth for the Actively Mode-Locked Laser
Thirty Third Annual Lloyd Roeling Mathematics Conference, University of Louisianna, Lafayette LA, October 2003 (Paper).

28. John B. Geddes and Russell T. Carr
Nonlinear Oscillations in Microvascular Bloodflow
Dynamics Days Arizona, Phoeniz AZ, January 2003 (Paper).

29. John B. Geddes and Kelly Black
Using a force table to motivate systems
MAA Session on Enlivening Multivariate Calculus, MathFest Conference, Burlingtion VT, August 2002 (Paper).

30. Kelly Black and John B. Geddes
Linearity
SIAM Annual Meeting, Philadelphia PA, August 2002 (Poster).

31. Kelly Black and John B. Geddes
Building and Maintaining an Undergraduate Research Program - Undergraduate Training
MAA Session on Initiating and Sustaining Undergraduate Research Projects and Programs, II, Joint Mathematics Meetings, San Diego CA, January 2002 (Paper).

32. Kelly Black and John B. Geddes
Preparing Undergraduate Students for Research
SIAM Minisymposium on Undergraduate Programs and Research Projects in Applied and Computational Mathematics, Joint Mathematics Meetings, San Diego CA, January 2002 (Paper).

33. Kelly Black and John B. Geddes
The Force Table in the Mathematics Classroom
MAA Session on Classroom Demonstrations and Course Projects That Make a Difference, III, Joint Mathematics Meetings, San Diego CA, January 2002 (Paper).

34. John B. Geddes, Willie J. Firth, Kelly Black, and Matthew Beauregard
Pulse dynamics in a mode-locked laser
SIAM Conference on Applications of Dynamical Systems, Snowbird UT, May 2001 (Paper).
35. J. B. Geddes and Kelly Black
Developing Undergraduate Researchers: Preparing First and Second Year Students to Become Researchers
Conference on models for integrating research into the undergraduate experience, Tucson AZ, February 2000 (Paper).

36. J. B. Geddes, K. M. Short, and K. Black
Extracting signals from chaotic laser data
ICIAM, Edinburgh Scotland, July 1999 (Paper).

37. J. B. Geddes, K. M. Short, and K. Black
Extracting signals from chaotic laser data
SIAM Dynamical Systems, Snowbird UT, May 1999 (Paper).

38. J. B. Geddes, K. M. Short, and J. Perreault
Polarization-based laser communication schemes
SIAM Dynamical Systems, Snowbird UT, May 1999 (Poster).

39. J. B. Geddes
Incorporating Chaos Theory into the College Algebra Curriculum
Mathematical Association of America, Edison NJ, April 1997 (Paper).

40. J. B. Geddes, J. V. Moloney, E. M. Wright and W. J. Firth
Polarization patterns in a nonlinear cavity
European Quantum Electronics Conference ’94, Amsterdam, September 1994 (Paper).

41. J. B. Geddes, J. V. Moloney, E. M. Wright and W. J. Firth
Polarization patterns in a ring-cavity
Nonlinear Optics ’94, Hawaii, July 1994 (Poster).

42. J. B. Geddes, R. A. Indik, J. V. Moloney and W. J. Firth
Patterns due to counterpropagating laser beams
Nonlinear Optics Workshop, Tucson AZ, September 1993 (Paper).

43. J. B. Geddes, R. A. Indik, J. V. Moloney, A. C. Newell and W. J. Firth
Hexagons and squares due to counterpropagation in Kerr media
Optical Society of America Annual Meeting, Albuquerque NM, September 1992 (Paper).

44. J. B. Geddes, J. V. Moloney, R. Indik, W. J. Firth and G. S. McDonald
Pattern formation due to nonlinear counterpropagation in Kerr and Brillouin-active media
Nonlinear Dynamics of Optical Systems '92, Alpbach Austria, June 1992 (Paper).

45. J. B. Geddes, R. Indik, J. V. Moloney, W. J. Firth and G. S. McDonald
Hexagons and their dynamics and defects in nonlinear counterpropagation in Kerr media
International Quantum Electronics Conference '92, Vienna Austria, June 1992 (Paper).

46. J. B. Geddes, R. Chang, W. J. Firth, R. Indik, J. V. Moloney and E. M. Wright
Three-dimensional simulations and analysis of hexagonal pattern formation in Kerr media
Optical Society of America Annual Meeting, San Jose CA, November 1991 (Paper).

47. J. B. Geddes, J. V. Moloney and R. Indik
Spontaneous transverse spatial pattern formation due to stimulated Brillouin scattering of counterpropagating optical beams
European Quantum Electronics Conference, Edinburgh Scotland, August 1991 (Poster).

48. R. Chang,G. D'Alessandro,W. J. Firth,J. B. Geddes,R. Indik, J. V. Moloney and E. M. Wright
Three-dimensional simulations of degenerate counterpropagating beam instabilities in a nonlinear medium
European Quantum Electronics Conference, Edinburgh Scotland, August 1991 (Invited).