Vita and Bibliography

James P. Keener
Distinguished Professor

Birthdate: November 26, 1946
Birthplace: Lancaster, Pennsylvania

Academic Degrees:

B.A.	1968	Case Western Reserve University
M.S.	1969	California Institute of Technology
Ph.D.	1972	California Institute of Technology

Professional Experience:

Summers 1969, 72, 74	Numerical Analyst, Jet Propulsion Laboratory, Pasadena, California
1972-1977	Assistant Professor of Mathematics, University of Arizona, Tucson, Arizona
1977-1979	Associate Professor of Mathematics, University of Arizona, Tucson, Arizona
1978-1982	Associate Professor of Mathematics, University of Utah, Salt Lake City, Utah
1982-2004	Professor of Mathematics, University of Utah, Salt Lake City, Utah
2000-	Adjunct Professor of Bioengineering, University of Utah, Salt Lake City, Utah
2004-	Distinguished Professor of Mathematics, University of Utah
2019-	Member of the Center for Cell and Genome Science, University of Utah

Additional Positions:

1974-75	Research Associate, McGill University, Montreal, Quebec, Canada

Fall 1981	Research Member, Sonderforschungsbereich 123, University of Heidelberg, Heidelberg, West Germany
Spring 1984	Research Member, Centre for Mathematical Biology, Oxford University, Oxford, England
Fall 1984	Expert Consultant, National Institutes of Health, Bethesda, Maryland
Spring 1985	Visiting Scholar, Stanford University
Fall 1998	Visiting Professor, Calvin College

Research Support, Fellowships, and Honors:

1970-1972	John & Fannie Hertz Foundation Fellowship
1975-1979	NSF Grant MPS 75-07621 "Bifurcation of Nonlinear Differential Equations"
1979-1982	NSF Grant MCS 79-02505 Investigations of Nonlinear Diffusion Reaction Systems"
Fall 1981	Gardner Fellowship, University of Utah
1983-1986	NSF Grant MCS83-01881, Mathematical Studies of Cardiac Arrhythmias and Electrical Circuits
1986-1988	NSF Grant 8601134, Mathematical Studies of Cardiac Function and Related Excitable Media.
1988- 1990	NSF Grant DMS-8801446, Mathematical Studies of Wave Propagation in Excitable Media
1989	Selection of reference [51] as a Hot Paper by The Scientist
1990-1993	NSF Grant DMS-9000588, Waves in Excitable Media
1992	Runnerup, The Bellman Prize, Mathematical Biosciences
1993-1996	NSF Grant DMS-9303502, Wave Propagation in Excitable Media
1996-1999	NSF Grant 9626334, Wave Propagation in Cardiac Tissue, $210,000.
1999-2002	NSF Grant DMS-99700876 Excitable Waves in Physiological Systems, $266,000.

1999	Book "Mathematical Physiology" selected as Best New Title in Mathematics for 1998 by the Association of American Publishers, Profesional/Scholarly Publishing Division
1999	Computer graphics in [75] used by American Mathematical Society for Math Awareness Month Poster.
2000-2002	NSF-SGER, Cross-Disciplinary Training Program in Mathematical Biology, $100,000
2002-2005	NSF-FRG Grant DMS-0139926, The Dynamics of Growing Biogels, (Aaron Fogelson, PI) $1,014,555.
2002-2006	NSF Grant DMS-0211366, Excitability in Physiological Systems, $229,000.
2002-2008	NSF-IGERT: Cross Disciplinary Training in Mathematical Biology, $3,477,000.
2004-2009	NSF-RTG: Research Training Group in Mathematical and Computational Biology, $2,400,000
2006-2011	NSF-NIGMS Grant DMS 0540779 Formation and Function of Physiological Gels (A. Fogelson, PI) $2,071,871
2007	Paper [111] selected for "Best Paper Award" at ASYNC '07.
2007-2011	NSF-DMS-0718036 Mathematical Investigations of the Dynamics of Cellular Physiological Processes $294,419
2011-2016	NSF-DMS-1122297 Mathematical Modelling of the Dynamics of Cellular Processes, $378,477
2012	Selected SIAM Fellow
2012-2017	NSF-DMS-RTG: Research Training Group in Mathematical and Computational Biology, $2,496,299
2012-2015	NSF-DMS-FRG: Collaborative Research: Chemically-active Viscoelastic Mixture Models in Physiology: Formulation, Analysis, and Computation (PI A. Fogelson), $743,646
2014	Paper [143] featured as New and Notable and paper [144] featured on the cover of Biophysical Journal.

2015-2019 NSF-DMS-1515130 Mathematical Modelling of the Dynamics of Cellular Processes, $215,000

2017 Recipient of the Society for Mathematical Biology John Jungck Prize for Excellence in Education.

2017 Paper [156] recommended in F1000Prime as being of special significance in its field.

2017-2022 NIH-R01 5R01HL102298-07 Role of Extracellular Space as a Modulator of the Cardiac Gap Junction - Conduction Velocity Relationship, (S. Poelzing, PI), subcontract

2018-2021 NSF-NIGMS 1761976 Collaborative Research: Modeling gastric mucus layer physiology with application to Helicobacter pylori and gastric organoids (PI A. Fogelson).

2019 Paper [165] selected for Journal of Physics A Highlights of 2018 collection.

Research Interests:

Applied Mathematics, Nonlinear Differential Equations, Chemical and Biological Dynamics, Cardiology, Cellular and Systems Physiology

PH.D. Students:

Jack Dockery, Diffusive Effects on Dispersion for a System of Reaction Diffusion Equations, 1987.

Bertram Zinner, Traveling Wavefront Solutions for Discrete Nagumo Equation, 1988.

Thomas Nordhaus, Echo-cycles for Coupled FitzHugh Nagumo Equations, 1988.

Fred Phelps, The substitutional genetic load and the neutral theory of molecular evolution, 1989.

Ya Li, Asymptotic behavior of solutions of the nonlinear parabolic differential equations, 1990.

Eric Marland, The Dynamics of a Sarcomere, 1998.

Timothy Lewis, Wave Propagation in Excitable Media with Local Inhomogeneities, 1998.

Kristina Bogar, A semi-implicit time scheme for the study of action potential propagation in the bidomain model, 1999.

Eric Cytrynbaum, Using Low Dimensional Models to Understand Cardiac Arrhythmias, 2001.

Miguel Dumett, A Numerical method for the solution of elliptic boundary value problems on irregular domains, 2001.

Chung Seon Yi, Changes of volume and ionic concentration during ischemia and hypoxia, (joint with A. Fogelson) 2001.

Nick Cogan, A Model of Biofilm Growth and Structural Development, 2002.

Brad Peercy, Models of border zone arrhythmias in acute cardiac ischemia, 2003.

Brynja Kohler, T lymphocyte population dynamics in health and autoimmunity, 2004.

Young Seon Lee, Mechanisms of calcium alternans in cardiac cells, 2005.

Liz Copene, Ephaptic Coupling of Cardiac Cells, 2008.

Nessy Tania, Mathematical Models of Calcium Regulation in Cardiac Cells, 2009.

Frank Lynch, Mathematical Modeling of the Gastric Mucus Gel, 2009.

Blerta Shtylla, Mathematical Models of Chromosome Motility during Mitosis, 2011.

Geoffrey Alexander Munro Hunter, The Role of Small RNA in Quorum Sensing, 2013.

Ross Magi, Dynamic Behavior of Biological Membranes, 2014.

Megan Gorringe Dixon, Roles for ubiquitin and dimensional dependence in protein regulation, 2015.

Parker Lane Childs, Mathematical Models of Chemical Reactions: Discrepancies between Markov Chains and Mass Action Kinetics, 2016.

Jie Ma, Singular Perturbation Methods in Pharmacokinetics and Stochastic Modeling of Random Drug Taking Processes, 2017.

Christopher Miles, A Hop, Switch and Jump: Stochasticity in Models of Motor-mediated Intracellular Transport, 2018.

Kiersten Utsey, Bistability in Epigenetic and Genetic Regulation, 2020.

Cody Fitzgerald, Analysis of Environmentally-cued Gene Regulatory Networks in Plants and Bacteria, 2021.

Kyle Gaffney, Continuous models of the mechanics of flagellar and ciliary beating, 2021.

Kees McGahan, 2023.

Professional Activities:

Editorial:

SIAM Journal on Applied Mathematics, (Editor-in-Chief) 1989-1995

European Journal of Applied Mathematics, 1996 - 2004

Random and Computational Dynamics, 1992 - 1998

Physica D, 1996 - 2004

Journal of Theoretical Medicine, 1997-2005

Mathematical Medicine and Biology (co-editor-in-Chief), 2002-present

SIAM Journal on Applied Dynamical Systems, 2001-2011

Biophysical Journal, 2013-2018

Studies in Applied Mathematics, 2018-present

Lecture Activities:

Lectures of Distinction

- Plenary speaker, SIAM National Meeting, 7/89
- Taniguchi Lectureship, Kyoto, 8/89
- North British Differential Equations Seminar Lecture Tour, 5/92
- Porter Distinguished Lecture, Vanderbilt University, 10/94
- Distinguished Lectureship, Arizona State University, 4/95
- The Ulam Colloquium, University of Florida, 1/99
- Public Lecture, Arizona State University, 4/99

- Distinguished Lectureship Tour, Taiwan, 4/99
- Invited Lecture, Japan Mathematical Society, 10/01
- Plenary Speaker, SIAM/Life Science Activity Group, 3/02
- Invited Speaker, SIAM 50th Anniversary Meeting, 7/02
- Keynote Speaker, Red Raider Symposium Series, Texas Tech University, 11/03
- Bullitt Lectureship, University of Kentucky, April 2004
- The Winfree Lecture, University of Arizona, April 2005
- The Rowlee Lecture, University of Nebraska, April 2005
- British Applied Mathematics Colloquium, Plenary Speaker, April 2006.
- Frontiers of Science Lecture, University of Utah, Nov. 2006.
- The Barnett Lecture, University of Cincinnati, May 2008.
- The Ulam Memorial Lecture, University of Florida, February 2010.
- Plenary Lecture, Society for Mathematical Biology International Conference, Rio de Janeirio, Brazil, July 2010.
- Distinguished Lecture Series, Texas Tech University, March 2014.
- The T. G. Ostrum Lecture, Washington State University, April 2014.
- The MBI National Colloquium, April 2017.
- The SIAM Invited Address, Joint Math Meeting, Denver, 2020

Lecture Series and Short Courses

- National Center for Theoretical Science, Hsinchu, Taiwan 4/99
- Institute for Nonlinear Studies, UC Davis, 5/00
- Centrum voor Wiskunde en Informatica, Amsterdam, 6/00
- Institute for Mathematics and its Applications, New Directions Short Course, 6/03
- NIMS, Daejon, Winter PDE School (5 lectures on PDE in Biology) 1/17

Over 300 invited seminars and colloquia

Organizer:

Field Workshop on Mathematical Biology, Canyonlands, Utah, June 1981

Field Workshop on Mathematical Biology II, Canyonlands, Utah, June 1983

Gordon Research Conference on Theoretical Biology, Tilton, NH, June 1990.

Park City Mathematics Institute Summer School, June 2005.

Mathematical Biosciences Institute, The Interplay of Stochastic and Deterministic Dynamics in Networks, Feb. 2015.

Other Professional Activities:

SIAM Council, 1990-1995

Council, Society for Mathematical Biology, 1991-1996, 2002-2005

Board of Governors (Chairman 2000), Institute for Mathematics and its Applications, University of Minnesota, 1998-2000

Board of Governors (Chairman 2006-2007), Mathematical Biosciences Institute, Ohio State University, 2003-2007, Board of Trustees, 2011-2017 (Chairman, 2014-2016)

Professional memberships:

SIAM, Society for Mathematical Biology, Biophysical Society

Active Collaborations:

Owen Lewis - University of New Mexico

Steve Poelzing - Virginia Tech

Xueying Wang - Washington State University

Kelly Hughes - University of Utah

Marc Erhardt - Helmholtz Centre for Infection Research, Braunschweig

Markus Babst - University of Utah

Bruce Edgar - University of Utah

Publications:

Books:

1. J. P. Keener, Principles of Applied Mathematics; Transformation and Approximation, 2nd edition, Perseus Books, 1999.

2. J. P. Keener and J. Sneyd, Mathematical Physiology, 2nd Edition, Springer, 2008.

3. J. P. Keener, Biology in Time *and* Space: A Partial Differential Equation Modeling Approach, AMS, 2021.

Journal Articles:

1. J. P. Keener and H. B. Keller, Perturbed Bifurcation and Buckling of Circular Plates, Conference on Ordinary and Partial Differential Equations, University of Dundee, Lecture Notes in Mathematics, #280, Springer, 286-293 (1972).

2. J. P. Keener and H. B. Keller, Perturbed Bifurcation Theory, Arch. Rat. Mech. Anal., Vol. 50, #3, 159-175 (1973).

3. A. D. Randolph, G. L. Beer, and J. P. Keener, Stability of the Class II Classified Product Crystallizer with Fines Removal, AIChE. Journal, Vol. 19, #6, 1140-1149 (1973).

4. J. P. Keener and H. B. Keller, Positive Solutions of Convex Nonlinear Eigenvalue Problems, J. Diff. Eqns., Vol. 16, #1, 103-125 (1973).

5. J. P. Keener, Imperfection Sensitivity of Buckling for Columns and Spherical Caps, Quart. Appl. Math., 173-188 (1974).

6. J. P. Keener, Perturbed Bifurcation Theory at Multiple Eigenvalues, Arch. Rat. Mech. Anal., Vol. 56, #4, 348-366 (1974).

7. D. S. Cohen and J. P. Keener, Oscillatory Processes in the Theory of Particulate Formation in Super-saturated Chemical Solutions, SIAM J. Appl. Math., Vol. 28, #2, 307-318 (1975).

8. J. P. Keener and D. S. Cohen, Nonlinear Oscillations in a Reactor with Two Temperature Coefficients, Nuclear Sci. Eng., Vol. 56, 354-359 (1975).

9. D. S. Cohen and J. P. Keener, Multiplicity and Stability of Oscillatory States in a Continuous Stirred Tank Reactor with Exothermic Consecutive Reactions A . B. C, Chem. Eng. Sci., Vol. 31, 115-122 (1976).

10. J. P. Keener, Secondary Bifurcation in Nonlinear Diffusion-Reaction Equations, Stud. Appl. Math., **55**,187-211 (1976).

11. J. P. Keener, On the validity of the two-timing method for long times, SIAM J. Math. Anal., Vol. 8, No. 6 (1977).

12. J. P. Keener and D. W. McLaughlin, Solitons under perturbation, Phys. Rev. A, Vol. 6, No. 2 777-790 (1977).

13. J. P. Keener and D. W. McLaughlin, A Green's Function for a Linear Equation Associated with Solitons, J. Math. Phys., 16, 2008-2013 (1977).

14. J. P. Keener, Activators and Inhibitors in Pattern Formation, Stud. Appl. Math., **59**, 1-23 (1978).

15. J. P. Keener, Long Range Predation in Pattern Formation, Rocky Mtn. J. Math., **9**, 1, 99-114 (1979).

16. J. P. Keener, Secondary Bifurcation and Multiple Eigenvalues, SIAM J. Appl. Math., **37**, 330- 349 (1979).

17. J. P. Keener, Chaotic Behavior in Piecewise Continuous Difference Equations, AMS Transactions, **261**, 589-604 (1980).

18. J. P. Keener, Waves in Excitable Media, SIAM J. Appl. Math., **39**, 3, 528-548 (1980).

19. J. P. Keener, Chaotic Cardiac Dynamics, Mathematical Aspects of Physiology, Lectures in Applied Mathematics, **19**, 299-325 (1981).

20. J. P. Keener, F. C. Hoppensteadt, J. Rinzel, Integrate and Fire Models of Nerve Membrane Response to Oscillatory Input , SIAM J. Appl. Math., **41**, 503-517 (1981).

21. J. P. Keener, Infinite Period Bifurcation and Global Bifurcation Branches, SIAM J. Appl. Math., **41**, 127-144 (1981).

22. J. P. Keener, On Cardiac Arrhythmias: AV Conduction Block, J. Math. Biol., **12**, 215-225 (1981).

23. J. P. Keener, Infinite Period Bifurcation in Simple Chemical Reactors, in Modelling of Chemical Reaction Systems, Chemical Physics **18**, Springer ed., K. H. Ebert, P. Dueflhard, and W. Jager, 1981.

24. F. C. Hoppensteadt and J. P. Keener, Phase Locking of Biological Clocks, J. Math. Biol., **15**, 339-349(1982).

25. J. P. Keener, Chaotic Behavior in Slowly Varying Systems of Nonlinear Differential Equations, Stud. Appl. Math., **67**, 25-44 (1983).

26. K. Beck, J. P. Keener and P. Ricciardi, Influence of Infectious Disease on the Growth of a Population with Three Genotypes, Lecture Notes in Biomathematics,**52**, Springer, 1983.

27. J. P. Keener, Diffusion Induced Chaos, Contemporary Mathematics,**17**, 293-391 (1983).

28. J. P. Keener, Oscillatory Coexistence in the Chemostat: A Codimension Two Unfolding, SIAM J. Appl. Math., **43**, 5, 1005-1018 (1983).

29. J. P. Keener and J. Rinzel, Hopf Bifurcation to Repetitive Activity in Nerve, SIAM J. Appl. Math. **43**, 907-922 (1983).

30. J. P. Keener, Analogue Circuitry for the van der Pol and Fitzhugh Nagumo Equations, IEEE Trans. on Systems, Man, Cybernetics, **13**, 5, 1010-1014 (1983).

31. K. Beck, J. P. Keener, and P. Ricciardi, The Effect of Epidemics on Genetic Evolution, J. Math. Biol., **19**, 63-77 (1984).

32. J. P. Keener, Dynamic Patterns in Excitable Media, Lecture Notes in Biomathematics, **55**, 157-169, Springer Verlag, Berlin, 1984.

33. J. P. Keener and L. Glass, Global bifurcations of a periodically forced nonlinear oscillator, J. Math. Biol., **21**, 123-136 (1984).

34. J. P. Keener, Oscillatory Coexistence in a Food Chain Model with Competing Predators, J. Math. Biol. **22**, 123-136 (1985).

35. F. T. Krogh, J. P. Keener, and W. H. Enright, Reducing the Number of Variational Equations in the Implementation of Multiple Shooting, Progress in Scientific Computing, Vol. 5, Birkhauser Boston, (1985).

36. J. P. Keener, Spiral Waves in Excitable Media, Lecture Notes in Biomathematics,**66**, Springer, 115-127, (1986).

37. J. P. Keener and J. J. Tyson, Spiral Waves in the Belousov-Zhabotinskii Reaction, Physica D, **21**, 307-324 (1986).

38. J. P. Keener, A Sarkovskii Ordering for Stable Periodic Orbits of Maps of the Interval, SIAM J. Num. Anal., **23**, 976-985 (1986).

39. J. P. Keener, A Geometrical Theory for Spiral Waves in Excitable Media, SIAM J. Appl. Math., **46**, 1039-1056 (1986).

40. J. P. Keener, Propagation and its Failure in the Discrete Nagumo Equation, in Ordinary and Partial Differential Equations, eds. B. D. Sleeman and R. J. Jarvis, Pitman Research Notes in Mathematics Series, **157**, 95-112, Longman, New York, 1987.

41. W. C. Troy, E. A. Overman, G. B. Ermentrout and J. P. Keener, Uniqueness of a flow of a second order fluid past a stretching sheet, Quart. J. Appl. Math. **44**, 753-755 (1987).

42. J. P. Keener, Propagation and its Failure in Discrete Systems of Coupled Excitable Cells, SIAM J. Appl. Math. **47**, 556-572 (1987).

43. J. P. Keener, Causes of Propagation Failure in Excitable Media, Temporal Disorder in Human Oscillatory Systems, eds. L. Rensing, U. an der Heiden, M. C. Mackey, Springer Verlag, Berlin, 1987.

44. J. J. Tyson and J. P. Keener, Spiral Waves in a Model of Myocardium, Physica D **29**, 215- 222 (1987).

45. J. P. Keener and J. J. Tyson, The Motion of Untwisted Untorted Scroll Waves in Belousov-Zhabotinsky Reagent, Science **239**, 1284-1286 (1988).

46. J. P. Keener, On the Formation of Circulating Patterns of Excitation in Anisotropic Excitable Media, J. Math. Biology, **26**, 41-57 (1988).

47. J. D. Dockery, J. P. Keener, and J.J. Tyson, Dispersion in the Belousov-Zhabotinskii Reaction, Physica D **30**, 177-191 (1988).

48. J. P. Keener, The Dynamics of Three Dimensional Scroll Waves in Excitable Media, Physica D **31**, 269-276 (1988)

49. J. P. Keener, A Mathematical Model for the Vulnerable Phase in Myocardium, Math. Biosci. **90**, 3- 18, (1988).

50. J. P. Keener, Frequency Dependent Decoupling of Parallel Excitable Fibers, SIAM J. Appl. Math., **49**, 210-230, (1989).

51. J. J. Tyson and J. P. Keener, Singular Perturbation Theory of Spiral Waves in Excitable Media, Physica D **32**, 327-361 (1989).

52. J. D. Dockery and J. P. Keener, Diffusive Effects on Dispersion in Excitable Media, SIAM J. Appl. Math., **49**, 539-566, (1989).

53. J. P. Keener, Knotted Scroll Wave Filaments in Excitable Media, Physica D **34**, 378-390, (1989).

54. J. P. Keener and F. M. Phelps IV, Consequences of the Cellular, Anisotropic Structure of Myocardium, in Some Mathematical Questions in Biology, The Dynamics of Excitable Media, Lectures on Mathematics in the Life Sciences, Volume 21, ed H. Othmer, AMS, Providence, 1989.

55. J. P. Keener, A Mathematical Model for the Initiation of Ventricular Tachycardia in Myocardium, in Cell-to-Cell Signalling: From Experiments to Theoretical Models, 589-608, ed. A. Goldbeter, Academic Press, 1989.

56. J. P. Keener, Knotted vortex filaments in an ideal fluid, J. Fluid Mech. **211**, 629-651 (1990).

57. J. P. Keener, The effects of gap junctions on propagation in myocardium; A modified cable theory, in Mathematical Approaches to Cardiac Arrhythmias, Annals of the New York Academy of Sciences, volume 591, ed. J. Jalife, New York, 257-277, 1990.

58. J. P. Keener, Wave propagation in myocardium, in Theory of Heart, ed. L. Glass, P. Hunter, A. McCullock, Springer-Verlag, pp. 405-436.

59. J. P. Keener and J. J. Tyson, Helical and circular scroll wave filaments, Physica D, **44**, 191- 202 (1990).

60. J. P. Keener, The effects of discrete gap junction coupling on propagation in myocardium, J. Theor. Biol., **148**, 49-82 (1991).

61. J. P. Keener, An eikonal-curvature equation for action potential propagation in myocardium, J. Math. Biol., **29**, 629-651 (1991).

62. J. P. Keener and J. J. Tyson, The dynamics of helical scroll waves in excitable media, Physica D, **53**, 151-161 (1991).

63. J. P. Keener and J. J. Tyson, The Dynamics of Scroll Waves in Excitable Media, SIAM Rev., **34**, 1-39 (1992).

64. J. P. Keener, The core of the spiral, SIAM J. Appl. Math., **52**, 1372-1390 (1992).

65. J. P. Keener, Uses and Abuses of numerical analysis in cardiology, in The Dynamics of Numerics and the Numerics of Dynamics, ed. D.S. Broomhead and A. Iserles, Claredon Press, Oxford, 195-213, 1992.

66. J. P. Keener, The Perron-Frobenius Theorem and the ranking of football teams, SIAM Rev., 35, 80-93, (1993).

67. A. V. Panfilov and J. P. Keener, Twisted scroll waves in heterogeneous excitable media, Int. J. Bifurcation and Chaos, 3, 445-450 (1993).

68. M. Courtemanche, L. Glass and J. P. Keener, Instabilities of a propagating pulse in a ring of excitable media, Phys. Rev. Letts., 70, 2182-2185 (1993).

69. A.V.Panfilov and J.P. Keener, Modeling reentry in a finite element model of the heart, J.Physiol. 467, 152P (1993).

70. A. V. Panfilov and J. P. Keener, Generation of reentry in anisotropic myocardium, J. Card. Electrophys. 4, 412-421 (1993).

71. A. V. Panfilov and J. P. Keener, Effects of high frequency stimulation on cardiac tissue with an inexcitable obstacle, J. Theor. Biol. 163, 439-448 (1993).

72. J. P. Keener, Symmetric Spirals in Media with Relaxation Kinetics and Two Diffusing species, Physica D 70, 61-73 (1994).

73. K. Agladze, J. P. Keener, S. C. Müller, and A. V. Panfilov, Rotating spiral waves created by geometry, Science 264, 1746-1748 (1994).

74. J. J. Tyson and J. P. Keener, A theory of rotating scroll waves in excitable media, in *Chemical Waves* (R. Kapral and K. Showalter, eds.) 93-118, Kluwer, Dordrecht, 1994.

75. J. P. Keener and A. V. Panfilov, Three dimensional propagation in the heart: The effects of geometry and fiber orientation on propagation in myocardium, in Cardiac Electrophysiology, eds. D. P. Zipes and J. Jalife, W. B. Saunders Company, 335-348, 1995.

76. A. V. Panfilov and J. P. Keener, Dynamics of dissipative structures in excitable media, SIAM J. Appl. Math. 55, 205-219 (1995).

77. A. V. Panfilov and J. P. Keener, Re-entry in an anatomical model of the heart, Chaos, Solitons, and Fractals, 5, 681-689 (1995).

78. A.V. Panfilov and J. P. Keener, Reentry in 3-Dimensional FitzHugh-Nagumo medium with rotational anisotropy, Physica D 84, 545-552 (1995).

79. J. P. Keener, Direct activation and defibrillation of cardiac tissue, J. Theor. Biol., 178, 313-324 (1996).

80. M. Courtemanche, J. P. Keener, and L. Glass, A delay equation representation of pulse circulation on a ring in excitable media, SIAM J. Appl. Math., 56, 119-142, (1996).

81. J. P. Keener and A. V. Panfilov, A biophysical model for defibrillation of cardiac tissue, Biophys J. 71, 1335-1345 (1996).

82. J. P. Keener and A. V. Panfilov, The effects of geometry and fiber orientation on propagation and extracellular potentials in myocardium, in Computational Biology of the Heart, eds. A. V. Holden and A. V. Panfilov, Wiley, 1997.

83. J. P. Keener, The effect of gap junctional distribution on defibrillation, Chaos, 8, 175-187 (1998).

84. J. P. Keener and K. Bogar, A numerical method for the solution of the bidomain equations in cardiac tissue, Chaos, 8, 234-241 (1998).

85. J. P. Keener and T. J. Lewis, The biphasic mystery: Why a biphasic shock is more effective than a monophasic shock for defibrillation, J. Theor. Biol., 200, 1-17 (1999).

86. J. P. Keener, Homogenization and propagation in the bistable equation, Physica D 136, 1-17 (2000).

87. A. V. Panfilov, S. C. Müller, V. S. Zykov and J. P. Keener, Defibrillation of cardiac tissue by multiple subthreshold shocks, Phys. Rev. E, 61, 4644-4647 (2000).

88. J. P. Keener, Propagation of Waves in an Excitable Medium with Discrete Release Sites, SIAM J. Appl. Math. 61, 317-334 (2000).

89. T. J. Lewis and J. P. Keener, Wave-Blocking in excitable media due to regions of depressed excitability, SIAM J. Appl. Math., 61, 293-316 (2000).

90. J. D. Dockery and J. P. Keener, A Mathematical model for quorum sensing in *Pseudomonas Aeruginosa*, Bull. Math. Biol. 63, 95-116 (2001).

91. A. Fogelson and J. P. Keener, Immersed interface methods for Neumann and related problems in two and three dimensions, Siam J. for Scientific Computing, 22, 1630-1654 (2001).

92. J. P. Keener, Diffusion Induced Oscillatory Insulin Secretion, Bull. Math. Biol, 63, 625-641 (2001).

93. R. D. Vaughan-Jones, B. E. Peercy, J. P. Keener, and K. W. Spitzer, Intrinsic H^+ ion mobility in the mammalian ventricular myocyte, J. Physiology, 541.1, 139-158 (2002).

94. K. W. Spitzer, R. L. Skolnick, B. Peercy, J. Keener, and R. D. Vaughan-Jones, Facilitation of intracellular H^+ ion mobility by CO_2/HCO_3^- in ventricular myocytes is regulated by carbonic anhydrase, J. Physiology, 541.1, 159-167 (2002).

95. J. P. Keener, Arrhythmias by Dimension, in An Introduction to Mathematical Modeling in Physiology, Cell Biology, and Immunology, Proc. Symp. Applied Math., AMS, 59, ed. J. Sneyd, 2002.

96. E. Cytrynbaum and J. P. Keener, Stability conditions for the Traveling Pulse - Modifying the restitution hypothesis, Chaos, 12, 788-799 (2002).

97. J. P. Keener and E. Cytrynbaum, The Effect of Spatial Scale of Resistive Inhomogeneity on Defibrillation of Cardiac Tissue, J. Theoretical Biology 223, 233 - 248 (2003).

98. C. S. Yi, A. Fogelson, J. P. Keener and C. Peskin, A Mathematical Study of Volume Shifts and Ionic Concentration Changes during Ischemia and Hypoxia, J. Theor. Biol. 220:83-106 (2003).

99. J. P. Keener, A Model for the Onset of Fibrillation following a Coronary Occlusion, J. Cardiovasc. Electrophys. 14, 1225-1232 (2003).

100. M. Dumett and J. P. Keener, A Numerical Method for Solving Anisotropic Elliptic Boundary Value Problems in 3D, SIAM J. Sci. Comp. 25, 348-367, (2003).

101. J. P. Keener, The topology of defibrillation, J. Theor. Biol. 230, 459-473 (2004).

102. N. Cogan and J. P. Keener, The role of the biofilm matrix in structural development, Mathematical Medicine and Biology, 21, 147-166 (2004).

103. M. Dumett and J. P. Keener, An immersed interface method for Anisotropic Elliptic Problems on Irregular Domains in 2D, Num. Methods Partial Differential Eqs. 21:397-420, 2005.

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