

ROGER D. KAMM
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Curriculum Vitae

BRIEF NARRATIVE

A primary objective of Kamm's research has been the application of fundamentals in fluid and solid mechanics to better understand essential biological and physiological phenomena. Studies over the past thirty years have addressed issues in the respiratory, ocular and cardiovascular systems. More recently, his attention has focused on new areas, the molecular mechanisms of cellular force sensation, cell population dynamics, and the development of new microfluidic platforms for the study of cell-cell and cell-matrix interactions. Kamm has been a leader in bringing the fields of mechanics together with biology and chemistry; by exploring the ways in which single molecules transmit force through macromolecular networks and the resulting change in molecular binding or enzymatic activity; and by developing new cell culture methods that enable simultaneous of multiple cell types communicating in a realistic microenvironment. This cumulative work has led to over 200 refereed publications. Recognition for his contributions is reflected in Kamm's election as Fellow to AIMBE, ASME, BMES, AAAS and the IFMBE. He is also the 2010 recipient of the ASME Lissner Medal for lifetime achievements and was recently elected to the Institute of Medicine.

PROFESSIONAL EXPERIENCE:

1977	:	Instructor, M.I.T.
1977-1978	:	Lecturer and Research Associate in the Department of Mech. Engineering, M.I.T.
1978-1981	:	Assistant Professor of Mechanical Engineering, M.I.T.
1986-1987	:	Senior Visiting Scientist, University of Cambridge, Department of Applied Mathematics and Theoretical Physics. Visiting Fellow, Clare Hall, University of Cambridge.
1981-1988	:	Associate Professor of Mechanical Engineering, M.I.T.
1988-	:	Professor of Health Sciences and Technology, M.I.T. and Harvard University
1988-	:	Professor of Mechanical Engineering, M.I.T.
1992-1994	:	Co-Director: Program in Biomedical Engineering, M.I.T.
1994-	:	Associate Director, Center for Biomedical Engineering, M.I.T.
1995-	:	Lecturer on Medicine, Harvard Medical School
1998-2005	:	Professor of Mechanical Engineering and Bioengineering, M.I.T.
2005-2010	:	Germeshausen Professor of Mechanical and Biological Engineering, M.I.T.
2005-2008	:	Associate Head, Department of Mechanical Engineering, M.I.T.
2008- 2010:	:	Director, GEM4 Center@MIT
2010- 2011:	:	Singapore Research Professor of Biological and Mechanical Engineering, M.I.T.
2011-	:	Cecil and Ida Green Distinguished Professor of Biological and Mechanical Engineering, M.I.T.
2010-	:	Director, NSF Science and Technology Center on Emergent Behaviors of Integrated Cellular Systems

EDUCATION:

NORTHWESTERN UNIVERSITY, Evanston, Illinois
B.S. in Mechanical Engineering, June 1972
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA
S.M. in Mechanical Engineering, August 1973
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA
Ph.D. in Mechanical Engineering, May 1977

HONORS and AWARDS:

Graduate Student Council Teaching Award (1983)
American Inst. of Medical and Biological Engineering (Founding Fellow) (1993)
Class of 1960 Award (for development of the Undergraduate Minor in Biomedical Engineering) (1999)
Everett Moore Baker Memorial Award for Excellence in Undergraduate Teaching (2001)
Cambridge/MIT Fellow (2001)

Eschbach Distinguished Visiting Scholar Award, Northwestern University (2002)
 Fellow, American Society of Mechanical Engineering (2003)
 Distinguished Lecturer in Biomechanics, Stanford University, (2004)
 Fellow, Biomedical Engineering Society (2004)
 Fellow, International Academy of Medical and Biological Engineering (2005)
 Skalak Memorial Lecture, UC San Diego, (2007)
 Midwest Mechanics Lecturer (2007-8)
 Lissner Medal (for lifetime achievement), ASME Bioengineering Division (2010)
 Fellow, American Academy for the Advancement of Science (2010)
 Elected to the Institute of Medicine (2010)

PROFESSIONAL SOCIETIES:

American Institute for Medical and Biological Engineering (Founding Fellow)
 American Society for the Advancement of Science (Fellow)
 American Society of Mechanical Engineering (Fellow)
 Biomedical Engineering Society (Fellow)
 Biophysical Society
 International Federation for Medical and Biological Engineering (Fellow)

SELECTED OTHER PROFESSIONAL ACTIVITIES:

Biomedical Engineering Society; Chair, Awards Committee (1989-91)
 Board of Directors (1994-1997) (2003-2007)
 Publications Board, Member (2000-2006)
 Chair (2004-2006)
ASME Journal of Biomechanical Engrg., Associate Editor (1990-1996)
 NHLBI, NIEHS, NASA, NSF; Review Committees (1988-present)
Journal of Fluids and Structures, Associate Editor (1993-2005)
Methods in Cell Science, Editorial Board (1995-present)
 US National Committee on Biomechanics; (1997-present)
 Secretary (2000-2003)
 Vice chair (2003-2006)
 Chair (2006-2009)
 World Council on Biomechanics (1998-present);
 Vice chair (2002-2006)
 Chair (2006-2010)
 External Review Board, City University of New York, Biomedical Engineering Doctoral Program (1999)
 External Advisory Board, Northwestern University, Dept. of Biomedical Engineering (2000-2006)
Summer Bioengineering Conference, Conference Chair, 2001
Biomechanics and Modeling in Mechanobiology, Editorial Board, (2001-present)
 External Review Board, Pennsylvania State University, Dept. of Biomedical Engineering (2003)
 External Review Board, Duke University, Dept. of Biomedical Engineering (2003)
1st Annual Symposium on Frontiers in Biomechanics, Co-organizer, (2003)
Mechanics & Chemistry of Biosystems, Editorial Board (2003-present)
 Hypertension & Microcirculation Study Section, NIH (2004-2008)
 Expert Panel, *Strategy for the EuroPhysiome (STEP) project* (2006-)
 External Advisory Board, *Simbios Center*, Stanford University (2006-)
 Chair (2008)
 Co-organizer, *Summer Course on Molecular and Cell Biomechanics*, MIT (2006)
 Co-organizer, *Summit of Experts in Biomechanics*, Keystone, CO (2007)
 Advisory Board, Indian Institute of Technology, Kampur, (2007-)
 External Review Committee, UC Berkeley Bioengineering Dept., (2007)
 Editorial Advisory Board, *Cellular and Molecular Bioengineering* (2007-)
 Scientific Advisory Board, *Network of Excellence* (2007-)
 Director, Global Enterprise for MicroMechanics and Molecular Medicine (2007-)
 Co-organizer, *The Cell as a Machine Workshop*, Arlington, VA (2007)

External Advisory Committee, Chilean Nanotechnology Initiative (2008)
 Organizing Committee, 5th International Biofluids Symposium (2007)
 Editorial Board, *Journal of Multiscale Modeling* (2007-)
 Community Giving at MIT Campaign Committee (Chair, 2007-2009)
 Scientific Advisory Board, Virtual Physiologic Human, Center of Excellence (2007-)
 Scientific Advisory Board, CIBER BBN, Spain (2008-)
 Scientific Advisory Board, Global Center of Excellence in Nano-Bioengineering, Sendai, Japan (2006-2012)

INVITED LECTURES (since 2008)

The Midwest Mechanics Lecture Series, U. Michigan, Michigan State U., U. Iowa, U. Wisconsin, U. Minnesota, Northwestern U., IIT, Purdue U., Notre Dame U., *Sub-cellular mechanics and its influence on biological function*, December, 2007 - January, 2008.
 Plenary Lecture, Keio University 150th Anniversary, *Microfluidic platforms for studies of angiogenesis, cell migration, and cell-cell interactions*, Tokyo, Japan, March, 2008.
 Tohoku University, *Cellular force transmission and mechanotransduction*, Sendai, Japan, March, 2008.
 Northeastern University, *Cellular force transmission and mechanotransduction*, April, 2008.
 Plenary Lecture, 5th Biofluids Symposium, *Microfluidic platforms for studies of angiogenesis, cell migration, and cell-cell interactions*, Caltech, March, 2008.
 University of Santiago, *Cellular force transmission and mechanotransduction*, Santiago, Chile, April, 2008.
 Chilean Workshop on Nanotechnology, *Micro- and Nano-Medicine*, April, 2008.
 Plenary Lecture, ASME DSCC Workshop on BioSystems and Control, *On the application of system dynamics and control in biology: Real-time control of growth / Biological machines*, October 19, 2008
 University of Zaragoza, Bioengineering Seminar, *Regulating capillary morphogenesis in a microfluidic system. Zaragoza, Spain, September 25, 2008*
 Bioengineering 08 Keynote Lecture. *Regulating capillary morphogenesis in a microfluidic system*. Imperial College, London, UK, September 18, 2008
 UNCC, Biology Colloquium, *Regulating capillary morphogenesis in a microfluidic system*. October 17, 2008
 University of Zaragoza, *Structural cross-links in the cytoskeleton: Experiments and theory*. Zaragoza, Spain, February, 2009.
 Invited lecture, Department of Bioengineering, University of Texas, 'Regulating Capillary Morphogenesis in a Microfluidic System', Austin, TX, November, 2008.
 Plenary Lecture, Global COE Symposium, *New horizons in biomechanics: Thinking small*. Sendai, Japan, March, 2009.
 Invited lecture, Department of Bioengineering, University of Houston 'Regulating Capillary Morphogenesis in a Microfluidic System', Houston, TX, April, 2009.
 Plenary Lecture, Suddath Symposium, *New horizons in biomechanics: Thinking small*. Atlanta, GA, April, 2009.
 Invited lecture, *A Brownian dynamics model for cross-linked actin gels under high prestrain*. ICMAT, Singapore, June, 2009.
 IMAG Webinar, *A computational model for cytoskeletal mechanics – Comparisons with cell and gel experiments*. July, 2009.
 Plenary Lecture, PhysCell2009, *Numerical simulations of cytoskeletal rheology*. Stilbe, Croatia, September, 2009.
 Plenary lecture, International Conference on Computational Biology 2009 'Regulating Capillary Morphogenesis in a Microfluidic System', R.D. Kamm, Bertinoro, Italy, November, 2009.
 Invited lecture, *Regulating Capillary Morphogenesis in a Microfluidic System*. Lausanne, EPFL, May 2009.
 Invited lecture, Department of Bioengineering, Politecnico di Milano 'Regulating Capillary Morphogenesis in a Microfluidic System'. Milan, Italy, May, 2009.
 Invited lecture, Harvard University, Squishy Physics Seminar, *Numerical simulations of cytoskeletal rheology*, Cambridge, MA, November, 2009
 Invited lecture, Johnson & Johnson Executive Group, *Microfluidic cell culture systems for drug screening or clinical assays*, Cambridge, MA, December, 2009.
 Invited lecture, National University of Singapore, *Using a microfluidic assay to mimic different stages of metastatic cancer*, Singapore, January 2010.
 Invited lecture, University of Connecticut, *Microfluidics for cell culture: Studies of cell populations and cell-cell interactions*, Hartford, CT, February 2010.
 Invited lecture, Northeastern University, *Microfluidics for cell culture: Studies of cell populations and cell-cell interactions*, Boston, MA, March 2010.

- Invited lecture, Brown University, *Microfluidics for cell culture: Studies of cell populations and cell-cell interactions*, Providence, RI, March 2010.
- Invited lecture, University of Toronto, *Microfluidics for cell culture: Studies of cell populations and cell-cell interactions*, Toronto, Canada, May 2010.
- Invited lecture, *Microfluidics for cell culture: Studies of cell populations and cell-cell interactions*, San Sebastian, Spain, May 2010.
- Keynote Lecture, *Bridges to a New Biomechanics*, Lissner Award Lecture, Naples, FL, June 2010.
- Plenary Lecture, *Microfluidic platforms for studies of angiogenesis, cell migration, and cell-cell interactions*, 1st Keio / Korea International Symposium on Microfluidics and Tissue Engineering, Yokohama, Japan, July 2010.
- Invited lecture, *Integrated cellular systems: An integrated approach to the design of biological machines*, World Congress of BioMechanics, Singapore, August 2010
- Invited lecture, *Integrated cellular systems: An engineering approach to constructing multi-cellular systems*, BMES, Austin, TX, Oct. 2010
- Invited lecture, *A multiscale model of cytoskeletal mechanics*, Materials Research Society Fall Meeting, Boston, Nov., 2010
- Invited lecture, *Microfluidics for heterotypic cell culture: Application in angiogenesis and oncology*, Mahidol University, Bangkok, Thailand, Jan., 2011
- Invited lecture, *Microfluidics for heterotypic cell culture: Application in angiogenesis and oncology*, MBI/BioSyM Workshop, Singapore, Jan., 2011
- Invited lecture, *Hemodynamics of venous disease*, Venous Forum, San Diego, CA, Feb., 2011.
- Invited lecture, *Computational insights into cytoskeletal rheology*, Biophysical Society Meeting, Baltimore, MD, March, 2011.
- Invited lecture, *Creating 3D microvascular networks in vitro*, University of Pennsylvania, Feb., 2011.
- Invited lecture, *Creating 3D microvascular networks in vitro*, University of Michigan, March, 2011.
- Plenary lecture, *Controlling angiogenesis and forming microvascular networks in vitro*, Stem Cell and Regenerative Medicine Conference, March, 2011.
- Invited lecture, *The role for mechanotransduction in interstitial flow*, Clemson University, April, 2011.
- Invited lecture, *Computational models of the cytoskeleton and a look forward to simulation of mechanotransduction*, Microscale Modeling in Biomechanics and Mechanobiology, Ericeira, Portugal, May, 2011.
- Plenary lecture, *The Future for biological machines*, Frontiers in Biomechanics: Developmental Biology, Farmington, PA, June, 2011.
- Plenary lecture, *Microfluidic Assays as Models for Metastatic Cancers*, Seoul, Korea, July 2011
- Plenary lecture, *A Computational, Brownian Dynamics Simulation of Cytoskeletal Mechanics*, The 1st KIAS Conference on Subcellular Dynamics, Seoul, Korea, July 2011
- Plenary lecture, *Microfluidic technologies for cell population studies: Examples from cancer biology*, Emerging Paradigms in Physical Biology, NCSB, Bangalore, India, August, 2011
- Invited lecture, *The unique biomechanical properties of the cell: Insights from computational modeling*, Nanyang Technological University, October, 2011
- Invited lecture, BMES, Hartford, CN, October, 2011
- Invited lecture, *Multi-Cell Interactions in Metastatic Cancer*, MechanoBiology Institute, Singapore, November, 2011
- Invited lecture, *Creating 3D microvascular networks in vitro*, National University of Singapore, November, 2011
- Plenary lecture, *Heterotypic and Homotypic Cell Culture in Microfluidic Systems: Examples from Cancer Biology*, 5th East Asian Pacific Student Workshop on Nano-Biomedical Engineering, December, 2011
- Keynote lecture, *Biomechanical properties of the cell: Insights from computational modeling*, Society of Physical Regulation and Biomolecular Modeling, San Juan, Puerto Rico, January, 2012

PATENTS

- United States Patent 4,446,747 Kamm May 8, 1984
Method and apparatus for testing lip pressure applied to a smoking article and for calibrating the pressure testing apparatus
- United States Patent 5,954,745 Gertler and Kamm, September 21, 1999
Catheter-filter set having a compliant seal
 (patent rights to Embolic Protection, Inc., subsequently purchased by Boston Scientific)

United States Patent 6,117,087 Kamm, et al. September 12, 2000
Method and apparatus for noninvasive assessment of a subject's cardiovascular system
 United States Patent 6,605,053 Kamm, et al. August 12, 2003
Conduit designs and related methods for optimal flow control
 PCT Application, Kamm et al., Filed Oct 8, 2010
Three-dimensional microfluidic platforms and methods of use thereof
 Provisional patent application, Borenstein et al., October 6, 2009.
Improvements to three-dimensional microfluidic platforms and methods of use thereof
 Provisional Application No.: 61/394,624 Filed October 19, 2010
Device for High Throughput Investigations of Multi-Cellular Interactions

COMPANIES FOUNDED

2000 Cardiovascular Technologies (with Dr. Jonathan Gertler) Developing vascular filtration systems for carotid angioplasty. Technology ultimately purchased by Boston Scientific

2012 AIM Biotech (with Dr. Seok Chung) Developing microfluidic systems for heterotypic, 3D cell culture and drug screening for metastatic cancers

RECENT RESEARCH SUPPORT

<u>Agency</u>	<u>Grant Title</u>	<u>Period Covered</u>
NIH/NIGMS	<i>Multi-scale Models of the Cytoskeleton (PI)</i>	9/1/05 - 8/31/08
Private Foundation	<i>Molecular Controls for Differentiation of Corticospinal Motor Neurons from Neural Precursors (PI)</i>	11/1/06 – 10/31/08
NIH/NIBIB	<i>Peptide Scaffolds for Tissue Engineering (co-PI)</i>	8/1/05 – 7/31/10
NIH/NIBIB	<i>Molecular, Cell and Tissue Biomechanics Training Grant (PI)</i>	7/1/06 - 6/31/10
NSF	<i>EFRI-CBE: A Multifaceted Approach to the Modeling of Angiogenesis (PI)</i>	1/1/08 – 12/31/11
Singapore/MIT Alliance for Research & Tech	<i>Microfluidic Nanomechanic Analytic Biosystems (PI)</i>	10/1/08 – 9/30/13
NIH/NCI	<i>Microfluidic 3D Assay for Cancer Cell Migration and Intravasation</i>	9/1/09 – 8/31/12
NSF	<i>Science and Technology Center for Emergent Behavior of Integrated Cellular Systems (PI)</i>	8/1/10 – 7/31/15
DARPA	<i>Algorithms to Limit Viral Epidemics (ALiVE) Program</i>	9/1/11 – 8/31/16
Draper UR&D	<i>Applications of the developed technology for bacterial/epithelial interactions</i>	7/1/11 – 6/30/12
Johnson & Johnson	<i>Autocrine and Paracrine Signaling During Metastatic Progression</i>	3/1/11 – 2/28/13

RESEARCH INTERESTS

Microfluidic systems for homeotypic or heterotypic cell culture

Developing new methods to study emergent behavior of cell populations

Studies of stem cell differentiation, axon guidance and metastatic disease in novel microfluidic platforms.

Cell mechanics, molecular mechanics, and mechanotransduction

Cytoskeletal mechanics and computational modeling of cell deformations and force transmission through the cell.

Measurements of intracellular strain fields due to forces applied by adherent beads.

Transduction of mechanical signals by protein conformational changes using both experimental and computational approaches.

Cardiovascular tissue engineering

Using the methods of microfluidics and the concepts of combined biophysical control and biochemical control of cell function to develop microvascular beds in vitro.

Application of these technologies to the development of “organ mimics” for drug testing and toxicity screening.

Neurological diseases

Design of microfabricated systems for the control of neural stem cell differentiation.

Studies of migration and axonal growth in three-dimensional matrices using computational models and microfluidic platforms

PAPERS IN REFEREED JOURNALS

1. Dewey, C.F., Kamm, R.D., and Hackett, C.D. An acoustic amplifier for the detection of atmospheric pollutants. *Appl. Phys. Lett.* 23(11):633-635, 1973.
2. Kamm, R.D. Detection of weakly absorbing gases using a resonant opto-acoustic method. *J. Appl. Phys.* 47(8): 3550-3558, 1976.
3. Kamm, R.D., and Shapiro, A.H. Unsteady flow in a collapsible tube subjected to external pressure or body forces. *J. Fluid Mech.* 95(1): 1-78, 1979.
4. Thirsk, R.B., Kamm, R.D., and Shapiro, A.H. Changes in venous blood volume produced by external compression of the lower leg. *Medical and Biological Engineering and Computing* 18(5): 650-656, 1980.
5. Slutsky, A.S., Drazen, J.M., Ingram, R.H., Jr., Kamm, R.D., Shapiro, A. H., Fredberg, J.J., Loring, S.H. and Lehr, J. Effective pulmonary ventilation with small-volume oscillations at high frequency. *Science* 209: 609-610, 1980.
6. Kececioglu, I., McClurken, M.E., Kamm, R.D., and Shapiro, A.H., Steady supercritical flow in collapsible tubes. Part I: Experimental observations. *J. Fluid Mech.* 109:367-389, 1981.
7. McClurken, M.E., Kececioglu, I., Kamm, R.D., and Shapiro, A.H. Steady supercritical flow in collapsible tubes. Part II: Theoretical studies. *J. Fluid Mech.* 109: 415, 1981.
8. Lueptow, R.M., Karlen, J.M., Kamm, R.D., and Shapiro, A.H. Circulatory model studies in external cardiac assist by counter-pulsation. *Cardiovascular Research* 15: 443-455, 1981.
9. Rossing, T.H. Slutsky, A.S., Lehr, J.L., Drinker, P.A., Kamm, R.D., and Drazen, J.M. Tidal volume and frequency dependence of CO₂ elimination by high frequency ventilation. *NEJM* 305(23): 1375-1397, 1981.
10. Slutsky, A.S., Kamm, R.D., Rossing, T.H., Loring, S.H., Lehr, J. Shapiro, A.H. Ingram, R.H., Jr., and Drazen, J.M. CO₂ elimination in dogs of high frequency (2-30 Hz), low tidal volume ventilation. Effects of frequency, tidal volume and lung volume. *J. Clin. Invest.* 68: 1475-1484, 1981.
11. Kamm, R.D. Bioengineering studies of periodic external compression as prophylaxis against deep vein thrombosis. Part I: Numerical studies. *J. Biomech. Eng.* 104(2): 87-95, 1982.
12. Olson, D.A., Kamm, R.D., and Shapiro, A.H. Bioengineering studies of periodic external compression as prophylaxis against deep vein thrombosis. Part II: Experimental studies on a simulated leg. *J. Biomech. Engineering*, 102(2): 96-104, 1982.
13. Rossing, T.H., Slutsky, A.S., Ingram, R.H., Jr., Kamm, R.D., Shapiro, A.H., and Drazen, J.M. CO₂ elimination by high frequency oscillations in dogs - effects of histamine infusion. *J. Appl. Physiol.: Respir. Environ. Exercise Physiol.* 53: 1256-1262, 1982.
14. Jan, D.L., Kamm, R.D., and Shapiro, A.H. Filling of partially- collapsed compliant tubes. *J. Biomech. Eng.* 105: 12-19, 1983.
15. Johnson, M.C., and Kamm, R.D. The role of Schlemm's canal in aqueous outflow from the human eye. *Invest. Ophthalmol. Vis. Sci.* 24: 320-325, 1983.

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16. Joshi, C.H., Kamm, R.D., Drazen, J.M., and Slutsky, A.S. An experimental study of gas exchange in laminar oscillatory flow. *J. Fluid Mech.* 133: 245-254, 1983.
 17. Battaglioli, J.L. and Kamm, R.D. Measurements of the compressive properties of scleral tissue. *Invest. Ophthalmol. Vis. Sci.* 25: 59-65, 1984.
 18. Kamm, R.D., Drazen, J.M., and Slutsky, A.S. High frequency ventilation. *Critical Reviews in Biomedical Engineering* 9: 347-379, 1984.
 19. Solway, J., Gavriely, N., Kamm, R.D., Drazen, J.M., Ingram, R.H., Khoo, M.C.K., Brown, R., and Slutsky, A.S. Intra-airway gas mixing during HFV. *J. Appl. Physiol.: Respirat. Environ. Exercise Physiol.* 56: 343-354, 1984.
 20. Drazen, J.M., Kamm, R.D., and Slutsky, A.S. High frequency ventilation. *Physiological Reviews.* 64(2): 505-543, 1984.
 21. Khoo, M.C.K., Slutsky, A.S., Drazen, J.D., Solway, J., Gavriely, N., and Kamm, R.D. Gas mixing during high frequency ventilation: An Improved model. *J. Appl. Physiol.: Respirat. Environ. Exercise Physiol.* 57(3): 493-506, 1984.
 22. Akhavan, R., and Kamm, R.D. Pressure excursions during oscillatory flow in a branching network of tubes. *J. Appl. Physiol.: Respirat. Environ. Exercise Physiol.* 57(3): 665-673, 1984.
 23. Kamm, R.D., Collins, J., Whang, J., Slutsky, A.S., and Greiner, M. Gas transport in a network of branching tubes. *J. Biomech. Engineering.* 106: 315-320, 1984.
 24. Kamm, R.D., Measurements of lip pressure exerted on a cigarette during normal smoking. *Behavior Research Methods, Instruments, & Computers*, 17(3):379-384, 1985.
 25. Venegas, J.G., Custer, J., Kamm, R.D., and Hales, C.A., A relationship for gas transport during high frequency ventilation in dogs. *J. Appl. Physiol.: Respirat. Environ. Exercise Physiol.* 59(4): 1539-1547, 1985.
 26. Johnson, M., Ethier, C.R., Kamm, R.D., Grant, W.M., Epstein, D.L., and Gaasterland, D. The Flow of Aqueous Humor through Micro-Porous Filters. *Investigative Ophthalmology and Visual Science*, 27: 92-97, 1986.
 27. Ethier, C.R., Kamm, R.D., Palaszewski, B.A., Johnson, M., and Richardson, T.M. Calculations of flow resistance in the juxtacanalicular meshwork. *Investigative Ophthalmology and Visual Science*, 27: 1741-1750, 1986.
 28. Kamm, R.D., Butcher, R., Froelich, J., Johnson, M., Salzman, E., Shapiro, A., and Strauss, H.W. Optimization of parameters of external pneumatic compression for prophylaxis against deep vein thrombosis: radionuclide gated imaging studies. *Cardiovascular Research*, 20(8): 588-596, 1986.
 29. Watson, J.W., Burwen, D.R., Kamm, R.D., Brown, R., and Slutsky, A.S. Effect of flow rate on blood gases during constant flow ventilation in dogs. *American Review of Respiratory Diseases*, 133: 626-629, 1986.
 30. Johnson, M. and Kamm, R.D. Numerical studies of steady flow dispersion at low Dean number in a gently curving tube. *J. Fluid Mech.*, 172: 329-345, 1986.
 31. Kamm, R.D., Bullister, E.T., and Keramidas, C. The effect of a turbulent jet on gas transport during oscillatory flow. *J. Biomech. Engrg.* 108: 266-272, 1986.
 32. Kimmel, E., Kamm, R.D., and Shapiro, A.H. A cellular model of lung elasticity. *J. Biomech. Engrg.* 109: 126-131, 1987.
 33. Elad, D., Kamm, R.D., and Shapiro, A.H. Choking phenomena in a lung- like model. *J. Biomech. Engrg.* 109: 1-9, 1987.

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34. Paloski, W.H., Slosberg, R.B., and Kamm, R.D. Effects of gas properties and waveform asymmetry on gas transport in a branching tube network. *J. Appl. Physiol.*, 62(3): 892-901, 1987.
 35. Watson, J., Kamm, R.D., Burwen, D., Brown, R., Ingenito, E., and Slutsky, A.S. Gas exchange during constant flow ventilation with different gases. *Am. Rev. of Respir. Dis.*, 136: 420-425, 1987.
 36. Salzman E.W., McManama, G.P., Shapiro, A.H., Robertson, L.K., Donovan, A.S., Blume, H.W., Sweeney, J., Kamm, R.D., Johnson, M. and Black, P. Effect of optimization of hemodynamics on fibrinolytic activity and antithrombotic efficacy of external pneumatic calf compression. *Annals of Surgery*, 206(5): 636-641, 1987.
 37. Johnson, M., Kamm, R.D., Ethier, C.R., and Pedley, T. Scaling laws and the effects of concentration polarization on the permeability of hyaluronic acid. *PhysicoChemical Hydrodynamics*, 9(3/4): 427-441, 1987.
 38. Ingenito, E., Kamm, R.D., Watson, J.W. and Slutsky, A.S. A model of constant flow ventilation in a dog lung. *J. Appl. Physiol.* 64(5): 2150-2159, 1988.
 39. Pedley T. and Kamm, R.D. The effect of secondary motion on axial transport in oscillatory tube flow. *J. Fluid Mech.*, 193: 347- 367, 1988.
 40. Elad, D., Kamm, R.D. and Shapiro, A. Tube law for the intrapulmonary airway. *J. Appl. Physiol.* 65(1): 7-13, 1988.
 41. Elad, Kamm, R.D. and Shapiro, A. Mathematical simulation of forced expiration. *J. Appl. Physiol.* 65(1): 14-25, 1988.
 42. Kimmel, E., Kamm, R.D. and Shapiro, A.H. Numerical solutions for steady and unsteady flow in a model of the pulmonary airways. *J. Biomech. Engrg.* 110:292-298, 1988.
 43. Kamm, R.D. Toward improved methods of high frequency ventilation: a study of gas transport mechanisms. *Acta Anaesthesiologica Scand.* 33, Suppl. 90: 51-57, 1989.
 44. Kamm, R.D. and Schroter, R.C. Is airway closure caused by a liquid film instability? *Respir. Physiol.*, 75: 141-156, 1989.
 45. Ethier, C.R., Kamm, R.D., Johnson, M., Pavao, A.F., and Anderson, P.J. Further studies on the flow of aqueous humor through microporous filters. *Invest. Ophthalmol.* 30: 739-746, 1989.
 46. Ethier, C.R. and Kamm, R.D. Mass transfer during rate-limited Langmuir adsorption in a pore. *PhysicoChemical Hydrodynamics*, 11(2): 205-217, 1989.
 47. Ethier, C.R. and Kamm, R.D. The hydrodynamic resistance of filter cakes. *J. Membrane Science*, 43: 19-30, 1989.
 48. Ethier, C.R. and Kamm, R.D. Flow through partially gel-filled channels. *PhysicoChemical Hydrodynamics*, 11(2): 219-227, 1989.
 49. Jan, D.L., Shapiro, A.H. and Kamm, R.D. Some features of oscillatory flow in a model bifurcation. *J. Appl. Physiol.* 67(1): 147-159, 1989.
 50. Kamm, R.D. and Pedley, T.J. Flow in collapsible tubes: A brief review. *J. Biomech. Engrg.* 111: 177-179, 1989.
 51. Elad, D. and Kamm, R.D. Parametric evaluation of forced expiration using a numerical model. *J. Biomech. Engrg.* 111: 192-199, 1989.
 52. Elad, D. Kamm, R.D., and Shapiro, A.H. Steady compressible flow in collapsible tubes: application to forced expiration. *J. Fluid Mech.* 203: 401-418, 1989.

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53. Freddo, T.F., Bartels, S.P., Barsotti, M.F., and Kamm, R.D. The source of proteins in the aqueous humor of the normal rabbit. *Invest. Ophthalm. Vis. Sci.* 31:125-137, 1990.
 54. Tsuzaki, K. and Kamm, R.D. Flow distribution in a single bifurcation during high-frequency oscillation. *Respiration Physiol.* 82:89-106, 1990.
 55. Tsuda, A., Kamm, R.D., and Fredberg, J.J. Periodic flow at airway bifurcations: II. Flow partitioning. *J. Appl. Physiol.* 69(2): 553-561, 1990.
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