

**ROGER D. KAMM**  
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## Curriculum Vitae

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### 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-five 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 study of multiple cell types communicating in a realistic microenvironment. This cumulative work has led to over 250 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 is a member of 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.  
1994-2012 : 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)  
 Honorary Member, American Venous Forum (2011)  
 Huiskes Medal, European Society of Biomechanics (2015)

#### 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)  
 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* (2006-2007)  
 External Advisory Board, *Simbios Center*, Stanford University (2006- 2010)  
     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- 2008)  
 External Review Committee, UC Berkeley Bioengineering Dept., (2007)  
 Scientific Advisory Board, *VPH Network of Excellence* (2007- 2010)  
 Director, Global Enterprise for MicroMechanics and Molecular Medicine (GEM<sup>4</sup>) (2007-2010)  
 Co-organizer, *The Cell as a Machine Workshop*, Arlington, VA (2007)

External Advisory Committee, Chilean Nanotechnology Initiative (2008)  
 Organizing Committee, 5<sup>th</sup> International Biofluids Symposium (2007)  
 Community Giving at MIT Campaign Committee (Chair, 2007-2009)  
 Scientific Advisory Board, CIBER BBN, Spain (2008-2013)  
 Scientific Advisory Board, Global Center of Excellence in Nano-Bioengineering, Sendai, Japan (2006-2012)  
 Chair, International Academy of Medical and Biological Engineering (2011-2014)  
 Current Editorial Boards: *Journal of Multiscale Modeling*, *Cellular and Molecular Bioengineering*, *Methods in Cell Science*, *Cellular and Molecular Bioengineering*, *Biomedical Engineering Letters*, *Journal Royal Society Interface*  
 Current Advisory Boards: Imperial College, EPSRC Centre for Doctoral Training in Fluid Dynamics across Scales; Biomedical Engineering Department at the University of Texas, Austin; Institute of Biological Engineering in Catalonia; Department of BioMedical Engineering, Technische Universiteit at Eindhoven, Netherlands.

### 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 150<sup>th</sup> 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, 5<sup>th</sup> 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 Colloquim, *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 lecturer, *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
- Invited lecture, *Bioengineering in a Mechanical Engineering Department*, The Technion, Haifa, Israel, January 29, 2012.
- Infinity Pharmaceuticals, *Microfluidics for Cancer Applications*, February 24, 2012, Cambridge, MA

- Invited lecture, *Microfluidic Studies of Angiogenesis: Growing Microvascular Networks in vitro*, University of Illinois, Chicago, March, 2012.
- Invited lecture, *The unique biomechanical properties of the cell: Insights from computational modeling*, WPI, Worcester, MA, April, 2012
- Invited lecture, *Fostering Team Science*, FASEB Science Policy Committee, Washington, DC, May, 2012.
- Invited lecture, *Microfluidic Technologies for Cell Population Studies: Examples from Developmental Biology*, GEM<sup>4</sup> Summer School, Cambridge, MA, July, 2012.
- Keynote lecture, *Biological Machines*, Weizmann Institute, Israel, January 30-31, 2012
- Keynote lecture, *Microfluidic Studies of Cancer Metastasis*, 7<sup>th</sup> International Biofluids Symposium, Dead Sea, Israel, March 26-30, 2012
- Keynote lecture, *Creating 3D Microvascular Networks in vitro*, American Venous Forum, Orlando, February 10-11, 2012
- Keynote lecture, *The unique biomechanical properties of the cell: Insights from computational models*, IFMBE, Beijing, China, May 26-30, 2012
- Invited lecture, *Engineering Microvascular Networks for Therapeutic and in vitro Applications*, IEEE Conference on Life Sciences, Grand Challenges, Washington, DC, October 4-5, 2012.
- Keynote lecture, *Using Microfluidics to Study Multi-Cell Interactions in Cancer*, Symposium on Multi-Cellular Interactions, Rice University and Texas Medical Center, Nov. 9, 2012.
- Invited lecture, *Microfluidic technologies: Where we are, and some future grand challenges*, Lester Wolfe Workshop in Laser Biomedicine, MIT, Cambridge, MA, Tuesday, December 18, 2012
- Invited lecture, *Using microfluidics to study multi-cell interactions in metastatic cancer*, Politecnico di Torino, Italy, December 13, 2012
- Invited lecture, *Using microfluidics to study multi-cell interactions in metastatic cancer*, Tsinghua University, School of Life Sciences, Beijing, China, January 2013
- Invited lecture, *Microfluidic technologies for stem cell differentiation and co-culture*, Stem Cells for Drug Developers, Boston, MA, February, 2013
- Invited lecture, *Microfluidic technologies for growing vascular networks*, American Venous Forum, Phoenix, AZ, February, 2013
- Invited lecture, *Creating living machines (talk given by Rashid Bashir)*, Frontiers in Bioengineering, Atlanta, GA, February, 2013
- Invited lecture, *Mechanotransduction of fluid stress by tumor cells within 3D collagen scaffolds (talk given by William Palacheck)*, FASEB Meeting, San Diego, CA, February, 2013
- Invited lecture, *Using Microfluidics to Study the Roles of 3D Matrices and Physical Factors in Cancer*, NEMB, Boston, MA, February, 2013
- Invited lecture, *Creating Living Machines*, Frontiers in Bioengineering, Georgia Tech, Atlanta, GA, March 2013
- Invited lecture, *Microfluidic studies for stem cell differentiation and co-culture*, Stem Cells for Drug Developers, Boston, MA, March 2013
- Invited lecture, *Using Microfluidics to Study Multi-Cell Interactions in Metastatic Cancer*, Texas A&M, March 2013
- Invited lecture, *Using Microfluidics to Study Multi-Cell Interactions in Metastatic Cancer*, University of Iowa, Iowa City, March 2013
- Invited lecture, *Creating Living Machines*, University of Illinois, Urbana, IL, March 2013
- Invited lecture, *Using Microfluidics to Study Multi-Cell Interactions in Metastatic Cancer*, Illinois Institute of Technology, Chicago, March 2013
- Invited lecture, *Microfluidics: A powerful tool to study multi-cell interactions in metastatic cancer*, Yonsei University, Seoul, June 7, 2013
- Organizer and Lecturer, *Microfluidics & Extravasation – An Overview*, BioSyM Workshop, June 29, 2013
- Invited lecture, *Microfluidics: A powerful tool to study multi-cell interactions in metastatic cancer*, Nanyang Technological University, Singapore, June 27, 2013
- Invited presentation, *Microfluidics: A powerful tool to study multi-cell interactions in metastatic cancer*, Micro- and Nanotechnologies for medicine: Emerging frontiers and applications, Cambridge, MA, August 2, 2013
- Invited Departmental Seminar, *Microfluidics to study multicell interactions*, Oxford University, Applied Maths, September 15, 2013
- Plenary Lecture, *Engineering contractile muscle and its use in engineering biological systems*, Cardiac ElectroMechanical Coupling & Arrhythmias, Oxford, UK, September 12, 2013.
- Invited lecture, *Microfluidic models for metastatic processes*, Physics of Cancer, Leipzig, Germany, September 22, 2013.

- Invited presentation, *Modeling force sensation through modulation of cytoskeletal tension*, TERMIS, Atlanta, November, 2013.
- Invited Presentation, *Building living machines: Microvascular networks for a living machine*, 2014 AAAS Meeting, Chicago, February, 2014.
- Invited Lecture, *Microfluidics to study multicell interactions*, Brigham & Women's Hospital, March 13, 2014.
- Invited Lecture, *Adventures in biomechanics: Past, present, and (a look to) the future*. BioEngineering Seminar Series, Northeastern University, Boston, March 2014.
- Invited Lecture, *Studies of Single Cell and Cell Population Behaviors in 3D Co-Culture Microfluidic Systems*, SCI Distinguished Lecture Series, Scientific Computing Institute, University of Utah, March 21, 2014
- Invited Lecture, *Microfluidics: A powerful tool to study multi-cell interactions in cancer*. University of Pennsylvania, Biomedical Engineering Department, April 2014.
- Invited Lecture, *The effects of interstitial flow on angiogenesis and cell migration*. New England Bioengineering Conference, Boston, April, 2014.
- Invited Lecture, *In vitro models of metastatic cancer*, World Congress of Biomechanics, Boston, July 2014.
- Invited Lecture, *Microfluidic models of microvascular networks to study cell extravasation and metastasis*, Cell-to-Cell Communication in Cancer Workshop, Sloan-Kettering Institute, New York, July 2014
- Invited Lecture, *Mirofluidic models of tumor cell metastasis and their use in drug screening*, Chungbuk National University, Seoul, Korea, August 2014
- Keynote Lecture, *Growing vascularized tissues in vitro*, IEEE Conference on Engineering in Medicine and Biology, Chicago, August 2014
- Invited Lecture, *Biological machines: Creating the essential components*, Frontiers in Bioengineering, Urbana-Champaign, September 2014
- Distinguished Keynote Lecture, *In vitro tissue models, and their use in modeling cancer cell extravasation*, Institute for Engineering in Medicine Annual Conference and Retreat, Minneapolis, October, 2014
- Invited Lecture, *Microfluidic Models with Microvascular Networks to Study Metastatic Disease*, Functional Analysis and Screening Technologies Congress, Boston, November 2014
- Invited Lecture, *Using microfluidics to grow perfusable vascular networks*, Clinical Applications & Clinical Translation of Tissue Engineering, Boston, February, 2015
- Invited Lecture, *Emergent behaviors of cellular systems: Lessons in Making Biological Machines*, University of Texas, Dallas, February 2015
- Invited Lecture, *Microfluidic models of tumor cell metastasis and their use in drug screening*, RPI, Troy, NY, April 2015
- Invited Lecture, *An in vitro neuromuscular junction model with light activation*, Nano Engineering in Medicine and Biology, Minneapolis, MN, April 2015
- Invited Lecture, *The future potential for living, multicellular machines*, IUPESM World Congress, Toronto, Canada, June 2015
- Huiskes Medal Lecture, European Society of Biomechanics, Prague, Czech Republic, July 2015
- Invited Lecture, *Vascularized organs-on-a-chip*, Organ-on-a-Chip World Congress, Boston, MA, July 2015
- Invited Lecture, *Vascularized 3D On-Chip Tissue Models*, Workshop on Micro and Nanotechnologies for Medicine, Boston, July 2015
- Invited Lecture, *Engineered Microvascular Networks for 3D Integrated Biological Systems*, TERMIS, Boston, September 2015
- Invited Lecture, *Modeling the Blood-Brain Barrier in a 3D Co-culture Microfluidic System*, TERMIS, Boston, September 2015
- Invited Lecture, *An In Vitro 3D Model for a Neuromuscular Junction*, TERMIS, Boston, September 2015

## 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*

United States Patent 9,121,847, Kamm et al., September 1, 2015  
*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*  
 PCT/US11/54029, Kamm et al., Filed October 19, 2010  
*Device for High Throughput Investigations of Multi-Cellular Interactions*  
 United States Patent Application No. 13/743,223, Ragunath et. al., Filed January 16, 2013  
*Compositions and Methods for Neovascularization*

## 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

Agency	Grant Title	Period Covered
NIH/NIGMS	<i>Multi-scale Models of the Cytoskeleton</i> (PI)	9/1/05 - 8/31/08
Private Foundation	<i>Molecular Controls for Differentiation of Corticospinal Motor Neurons from Neural Precursors</i> (PI)	11/1/06 – 10/31/08
NIH/NIBIB	<i>Peptide Scaffolds for Tissue Engineering</i> (co-PI)	8/1/05 – 7/31/10
NIH/NIBIB	<i>Molecular, Cell and Tissue Biomechanics Training Grant</i> (PI)	7/1/06 - 6/31/10
NSF	<i>EFRI-CBE: A Multifaceted Approach to the Modeling of Angiogenesis</i> (PI)	1/1/08 – 12/31/11
NIH/NCI	<i>Microfluidic 3D Assay for Cancer Cell Migration and Intravasation</i> (PI)	9/1/09 – 8/31/12
DARPA	<i>Algorithms to Limit Viral Epidemics (ALiVE) Program</i>	9/1/11 – 8/31/13
Draper UR&D	<i>Applications of the developed technology for bacterial/epithelial interactions</i>	7/1/11 – 6/30/12
Jannsen J&J	<i>Autocrine and Paracrine Signaling During Metastatic Progression</i>	3/1/11 – 2/28/13
Singapore/MIT Alliance for Research & Tech	<i>BioSystems and MicroMechanics IRG</i> (PI)	10/1/08 – 9/30/18
NSF	<i>Science and Technology Center for Emergent Behaviors of Integrated Cellular Systems</i> (PI)	9/1/10 – 8/31/15
NIH/NCI	<i>Microfluidic 3D Assay for Cancer Cell Migration and Intravasation</i> (PI)	4/1/13 – 3/31/16
NIH/NCI	<i>Multiscale Models of Cell Migration in 3D</i> (Co-PI)	5/1/13 – 4/31/18

## 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

For an up-to-date list, see:

[https://scholar.google.com/citations?sortby=pubdate&hl=en&user=NfKZXMUAAAAJ&view\\_op=list\\_works](https://scholar.google.com/citations?sortby=pubdate&hl=en&user=NfKZXMUAAAAJ&view_op=list_works)

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 CO<sub>2</sub> 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. CO<sub>2</sub> 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.
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