

CURRICULUM VITAE

KENNETH R. LUTCHEN

College of Engineering, Boston University
 44 Cummington Mall
 Boston, MA 02215
 617-353-2800

1095 Commonwealth Ave
 Newton, MA 02459

EDUCATION

1977	University of Virginia	<i>B.S. Engineering Science</i>
1980	Case Western Reserve University	<i>M.S. Biomedical Engineering</i>
1983	Case Western Reserve University	<i>Ph.D. Biomedical Engineering</i>

EMPLOYMENT

2006-Present	Dean, College of Engineering	<i>Boston University – Boston, MA</i>
1998-2006	Chair, Biomedical Engineering	<i>Boston University – Boston, MA</i>
1998-Present	Professor of Biomedical Engineering	<i>Boston University – Boston, MA</i>
1991- 1998	Associate Professor of Biomed. Eng.	<i>Boston University – Boston, MA</i>
10/91-11/91	Visiting Professor of Bioengineering	<i>University of Siena – Siena, Italy</i>
1984– 1991	Assistant Professor of Biomed. Eng.	<i>Boston University – Boston, MA</i>
1983– 1995	Technical Staff & Consultant	<i>M.I.T. Lincoln Laboratory - Lexington, MA</i>

PROFESSIONAL & EDUCATION HONORS

2021	Identified in top 0.07% of experts in Respiratory Mechanics: https://expertscape.com/au/respiratory+mechanics/Lutchen%2C+Kenneth+R
2020	Keynote Speaker, International Association of Medical and Biological Engineering
2020	Life Member Status, IEEE
2019	Elected a Fellow of the International Academy of Medical and Biological Engineering (IAMBE)
2016-19	Advisory Committee; Directorate for Engineering of the National Science Foundation
2016	Keynote Speaker, Institute for Engineering and Medicine Annual Event, Minnesota
2014	Pierre Galletti Award (\$10,000): Highest honor the American Institute for Medical and Biological Engineering (AIMBE) bestows upon an individual for career impact on the field of Medical and Biological Engineering
2015 -22	Chair, Study Section for NIBIB Team-Based Design in Biomedical Eng. Educ.
2010 - 15	NIH-NHLBI: Member, Resp. Integ. Biol. & Translational Research Study Section
2010 - 13	Elected President of American Institute for Medical and Biological Engineering
2009	Case Western Reserve University, Distinguished Alumni Award
2005	Elected Biomedical Engineering Professor of the Year
2005	Elected as Biomedical Engineering Society Fellow (Inaugural Class)
2004	NSF Review Panel: Distinguished Teacher-Scholar Award
2003 - 06	NIH-NIGMS Biomedical Research and Research Training (BRT) Study Section
2004	Elected Secretary/Treasurer and Executive Board Member of AIMBE
2000 -	Associate Editor, Annals of Biomedical Engineering
2000 - 01	Board of Directors, AIMBE
Elected 1999	Chair/Vice Chair AIMBE Academic Council
Elected 1999	AIMBE (American Institute for Medical and Biological Engineering) Fellow
Elected 1999	President, Council of Chairs of Biomedical Engineering and Bioengineering
1993	Elected to Senior Member Status, Biomedical Engineering Society
1992 – 1995	Board of Directors, Biomedical Engineering Society
1994 – 1999	Editorial Board, Annals of Biomedical Engineering

1991 – 1996 Editorial Board, Mathematical Modeling, American Physiological Journal
1990 Professor of the Year, College of Engineering, Boston University

KEY ACCOMPLISHMENTS / ACTIVITIES AS DEAN of ENGINEERING

- Conceived and implemented concept and vision for **Creating The Societal Engineer** as guiding principal of our Strategic Vision. *Concept received Trademark from US Patent Office.* See: <http://www.bu.edu/eng/about/boston-university-creating-the-societal-engineer/>
- College of Engineering **Graduate Ranking Improved** from 54 (2006) to top 35th (2022) in US News and World Report.
- Undergraduate Enrollment nearly doubled while increasing SAT scores by over 200 points, improved selectivity and increased yield simultaneously
- Created **Associate Dean of Outreach and Diversity & Associate Dean of Educational Initiatives**; First School/College at BU to create such positions
- Implemented new process and expectations for student advising and mentoring
- Recruited 75 faculty: 24 female (32% of hires, national average 18%), and 6 URMs (10% of hires).
- **Restructured the College** via faculty inclusive approach from six accredited majors/depts. to three major departments and two interdisciplinary and inter-school graduate divisions covering 4 undergraduate degrees. Resulted in substantial flexibility in faculty recruiting to advance distinctive excellence in education and research, especially at the intersection of multiple disciplines.
- Oversaw the conception, fund-raising and creation of a new **Engineering Product Innovation Center (EPIC)**, a 15,000 sq. ft. Maker space which partners with Industry and transform engineering and design education to introduce all student to the process of going from product design-to-deployment, and serves as a resources for students throughout all of Boston University
- Raised funds to create a new 4500 sq ft., **Bioengineering Teaching and Entrepreneurship Center (BTEC)** with a Cellular and Biomolecular Facility, Sensor and Instrumentation Facility, and a Digital Medicine Suite all designed to transform hands on education for students at the intersection of technology, biology, and data science. (opened in Spring 2020)
- Won grant from Massachusetts Technology Council to create \$8.1M **Robotics and Autonomous Systems Teaching and Innovation Center (RASTIC)** to facilitate Industry-BU partnerships for supplying valuable Robotics workforce for Massachusetts Robotics industries.
- Catalyzed new initiative **with School of Management** via external foundation funding to educate engineering students on how innovations (ideas) become commercialized products. Secured \$1 Million to seed new undergraduate **Cross-Concentration in Technology Innovation.**
- Conceived and implemented the **transformation of all undergraduate engineering programs to prepare all engineers for the data-driven economy** via incorporating data science principles throughout all curricular and creating a **Machine Learning Concentration** accessible to all majors (<http://www.asee-prism.org/new-core-values/>)
- Conceived and Implemented novel and nationally scalable Technology Ambassadors programs to amplify passion and quality of **K-12 STEM** in partnership with FIRST Robotics. In first 4 years **Program has reached ~30,000 students in 26 states** and attracted nearly \$2 Million in funding from foundations, industry and alumni.
- Established **New Interdisciplinary Graduate Division of Materials Science and Engineering and new Division of Systems Engineering**, each offering new Ph.D. and M.S. programs and supporting undergraduate minors, and each in partnership with the College of Arts and Sciences (Physics, Math, Chemistry and Computer Science), and the School of Management
- Spearheaded the creation of a seven **new Professional Master's Degree Programs** across the college achieving enrollments of over 500 students per year and approximately **\$20 Million of new income per year** for the University.
- Created new **Master's Degree in Robotics and Autonomous Systems** and new **Master's Degree in Produce Design and Manufacture.**

- Created new Interdisciplinary **Masters Specializations in Data Analytics & Cybersecurity**, both accessible from any of our existing Master's degree programs.
- Introduced several new undergraduate concentrations: **Energy Technologies**; **Nanotechnology**, **Machine Learning**, and **Technology Innovation** (partnering with Business School) Concentrations designed accessible from any existing major and allow students access to cutting edge technology areas with degree acknowledgement.
- Coordinated new **Clean Energy and Environmental Sustainability Initiative** among College of Engineering, College of Arts and Sciences and School of Management
- Orchestrated nearly **700% increase in Engineering Annual Fund gifts** between 2008-2017;
- Lead the **College's Capital Campaign to exceed 100% of original Campaign goal 4.5 years into a 7 year campaign.**
- Oversaw the creation of several new research centers including: **Biological Design Center** (2017); **Precision Diagnostics Center** (2017); **Neurophotonics Center** (2018)
- Mentored the College successfully competing as the Lead institution on a new **\$40 Million NSF Engineering Research Center** on Cellular Metamaterials synthesizing nano-methods with bioengineering to propose transformative approach to engineer personalized functional human heart tissue on a chip and for scalable clinical application to replace damaged heart tissue (2017).

MAJOR ACCOMPLISHMENTS AS CHAIR OF BIOMEDICAL ENGINEERING

- Department Graduate Ranking Improved **from 18th to 6th in US News and World Report** while graduate program doubled in size in 3 years.
- Department Undergraduate Ranking Improved from 20th to 8th in US News and World Report.
- Principal Investigator and chief architect of a \$14 million dollar Leadership Award from the Whitaker Foundation, one of only three such awards ever given, and of a \$5 million dollar Translational Biomedical Engineering Research Award from the Wallace H. Coulter Foundation.
- Principal Investigator/Author on BME department's NIH Pre-Doctoral Graduate Student Training Grant in Quantitative Biology and Physiology
- Increased primary faculty from 21 – 32, creating one of the largest BME department in the nation. Recruited 5 joint faculty with School of Medicine and BME. Fundamental in recruitment of faculty into Mechanical, Manufacturing and Chemistry departments with joint appointments in BME.
- Increase in new extramural funding by factor of three from primary BME faculty.

ADDITIONAL HONORS

2009	Namesake of the Kenneth R. Lutchen Summer Research Fellowships , a \$100,000/yr funded by an endowment created by an anonymous donor.
2002	Keynote Speaker, NSF Workshop on Undergraduate and Design in Bioengineering
1998-	Who's Who Among American Teachers
1985 - 2009	Created the Senior Design Project Program and Conference at Boston University - 2-Semester course on a) How to Approach and Communicate Independent Technical Research and Design; and b) Product Development and Entrepreneurship for Bioengineering

PUBLICATION SUMMARY

- **147 peer reviewed journal articles or book chapters** published, in press, or submitted
- **~9300 Citations, h-index 54**, Over 121 papers cited 10 times or more each (Google Scholar)

MAJOR RESEARCH AREAS

- Applications of mechanistic and anatomic based computational models for developing an integrated understanding of the structure-function relations in the lung with emphasis on asthma and COPD
- Image-Driven Computational models of integrated lung function for personalized medicine

- Development of novel measurement, monitoring, imaging, and signal processing techniques that provide new insights on the structural airway and tissue conditions of the healthy and diseased lung.
- Advancing new paradigms and technologies for mechanical ventilation base on fundamental biological principals so as to improve diagnostic and therapeutic applications.

ADVISORY BOARDS

2016-19	Advisory Committee; Directorate for Engineering of the National Science Foundation
2010 -	Board of Directors, Wyss Institute for Bioinspired Engineering, Harvard University
2016	External Advisory Board, College of Engineering, University of Florida
2016	Board of Directors, BetaBionics, Inc.
2014	Program Review Board, University of Utah, College of Engineering
2012	Advisory Board, College of Engineering and Applied Science, George Washington Un.
2012	National Science Foundation: Advisory Board: Cyberphysical Systems and Healthcare
2011	Selection Committee, Whitaker International Fellows Program
2010 -	Scientific Advisory Board, Tufts University, School of Engineering
2007 -	Visiting Committee, Biomedical Engineering, University of Virginia
2006 -	Scientific Advisory Board, Institute for Biomedical Imaging Science
2005 -	Dean's Advisory Council, Case Western Reserve University
2005	Advisory Committee, Biomedical Engineering, Marquette University
2005	Advisory Committee, College of Engineering, McMaster University
2002	Advisory Committee, College of Engineering, University of Vermont
2002 - 06	Scientific Advisory Board, Asthma Research Center, Brigham and Women's Hosp.
2002 - 07	Advisory Committee, Biomedical Engineering, University of Pittsburgh
2003 - 04	Visiting Committee, Biomedical Engineering, Arizona State University

HIGHER ENGINEERING AND HIGHER EDUCATION COMMENTARY PIECES

<http://www.bu.edu/eng/about/dean-lutchen/>

University-Corporate Research Relationships

- <https://hbr.org/2018/01/why-companies-and-universities-should-forge-long-term-collaborations> “Why Companies and Universities Should Forge Long-Term Collaborations” *Harvard Business Review* (on-line) Op-Ed
- <https://chiefexecutive.net/seven-ways-company-research-university/> **Seven Ways Your Company Can Partner With A Research University.** *Chief Executive.Net*, August 27, 2018
- <http://www.asee-prism.org/last-word-mar-apr-6/> “Better Corporate Partnerships Create a Better-Prepared Workforce” *ASEE Prism Magazine: Last Word*, March 2021

Inspiring Engineering Careers

- <http://fortune.com/2016/05/22/women-stem> “This is the Best Major for Wannabe CEO: Securing the Future of America’s Leadership in Innovation”. *Fortune Magazine* Commentary. 2016. We need to inspire a more diverse group of US Citizens to pursue engineering. Here are some examples of how to do so.

University-Corporate Partnerships for Technology Transfer

- http://podcasts.aaas.org/science_transl_med/ScienceTranslMed_111123.mp3; & Lutchen, K. J. et. al.; Engineering Efficient Technology Transfer. *Science Translational Medicine*, Vol. 3;

Educating Engineers

- [Engineering's Gender Diversity Problem](#): Why does the most popular engineering discipline attract so few females?
- [Educating the Maker Generation for the Digital Economy](#): The Days of the Single-Discipline Engineering Degree Have Passed
- [A Foundational Experience: Students at the Forefront of Research](#): Senior Design Projects and alumni-funded undergraduate research opportunities have evolved into integral hallmark experiences for students.
- [Looking Forward](#): Several College initiatives now bearing fruit were envisioned years ago, and others are now in the early stages of development.
- [The Hidden Value Proposition Via On-Campus Digital Learning](#): These new technologies have the potential to excite and engage students so they will be more likely to remain in science, technology, engineering and math fields.
- [The Challenges of Success](#): As we welcome rising interest in engineering, we need to take a closer look at who our students are and how we are educating them.
- [Transforming Engineering Education for a New Era of Product Innovation](#): The Engineering Product Innovation Center promises to prepare students for a changing design and manufacturing landscape.
- [Putting MOOCs Where Our Mouths Are](#): Massive Open Online Courses aren't the educational nirvana some think they are, but they can play an important role in transforming engineering education.
- [A Trademarked Education](#): The concept was so important that Boston University trademarked the phrase Boston University Creating the Societal Engineer. Here's how it's done.
- [Engineering Education for the 21st Century](#): The technology leaders of tomorrow need more than what the classroom alone can offer.

STEM and K–12 Outreach

- [We Can Build the Future](#): How we can get K–12 kids interested in engineering, retain engineering undergraduates and create Societal Engineers.
- [Engineering Is Not Science](#): We need to excite kids about engineering and innovation, not just science.

Public Policy

- [Partners in Innovation](#): A new model for academic-industry research partnerships.
- [Society's Technology Gap](#): America's lack of basic technology knowledge threatens our future.
- [Healthy Investing](#): Continued federal research support is critical to our economic prosperity.

Engineering in Society

- [Creating the Societal Citizen...or Else?](#): All of higher education needs to commit to Creating the Societal Citizen.
- [Planning for a Bright Future](#): Leveraging emerging technologies in research and education.
- [Creating the Societal Engineer](#): Engineers need an appreciation and passion for how they can use their education to improve society.
- [Lessons Learned](#): A year after the outbreak of COVID-19, science and technology have proven to be the heroes.

INVITED TALKS RELATED TO HIGHER EDUCATION and PUBLIC POLICY

- **Bioengineering as a Role Model for How Convergence Will Advance Society's Grand Challenges and Opportunities.** Keynote Speaker. IAMBE and Carnigie Melon Forum on Biomedical Engineering, 2020.
- **The Value Proposition of Higher Education.** The A.C. Suhren Lecture. Tulane University, New Orleans, LA. January 2019.
- **Potential Impact & Need of Disruptive Innovations to Impact Grand Challenges in Medicine.** Introductory Address. Turkish American Scientist and Scholars Association. Boston, MA, June 1, 2018.
- **The Challenge & Opportunities of BME and Engineering Education.** Department of Biomedical Engineering, Northeastern University, Dec, 2017.
- **Relating Higher Education and Research to the Impact of Bioengineering on Societies Grand Challenges in Healthcare.** Distinguished Keynote Speaker at Institute for Engineering and Medicine Annual Event , Univ. Minnesota, Sept 26, 2016
- **"How Can the National Science Foundation Stimulate Junior Faculty to Pursue Higher Impact Research Connected to Society's Major Challenges?"** NSF Germination Workshop Invited Panellist, Washington DC, May 2016.
- **"Creating the K-12 STEM Teacher for the Future to Inspire Careers in Innovation"** 100Kin10 Speaker at White House; November 2015.
- **"The Future of Higher Education: What is the Value Proposition of American Universities"** 50th Anniversary Celebration Symposium on the Future Impact of Technology on Society. Boston University, Sept. 19, 2014.
- **"Challenges and Opportunities for Advancing our Medical and Biological Engineering Ecosystem?"** Presidential Address, American Institute of Medical and Biological Engineering 21st Annual Event., February 2012.
- **"Technology Translation"** Science Translational Medicine Podcast: 23 November 2011.
http://podcasts.aas.org/science_transl_med/ScienceTranslMed_111123.mp3

SELECTED FUNDING HISTORY (PI unless indicated otherwise)

- **R01: A multi-scale computational model of the extracellular matrix of the lung**
Agency: **National Institute of Health**
Duration of Grant: 5/01/18 – 4/30/23
Role (Co-Investigator)
Total Costs: \$4,013,796
- **R01: Factors Determining Hyperresponsiveness in Intact Airways**
Agency: **National Institute of Health**
Duration of Grant: 4/01/10 – 3/31/16
Total Costs: \$1,913,235
- **Kern Entrepreneurship Education Network (Phase II)**
Agency: **Kern Foundation (Co-PI)**
Duration of Grant: 7/1/11 – 6/30/14
Total Costs: \$750,000
- **Kern Entrepreneurship Education Network**
Agency: **Kern Foundation**
Duration of Grant: 7/1/08 – 6/30/11
Total Costs: \$125,000
- **Training Program in Quantitative Biology and Physiology**
Agency: **National Institute of Health**

Duration of Grant: 7/1/06 – 6/30/11

Total Costs: \$3,934,158

- **R01: Airway Reactivity and Heterogeneity in Asthma**

Agency: **National Institute of Health**

Duration of Grant: 2/15/05 – 1/31/11

Total Costs: \$2,228,512

- **Translational Research Partnership in Biomedical Engineering**

Agency: **The Wallace H. Coulter Foundation**

Duration of Grant: 1/1/05 – 1/1/10

Total Costs: \$2,900,000

Grant will Accelerate Transition BME Research to Patients

- **Cell and SubCellular Based Biomedical Engineering**

Agency: **The Whitaker Foundation**

Duration of Grant: 7/1/01 – 6/30/06

Total Costs: \$ 32,845,047, Amount Awarded from Whitaker Foundation: \$14,000,000

Grant Enhanced Education and Research in Biomedical Engineering at the Charles River and Medical School Campuses of Boston University

- **Training Program in Quantitative Biology and Physiology**

Agency: **National Institute of Health**

Duration of Grant: 7/1/01 – 6/30/06

Total Costs: \$1,279,098

- **A New Paradigm in Mechanical Ventilation**

Agency: **National Science Foundation: GOALI**

Duration of Grant: 7/1/00 – 6/30/04

Total Costs: \$382,847

- **R01: Role of Inflammation on Airway Constriction in Asthma**

Agency: **National Institute of Health**

Duration of Grant: 4/1/99 – 3/31/04

Total Costs: \$1,248,259

PROFESSIONAL ORGANIZATIONS

- Engineering Deans Institute, ASEE
- American Association for the Advancement of Science (AAAS)
- American Institute for Medical and Biological Engineering (AIMBE)
- Biomedical Engineering Society (Senior Member)
- IEEE Engineering in Medicine and Biology Society
- American Thoracic Society
- American Physiological Society
- American Society of Engineering Education

PROFESSIONAL SERVICE

National Science Foundation

Member Advisory Committee for Engineering Directorate (1 of 12 members) 2016-2019

Member of Site-Visit Team for \$8M Engineering Research Visioning Alliance program (2022)

Professional Societies and Conferences

- Engineering Deans Institute of ASEE
 - Chair of Planning Committee, 2009 Annual Meeting *“Engineering Education in the 21st Century”*
- AIMBE

- President, (Transformed organizational structure, mission, impact, admin. and reputation)
- Vice President
- Executive Board: Secretary/Treasurer
- Chair, Academic Council
- Board of Directors
- Nominating Committee
- Fellows Selection Sub-Committee on Education
- Biomedical Engineering Society
 - 2007 Long Range Planning Committee
 - 2005 Track Chair, Pulmonary Bioengineering
 - 2003 Track Chair, Pulmonary Bioengineering
 - 2001 Track Chair, Respiratory Systems Engineering
 - 2000 Session Chair, Dynamics in Lung Function
 - 1998 Track Chair, Cardiopulmonary Engineering
 - 1996 Session Chair, Airways, Tissues and Cell Mechanics Sessions
 - 1995 Track Chair, Cardiopulmonary Eng. & New Frontiers in BME,
 - 1995 Co-Chair of Entire Fall BMES Meeting at Boston University
 - 1994 Session Chair, Respiratory Modeling
 - 1993 Session Chair, Respiratory Mechanics I and Respiratory Mechanics II
 - 1992-1995 Board of Directors
 - 1992 Co-coordinator of Cardiopulmonary Track at BMES Fall Conference
 - 1989-1991 Chairman, Student Affairs Committee
 - 1987-1988 Member, Program Committee
 - 1985 Faculty Advisor for Student Chapter
- IEEE – Engineering in Medicine and Biology Society
 - 1987 Respiratory Track Coordinator at IEEE-EMBS Conference
 - 1987 Session Chairman at IEEE-EMBS Conference
 - 1987 Student Professional Awareness Conference (SPAC) Coordinator
 - 1985 Faculty Advisor for Student Chapter
- American Physiological Society
 - 1991-1996 Editorial Board for Modeling Methodology Forum
- American Thoracic Society
 - 2011 Invited Session Chair: Computational Models of the Lung
 - 2006 – 2007 Chair, Nomination Committee for Respiratory Structure Function Assembly
 - 2003 – 2006 Respiratory Structure Function Program Committee
 - 1991 Chair of Lung Mechanics Session

Journals Reviewer (several including)

- Journal of Applied Physiology
- ASME Journal of Biomedical Engineering
- Journal of Clinical Investigation
- Journal of Acoustical Society of America
- Annals of Biomedical Engineering
- IEEE Transactions in Biomedical Engineering
- American Journ. Of Resp. Crit. Care Medicine
- European Journal of Respiratory Research

Grant Agency Reviewer

- National Science Foundation:
 - Review Panels Biomedical Engineering Division
 - Review Panel Engineering Research Center
 - Review Panel Distinguished Teacher and Scientist
- National Institute of Health:
 - Study Section Members for:
 - Respiratory and Integrated Systems Physiology (Twice)
 - Biomedical Research Partnerships
 - Ad Hoc: Respiratory and Applied Physiology Study Sect.
 - Roadmap: Centers for Interdisciplinary Research

- Medical Research Council of Canada:
 - NIGMS Biomedical Research Training Study Section
 - Ad Hoc Reviewer
- Whitaker Foundation:
 - Graduate Fellowship Review Committee
 - Special Opportunities Award Review / Site Visitor
 - Leadership & Development Award Review / Site Visitor

KEY FACULTY COMMITTEES

- Chaired Search Committee: Executive Director of Innovate@BU (2022-2023)
- Chaired Search Committee: Director of National and Emerging Infectious Disease Laboratories (2022)
- Dean Search Committee, Questrom School of Business (2017/18)
- Dean Search Committee, School of Education (2016/17)
- Dean Search Committee, College of Arts and Sciences (2014/15)
- Dean Search Committee, Sargent College of Allied Health and Rehabilitation Sciences (2013/14)
- President's Committee on Diversity, Boston University (2014)
- Provost Search Committee, Boston University (2011)
- President's Inauguration Committee, 10th President of Boston University (2006)
- College of Engineering Executive Committee
- Dean Search Committee, College of Engineering (2000)
- University NCAA Review Committee
- Faculty Advisor for Student Chapter of IEEE Engineering in Medicine and Biology Society
- Faculty Advisor for Student Chapter of Biomedical Engineering Society
- Department of Biomedical Engineering Graduate Committee, *Chairman*
- Engineering College Student Conduct Committee, *Chairman*

TEACHING, COURSE, AND CURRICULUM DEVELOPMENT

Courses* (*Self Developed)

- BE 467* **Product Design, Development, Marketing and Entrepreneurship in Biomedical Engineering** (Created Course)
Taught primarily by Industry and Management School to all BME Seniors and 1st year graduate students to introduce students to the world of bench-to-bedside in industry or self-initiated companies. Taught in coordination with Senior Project courses below.
- BE465* **Senior Project: Senior technical/research project** (Created Course)
Responsible for teaching written and oral technical communication skills at level of project proposal and how to approach independent research.
- BE466* **Senior Project: Senior technical/research project** (Created Course)
Responsible for teaching written and oral technical communication skills at level of final project and how to approach independent research.
- BE740* **Parameter Estimation and Systems Identification**
Self developed upper-graduate course with applications primarily in Biomedical Engineering.
- BE402 **Control Systems in Biomedical Engineering**
Junior/Senior level with laboratory
- SC411 **Electronics I:** Junior level course in electronics.
- SC412 **Electronics II:** Junior/Senior level class in electronics and signals

Curriculum Development

- 1993 Designed new Post-B.S. and Post-M.S. Ph.D. program in Biomedical Engineering
- 1985 Created of Senior Design Project Program and Conference
"How to Approach and Communicate Independent Technical Research and Design"
- 1985 **Creator of "Annual Biomedical Engineering Senior Project Conference"**
Conference attended by industry, hospitals, alumni, and other universities. Average > 100 outside industry/research guests per year at conference.
Conference now entering its 19th year
- 2003 Created: **Product Design, Development, Marketing and Entrepreneurship in Biomedical Engineering**

SUPERVISION OF STUDENTS AND POST-DOCTORAL SCIENTISTS

Graduate Student Primary Supervision

Ph.D. Students

Qin Zhang, Ph.D., Principal Scientist, Medtronics, Inc.
David Kaczka, M.D., Ph.D.: Associate Professor, Biomedical Engineering, U. Iowa
Cortney Henderson, Ph.D. Assistant Professor, Univ. California at San Diego
Nora Tgavelekos, Ph.D., Senior Scientist, Raytheon Corporation
Carissa Bellardine, Ph.D., Director of Venture Capital, Medtronic, Inc.
Derek Affonce, Ph.D., Development Engineer, Primaira, LL
Adam Laprad, Ph.D., Sr. Manager, Pre-Clinical R&D at BTG - PneumRx, Inc.
Brian Harvey, Ph.D. Senior Principal Scientist at Respiratory Motion, Inc

- Primary Advisor for 14 Masters students, Thesis Committee for 18 Masters Students

Senior Projects Supervised

- 63 students
- 1995, 2005. 2014 winner of Most Outstanding Biomedical Engineering Senior Project of the Year

Post-Doctoral Scientist Supervised

David Westwick, Ph.D.: Professor, University of Calgary
Gianluca Nucci, Ph.D: VP Early Clinical Development Clinical Pharmacology
Adam Polack, Ph.D: Chair of Electronic Met, Wroclaw Univ. of Technology, Poland.
Raffaele L. Delaca, Ph.D: Associate Professor, Polytechnic Institute of Milan
Baoshon, MA, Ph.D.: Research Scientist, University of Vermont Medical Center
Hari Parameswaran, Ph.D., Assistant Professor of Biomedical Engineering, Northeastern University

PEER REVIEWED PUBLICATIONS

Articles Published or In Press

1. Lutchen, K.R., F.P. Primiano, Jr., and G.M. Sidel. A nonlinear model combining pulmonary mechanics and gas concentration dynamics. *IEEE: Trans. Biomed. Eng.* (29), 629-641, 1982.
2. Lutchen, K.R. and G.M. Sidel. Sensitivity analysis and experimental design techniques: application to nonlinear dynamic lung models. *Comp. and Biomed. Res.* (15), 434-454, 1982.

3. Lutchen, K.R., G.M. Saidel, and J.G. Horowitz. Nonuniform mechanics and gas mixing in normal human lungs: inadequacies of parallel compartment models. *Advances in Bioengineering*, Amer. Soc. Mech. Engs., 473-476, 1983.
4. Lutchen, K.R., G.M. Saidel, F.P. Primiano, Jr., J.G. Horowitz, and E.C. Deal Mechanics and gas distribution in normal and obstructed lungs during tidal breathing. *Amer. Rev. Respir. Dis.* (130), 974-979, 1984.
5. Swidwa, D.M., H.D. Montenegro, M.D. Goldman, K.R. Lutchen, and G.M. Saidel, Helium-oxygen breathing in severe chronic obstructive pulmonary disease. *Chest* (87), 790-795. 1985.
6. Jackson, A.C. and K.R. Lutchen, Modeling of respiratory system impedances in dogs. *J. Appl. Physiol.* 62:414-420, 1987.
7. Lutchen, K.R. and G.M. Saidel. Evaluation of mechanical parameters in multi-compartment models applied to normal and obstructed lungs during tidal breathing *IEEE: Trans. Biomed. Eng.* vol. 33 (9), 878-887, 1986.
8. Lutchen, K.R. and A.C. Jackson. Statistical measures of parameter estimates from models fit to respiratory impedance data: emphasis on joint variabilities. *IEEE: Trans. Biomed. Eng.* vol. 33 (11), 1000-1010, 1986.
9. Lutchen, K.R. and A.C. Jackson. Reliability of parameter estimates from models applied to respiratory impedance data: importance of higher frequencies. *J. Appl. Physiol.* 62:403-413, 1987.
10. Jackson, A.C., K.R. Lutchen, and H.L. Dorkin. Inverse modeling of dog airway and respiratory system impedances. *J. Appl. Physiol.* 62:2273-2282, 1987.
11. Dorkin, H.L., K.R. Lutchen, and A.C. Jackson. Human input impedance from 4-200 Hz: Physiological and modeling implications. *J. Appl. Physiol.* 64(2), 1988.
12. Lutchen, K.R. Optimal selection of frequencies for estimating parameters from respiratory impedance data. *IEEE Trans. Biomed. Eng.* 35(8). 1988.
13. Lutchen, K.R., Z. Hantos, A.C. Jackson. Importance of low frequency impedance data for reliably quantifying parallel inhomogeneities of respiratory mechanics. *IEEE Trans. Biomed. Eng.* 35 (6), pp. 472-481, 1988
14. Lutchen, K.R. Use of sensitivity and optimal experiment design for estimating mechanical parameters in respiratory system models. In Modeling and Control in Biomedical Systems, ed. C. Cobelli, L. Mariani, Pergamon Press, New York, 473-478, 1989.
15. Lutchen, K.R. and Jackson, A.C., Effects of tidal volume and methacholine on low frequency total respiratory impedance in dogs. *J. Appl. Physiol.* 68, 2128-2138, 1990.
16. Lutchen, K.R.; Guiridenella, C; and Jackson, A.C.. Inability to separate airway from tissue properties using input impedance in humans. *J. Appl. Physiol.* 68, 2403-2412, 1990.
17. Lutchen, K.R.; Habib, R.H; Dorkin, H.L.; and Wall, M.. Relation of respiratory impedance to a multibreath nitrogen washout in healthy, asthmatic and cystic fibrosis subjects. *J. Appl. Physiol.* 68, 2139-2149, 1990.
18. Lutchen, K.R. Sensitivity analysis of respiratory parameter uncertainties: Impact of criterion function form and constraints. Modeling Methodology Forum, *J. Appl. Physiol* 69(1), 766-775, 1990.
19. Lutchen, K.R.; Costa, K.D.; Physiological behavior of lumped parameters estimated from respiratory impedance data: use of forward inverse modeling. *IEEE Trans. Biomed. Eng.* 11, 1076-1086, 1990.
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134. Lutchen, KR. How does an airway and subsequently the lung become hyperresponsive. *Journal of Applied Physiology, J Appl Physiol* 121: 221–222, 2016;
135. Brown, RH and K.R. Lutchen Podcast, <http://jappl.podbean.com/e/measurement-of-intra-individual-airway-tone-heterogeneity-and-its-importance-in-asthma/> (2016)
136. Harvey, B.C., K.R. Lutchen, and P.E. Barbone. Spatial distribution of airway wall displacements during breathing and bronchoconstriction measured by ultrasound elastography using finite element image registration ultrasonics. *Ultrasonics*. 75, 174-184, 2017.
137. K. R. Lutchen, P. D.. Paré, and Chun Y. Seow: Hyperresponsiveness: Relating the Intact Airway to the Whole Lung. *J. Appl. Physiology*. Invited Review. Vol. 32 no. 4, 322-331 DOI: 10.1152/physiol.00008.2017 June 2017.
138. Lui, J.K and K.R. Lutchen. Role of Heterogeneity in Asthma: A Structure-to-function Perspective Clinical and Translational Medicine Clinical and Translational Medicine. DOI 10.1186/s40169-017-0159-0, 6:29, 2017
139. Xu Xiaohe K., B.C. Harvey, K.R. Lutchen, B.D. Gelbman, S.L. Monfre, R.E. Coifman and C.E. Forbes: A comparison of a micro-electro-mechanical system airflow sensor with the pneumotach in the forced oscillation technique. *Medical Devices: Evidence and Research* 2018.
140. Bou Jawde, S, A. J. Walkey, A. Majumdar¹, G.T. O'Connor, B. J. Smith³, J.H.T. Bates, K. R. Lutchen, and B. Suki¹ A novel approach to assess respiratory mechanics via variable ventilation reveals therapeutic improvement in patients with acute lung injury. *Scientific Reports*. 10: 6722. PMID [32317734](https://pubmed.ncbi.nlm.nih.gov/32317734/) DOI: [10.1038/s41598-020-63663-8](https://doi.org/10.1038/s41598-020-63663-8). 2020.
142. Brown, R.A. and K.R. Lutchen. Organizing academic engineering for leading in an entangled world. *National Academy of Engineering: The Bridge, 50th Anniversary Issue*. 27-29, 2020.
143. Lutchen, K.R. The Silent “Zone” Screams Again: Identifying COPD patients Most at Risk. *Editorial. Chest* 159 (4), 1313-1314, 2021
144. Bou Jawde S.A., Karrobi K., Roblyer D., Vicario F., Herrmann J., Casey D., Lutchen, K.R., Stamenović D., Bates JHT, and Suki, B. Inflation instability in the lung: An analytical model of a thick-walled alveolus with wavy fibers under large deformations. *J. R. Soc. Interface*. 18: 20210594, 17 pages; 2021
145. Yuan, Z. Herrmann, J., Murthy, S., Peters, K., Nia, H., Lutchen K.R., and Suki, B. A personalized consistent spring network representation of emphysematous lungs from ct images. *Frontiers in Network Physiology*. Doi: 10.3389/fnetp.2022.828157. March 2022.

145. Kim, J.H, N.Schaible, J. Hall, E.Bartolák-Suki, Y. Deng, J.Herrmann, A. Sonnenberg, H. P. Behrsing, K. R. Lutchen, R. Krishnan, B.Suki. A novel approach to measure the multiscale stiffness of precision cut lung slices: Application to human emphysema *Nature Biomedical Engineering* (under review)

Books and Book Chapters

1. Béla Suki and Kenneth R. Lutchen , “*Lung tissue viscoelasticity: from extracellular matrix complexity to constitutive equations*”; Handbook of Biomedical Engineering, 2005.
2. Lutchen, K.R. and B. Suki, "*Understanding Pulmonary Mechanics Using the Forced Oscillation Technique: Emphasis on Breathing Frequencies*" Chpt. 15, pgs 227-253 in Bioengineering Approaches to Pulmonary Physiology, Plenum Press, Edited by Michael Khoo, 1996.
3. Lutchen, K.R., and H.F. Voigt, Guest Editors, Abstracts for 1995 BMES Meetings. Annals of Biomedical Engineering, Vol. 23, No. 4, 1995.

INVITED TALKS

Bioengineering as a Role Model for How Convergence Will Advance Society’s Grand Challenges and Opportunities. Keynote Speaker. IAMBE and Carnigie Melon Forum on Biomedical Engineering, 2020.

The Value Proposition of Higher Education. The A.C. Suhren Lecture. Tulane University, New Orleans, LA. January 2019.

Potential Impact & Need of Disruptive Innovations to Impact Grand Challenges in Medicine. Introductory Address. Turkish American Scientist and Scholars Association. Boston, MA, June 1, 2018.

The Challenge & Opportunities of BME and Engineering Education. Department of Biomedical Engineering, Northeastern University, Dec, 2017.

Relating Higher Education and Research to the Impact of Bioengineering on Societies Grand Challenges in Healthcare. Distinguished Keynote Speaker at Institute for Engineering and Medicine Annual Event , Univ. Minnesota, Sept 26, 2016

How Does the Lung Become Asthmatic?; Department of Biomedical Engineering, Northeastern University, Dec, 2017.

“What are the Structural Changes in the Lung Necessary to Create Human Asthma?” Tufts University, October 14, 2013

“Why do Asthmatics have Hyperresponsive Airways?: Understanding the Whole Lung Response in the Context of its Parts.” Dartmouth College, March 1, 2013

“Structural Versus Functional Defects in Asthma: How the Whole Emerges from the Sum of the Parts”. Distinguished Lecturer, University of California Riverside, BioEngineering. April 3, 2013

“Invited Session Chair/Speaker: Computational Modeling of the Lung: What Can they Accomplish?” American Thoracic Society Meeting, Denver, CO, May, 2011.

“Synthesizing Imaging and Structural Models to Probe Airways and Airway Structures Responsible for Asthma” Keynote Speaker 1st International Conference on Mathematical and Computational Biomedical Engineering; June 29 – July 1, 2009, Swansea, UK

“Creating and Educational Experience for Engineers: Focus on Bioengineering” Key Speaker, 3rd Annual Engineering Science Education Conference, University of Toronto, Jan. 18, 2008.

“The Forced Oscillation Technique in Asthma” Scientific Symposium on Oscillation Mechanics of the Respiratory System: Basic Research to Clinical Application. American Thoracic Society, San Francisco, CA, May 21, 2007.

Airway Hyperreactivity: From Whole Lung to Isolated Airways and Smooth Muscle and Back Again”. Symposium on the Pathophysiology of Asthma, Antigua, November 20-22, 2006

“Understanding Structure vs Function Relations in Asthma: How the Whole Emerges from the Sum of the Parts”. McGowan Institute for Regenerative Medicine, Univ. of Pittsburgh, October 5, 2006

“Structure-Function Relations Governing Airway Hyperreactivity in Asthma”. Dept. Biomedical Engineering, Mayo Clinic, Rochester, MN August 18, 2006

“The Coulter Foundation Translational Research Partnership in Biomedical Engineering at Boston University: Catalyzing and Accelerating Innovation”. Mass. Medical Society (MassMEDIC) Conference: Working with Academic Research Institutions. May 25, 2006.

“Multi-scale Image Functional Modeling of the Lung”. Dept. Biomedical Engineering, Case Western Reserve University, Keynote Speaker for Alumni Reunion Weekend for BME, Oct. 15, 2005..

“Integrating Multi-Scale Modeling with Imaging to Distill Structure-Function Relations in Asthma”. Dept. Biomedical Engineering, University of Pennsylvania, Philadelphia, PA, Sept. 22, 2005.

“The Coupling Between Airway Smooth Muscle Length and Lung Volume”. Workshop on Airway Smooth Muscle: From Cell to Organ”, American Thoracic Society, May 2005.

“Probing the Origins of Airway Dysfunction in Asthma via Multi-scale Image Functional Modeling”. Biomedical Engineering, Tufts University, April 8, 2005.

“Building an Exciting Biomedical Engineering Department”. Plenary Talk, Whitaker Foundation Educational Summit, Lansdowne Center, Washington, March 6, 2005.

“Multiscale Image Functional Modeling of the Lung: From Basic Science to Clinical Practice in Asthma and Respiratory Distress Syndrome”. Biomedical Engineering, Univ. of California Irvine. Irvine, CA, Feb. 2005.

“Heterogeneity and Integrated Lung Function in Asthmatic Humans: Is the whole greater than the sum of the parts” Symposium on Lung Reactivity and Structure, American Thoracic Society Meeting, Orlando, FL, May 26, 2004.

Understanding the Integrative Structure-Function Pathology of Asthma: Inflammation to Clinical Phenotype” Dept. Molecular and Cellular Biology, Goldman School of Dentistry, Boston, MA., Jan. 29, 2004.

“The Interface Between Computational Modeling of the Lung and Clinical Practice” Vermont Lung Center, University of Vermont, Nov. 18, 2003.

“Airway Hyperreactivity and Heterogeneity: Is the Whole greater than the sum of the parts?” Flow Volume Underworld, Grand Isle, Vermont, Sept. 11, 2003.

"The Mechanical Phenotype of Asthma: Airway Inflammation, Heterogeneity, and Airway Reactivity" Dept.. Bioengineering, Politecnico di Milano, Milano, Italy. April 2, 2003.

"Heterogeneity of Airway Constriction and Airway Hyperreactivity in Asthma" Plenary Talk, 20th Veterinary Comparative Respiratory Society, Boston, MA, October 4, 2002.

"Heterogeneity and Lung Function: Airway and Tissue Disease" Department of Anesthesiology, Johns Hopkins University. July 10, 2002.

"Where is the locus of the functional defect in asthma?: Tracking Airway Diameter and Smooth Muscle Stretch In Situ". Department of Biomedical Engineering, University of Virginia, September, 28, 2001.

"Senior Design in Biomedical Engineering." Moderator and Key Speaker, Special NSF Panel on Undergraduate Design in Bioengineering, National Science Foundation, Arlington, VA, June 28-29, 2001.

"Structure/Function Relationships in the Lung Associate with Asthma." Biomedical Science and Engineering Seminar Series, Shriners Burns Hospital of Mass General Hospital, Boston, MA, March 20, 2001.

"An Engineering Systems Approach to Probing Lung Structure and Function in Asthma." Biomedical Engineering Department, Bucknell University, Lewisberg, PA, February 22, 2001.

"Combining Systems Engineering and Structural Modeling to Understand Asthma." Marquette University, Biomedical Engineering, February 9, 2001.

"Structure-Function Relations Governing Airway Hyperactivity in Asthma" Flow Volume Underworld, Genoa, Italy, September 4, 2000.

"Probing Structure-Function Relations in the Lung Using Forced Oscillations" Center for Sleep Disorders, Harvard Medical School, Brookline, MA, June 12, 2000.

"Computational Challenges to Probing Structural and Integrative Lung Phenotypes" Invited Speaker at Computational Challenges in the Post-Genomic Age Conference in San Francisco, CA May 11, 2000.

"Morphological Modeling of Lungs: The virtual Human Project" National Academy of Sciences, Washington, DC., October 28, 1999.

"The Respiratory Mechanic" Invited lecturer for short course in oscillatory mechanics. University of Vermont, Burlington Vermont, October 24 and 25, 1999.

"Computational Advances in Morphometric Lung Models for Probing Structure-Function Relations in Lung Pathophysiology" Life Science and Computational Physics Sections of Oak Ridge National Laboratory, Oak Ridge, TN, July 13, 1999.

"Monitoring of Lung Mechanics During Mechanical Ventilation" Mallinckrodt, Inc. San Diego, CA, April 22, 1999

"How Important is the Pattern of Constriction in Establishing the Phenotype of Asthma" Pulmonary Division, Vancouver Hospital, Canada, April 29, 1999.

"Probing Structure-Function Relations in the Lung: Implications on the Role of Inflammation in Asthma and on Lung Volume Reduction Surgery" Department of Biomedical Engineering, University of Virginia, Charlottesville, VA, Oct 1, 1998.

“From Research to Academics: Can a Research Institution train Senior Engineering Students for Independent Work at the Next Level?” National Science Foundation PI Conference for Undergraduate and Graduate Design Projects. Key Speaker, June 24, 1998

“On the Role of Heterogeneous Constriction in Establishing Lung Mechanical Function During Asthma” Harvard School of Public Health, Boston, MA, February 17, 1998.

”Novel Methods to Track Lung Mechanical Properties During Breathing: Applications to Outpatient Asthma and Intubated Surgical Patients” Boston Children’s Hospital, Boston, MA. May, 1997.

“Lung Mechanics During Breathing: New techniques That Permit Inference on Lung Structural Status”. Biotechnology and Bioengineering Research Center. University of Pittsburgh, December 13, 1996.

“Structural Origins of Changes in Resistance and Elastance in Diseased Lungs and Who Cares? ” Meakin's Christie Laboratories of McGill University, Montreal, Quebec, Canada., September 10, 1996.

“Assessment of Lung Mechanics During Mechanical Ventilation” Nellcor Puriton Bennett Co, San Diego, CA, April 9, 1996.

"How to Make Airways Look Like Tissues". Meakin's Christie Laboratories of McGill University, Montreal, Quebec, Canada., October 17, 1995.

"Linear and Nonlinear Identification of Lung Mechanics". Dept. of Biomedical Engineering; McGill University, Montreal, Quebec, Canada., October 18, 1995..

"The Forced Oscillation Technique for Probing Pulmonary Physiology" Portion of short course in Bioengineering Approaches to Pulmonary Physiology., Sponsored by the Biomedical Engineering Resource at USC. Seattle, WA, May 1995.

"BME Senior Project Design Program" Senior Design Workshop at Fall 1994 Biomedical Engineering Society Meeting, Tempe, Arizona. Sponsored by NSF and Whitaker Foundation. October 14, 1994

"A Capstone Senior Project as Part of an Integrated Design Experience for Biomedical Engineering Undergraduates" Amer. Soc. Eng. Educ., Edmonton, Canada, June, 1994

"Separating Airway and Tissue Mechanics In-Situ Using an Optimal Ventilator Waveform" Pulmonary Division of Baylor Medical Center, Houston, TX, March 1994.

"Optimal Input Design to Evaluate Linear and Nonlinear Mechanical Properties of the Airways and Respiratory Tissues" Key Speaker in Session on Respiratory Mechanics Systems Identification. IFAC Modeling and Control in Biomedical Systems., Galveston, TX, March 1994.

"Frequency and amplitude dependence of lung mechanical properties during bronchoconstriction and under physiological breathing conditions". Symposium on New Approaches to Evaluation of Lung and Chest Wall Function. American Thoracic Society Meetings, San Francisco, CA 1993.

"Direct Use of Mechanical Ventilation to Measure Respiratory Mechanics Associated With Physiological Breathing." Workshop on "Mechanical Airway Impedance, sponsored by Forced Respiratory Oscillation Group, Zeist, Netherlands, March 9, 1993.

"Respiratory Impedance From Low to High Frequencies: Physiological, Modeling and Clinical Implications". University of Siena, Siena, Italy. Nov. 6, 1991.

"Evaluation of Respiratory Mechanics at Low frequencies with Time and Frequency Domain Processing". Workshop on Asthma: Mechanics Mediators and Morphology, sponsored by the Centers for Excellence at the Meakin's Christie Laboratories of McGill University, Montreal, Quebec, Canada., May 26, 1991.

"Sensitivity of Respiratory Impedance to Peripheral Airway Disease as Implied from Nitrogen Washout and Low Frequency Data". Pulmonary Research Dept., University Ziekenhuizen Leuven, Belgium June 21, 1990.

"Respiratory Impedance Parameter Uncertainty Issues". Workshop on "Mechanical Airway Impedance, sponsored by Forced Respiratory Oscillation Group, Antwerp, Belgium, June 18-19, 1990.

"Low Frequency Impedance of the Dog Respiratory System". Respiratory Research Laboratory, Boston University, Boston, MA, April, 1989.

"Issues When Modeling of Respiratory Impedance." Department of Biomedical Engineering, Worcester Polytechnic Institute, Worcester, MA, Feb. 22, 1989.

"Inverse Modeling of the Respiratory Mechanical System: Application to Forced Oscillation Data from Humans." Department of Biomedical Engineering, University of Virginia, Charlottesville, VA, September 24, 1987.

"Forced Oscillations of the Respiratory System from 4-200 Hz." Harvard School of Public Health, Cambridge, MA, April 10, 1985.

"Preparing and Giving an Oral Presentation of Scientific Research." Given to NSF High School Research Program students. Department of Physics, Boston University, August 3, 1990.

PATENTS/SOFTWARE LICENSES

- TRAJ2: Ground-Based Radar Simulation Software, M.I.T. Lincoln Laboratory Software Center
- "Infant Respiratory Impedance Measuring Apparatus and Methods Using Forced Oscillations", Patent number: 5,318,038
- "Enhanced Ventilation Waveform Device for Mechanical Ventilators," Patent number: 6,435,182
- "Variable Peak Pressure Ventilation Method and System" Patent Number 6,907,881
- Provisional: "Pneumatically-Driven Oscillatory Flow Generator
- Provisional: "System and Method for Setting Positive End Expiratory Pressure During Mechanical Ventilation Based on Dynamic Lung Function"

CONSULTING

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|----------------|--|---|
| • 2014 - 2018 | Feather Sensors
Design of new forced oscillation flow sensors. | <i>New Jersey</i> |
| • 1985-1998 | Systems and Analysis
Simulation of and sensitivity analysis of various detection systems | <i>M.I.T. Lincoln Laboratory,
Lexington, MA</i> |
| • 1996-Present | Nellcor Puritan Bennett/Mallinckrodt
Diagnostic lung mechanics from patient ventilators | <i>San Diego, CA</i> |
| • 1990, 1991 | Department of Anesthesiology
Low Frequency Mechanics in the Canines | <i>University of Maryland</i> |

