

Academic Appointments:

- 1989-1991 Instructor in Medicine, Harvard Medical School, Boston, MA
- 1991-1995 Assistant Professor of Medicine, Harvard Medical School, Boston, MA
- 1993-1996 Hermann von Helmholtz Assistant Professor, Harvard-M.I.T. Division of Health Sciences and Technology, MIT, Cambridge, MA
- 1994 Senior Fellow, Program in Advanced Biological Sciences, Harvard Medical School, Boston, MA
- 1995-2005 Associate Professor of Medicine, Harvard Medical School, Boston, MA
- 1996-1997 Thomas D. and Virginia W. Cabot Associate Professor of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA
- 1997-2000 Associate Professor with tenure, Massachusetts Institute of Technology, Cambridge, MA
- 2000-Present Thomas D. and Virginia W. Cabot Professor of Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA
- 2005-Present Professor of Medicine, Harvard Medical School, Boston, MA

Hospital or Affiliated Institution Appointments:

- 1989-2006 Associate Physician, Brigham and Women's Hospital, Boston, MA
- 2006-Present Senior Physician, Brigham and Women's Hospital, Boston, MA
- 2006-2007 Director, ECI Laboratory, Brigham and Women's Hospital, Boston, MA

Other Professional Positions and Major Visiting Appointments:

- 1974-1979 Engineering Associate, MITRE Corporation, Bedford, MA
- 1985-1989 Visiting Scientist, Departments of Applied Biology and Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA
- 1985-1989 Associate in Engineering, Center for Biomedical Engineering, Massachusetts General Hospital, Boston, MA
- 2005-Present Visiting Professor, Norwegian University of Science and Technology, Department of Biology
- 2007-Present Member, Scientific Advisory Committee, MIT-Spain Collaborative Research Program

Hospital and Health Care Organization Service Responsibilities:

- 1989-Present Attending Physician, Samuel Levine Coronary Care Unit
- 1989-Present Reader electrocardiograms
- 1989-Present Attending Physician, Cardiothoracic Surgical Service

Major Administrative Assignments:

- 1993-Present Director, Harvard-MIT Biomedical Engineering Center
- 1998-Present Chair, Harvard Medical School, Faculty and Fellows Internal Grant Program

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Major Committee Assignments:

National and Regional:

Year	Name of Committee	Role	Institution
1984-Present			Controlled Release Society
1991-Present			American Heart Association
1991-Present			American College of Cardiology
1994	Outcomes Based Clinical Research Committee		Society for Biomaterials
1997-2009	ASTM-F4 Committee		Co-Chairman on Interventional Devices
2005	NHLBI-Specialized Center for Clinically Oriented Research External Advisory Committee		The Children's Hospital of Philadelphia
2008	External Review Committee, Weldon School of Biomedical Engineering		Purdue University
2008-2010	Planning Committee Cancer, Stem Cell Biology and Transplantation Interest Group(IG 13)		Institute of Medicine of the National Academies
2011-2014	Science Board of the Food and Drug Administration		Food and Drug Administration

Academic:

Year	Name of Committee	Role	Institution
1974-1979	Committee on Educational Policy		Dept. of Electrical Engineering, M.I.T.
1979-1985	Committee on Curriculum		Harvard-M.I.T. Division of Health Sciences and Technology
1984	Committee on Skills, New Pathway Program		Harvard Medical School

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1991-1993	Committee on Curriculum	Harvard-M.I.T. Division of Health Sciences and Technology
1992-present	Board of Advisors	Harvard-M.I.T. Division of Health Sciences and Technology
1993	Joint Faculty Committee	Harvard-M.I.T.
1993-1994	Search Committee	Harvard-M.I.T. Division of Health Sciences and Technology
1993-1997	Curriculum Committee	M.I.T. Program in Biomedical Engineering
1995-present	Admissions Committee	Harvard-M.I.T. Medical Engineering/Medical Physics Program
1995-1999	Executive Board (Dept.)	M.I.T., Center for Biomedical Engineering
1997-2000	Lemelson Prize Selection Committee (Inst.)	M.I.T.
1997	Executive Committee	Center for Innovation and Minimally Invasive Technology
1997	Committee on the Formation of the Division of Bioengineering and Environmental Health	School of Engineering
1997-present	Faculty Fellowship, Faculty of Medicine Committee	Harvard Medical School
1997-2000	HST/DEAS Bioengineering Committee	Harvard University
1998-present	Committee on Biological Sciences (UCBS)	Harvard University
1998-present	Faculty Search Committee	Harvard-M.I.T. Division of Health Sciences and Technology
1999-present	Faculty Committee	Harvard-M.I.T. Division of Health Sciences and Technology
1999-present	Board of Directors	M.I.T. Hillel Foundation
2000-2005	HMS Faculty Fellowship Subcommittee	Harvard Medical School

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2000	Advanced Biomedical Sciences Program Committee		Harvard Medical School
2000-2005	The Schepens Eye Research Institute Scientific Advisory Board		Harvard Medical School
2003	Ad Hoc Faculty Search Committee: Biomedical Engineering		Harvard University
2005-present	MD Admissions Committee		Harvard-MIT Division of Health Sciences and Technology
2005	Admissions Committee		Massachusetts Institute of Technology
2005-present	Committee On Assessment of Biohazards		Massachusetts Institute of Technology
2005-present	Committee on Animal Care		Massachusetts Institute of Technology
2006-present	HMS Faculty Fellowship	Chair	Harvard Medical School
2006	Ad Hoc Faculty Search Committee: Children's Hospital		Harvard Medical School
2006-present	Howard Hughes Medical Institute Graduate Education In Medical Science	Program Director	Massachusetts Institute of Technology
2007 - 2008	Clinical and Translational Science Centers, "Scientific Incubator Subcommittee		Harvard Medical School
2007 - 2008	Harvard University Bioengineering Planning Group		Harvard University
2007 – 2008	Harvard Medical School Executive Planning Tools and Technologies subcommittee	Co-Chair	Harvard Medical School
2008	Faculty Search Committee		Harvard University School of Engineering and Applied Sciences
2008	Search Committee for Director of the Vascular Biology Program		Children's Hospital Boston, Harvard Medical School

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2009-present	Committee on the Use of Humans as Experimental Subjects	Massachusetts Institute of Technology
2009-present	SEAS/Wyss Senior Faculty Search Committee in Engineered Biomaterials	Harvard University

Study Section:

1993	Swiss National Science Foundation
1994	National Institutes of Health - Technology and Applied Sciences
1994-present	Israel Science Foundation
1996	National Institutes of Health - Cardiovascular-A
1998-2002	American Heart Association - Cardiovascular Physiology & Pathophysiology
1999-2002	Massachusetts Affiliate, American Heart Association
1999-2003	American Heart Association – Affiliate Consortia Northeast 1 Research Peer Review Group
2002	National Institutes of Health – Chairman, Bioengineering Research Partnership Review
2004	National Institutes of Health—Reviewer, Bioengineering Science and Technology 50
2004	CVS J 50—Reviewer and Chairman, Cardiovascular Tissue Engineering Bioengineering Research Partnership Study Section
2006	National Institutes of Health—Reviewer, International and Cooperative Projects-1 Council

Professional Societies:

American College of Cardiology
American Heart Association
American Institute for Medical and Biological Engineering
American Society for Clinical Investigation
Controlled Release Society

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Community Service Related to Professional Work:

Editorial Boards:

Years	Role	Journal
1987-Present	Ad Hoc Reviewer	Journal of Biomedical Materials Research
1988-Present	Ad Hoc Reviewer	Journal of Controlled Release
1988-Present	Ad Hoc Reviewer	Annals of Biomedical Engineering
1989-present	Ad Hoc Reviewer	Journal of Pharmaceutical Sciences
1989-Present	Ad Hoc Reviewer	Biomaterials
1989-Present	Ad Hoc Reviewer	Circulation Research
1990-Present	Ad Hoc Reviewer	The Lancet
1990-Present	Ad Hoc Reviewer	Proceedings of the National Academy of Sciences
1993-Present	Ad Hoc Reviewer	Chest
1993-Present	Ad Hoc Reviewer	Macromolecules
1994-Present	Ad Hoc Reviewer	Biophysical Journal
1995-Present	Editorial Board	Drug Delivery
1995-2004	Editorial Board	Biomaterials
1996	Editorial Board	REMEDICA
1996-Present	Ad Hoc Reviewer	Arteriosclerosis, Thrombosis and Vascular Biology
1996-Present	Ad Hoc Reviewer	Catheterization and Cardiovascular Diagnosis
1996-Present	Ad Hoc Reviewer	Journal of the American College of Cardiology
1997-Present	Ad Hoc Reviewer	Cardiovascular Radiation Medicine
1998-Present	Editorial Board	Circulation, Journal of the American Heart Association
1999-Present	Editorial Board	Cardiovascular Radiation Medicine
1999-Present	Editorial Board	Frontiers in Interventional Cardiology
1999-Present	Editorial Board	Journal of Vascular Research
2000-present	Ad Hoc Reviewer	American Journal of Physiology
2000-present	Ad Hoc Reviewer	Journal of Biomechanics
2004-Present	Consulting Editor	Journal of Clinical Investigation
2006-Present	Editorial Board	Acute Cardiac Care Journal
2009-2011	Program Chair	Society for Biomaterials

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2010	Ad Hoc Reviewer	PLOS-one
2010-2011	Senior Scientific Advisor	Science Translational Medicine
2011-present	Chief Scientific Advisor	
2011-present	Ad Hoc Reviewer	Advanced Materials

Awards and Honors:

1973-1974	Harvard Book Prize Telluride Scholarship - semifinalist Citation of the Secretary of the Commonwealth of Massachusetts for Excellence in State Funded Research
1978	M.I.T. Undergraduate Research Opportunities Program Citation Research Excellence
1979	Sigma Xi
1980-1981	Kleberg Foundation Scholar in Health Sciences and Technology
1982-1983	Soma Weiss Award, Harvard Medical School
1983	<i>Cum laude</i> graduate, Harvard Medical School
1984-1985	Surdna Fellowship Award, M.I.T.
1989	Inaugural Address, 350th anniversary the University of Helsinki
1989-1991	Grant-in-Aid, American Heart Association
1989-1994	Physician-Scientist Award, National Institutes of Health
1990	Syntex Scholar Finalist Visiting Professor, Dept. of Vascular Surgery, Northwestern Medical School
1991	Katz Award, American Heart Association, Finalist
1992	Marcus Award, American Heart Association
1993-1996	Hermann von Helmholtz Chair, MIT
1993-1995	Johnson and Johnson Foundation Grant
1993-1996	Whitaker Foundation Young Investigator Grant in Biomedical Engineering
1994	Cardinal and Gray Lecturer, MIT
1994-1997	Whitaker Foundation Special Opportunity Award in Biomedical Engineering
1994-2002	Perivascular Drug Delivery, NIH-NIGMS (grant # 1R01-GM49039-06)
1994-1999	Burroughs Wellcome Award in Experimental Therapeutics Development of the MIT Quantitative MICR
1995	Academic Research Infrastructure Grant, NSF, (grant # NSF BIR-9512316)
1996-1997	Thomas D. & Virginia W. Cabot Chair, MIT
1997	Tenure, MIT John F. and Virginia B. Taplin Award Tau Beta Pi Leonardo Da' Vinci Lecturer
1998	Honorary Member, Israel Society of Interventional Cardiology Visiting Professor, Thomas Jefferson University Hospital
1999-2002	Diabetes Mellitus and Vascular Repair, AHA: Established Investigator Award, (grant # AHA9940449U)

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- 1999 Simon Dack Visiting Professor, Mount Sinai School of Medicine
Visiting Professor, Mount Sinai School of Medicine
Visiting Professor, University of Pennsylvania, Institute of Medicine
- 1999-2004 Biology of Tissue Engineered Endothelial Implants
NIH/NIGMS (grant # NIH 1R01HL60407-01A1)
- 2000 First Place, V.I.R. Category, National Society for Histotechnology Poster
Session Special Recognition Award
- 2000 Thomas A. McMahon Mentoring Award, Harvard University / Massachusetts
Institute of Technology Division of Health Sciences and Technology
- 2001 Fellow, American Institute for Medical and Biological Engineering
- 2001 Member, American Society for Clinical Investigation
Hermann Lecturer and Visiting Professor, Dept. of Medicine, University of
Texas, Galveston
- 2002 Scholar, Academy at Harvard Medical School
- 2005 Visiting Professor, Norwegian University of Science and Technology,
Department of Biology-Molecular/Cellular
- 2005 Distinguished Speakers in Bioengineering, University of Toronto, Institute of
Biomaterials and Biomedical Engineering.
- 2006 American Society for Testing and Materials (ASTM) Joseph S. Barr Award
- 2006 Fellow, Institute of Medicine, National Academies of Science
- 2007 Feigenbaum/Levine Lecture, Beth Israel Deaconess Hospital
- 2007-2008 A. Clifford Barger Excellence in Mentoring Award
- 2008 Hellenic Atherosclerosis Association 4th Scientific Conference Manuscript
Recognition Award, Thessaloniki, Greece (Circulation 2008 117:993-1002)
- 2008 European Society of Cardiology Young Investigator Award (Dr. Yiannis
Chatzizisis)(Circulation 2008 117:993-1002)
- 2008 Ioannis Vlyssidis Award, Academy of Athens (Circulation 2008 117:993-
1002)
- 2009 Jeffrey M. Hoeg Arteriosclerosis, Thrombosis and Vascular Biology Award
for Basic Science and Clinical Research
- 2009 European Society of Cardiology Young Investigator-Working Group Award
(Dr. Yiannis Chatzizisis)(Circulation 2011 123:621-30)
- 2010 Officer's Cross of the Civil Merit from the Spanish Government
- 2011 European Atherosclerosis Society Award for Best Paper in Clinical Research
(Circulation 2011 123(6):621-630)
- 2011 Atherosclerosis Society of Northern Greece Award for Best Abstract of non-
Hellenic origin (Koskinas KC et al. Book of Abstracts p. 36)
- 2011 Nominee, Harvard Medical School Donald O'Hara Faculty Prize for
Excellence in Teaching (Years I & II)
- 2011 Plenary Lecture, American Society of Mechanical Engineering Annual
meeting
- 2011 Dean's Distinguished Lecture, The Fu Foundation School of Engineering and
Applied Science, Columbia University, New York, New York
- 2011 Lewis Katz Senior Investigator Award

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Research, Teaching, and Clinical Contributions:

A. Narrative report

Elazer R. Edelman received Bachelors and Masters degrees in Electrical Engineering from the Massachusetts Institute of Technology, an M.D. degree with distinction from Harvard Medical School, and then his Ph.D. in Medical Engineering and Medical Physics from the Harvard-Massachusetts Institute of Technology Division of Health Sciences and Technology. His doctoral thesis concentrated on the definition and characterization of polymeric controlled drug release systems. After receiving his degrees he completed an internship and residency in Internal Medicine and fellowship in Cardiovascular Medicine, all at the Brigham and Women's Hospital in Boston. He is a fellow of the American College of Cardiology and currently serves as one of the Core Attending Physicians in the acute coronary care unit at the Brigham and Women's Hospital.

Prof. Edelman's research interests combine his scientific and medical training. His work integrates multiple disciplines including polymer based controlled and modulated drug delivery; growth factor biology and biochemistry; tissue engineering; biomaterials-tissue interactions and the vascular response to injury. He uses elements of continuum mechanics, digital signal processing and polymeric controlled release technology to examine the cellular and molecular mechanisms that produce accelerated atherosclerosis and transform stable coronary artery disease to unstable coronary syndromes. His work on angiogenesis includes basic studies of endothelial cell and vascular biology, computational modeling of vessel formation, and creation and use of controlled angiogenic factor release devices in clinical trials. His most recent publications have focused on how tissue engineered cells might be used for the local delivery of growth factors and growth inhibitors in the study of the vascular homeostasis and repair, cancer invasiveness and metastases and the homology between endothelial paracrine and angiocrine regulation in cancer and vascular diseases.

Prof. Edelman holds tenured faculty appointments in the Department of Medicine at Harvard Medical School, and in the Division of Health Sciences and Technology at the Massachusetts Institute of Technology. He is the director of the Harvard-MIT Biomedical Engineering Center, and the current occupant of the Thomas D. and Virginia W. Cabot Chair at MIT. He has mentored more than 100 graduate students and postdoctoral fellows. Among Dr. Edelman's most important accomplishments are marrying his wife Cheryl, and surviving the increasingly adventurous childhood and young adulthood of his three boys, Alex, A.J. and Austin, which includes coaching their Bantam hockey team.

Dr. Edelman's research program falls in a variety of general categories:

POLYMER-BASED CONTROLLED AND MODULATED DRUG DELIVERY

Standard means of drug administration are unacceptable for the newer classes of drugs and many experimental compounds. Polymer-based controlled drug delivery is used to obtain sustained and modulatable drug delivery. There is a particular focus on the design and development of such systems, mathematical modeling of transport from these systems and the in vivo use of these devices in understanding their impact and potential use in a variety of disease states.

VASCULAR BIOLOGY, GLYCOBIOLOGY, and GROWTH FACTOR BIOCHEMISTRY

The endogenous analog of local drug delivery involves natural signaling within tissues and between cells. Accordingly the Edelman laboratory has for some many years defined cell-cell interactions, and especially the forces that determine and drive autocrine, paracrine and endocrine growth control. Polypeptide growth factors and their associated proteoglycan binding proteins have been shown to play a primary role in the physiology of normal cells and tissues. In addition, it has become increasingly appreciated that these factors may play a significant role in the pathophysiology of many diseases. Natural storage, binding, stabilization and release of these factors are being examined in hopes of understanding growth factor biology and how different diseases are affected by these growth mediators.

From this perspective the Edelman laboratory has defined the nature of endothelial cell control of vascular smooth muscle cells and monocyte-endothelial interaction with special attention to the local regulation of angiogenic growth factors and associated proteoglycans.

TISSUE ENGINEERING

The findings in vascular biology stimulated studies at defining tissue physiology on the one hand and in harnessing these insights to create synthetic constructs that possess bioregulatory function. Tissue engineering of vascular cells allows both for a controlled means of examining complex issues in tissue repair and as potential novel therapeutic modalities. Dr. Edelman uses the science of tissue engineering to examine whether mechanical structure must be completely recapitulated to regain full biochemical function of an injured blood vessel. In particular, he and his colleagues investigate the linkage between the mechanical and biochemical aspects of endothelial cell function. They have already shown that the endothelial cells need not reside at the luminal interface for the endothelium to impose its biochemical control on the artery. In this regard they have continued to use the complex architecture of the blood vessel wall, the controlled vascular injury induced by implantation of endovascular devices and their knowledge of cell and molecular vascular biology to examine autocrine and paracrine growth control. Of the most intriguing findings are that the form and nature of the supporting extracellular matrix – native and synthetic – allows endothelial cells to not only become immune tolerated but also immunomodulatory. Preclinical findings have now been validated in five phase I and II clinical trials where tissue engineered allogenic endothelial cells have staved off vasoproliferative disease without engendering an immune response.

Most recently Edelman and his students have extended the angiocrine view of cancer control. They have shown now how endothelial state governs cancer invasiveness and metastases just as it does control of vascular repair. They have defined a spectrum of endothelial states – quiescent cells which offer structural support, reparative cells which inhibit cancer growth and metastases just as they control smooth muscle cell proliferation and intimal hyperplasia, and dysfunctional endothelial cells which promote these processes. Working with colleagues at the Brigham and Women's Hospital benchtop and animal experiments have been validated in clinical specimens.

BIOMATERIALS - TISSUE INTERACTIONS

Increasingly mechanical interventions and composite devices are being used to deal with complex disease. Using innovations in material science the Edelman laboratory has defined a set of materials with tissue specific adhesion, regulated cohesion and the highest form of contextual

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biocompatibility. Polymer based drug delivery systems, image analysis, molecular and cell biology, and histo- and immunocytochemistry are used to more fully appreciate the role of locally expressed growth mediators in the pathobiology of the tissue repair. Bench top work with isolated cells in culture or cells grown on synthetic materials is verified in models of disease of increasing complexity, including a range from small rodents to large animals.

DEVICE BIOLOGY

Edelman and his students have used their findings and resources in vascular biology and immunology, materials science and pharmacology to define the cardiovascular reactivity to implanted devices. Indeed, their basic work paved the way for modern endovascular stents and their drug-eluting counterparts and more recently endovascular valve-stents. Edelman's work served as the basis for regulatory guidelines and standards in this field.

TEACHING and CLINICAL WORK

Prof. Edelman is involved in a wide range of teaching programs at the Massachusetts Institute of Technology, Harvard Medical School, Harvard University and the Brigham and Women's Hospital. He directs HST090, Cardiovascular Pathophysiology, a 15 unit required course for all medical and graduate students in the Harvard-MIT Division of Health Sciences and Technology. This course uses a mechanistic focus and leverages quantitative sciences to explain fundamental physiology and applied pathology of the heart and vascular system. Instruction emphasizes hemodynamics, electrophysiology, gross pathology and clinical correlates of cardiovascular function in health and a variety of disease states. Special attention is given to congenital, valvular, myocardial, and arteriosclerotic coronary heart disease. The case method is emphasized in tutorial sessions. There is extensive use of computers in accessing data bases and in quantitative modeling of the circulation. Prof. Edelman also serves for 6-8 weeks per year as the teaching attending in the Levine Cardiac Unit, the cardiovascular intensive care unit of the Brigham and Women's Hospital. This ten bed unit provides clinical care for the most acutely ill patients with cardiovascular diseases in the hospital including advanced heart failure, cardiogenic shock, complicated myocardial infarctions, refractory electrophysiologic disorders and complex congenital heart disease in the adult. Dr. Edelman directs the care of these patients and the clinical teaching of seven house officers, clinical fellows in cardiovascular medicine and nurses and pharmacists. The latter involves education in the basic biology and physiology of disease, the practical means of caring for intensive and acutely ill patients and the technical and procedural aspects of such care including placement of central lines, pulmonary artery catheters, temporary pacemakers, and intraortic balloon devices, pericardial and pleurocentesis, and ventilator management.

Prof. Edelman is also Program Director of the MIT Graduate Education in Medical Sciences (GEMS) sponsored by HHMI, intended to provide graduate students at MIT with deep exposure to clinical sciences and applied biology. He routinely lectures as well in a range of MIT and Harvard Courses.

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B. Funding Information:

Past:

1989	--(b)(6)--	PI	Vascular Response to Endovascular Stents
1989-1991	American Heart Association: Massachusetts Affiliate Grant-in-Aid	PI	Vascular Response of Injury: Controlled Adventitial Heparin Delivery
1989-1994	National Institutes of Health: Physician Scientist Program Award	PI	Vascular Response of Injury: The Effects of the Controlled Release of Anti-proliferative Agents and Oxygen Free-Radical Scavengers
1992-1994	--(b)(6)--	PI	Adventitial control of vascular injury
1993-1995	--(b)(6)--	PI	Cell Biology of Linker Compounds
1993-1995	Johnson and Johnson Foundation Grant	PI	
1993-1996	Whitaker Foundation Grant in Biomedical Engineering	PI	Controlled release of growth factors
1994-1999	Burroughs Welcome Fund	PI	Experimental Therapeutics Scholar Award
1995-1998	Whitaker Foundation Special Opportunities Grant	PI	Center for Biomedical Engineering Teaching Facility
1994-2002	R01, National Institutes of Health (grant # NIH 5R01-GM49039)	PI	Perivascular Drug Delivery
1995-1998	NSF Infrastructure Development Grant	PI	Quantitative Microscopy and Imaging Networks
1997-1998	Whitaker Foundation Grant in Biomedical Engineering	PI	Tissue engineered endothelial implants
1997-1998	Taplin Development Award	PI	Harvard/M.I.T. Biomedical Engineering Center
1997-1999	Center for Innovative and Minimally Invasive Technologies	PI	Smart Catheter
1999-2001	National Science Foundation	PI	

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1999-2003	American Heart Association	PI	Established Investigator Award
2001	--(b)(6)---MIT Alliance Grant	Co-PI	A Biological Wireless Link
1999-2003	R01, National Institutes of Health (grant # NIH 1R01HL60407-01A1)	PI	Biology of Tissue Engineered Endothelial Implants
2003-2006	R01, National Institutes of Health (grant # NIH HL67246	PI	Tissue and Cellular Pharmacodynamics of Vascular Growth
2008-2009	Center for Integration of Medicine and Innovative Technology	PI	High Throughput Flow System for the Generation of Thrombotic Fingerprints
2006-2009	--(b)(6)---MIT Alliance Grant	PI	Bioadhesive Sealants
2007 – 2009	MIT Deshpande Center for Integration of Medicine and Innovative Technology	PI	Pericardial Inotropic Drug Delivery

Industrial Grants:

2001-2003	--(b)(6)--	PI	Modulation of Kinase Signaling
2003-2004	--(b)(6)--/MIT	PI	FKBP Binding Kinetics

Current:

4/1/08- 01/31/12	RO1, National Institutes of Health (grant # NIH R01HL049039)	PI	Vascular Drug Delivery
09/30/09- 8/31/11	R01 Supplement, National Institute of Health (grant # NIH R01HL049039)	PI	Vascular Drug Delivery
01/01/10- 12/31/10	Center for Integration of Medicine & Innovative Technology	PI	Tissue Engineering Therapies for Inhalation Injury
09/01/10- 8/31/11	Deshpande Center for Technological Innovation	PI	Tissue Specific Adhesive Materials
08/01/10- 07/31/11	Harvard Catalyst Pilot Grant	PI	Injectable Matrix Embedded Endothelial Cells for Vascular Therapy

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Pending:

12/01/11- R01 National Institutes of Health PI Endothelial cell action on non-
11/30/16 small cell Lung Cancer: 1L6
Perlecan Interactions

C. Report of Current Research Activities:

Bench:

1. Paracrine and autocrine mechanisms of growth control
2. Vascular injury and repair
3. Cell-cell communication within the blood vessel wall
4. Transformation of stable atherosclerotic processes to unstable syndromes
5. Application of biomedical engineering and physics to cell and molecular biology
6. Biology and biochemistry of growth factors
7. Transvascular transport of therapeutic compounds and endogenous growth mediators

Clinical:

D. Report of Teaching:

1. Local contributions

a. Medical School courses

Harvard-MIT Division of Health Sciences and Technology, Harvard Medical School, Boston

<i>HST-050</i> 1979	<i>Quantitative Physiology</i> Tutor 25 Medical students 96 hours/year
<i>HST-010</i> 1980-present	<i>Anatomy</i> Lecturer 40 Medical and Graduate students 4 hours/year
<i>HST-090</i> 1980, 1982 1991-1998 1999-present	<i>Cardiovascular Pathophysiology</i> Tutor Core faculty member Director 60 Medical and Graduate students 60 hours/year

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<i>HST-150</i> 1989-1995	<i>Pharmacology</i> Founding and core faculty member 40 Medical and Graduate students 60 hours/year
<i>HST-240</i> 1989-present	<i>Physician-Scientist Preceptorship</i> Founding faculty and course director 40 Medical and Graduate students required graduation 1 month elective
<i>HST-521</i> 2005-present	<i>Biomaterials and Tissue Engineering in Medical Devices and Artificial Organs</i> Lecturer
<i>HST-582</i> 2003-present	<i>Biomedical Signal & Image Processing</i> Lecturer
<i>HST-500</i> 2007	<i>Frontiers in (Bio) Medical Engineering and Physics</i> Lecturer

Harvard Medical School, Boston

Metabolism and Function of Human Organ Systems

1988-present	Lecturer 125 Medical Students 4 hours/year
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Third Year Harvard Medical Student Rotation in Internal Medicine

1989-present	12 Medical Students 4 hours/year
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Clinician-Scientist Preceptorship–MIT & HMS Teaching Hospitals

2006-present	Graduate Students
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Massachusetts Institute of Technology

1976	21.737	English Literature
1977	6.082	Acoustics
1978-1989	6.023J	Quantitative Physiology: Organs and Systems
1984	20.035	Pharmacoengineering
1984	HST-590	Biomedical Engineering
1995-1999	3.081	Materials Science Laboratory

b. Graduate medical courses

1989-1992 Introductory Course for First Year Cardiology Fellows,
Brigham and Women's Hospital, Boston
Organizer and Lecturer
20 cardiology fellows, and faculty members
25 hours per year

c. Local invited teaching presentations

d. Continuing medical education courses

1989-2000 Cardiovascular Pathophysiology for Engineers and
Scientists
Harvard-MIT Division of Health Sciences and Technology,
Cambridge, summer professional program
Lecturer
100 engineers and biomedical technology professionals

1985-2005 Intensive Review of Internal Medicine
Department of Internal Medicine, Brigham and Women's
Hospital, Boston
Lecturer and case review
600 internists (Lecturer)

1985-2005 Intensive Review of Cardiovascular Medicine
Cardiovascular Division, Brigham and Women's Hospital,
Boston
Lecturer and case review
250 cardiologists/internists (Lecturer)
30 cardiologists/internists (Electrocardiograms)

e. Advisory and supervisory responsibilities in clinical and laboratory settings

1989-Present Brigham and Women's Hospital, Boston
Coronary Care Unit and Cardiology consult service attending
2-3 days/week

1995-Present Postdoctoral research supervisor
4-6 cardiology fellows/year
6-12 post-doctoral fellows/year
6-10 graduate students/year
4-6 medical students/year
4-8 undergraduate students/year

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f. Teaching leadership role

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| 1995-Present | Director, Biomedical Engineering Center, Harvard-MIT Division of Health Sciences and Technology |
| 1997-2001 | Executive Committee, Center for Innovation and Minimally Invasive Technology, Partner's in Health, Brigham and Women's and Massachusetts General Hospitals |
| 1995-present | Director, HST090, Cardiovascular Pathophysiology |
| 2005-present | Director, MIT Graduate Program of Excellence in Medical Sciences (GEMS), Howard Hughes Medical Institute |

g. Names of advisees and trainees

--(b)(6)--

Theses Supervised:

--(b)(6)--

2. Regional, National, or International Contributions

a. Invited Presentations

- 1987 *Polymer-based controlled delivery: Its role in angiogenic processes* Beth Israel Hospital, Boston, MA, Cardiovascular Grand Rounds, Invited Lecture.
- 1988 *Neovascularization of Atherosclerotic Plaque* Beth Israel Hospital, Boston, MA, Cardiovascular Grant Rounds, (April 1988), Invited Lecture.
- Neovascularization of Atherosclerotic Plaque*, Brigham & Women's Hospital, Boston, MA, Cardiovascular Grand Rounds, (May 1988), Invited Lecture.
- Neovascularization of the coronary arterial wall*, Brigham & Women's Hospital, Harvard Medical School, The Multidisciplinary Program in Cardiovascular Disease Vascular Medicine Series, Boston, MA, Invited Lecture.
- Polymer-based controlled delivery: Its role in basic science research* Ministry of Trade and Technology, Danish Council on Technology, Copenhagen, Denmark, Invited Lecture.
- 1989 *Polymer-based controlled delivery: Its role in the study of growth factor biology*, Inaugural Address, Biopharmaceutics Program, 350th Anniversary of the Founding of the University of Helsinki, University of Helsinki, Helsinki, Finland, Visiting Professorship.
- 1991 *Local therapy of atherosclerosis*, Cardiovascular Grand Rounds, Beth Israel Hospital, Boston, MA, Invited Lecture.
- Peri-adventitial control of neointimal proliferation*, Northwestern University, Department of Vascular Surgery, Evanston, Illinois, Visiting Professorship.
- bFGF regulation of smooth muscle cell proliferation and angiogenesis is linked in the perivascular space of injured blood vessels*, The Blood Vessel Club, Atlanta, GA, Invited Lecture.
- Molecular aspects of growth and inflammatory mechanisms in vascular cells*, FASEB, Atlanta, GA, Invited Lecture.
- 1992 *Restenosis: Local action of heparin and heparin binding growth factors*, Grand Rounds, University of Cincinnati, Cardiovascular Division, Cincinnati, OH, Visiting Professorship.
- Longwood Area Vascular Biology Series, Boston, MA, Invited Lecture.

- Grand Rounds, Yale University, Cardiovascular Division, New Haven, CT, Invited Lecture.
- Restenosis Summit, Cleveland, OH, Invited Lecture.
- 1994 *Endothelial control of smooth muscle cell proliferation*, Northwestern University Medical School. Cardiovascular Division, Feinberg Institute, Evanston, IL, Visiting Professorship.
- 1995 *Prevention and treatment of restenosis: Lessons learned from endogenous forms of vascular repair*, Restenosis Summit VII, Cleveland, OH, Invited Lecture.
- Issues in the Responsible Conduct of Research*, Massachusetts Institute of Technology, Boston, MA, Invited Lecture.
- 1996 Longwood Area Vascular Biology Series, Invited Lecture.
- Cardiovascular Research Seminar, Boston VA Medical Center, Boston University School of Medicine, Boston, MA, Seminar.
- Perivascular and Endovascular Drug Delivery Concepts and The Biology of Endovascular Implants*, Transcatheter Cardiovascular Therapeutics Symposium, 8th Annual Symposium, Cardiology Research Foundation & Washington Hospital Center, Washington, DC, February 28-March 3, Invited Lecture.
- Antisense Strategies for Controlling the Vascular Response to Injury*, Research Initiatives in Vascular Disease, Bethesda, MD, Invited Lecture.
- Balloons to stents: Reduction and restenosis with evolving interventional technology*, The Physician's Meeting, Chicago, IL, Invited Lecture.
- Endogenous mediators of restenosis*, Columbia University, Cardiology Grand Rounds, New York, NY, Visiting Professorship.
- Exploring Medical Career Options*, National Youth Leadership Forum on Medicine, Cambridge, MA, Seminar.
- Balloons and stents: Local drug delivery potential*, Johnson & Johnson's Annual Symposium on Drug Delivery Technology, Chicago, IL, Invited Lecture.
- 1996 Physician's Meeting Seminar
- Vascular Biology, Vascular Medicine and Vascular Interventions: Balloons and Stents*, New Jersey Society of Interventional Cardiology, Passaic, NJ, Invited Lecture.

1997

Cardiovascular Research Seminar Series, St. Elizabeth's Medical Center, Boston, MA, Invited Lecture.

Tissue engineered vascular endothelial cell implants for the delivery of vasoactive compounds, Eighth International Symposium on Recent Advances in Drug Delivery, Salt Lake City, Utah, Invited Lecture.

Pathology of restenosis, Interventional Cardiology, Twelfth Annual Demonstrations Course, Snowmass, CO, Invited Lecture.

Grand Rounds, The New York Hospital-Cornell Medical Center, New York, Invited Lecture.

Medical Breakthroughs from M.I.T.: Sampling Current Research, Catherine N. Stratton Lectures on Aging Successfully, M.I.T Invited Lecture.

Restenosis and Growth Factors: Model of Paracrine Growth Control Seminars in Vascular Biology, Harvard Medical School, Seminar.

Controlled Release of Heparin, Antisense Oligonucleotides, and Cytokines for Restenosis, Controlled Release Society, Stockholm, Sweden, Invited Lecture.

Biology and Pathology of Endovascular Implants, 2nd International Meeting on Interventional Cardiology, Jerusalem, Israel, Invited Lecture.

Controversies in the Biology of Restenosis, 2nd International Meeting on Interventional Cardiology, Jerusalem, Israel, Invited Lecture.

Materials and Cells in Cardiovascular Healing, Gordon Research Conference on Biomaterials: Biocompatibility and Tissue Engineering, Holderness, NH, Invited Lecture.

Evolution of Thought in Coronary Artery Disease, Cadillac Trial Meeting/Guidant Corp., July 27-29, San Francisco, CA, Invited Lecture.

High Risk Coronary Angioplasty, The Cardiovascular Nursing & Technologist Symposium, Transcatheter Cardiovascular Therapeutics IX, September 24, Washington, DC, Invited Lecture.

Tissue Engineering Concepts (cells + composite modalities) to Achieve Therapeutic Effects, Local Cardiovascular Drug Delivery, Transcatheter Cardiovascular Therapeutics IX, September 24, Washington, DC, Invited Lecture.

Nir-ly There: Technology Assessment and New Product Review, Nir-ly There: Evolution of an Advanced Stent Technology, Transcatheter Cardiovascular Therapeutics IX, September 24, Washington, DC, Invited Lecture.

Nir-ly There: Vessel Requirements, Product Development, Clinical Verification – The NIR Future, Nir-ly There: Evolution of an Advanced Stent Technology, Transcatheter Cardiovascular Therapeutics IX, September 24, Washington, DC, Invited Lecture.

Future Roles and Impact of Biological Coatings in Interventional Vascular Therapy and Future Coating Technologies, Biological Coatings for Interventional Devices: Setting A New Standard for Success, Transcatheter Cardiovascular Therapeutics IX, September 24, Washington, DC, Invited Lecture.

Developing Improved Engineering and Animal Study Guidelines for Stents in the Future and Stents and the FDA Streamlining the Pathway for Regulatory Approval of Stents in the Future: A Fireside Chat with the FDA, Transcatheter Cardiovascular Therapeutics IX, September 25, Washington, DC, Invited Lecture.

The Impact of Stent Design on Pathobiologic Responses and The Role of Stents and the Impact of Multilink in Coronary Intervention, The Advanced Multilink Intracoronary Stent: Harmonizing Design and Function, Transcatheter Cardiovascular Therapeutics IX, September 25, Washington, DC, Invited Lecture.

When to Integrate Molecular Biology and Advanced Quantitative Techniques, Advanced Workshop on Experimental Animal Models, Transcatheter Cardiovascular Therapeutics IX, September 26, Washington, DC, Invited Lecture.

Future Needs and Developments in Antisense Technology, National Heart, Lung, and Blood Institute, National Institutes of Health, September 25-26, Bethesda, Maryland, Invited Lecture.

Stent Design – Pathobiologic Responses, Advanced Stent Workshop: Practical Tips and Tricks (including hands-on industry presentations of the new stents), Transcatheter Cardiovascular Therapeutics IX, September 28, Washington, DC, Invited Lecture.

Barriers in Drug Delivery, Conference on Formulations and Drug Delivery II, American Chemical Society/Controlled Release Society, Inc., October 5-8, La Jolla, California, Invited Lecture.

Polyampholytic Hydrogen Phase Transitions at High Ionic Strengths, Materials Research Society, Invited Lecture.

Equilibrium and Non-Equilibrium Polyelectrolyte Hydrogen Phase Transitions, Materials Research Society, Invited Lecture.

Tissue Engineering in Restenosis, American Association of Pharmaceutical Scientists, November 4, Boston, Mass, Invited Lecture.

Stent and artery geometry determine intimal thickening independent of deep arterial injury, 70th Scientific Sessions, American Heart Association, November 9-12, Invited Lecture.

Blockage of the Leukocyte integrin Mac-1 Reduces Experimental Restenosis, 70th Scientific Sessions, American Heart Association, November 9-12, Invited Lecture.

Heparin-coated stents eliminate mural thrombus deposition for days without affecting restenosis, 70th Scientific Sessions, American Heart Association, November 9-12, Invited Lecture.

Vascular endothelial growth factor effect on vascular permeability is mediated by synthesis of platelet-activating factor, 70th Scientific Sessions, American Heart Association, November 9-12, Orlando, FL, Invited Lecture.

Effects of stent geometry, balloon compliance, and deployment pressure on balloon-artery interactions during stent placement: A finite element model, American Heart Association 70th Scientific Sessions, November 9-12, Orlando, FL, Invited Lecture.

Controlled Drug Delivery and Vascular Disease, The 4th US-Japan Symposium on Drug Delivery Systems, December 14-19, Kauai, HI, Invited Lecture.

Research Seminar, Guidant Inc, Santa Clara, CA, Seminar.

1998

Pathology of Local Vascular Implants, 15th Annual International Symposium on Interventional Cardiology, January 21-25, Miami Beach, FL, Invited Lecture.

Frontier Therapy for Vascular Proliferative Diseases, 15th Annual International Symposium on Interventional Cardiology, January 21-25, Miami Beach, FL, Invited Lecture.

Local Cardiovascular Drug Delivery, 15th Annual International Symposium on Interventional Cardiology, January 21-25, Miami Beach, FL, Invited Lecture.

Stent-Based Drug Delivery, 4th Local Drug Delivery Meeting and Cardiovascular Course on Radiation and Molecular Strategies, February 26-28, Hotel Noga Hilton, Geneva, Switzerland, Invited Lecture.

Expanded polytetrafluoroethylene stent graft encapsulation reduces intimal thickening regardless of stent design, 47th Annual Scientific Session, American College of Cardiology, March 29-April 1, Atlanta, GA, Invited Lecture.

Local Perivascular Basic Fibroblast Growth Factor (bFGF) Treatment in Patients with Ischemic Heart Disease, 47th Annual Scientific Session, American College of Cardiology, March 29-April 1, Atlanta, GA, Invited Lecture.

The Endothelium in Vascular Disease, Cardiology & Cardio-thoracic Surgery, Third International Symposium, June 8-9, Jerusalem, Israel, Invited Lecture.

Development of Scientifically-based Cardiovascular Therapies, Thomas Jefferson University Hospital/Cardiovascular Research Center, July 17, Philadelphia, PA, Invited Lecture.

Intensive Review of Internal Medicine. Brigham & Women's Hospital and Harvard Medical School, August 9-16, Cambridge, MA, Invited Lecture.

Vascular Visions: Acute Myocardial Infarction and Cardiogenic Shock: Salvaging Myocardium, Stabilizing Rhythm, and Prolonging Life. Cardiology Research Foundation, September 15-17, Washington, D.C, Invited Lecture.

Molecular Cardiology and Local Cardiovascular Drug Delivery I, Washington Convention Center, October 6, Washington, D.C, Invited Lecture.

Molecular Cardiology and Local Cardiovascular Drug Delivery II, Washington Convention Center, October 7, Washington, D.C, Invited Lecture.

Coronary Stents I: Stent Designs, Controversies in Stenting, and The NIR Stent: An Advanced Platform for the Future. Interactive FDA Working Session, October 8, Washington Convention Center, Washington, D.C, Invited Lecture.

Understanding The Biomaterials, Biomechanics, and Pathobiologic Responses of Coronary Stents: Revising U.S. Regulatory Standards, Plenary Session #7 Endovascular Prosthetic Devices I. (Stents). October, 9, Washington Convention Center, Washington, D.C, Plenary Presentation.

Vascular Biology and Biomedical Engineering, Center for Engineering in Medicine, Shriners Hospital for Children, October 21, Boston, MA, Invited Lecture.

The Vascular Biology of Interventional Cardiology over the last 400 years, Mt. Sinai Hospital, October 21, New York, NY, Invited Lecture.

The Future of the Clinician-Scientist, Mt. Sinai Hospital, October 21, New York, NY, Invited Lecture.

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1999

Tissue engineering and vascular disease, Mt. Sinai School of Medicine, July 14, New York, NY, Invited Lecture.

Controlled release of growth factors: Biology, pharmacokinetics and clinical applications, Alkermes, Inc., August 3, Invited Lecture.

Drug Delivery: Innovations in Therapeutic Targeting, Massachusetts Biotechnology Council, October 18, Invited Lecture.

Tissue Engineering and Vascular Disease, Institute for Medicine and Engineering, University of Pennsylvania, December 7, Visiting Professorship.

Controlled release from endovascular implants, 5th Japan Symposium on Drug Delivery Systems, December 12-17, Maui, Hawaii, Invited Lecture.

2000

Molecular Intervention in Cardiovascular Disease and Stent-based Drug Delivery, 12th Annual International Symposium on Endovascular Therapy, ISET 2000, January 23-27, Miami Beach, FL, Invited Lecture.

Frontiers in Cardiovascular Biology, Harvard School of Public Health, Laboratory of Cardiovascular Biology-Center for the prevention of Cardiovascular Disease, February 11, Boston, MA, Seminar.

Vascular Tissue Engineering: Structure vs. Function, The Biology of Vascular Interventions – Minimally Invasive Approaches to Vascular Disease, February 17-18, Bethesda, MD, Invited Lecture.

Tissue Engineering & Vascular Disease, Cardiovascular Research Seminar 1999-2000, February 23, St. Elizabeth's Medical Center, Boston, MA, Invited Lecture.

Scaffolds for Perivascular Endothelial Cell Implantation, Tissue Engineering, Biomimetics and Medical Implant Science: Second Annual Grantees Meeting, National Institute of Health, March 2, 2000, Bethesda, MD, Invited Lecture.

Scaffolds for perivascular endothelial cell transplantation, VIIth Biannual Meeting of the International Society for Applied Cardiovascular Biology, March, 9-11, Tucson, AZ, Invited Lecture.

4th Biannual International Symposium on Cardiology and Cardio-Thoracic Surgery, July 3-4, Jerusalem, Israel, Invited Lecture.

Local treatment and biomaterials, XIth International Vascular Biology Meeting, September, 5-9, Geneva, Switzerland, Invited Lecture.

Debate: Gold Stents Represent a New Standard for Visibility, Performance and Clinical Outcomes, The 12th Annual Symposium,

Washington Convention Center, October 19, Washington, DC, Invited Lecture.

Coronary Stents I: Differentiating Stent Design and Performance, Transcatheter Cardiovascular Therapeutics, The Twelfth Annual Symposium, Washington Convention Center, October 19, Washington, DC, Invited Lecture.

Implications of Stent Design: Key Findings from Multi-Link Tetre Animal Studies, Controversies in Coronary Stenting, Transcatheter Cardiovascular Therapeutics, The Twelfth Annual Symposium, Washington Convention Center, October 19, Washington, DC, Invited Lecture.

Molecular Cardiology for the 'Clinician': Concepts, Semantics, and Clinical Applications -- Hope or Hype?, Plenary Session #3: Atherosclerosis and Molecular Cardiology, Transcatheter Cardiovascular Therapeutics, The Twelfth Annual Symposium, Washington Convention Center, October 19, Washington, DC, Invited Lecture.

Stent Design Dictates Thrombosis and Restenosis: New Insight Into the Performance of Standard Stainless Steel Stents from Computer Modeling

2001

Evaluating Stent Performance and Biocompatibility in Bench and Animal Models, CIMIT Forum, Massachusetts General Hospital, January 9, Boston, MA.

BioTechnology and Entrepreneurship: Visions of the Future, MIT-Science and Engineering Business Club, January 19, Cambridge, MA.

Does Stent Design Really Matter?, Cardiovascular Radiation Therapy V/Restenosis Forum, February 7, Washington, DC.

Tissue Engineering: Living Stent II, Cardiovascular Radiation Therapy V/Restenosis Forum, February 7, Washington, DC.

Stent Design and Drug Delivery, Cardiology of Georgia, P.C., March 15, Atlanta, GA.

Cardiology Grand Rounds, Columbia University, May 15, New York, NY

Vascular Biology, Vascular Medicine, and Vascular Biotechnology, Division of Cardiology, University of Texas Medical Branch at Galveston, May 24, Galveston, TX.

Endovascular Stents: Model Systems for Vascular Biology Research, Division of Cardiology, University of Texas Medical Branch at Galveston, May 24, Galveston, TX.

Do We Understand Restenosis? Which Pathways Should Be Interrupted? Transcatheter Cardiovascular Therapeutics 2001, September 11, Washington, DC.

Importance of Release Kinetics and Depth of Penetration, Transcatheter Cardiovascular Therapeutics 2001, September 11, Washington, DC.

The Burgeoning Field of Clinical Tissue Engineering: From Stem Cell Implants to Vascular and Myocardial Remodeling, Transcatheter Cardiovascular Therapeutics 2001, September 12, Washington, DC.

Tissue Engineering - Present Status and Future Expectations, Transcatheter Cardiovascular Therapeutics 2001, September 12, Washington, DC.

2002 *Stent Based Drug Delivery*, 14th Annual International Symposium on Endovascular Therapy, ISET 2002, January 20-24, Miami Beach, FL, Invited Lecture.

What is Tissue Engineering and How Can it be Applied?, 14th Annual International Symposium on Endovascular Therapy, ISET 2002, January 20-24, Miami Beach, FL, Invited Lecture.

Polymers on Stents: Biocompatibility, Release Kinetics, and Depth of Penetration, Cardiovascular Radiation Therapy VI/Restenosis Forum II, February 6-8, Washington, DC.

Joint Interventional Meeting, JIM 2002, February 7-9, Rome, Italy.

Cyphers, the 'Key' Difference, Cordis Symposium, May 22-24, 2002, France, Paris.

Vascular Biology, Tissue Engineering and Vascular Repair, Morris Karnovsky Symposium, June 10, 2002, Cambridge, MA, Invited Lecture.

The Drug-Eluting Stent Revolution: Multi-Component Design Elements of a Breakthrough Technology, Transcatheter Cardiovascular Therapeutics 2002, September 24, 2002, Washington, DC, Invited Lecture.

Live Case Transmissions, Transcatheter Cardiovascular Therapeutics 2002, September 24, 2002, Washington, DC, Discussant.

Moderated Panel and Audience Q & A: Drug-Eluting Stents, Transcatheter Cardiovascular Therapeutics 2002, September 25, 2002, Washington, DC, Discussant.

The Molecular Cardiology Symposium: Angiogenesis, Cell Therapy, and Local Drug Delivery, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Event Moderator.

The Burgeoning Field of Tissue-Engineering—From Cell Therapy approaches to Vascular and Myocardial Remodeling to Organogenesis, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Invited Lecture.

The Drug-Eluting Stent Summit, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Section Moderator.

The drug carrier vehicle—1) Polymer vs. Phosphorylcholine vs. Direct Adherence; 2) Impact of Bioerodability and Vascular Reactivity, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Invited Lecture.

Drug Release Kinetics—Factors Governing Dose and Tissue Penetration From Polymer and Non Polymer Based Systems, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Invited Lecture.

Basic Science and Desirable Components of a Drug Eluting Stent, Roundtable Discussion and Audience Q & A, Transcatheter Cardiovascular Therapeutics 2002, September 27, 2002, Washington, DC, Discussant.

2003

Understanding the Concept of Drug-Eluting Stents, January 19, 2003, International Symposium on Endovascular Theory, Miami, FL.

Hot Topics in Interventional Cardiology, January 19, 2003, International Symposium on Endovascular Theory, Miami, FL, Panelist.

Controversies in Endovascular Medicine, January 20, 2003, International Symposium on Endovascular Theory, Miami, FL, Moderator.

What do Vascular Specialists Need to Know about Drug Eluting Stents, January 20, 2003, International Symposium on Endovascular Theory, Miami, FL.

Issues Regarding Stent Design Drug-Related System, April 1 2003, American College of Cardiology Meeting 2003, Chicago, IL.

Inhibitor Macrophage Infusion, May 23, 2003, EuroPCR, Paris, France

A novel systemic anti-inflammatory strategy to reduce restenosis: Liposomal bisphosphonates and macrophage depletion, September 16 2003 Transcatheter Cardiovascular Therapeutics, Washington, DC.

Drug-eluting stents: A 'case study' of the first successful biotechnology platform- pitfalls, lessons and insights, September 17 2003 Transcatheter Cardiovascular Therapeutics, Washington, DC.

A basic primer on the essentials of drug-carrier systems- polymers, PC coatings, and direct bonding methods- similarities, differences and other innovative solutions, September 18 2003 Transcatheter Cardiovascular Therapeutics, Washington, DC.

Pharmaceutical Patent Forum, SG Cowen Securities Corporation, October 7 2003, 6th Annual Pharmaceutical Therapeutic Categories Review Conference, New York, NY.

Drug-Eluting Stents: Technical Update, December 8 2003, 5th International Meeting on Interventional Cardiology, Tel Aviv, Israel.

2004 Understanding the Concept of Drug Eluting Stents: The Impact of Stent Design, January 25 2004, International Symposium on Endovascular Theory, Miami, FL.

Crossfire: Topical debates in Endovascular Therapy, January 26 2004, International Symposium on Endovascular Theory, Miami, FL.

Live Case Demonstrations, January 26 2004, International Symposium on Endovascular Theory, Miami, FL.

Carotid Artery Therapy, January 26 2004, International Symposium on Endovascular Theory, Miami, FL.

Engineering Solutions for Restenosis, January 26 2004, International Symposium on Endovascular Theory, Miami, FL.

Mechanisms of DES Failures, May 7, 2004, Drug Eluting Stents In-Dept Symposium, Washington, DC.

Bioabsorbable Polymers, May 7, 2004, Drug Eluting Stents In-Dept Symposium, Washington, DC.

Mechanistic insights into Sirolimus activity and distribution after stent delivery, May 24, 2004, PCR, Paris, France. Plenary Session.

The Brave New World: Drug Eluting Stents and Other Revolutions, August 12, 2004, Life Sciences Conference, Jerusalem, Israel.

Innovations in Experimental Medicine: Impact on Drug-Eluting Stents and Other Antirestenosis Therapies, September 27, 2004, Transcatheter Cardiovascular Therapeutics, Washington, DC.

Understanding the Concept of Drug Eluting Stents: The Impact of Stent Design, International Symposium on Endovascular Theory, January 25 2004, Miami, FL, Invited Lecture.

Session II- Crossfire: Topical debates in Endovascular Therapy, International Symposium on Endovascular Theory, January 26 2004, Miami, FL, Moderator.

Live Case Demonstrations, International Symposium on Endovascular Theory, January 26 2004, Miami, FL, Panelist.

Topic I- Carotid Artery Therapy, International Symposium on Endovascular Theory, January 26 2004, Miami, FL, Moderator.

Engineering Solutions for Restenosis, International Symposium on Endovascular Theory, January 26 2004, Miami, FL, Invited Lecture.

Stent Design and Geometry, A.G. Edwards 3rd Annual Panel and Interactive Discussion on Emerging Medical Technology, February 24, 2004, NY, NY, Keynote Speaker.

2005

The Basics of Restenosis and DES, January 16 2005, International Symposium on Endovascular Theory, Miami, FL.

The Trials and Tribulations of Drug Eluting Stents, January 16 2005, International Symposium on Endovascular Theory, Miami, FL.

Stent Based Drug Delivery: Conception, Clinical Use and Remaining Challenges, January 27 2005, St. Elizabeth's Hospital, Tufts University.

Tissue Engineering: Examples from the Cardiovascular System, February 7, 2005, Pathology Grand Rounds, Brigham and Women's Hospital, Boston, MA.

Drug Eluting Stents: Mechanisms and Myths, February 21 2005, 12th International Symposium on Recent Advances in Drug Delivery Systems, Salt Lake City, UT.

Drug Eluting Stents: Conception, Implementation and Current Challenges, April 13 2005, Minnesota's Medical Device Community Forum: Design of Medical Devices, Minneapolis, MN.

Current Trends and Lab Issues regarding Drug Eluting Stent Technology, February 24, 2005, Morgan Stanley 8th Annual Interventional Cardiology, Conference, New York, NY.

Drug Eluting Stents: Conception, Implementation and Current Challenges, Design of Medical Devices Conference and President's Interdisciplinary Conference on Medical Devices, April 13-15, 2005, Minneapolis, MN, Invited Lecture.

Innovations in Cardiovascular Tissue Engineering, National Academy of Engineering and MIT School of Engineering Symposium on Stimulating Invention and Innovation, May 17, 2005, Cambridge, MA, Panelist.

Biomedical Applications of Expandable Microspheres, DuPont Symposium, May 19, 2005, Wilmington, DL, Panelist.

Stent-Based Drug Delivery, Controlled Release Society Annual Meeting, June 18-22, 2005, Miami, FL, Invited Lecture.

Vascular Repair, Inside and Out, Devices, Drugs and Cells, Gordon Research Conference on Biomaterials: Biocompatibility/ Tissue Engineering, July 31-August 5, 2005, Plymouth, NH, Invited Lecture.

The Evolution of Medical Sciences in Judaism, MIT Hillel Faculty Lunch Speakers Series, September 23, 2005, Invited Lecture.

Advances in Polymer and Drug Development, American Heart Association Annual Meeting, Dallas, Texas, November 14, 2005, Invited Lecture.

Cardiovascular Tissue Engineering: Lessons from Devices and Vascular Biology, Cardiovascular Grand Rounds, Dartmouth-Hitchcock Medical Center, Hanover, New Hampshire, December 2005. Invited Lecture.

2006 *Drug Eluting Stents In-Depth*, Cardiovascular Revascularization Therapies 2006 Conference, Cardiovascular Research Institute, Washington Hospital Center, Washington, DC, Moderator.

New Insights into the Biology of DES, Cardiovascular Revascularization Therapies 2006 Conference, Cardiovascular Research Institute, Washington, DC, Invited Lecture.

Tissue Regeneration and Translational Research, Massachusetts Medical Device Industry Council, Massachusetts Medical Society, Waltham, MA, May, 2006, Invited Panelist.

Tissue Engineering of Endothelial Cells and the Immune Response, World Transplant Congress, Washington, DC, Invited Lecture.

2007 *Stents, Drug Elution and Tissue Engineering: Technology in Evolution*, Cardiology Grand Rounds, Cardiovascular Research Institute, Washington Hospital Center, Washington, DC, May 1, 2007. Invited Lecture.

Animal Studies, Harvard Clinical Research Institute-Cardiomed Device Consultants Seminar: Medical Device Development Workshop: A Case Study Approach, Boston, MA, May 16, 2007. Invited Lecture.

Cardiovascular Tissue Engineering and Biotechnologies, Re-Engineering of the Cardiovascular Stem Cell Biology, Harvard Stem Cell Institute's Strategic Development in Biological Innovation, Cambridge, MA, April 30, 2007, Invited Lecture.

The Right Approaches for Animal Models and Pre-clinical Studies to Gain the Required Data to Allow Clinical Studies, ICI 2007 – Innovations in Cardiovascular Interventions, Tel Aviv, Israel, December 4, 2007, Invited Lecture.

2008

Drug Transport in Artery Walls, FDA/NSF/NIH Workshop on Computer Methods in Cardiovascular Device Design & Evaluation, Bethesda, MD, March 18, 2008, Invited Lecture

Challenges of Academic-Industry Collaboration in the Modern Era, 3rd Annual Medical Device Regulatory, Reimbursement and Compliance Congress, Harvard University, Cambridge, MA, March 27, 2008, Invited Lecture.

Vascular Biology, Endovascular Stents, and Tissue Engineering: Robert Koch and The Dread Pirate Robert, 25th Reunion Symposium, Harvard Medical School, Boston MA, June 5, 2008, Invited Lecture.

Stents as a Case-Study of Experimental Interventional Medicine, Transcatheter Cardiovascular Therapeutics 20th Annual Symposium; 2008 Washington, DC, October 12-17, Plenary Lecture.

Biodegradable Polymers, Healing Drugs and Disappearing Stents: Where Is the Future? Scientific Sessions 2008, American Heart Association Annual Meeting, New Orleans, LA, November 11, Invited Lecture.

2009

Endothelial Engineering Concept to Clinic, Cardiovascular Grand Rounds, Massachusetts General Hospital, Boston, MA, March 4, 2009. Invited Lecture.

Keynote Speaker, 4th International Symposium on Biomechanics in Vascular Biology and Cardiovascular Disease, Rotterdam, The Netherlands, April 16-17, 2009.

Endothelial Regulation of Vascular Homeostasis: Intersection of Vascular and Immune Biology Inside and Out, Jeffrey M. Hoeg Arteriosclerosis,

Thrombosis and Vascular Biology Award for Basic Science and Clinical Research Lecture. American Heart Association Arteriosclerosis, Thrombosis and Vascular Biology Annual Conference, April 29-May 1, 2009, Washington, DC.

Climate for Innovation in Massachusetts, Medical Technology Leadership Forum, May 7-8, 2009, Boston, MA, Invited Lecture.

Center for Scientific Review Special Emphasis Panel: American Recovery Reinvestment Act Grand Opportunity (GO) Grant Applications, August 6, 2009, Bethesda, MD.

Part I: A Basic Science Tour de Force: Perivascular Tissue Engineered Allogeneic Endothelial Cells: Vascular Repair After Intervention: Preclinical and Clinical Results, Transcatheter Cardiovascular Therapeutics 21st Annual Conference, September 21-25, 2009, San Francisco, CA, Invited Lecture.

Polymer Bioabsorption Fundamentals and Differences Among DES Systems, Transcatheter Cardiovascular Therapeutics 21st Annual Conference, September 21-25, 2009, San Francisco, CA, Invited Lecture.

Session III- Polymer-Free DES Platforms, Transcatheter Cardiovascular Therapeutics 21st Annual Conference, September 21-25, 2009, San Francisco, CA, Moderator.

2010

Vascular Biology, Vascular Tissue Engineering and Novel Vascular Therapeutics, Translational and Molecular Imaging Institute Seminar Series, Mount Sinai School of Medicine, May 21, 2010, New York, New York. Invited Lecture.

Tissue Engineering for the Injured Lung, Harvard Lung Conference & CIMIT:Center for Integration of Medicine & Innovative Technology, Inhalation Technology Workshop, Harvard Medical School, October 6-7, 2010, Boston MA. Invited Lecture.

Early, Innovative Resuscitation and Bleeding Control after Injury, CIMIT:Center for Integration of Medicine & Innovative Technology Forum-Trauma and Critical Care, Pre-Hospital Resuscitation Workshop, Massachusetts General Hospital, Boston, MA. Invited Lecturer

The Impact of Vascular Biology & Computational Models on Device Innovation in Cardiovascular Medicine (Case Examples), Transcatheter Cardiovascular Therapeutics 22st Annual Conference, September 21-25, 2010, Washington, DC. Invited Lecture.

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2011 *Tissue-Specific Adhesive Materials*, IDEASTREAM Deshpande Center Symposium 2011, April 15, 2011, Massachusetts Institute of Technology, Cambridge, MA. Invited Lecture.

Bench to Bedside: Marriage of Engineering and Biological Sciences: Forget the Future, What have we learned from the past, Dean's Distinguished Lecture, April 21, 2011, The Fu Foundation School of Engineering and Applied Science, Columbia University, New York, New York. Invited Lecture

A Report from the Edelman Lab, Harvard-MIT Biomedical Engineering Center, Massachusetts Medical Device Industry Council, 15th Annual Conference, May 3, 2011, UMass Boston Campus Center, Boston, MA. Plenary Speaker

Bioengineering, Vascular Biology and Emerging Cardiovascular Therapeutics, American Society of Mechanical Engineering (ASME) 2011 Summer Bioengineering Conference, June 23, 2011, Farmington, PA. Plenary Speaker

b. Professional and educational leadership role

3. Teaching awards received

2000 The 2000 Thomas A. McMahon Mentoring Award, Harvard University / Massachusetts Institute of Technology Division of Health Sciences and Technology

4. Major curriculum offerings/educational programs developed

1989-1992 Introductory Course for First Year Cardiology Fellows, Brigham and Women's Hospital, Boston
Organizer and Lecturer
20 cardiology fellows, and faculty members
25 hours per year

HST-150
1989-1996 *Pharmacology*
founding and core faculty member
40 Medical and Graduate students
60 hours/year

HST-240
1989-present *Physician-Scientist Preceptorship*
founding faculty and course director
40 Medical and Graduate students
required graduation 1 month elective

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<i>HST-090</i>	<i>Cardiovascular Pathophysiology</i>
1980, 1982	tutor
1991-1998	core faculty member
1999-present	director
	40 Medical and Graduate students

E. Report of Clinical Activities:

1989 Attending Physician, Levine Coronary Care Unit, Brigham and Women's Hospital, Boston

1. Core member of the Brigham and Women's Hospital coronary care unit faculty in addition to general cardiology outpatient and inpatient care.
2. Clinical activity includes directing the day-to-day care of the most acutely ill patients in our hospital with ischemic heart disease, unstable angina, myocardial infarction, respiratory distress, shock, sepsis, sudden death, congestive heart failure, dysrhythmias etc. I routinely perform diagnostic right heart catheterization, trans-thoracic echocardiograms, pluerocenteses, paracenteses, and insertion of temporary pacemakers, pulmonary artery catheters, central venous catheters, and arterial pressure monitoring catheters. On an emergent basis I perform pericardiocenteses, tracheal incubations and insert intra-aortic balloon counterpulsation pumps.
3. I also spend three weeks of the year interpreting approximately 300 electrocardiograms per day.
4. I serve, as well, as a cardiac consulting physician in the Cardio-thoracic surgical intensive care unit.

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Original Articles:

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3. Edelman ER, Brown L, Kost J, Taylor J, Langer RS. Modulated release from polymeric drug delivery systems using oscillating magnetic fields: in vitro and in vivo characteristics. Trans Am Soc for Artif Intern Organs 1984;30:445-9.
4. Langer RS, Seigel R, Brown L, Leong K, Kost J, **Edelman ER**. Controlled release systems: some recent advances. Polymeric Material Science and Engineering 1984;51:115-118.
5. McCarthy MJ, Soong DS, **Edelman ER**. Control of drug release from polymer matrices impregnated with magnetic beads - a proposed mechanism and model for enhanced release. Journal of Controlled Release 1984;1:143-147.
6. Brown L, **Edelman ER**, Langer RS. Quantitation of simultaneous controlled release of insulin and somatostatin from implantable polymer matrices. Diabetes 1984;33(suppl. #1):177a.
7. **Edelman ER**, Kost J, Bobeck H, Langer RS. Regulation of drug release from polymer matrices by oscillating magnetic fields. J Biomed Mater Res 1985;19(1):67-83.
8. Langer RS, Brown L, **Edelman ER**. Controlled release and magnetically modulated release systems for macromolecules. Methods Enzymol 1985;112:399-422.
9. Langer RS, Seigel R, Brown L, Leong K, Kost J, **Edelman ER**. Controlled release and magnetically modulated systems for macromolecular drugs. Ann NY Acad Sci 1985;446:1-13.
10. Langer RS, Siegel R, Brown L, Leong K, Kost J, **Edelman ER**. Controlled release: three mechanisms, Chemtech.1986;16(2):108-10.
11. Brown L, Munoz C, Siemer L, **Edelman ER**, Langer RS. Controlled release of insulin from polymer matrices. Control of diabetes in rats. Diabetes 1986 Jun;35(6):692-7.
12. **Edelman ER**, Brown L, Taylor J, Langer RS. *In vitro* and *in vivo* kinetics of regulated drug release from polymer matrices by oscillating magnetic fields. J Biomed Mater Res 1987 Mar;21(3):339-53.

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13. Klagsbrun M, **Edelman ER**. Biological and biochemical properties of fibroblast growth factors. Implications for the pathogenesis of atherosclerosis. *Arteriosclerosis* 1989 May-Jun;9(3):269-78.
14. Muller JE, Tofler GH, **Edelman ER**. Probable triggers of onset of acute myocardial infarction. *Clin Cardiol* 1989 Aug;12(8):473-5.
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