

# Oscar J. Abilez, M.D., Ph.D.

---

## Personal Statement

My research interests are aimed at elucidating how various biophysical stimuli regulate cardiovascular development across time and length scales that span several orders of magnitude, using human pluripotent stem cells as a model system. Currently, my research focuses on applying biochemical, electrical, mechanical, and optogenetic stimulation to control and manipulate the directed differentiation, maturation, and organization of human pluripotent stem cell-derived cardiovascular cells. My areas of expertise are in directed differentiation, optogenetics, electrophysiology, microfluidics, long-term live cell imaging, mathematical modeling, computational simulation, and multiscale engineering. Guided by these quantitative approaches, my long-term research goal is to ascertain the mechanisms by which various biophysical stimuli direct the development of cells and tissues from human pluripotent stem cells, and to use these findings to address challenges in the basic, translational, and clinical sciences.

## Current Position

### Instructor

2013-present

Department of Medicine, Division of Cardiovascular Medicine  
Stanford University Medical Center

## Address

### Business

Stanford University  
Clark Center, E276  
318 West Campus Drive, MC 5433  
Stanford, CA 94305-5433  
(650) 725-2595 (lab)  
(650) 725-9082 (fax)  
ojabilez@stanford.edu  
[http://med.stanford.edu/profiles/Oscar\\_Abilez/](http://med.stanford.edu/profiles/Oscar_Abilez/)

## Personal

Hometown: Junction, TX

## Citizenship

USA

## Education

University of Texas, Austin, TX, 1987-1992  
B.S., Mechanical Engineering (1992)

Cornell University, New York, NY, 1996-2002  
M.D. (2002)

University of Texas, Austin, TX, 2010  
M.S., Bioengineering (2010)

Stanford University, Stanford, CA, 2007-2012  
Ph.D., Bioengineering (2012)

## Residency

Stanford University, Stanford, CA, 2002-2004  
Intern, General Surgery  
Resident, General Surgery

---

## Continuing Education

Stanford University, Stanford, CA

- “Department of Surgery Grand Rounds and Core Course”, 2004-2007
- “NIH Funding Opportunities Workshop”, Dec 2004
- “NIH Frontiers in Human Embryonic Stem Cells Advanced Training Course”, Jun 2005
- “BIOE 374A, Biodesign Innovation Course”, Audit, Jan-Mar 2005
- “BIO 157, The Stem Cell”, Audit, Jan-Mar 2006
- “Scientific Management Series for Postdocs”, Jan-Apr 2006
- “BIOE 370B, Microfluidic Device Laboratory”, Audit, Apr-Jun 2006
- “Bio-X Sponsored Design of Experiments & Engineering Statistics Workshop”, Jan 2007
- “Stanford Physics Machine Shop Course”, Apr-May 2007

## Publications

1. *Picquet J, Abilez O, Pénard J, Jousset Y, Rousselet MC, Enon B.* Superficial femoral artery transposition repair for isolated superior mesenteric artery dissection. *J Vasc Surg.* 2005 Oct;42(4):788-91. PubMed PMID: 16242570.
2. *Abilez O, Benharash P, Mehrotra M, Miyamoto E, Gale A, Picquet J, Xu C, Zarins C.* A novel culture system shows that stem cells can be grown in 3D and under physiologic pulsatile conditions for tissue engineering of vascular grafts. *J Surg Res.* 2006 May 15;132(2):170-8. Epub 2006 Mar 20. PubMed PMID: 16542683.
3. *Abilez O, Benharash P, Miyamoto E, Gale A, Xu C, Zarins CK.* P19 progenitor cells progress to organized contracting myocytes after chemical and electrical stimulation: implications for vascular tissue engineering. *J Endovasc Ther.* 2006 Jun;13(3):377-88. PubMed PMID: 16784327.
4. *Benharash P, Lee JT, Abilez O, Crabtree T, Bloch DA, Zarins CK.* Iliac fixation inhibits migration of both suprarenal and infrarenal aortic endografts. *J Vasc Surg.* 2007 Feb;45(2):250-7. PubMed PMID: 17263997.
5. *Cao F, Sadrzadeh Rafie AH, Abilez O, Wang H, Blundo JT, Pruitt B, Zarins C, Wu JC.* In vivo imaging and evaluation of different biomatrices for improvement of stem cell survival. *J Tissue Eng Regen Med.* 2007 Nov-Dec;1(6):465-8. PubMed PMID: 18163533.
6. *Picquet J, Thouveny F, Abilez O, Pégis JD, Blin V, Enon B.* First report of an ilio-popliteal bypass through the greater sciatic foramen. Case report. *J Cardiovasc Surg (Torino).* 2008 Jun;49(3):341-3. PubMed PMID: 18446119.
7. *Rafii BY, Abilez O, Benharash P, Zarins CK.* Lateral movement of endografts within the aneurysm sac is an indicator of stent-graft instability. *J Endovasc Ther.* 2008 Jun;15(3):335-43. PubMed PMID: 18540708.
8. *Assar AN, Abilez O, Zarins CK.* Outcome of open versus endovascular revascularization for chronic mesenteric ischemia: review of comparative studies. *J Cardiovasc Surg (Torino).* 2009 Aug;50(4):509-14. Epub 2009 May 19. Review. PubMed PMID: 19455085.
9. *Göktepe S, Abilez O, Parker KK, Kuhl E.* A multiscale model for eccentric and concentric cardiac growth through sarcomerogenesis. *J Theor Biol.* 2010 Aug 7;265(3):433-42. Epub 2010 May 4. PubMed PMID: 20447409.
10. *Huang NF\*, Patlolla B\*, Abilez O\*, Sharma H, Rajadas J, Beygui RE, Zarins CK, Cooke JP.* A matrix micropatterning platform for cell localization and stem cell fate determination. *Acta Biomater.* 2010 Dec;6(12):4614-21. Epub 2010 Jul 1. (\* equal contribution)
11. *Wang A, Abilez O, Zarins C, Taylor C, Liang D.* Power law as a method for ultrasound detection of internal bleeding: in vivo rabbit validation. *IEEE Trans Biomed Eng.* 2010 Jul 15. [Epub ahead of print] PubMed PMID: 20639172.
12. *Göktepe S, Abilez O, Kuhl E.* A generic approach towards finite growth with examples of athlete's heart, cardiac dilation, and cardiac wall thickening. *J Mechanics and Physics of Solids.* 2010 Oct;58:1661-1680.

- 
13. Wilson KD, Venkatasubrahmanyam S, Fu J, Sun N, **Abilez O**, Baugh JA, Jia F, Ghosh Z, Li RA, Butte AJ, Wu J. Dynamic microRNA expression programs during cardiac differentiation of human embryonic stem cells. Circulation Cardiovascular Genetics. 2010 Aug 23. [Epub ahead of print] PubMed PMID: 20733065.
  14. Haick MB, **Abilez OJ**, Johnson BL, Xu C, Taylor CA, Rich NM, Zarins CK. Localized control of exsanguinating arterial hemorrhage: an experimental model. Pol Przegl Chir. 2011 Jan;83(1):1-9. doi: 10.2478/v10035-011-0001-0. PubMed PMID: 22166236.
  15. Rausch MK, Dam A, Göktepe S, **Abilez O**, Kuhl E. Computational modeling of growth: systemic and pulmonary hypertension in the heart. Biomechanics and Modeling in Mechanobiology. 2011 Dec; 10(6):799-811. PubMed PMID: 21188611.
  16. Wei P, Taylor R, Ding Z, Chung C, **Abilez O**, Higgs G, Pruitt B, Ziaie B. Stretchable microelectrode array using room-temperature liquid alloy interconnects. J Micromechanics and Microengineering. 2011 May; 21(5). doi: 10.1088/0960-1317/21/5/054015.
  17. Chang EI, Galvez MG, Glotzbach JP, Hamou CD, El-ftesi S, Rappleye CT, Sommer K, Rajadas J, **Abilez OJ**, Fuller GG, Longaker MT, Gurtner GC. Vascular anastomosis using controlled phase transitions in poloxamer gels. Nature Medicine. 2011 Aug 28;17(9):1147-52. doi: 10.1038/nm.2424.
  18. **Abilez O**, Wong J, Prakash R, Deisseroth K, Zarins CK, Kuhl E. Multiscale computational models for optogenetic control of cardiac function. Biophysical Journal. 2011 Sep 21;101(6):1326-34. Epub 2011 Sep 20.
  19. Myers F, **Abilez O**, Zarins CK, Lee LP. Stimulation and artifact-free extracellular electrophysiological recording of cells in suspension. Conf Proc IEEE Eng Med Biol Soc. 2011 Aug:4030-3.
  20. Böl M, **Abilez O**, Assar AN, Zarins CK, Kuhl E. Active and passive stresses in electro-active cardiac muscle—a robust *in vitro/in silico* model to study isometric contractions. International Journal for Multiscale Computational Engineering. 2012;10(2):171-188.
  21. Wong J, **Abilez O**, Kuhl E. Computational optogenetics: A novel continuum framework for the photoelectrochemistry of living systems. J Mechanics and Physics of Solids. 2012 Jun 1;60(6):1158-1178. PubMed PMID: 22773861.
  22. Sun N, Yazawa M, Liu J, Han L, Sanchez-Freire V, **Abilez OJ**, Navarrete EG, Hu S, Wang L, Lee A, Pavlovic A, Lin S, Chen R, Hajar RJ, Snyder MP, Dolmetsch RE, Butte MJ, Ashley EA, Longaker MT, Robbins RC, Wu JC. Patient-specific induced pluripotent stem cells as a model for familial dilated cardiomyopathy. Science Translational Med. 2012; 4 (130): 130ra47. PubMed PMID: 22517884.
  23. Zöllner AM, **Abilez OJ**, Böl M, Kuhl E. Stretching skeletal muscle—chronic muscle lengthening through sarcomerogenesis. PLoS ONE, 2012;10:e45661.
  24. Myers FB, Zarins CK, **Abilez OJ\***, Lee LP\*. Label-free electrophysiological cytometry for stem cell-derived cardiomyocyte clusters. Lab Chip. 2013 Jan 21;13(2):220-8. doi: 10.1039/c2lc40905d. Epub 2012 Dec 3. PubMed PMID: 23207961. (\*co-corresponding authors) (cover article)
  25. Lan F, Lee AS, Liang P, Sanchez-Freire V, Nguyen PK, Wang L, Han L, Yen M, Wang Y, Sun N, **Abilez OJ**, Hu S, Ebert AD, Navarrete EG, Simmons CS, Wheeler M, Pruitt B, Lewis R, Yamaguchi Y, Ashley EA, Bers DM, Robbins RC, Longaker MT, Wu JC. Abnormal calcium handling properties underlie familial hypertrophic cardiomyopathy pathology in patient-specific induced pluripotent stem cells. Cell Stem Cell. 2013 Jan 3;12(1):101-13. doi: 10.1016/j.stem.2012.10.010. PubMed PMID: 23290139.
  26. **Abilez O**. Cardiac optogenetics. Conf Proc IEEE Eng Med Biol Soc. 2012:1386-9. PubMed PMID: 23366158
  27. Ardehali R, Ali SR, Inlay MA, **Abilez OJ**, Chen MQ, Blauwkamp TA, Yazawa M, Gong Y, Nusse R, Drukker M, Weissman IL. Prospective isolation of human embryonic stem cell-derived cardiovascular progenitors

---

that integrate into human fetal heart tissue. *Proc Natl Acad Sci U S A*. 2013 Feb 26;110(9):3405-10. doi: 10.1073/pnas.1220832110. Epub 2013 Feb 7. PubMed PMID: 23391730.

28. **Abilez OJ**, Wu JC. Stem cell isolation: Differential stickiness. *Nat Mater*. 2013 Jun;12(6):474-6. doi: 10.1038/nmat3664. PubMed PMID: 23695740.
29. **Abilez OJ**. Optogenetic LED array for perturbing cardiac electrophysiology. *Conf Proc IEEE Eng Med Biol Soc*. 2013 Jul;2013:1619-22. doi: 10.1109/EMBC.2013.6609826. PubMed PMID: 24110013.
30. Myers FB, Silver JS, Zhuge Y, Beygui RE, Zarins CK, Lee LP\*, **Abilez OJ**\*. Robust pluripotent stem cell expansion and cardiomyocyte differentiation via geometric patterning. *Integr Biol* (Camb). 2013 Nov 18;5(12):1495-506. doi: 10.1039/c2ib20191g. PubMed PMID: 24141327. (\*co-corresponding authors)
31. Burridge PW, Matsa E, Shukla P, Lin ZC, Churko JM, Ebert AD, Lan F, Diecke S, Huber B, Mordwinkin NM, Plews JR, **Abilez OJ**, Cui B, Gold JD, Wu JC. Chemically defined generation of human cardiomyocytes. *Nature Methods*. 2014 Aug;11(8):855-60. doi: 10.1038/nmeth.2999. Epub 2014 Jun 15. PubMed PMID: 24930130.
32. Sanchez-Freire V, Lee AS, Hu S, **Abilez OJ**, Liang P, Lan F, Huber BC, Ong SG, Hong WX, Huang M, Wu JC. Effect of human donor cell source on differentiation and function of cardiac induced pluripotent stem cells. *J Am Coll Cardiol*. 2014 Aug 5;64(5):436-48. doi: 10.1016/j.jacc.2014.04.056. PubMed PMID: 25082575.
33. Myers F, Zarins CK, Lee LP, **Abilez OJ**. Electrophysiology-activated cell sorting. (in revision).
34. **Abilez OJ**, Zhuge Y, Baugh J, Patlolla B, Chang PA, Gorrepati M, Prakash R, Jia F, Huang M, Yu J, Wilson KD, Riemer RK, Beygui RE, Wu JC, Deisseroth K, Zarins CK. Optogenetic control of human heart cells. (in revision).

### Manuscripts in Preparation

1. **Abilez O**, Benharash P, Xu C, Wu J, Zarins C. A multi-stimulus bioreactor for cardiovascular tissue engineering. (in preparation).

### Thesis and Dissertation

1. **Abilez O**. Development of a bioreactor imaging system for characterizing embryonic stem cell-derived cardiomyocytes. *Master's Report, University of Texas*, 2010 May.
2. **Abilez O**. Biochemical, mechanical, and optogenetic control of human pluripotent stem cell-derived cardiomyocytes. *Doctoral Dissertation, Stanford University*, Committee: Christopher K. Zarins, Robert C. Robbins, Joseph C. Wu, Paul Yock, Stephen R. Quake. 2012 March.

### Inventions

1. **Abilez O**, Stanford University. "Systems, Methods, and Apparatus Configurations Using Genetic Algorithms to Design Cells, Tissues, and Tissue Systems." USA. 2004. (Disclosed to Stanford Office of Technology Licensing, Docket S04-293).
2. **Abilez O**, Stanford University. "Tools and Instruments with Locking Mechanism that Allows Both Left and Right Handed Use." USA. 2004. (Disclosed to Stanford Office of Technology Licensing, Docket S04-303).
3. **Abilez O**, Zarins C, Stanford University. "Methods and Techniques for Creating *in situ* Biological Structures by Using Autologous Biological Materials in Combination with Intra- or Extra-Corporeal Bio-Mechanical, Bio-Chemical, Bio-Electric, and Bio-Thermal Conditioning." USA. 2005. (Disclosed to Stanford Office of Technology Licensing, Docket S05-067).
4. **Abilez O**, Hochberg L, Vase A, Velan A, Stanford University. "Systems and Methods for Temporally Regulating Agent Delivery to the Central Nervous System." USA. 2005. (Disclosed to Stanford Office of Technology Licensing, Docket S05-105).

- 
5. **Abilez O, Benharash P, Zarins C**, Stanford University. "Cell Sorter and Culture System." USA. 2005. (Disclosed to Stanford Office of Technology Licensing, Docket S05-377, USPTO Patent Pending 11/732,911, Filed 4/05/2007).
  6. **Abilez O, Benharash P, Zarins C**, Stanford University. "Magnetic Drug Delivery System." USA. 2006. (Disclosed to Stanford Office of Technology Licensing, Docket S06-044).
  7. **Abilez O, Benharash P, Zarins C**, Stanford University. "Computer-Controlled Physiologic Pump." USA. 2006. (Disclosed to Stanford Office of Technology Licensing, Docket S06-097).
  8. **Zarins C, Benharash P, Abilez O**, Stanford University. "Mechanism to Prevent Lateral Displacement of Stent-Grafts within Aneurysms." USA. 2006. (Disclosed to Stanford Office of Technology Licensing, Docket S06-208, USPTO Patent Pending 12/112,852, Filed 4/30/2008).
  9. **Abilez O, Myers F, Lee L, Zarins C**, Stanford University. "Systems and Methods for Electrophysiological Cell Sorting and Cytometry." USA. 2010. (Disclosed to Stanford Office of Technology Licensing, Docket S10-370, USPTO Patent Pending 61/474,213).
  10. **Abilez O, Kuhl E, Zarins C**, Stanford University. "Optical Biological Pacemaker and Defibrillator." USA. 2011. (Disclosed to Stanford Office of Technology Licensing, Docket S11-204).
  11. **Lee L, Myers FB, Silver JS, Zarins CK, Abilez OJ**, UC Berkeley and Stanford University. "Stencil Patterning Method for Generating Highly Uniform Stem Cell Colonies." USA. 2012. (Disclosed to UC Berkley Office of Technology Licensing, Docket BK-2012-020-1 and Stanford Office of Technology Licensing, Docket S11-387, USPTO Patent Pending 61/585,097).

## Books

1. Pocket Scalpel, Practical Guide to the Care of the Surgical Patient. 1<sup>st</sup> ed., *Nguyen T, Abilez O, (Editors)*. Elsevier, Philadelphia, PA; Nov 2008.

## Book Chapters

1. *Picquet J, Abilez O, Cau J, Goeau-Brissonnière O, Zarins CK: Laparoscopic Vascular Surgery in 2007.* In *Nezhat's Operative Gynecologic Laparoscopy with Hysteroscopy: Principles and Techniques*. Camran Nezhat, Farr Nezhat, Ceana Nezhat, (Editors), Cambridge University Press, 3rd ed., Dec 2007.
2. *Abilez O, Picquet J, Zarins CK: Laparoscopic Major Vascular Injury.* In *Nezhat's Operative Gynecologic Laparoscopy with Hysteroscopy: Principles and Techniques*. Camran Nezhat, Farr Nezhat, Ceana Nezhat, (Editors), Cambridge University Press, 3rd ed., Dec 2007.
3. *Abilez OJ, Wu JC: Human Pluripotent Stem Cells (hPSCs) for Heart Regeneration.* In *Cardiac Regeneration and Repair*. Ren-Ke Li, Richard D. Weisel (Editors), Woodhead Publishing, Vol 1, 2014.

## Professional Experience

General Motors, Shreveport, LA, 1989-1990

*Engineering Co-op Student*

Supervisor: Larry Johnson, P.E.

- Developed manufacturing processes at an assembly plant

General Motors, Mesa, AZ, 1991

*Engineering Co-op Student*

Supervisor: Karl Schmitz, P.E.

- Tested vehicles at Desert Proving Ground

CarboMedics, Inc., Austin, TX, 1993-1996

*Engineering Staff*

Supervisor: Andy Campbell, P.E.

- Supported design and development of Pyrolytic® and tissue heart valve prostheses
- Developed various manufacturing processes

---

## Research Experience

University of Texas, Austin, TX, 1994-1996

*Biomedical Engineering Graduate Student*

Advisor: Thomas Runge, M.D.

- Evaluated the rheology of blood mixed with a perfluorocarbon-based artificial blood substitute

Cornell University, New York, NY, summers 1996-1997

*Medical Student Research Fellow*

Department of Neuroscience

Advisor: Robert Duvoisin, Ph.D.

- Designed a DNA construct that coded for a fusion protein consisting of a metabotropic glutamate receptor and green fluorescent protein (GFP)

Cornell University, New York, NY, 1998-2000

*Medical Student Research Fellow*

Department of Medicine, Division of Hematology & Oncology

Advisor: Roy Silverstein, M.D.

- Characterized the role of scavenger receptor CD36 in the phagocytosis of apoptotic cells by dendritic cells derived from murine bone marrow stem cells
- Developed a monoclonal antibody to the scavenger receptor CD36 (Clone 63, Chemicon)

Stanford University, Stanford, CA, 7/04-6/12

*Postdoctoral Fellow*

Department of Surgery, Division of Vascular Surgery, Zarins Vascular Research Lab

Advisor: Christopher Zarins, M.D.

- Designed and built novel bioreactors for stem cell culture across scales
- Initiated first stem cell work in the lab
- Used human embryonic and induced pluripotent stem cells to create cardiovascular tissue
- Invented an electrically-activated cell sorter for cardiomyocytes
- Contributed significantly to cardiovascular computational models
- Using optogenetics to control human embryonic and induced pluripotent stem cell lines
- Using live cell imaging and genetic approaches to observe patterns of stem cell differentiation
- Using large-scale microfluidics to probe stem cell differentiation landscapes

Stanford University, Stanford, CA, 7/12-4/13

*Postdoctoral Fellow*

Department of Medicine, Division of Cardiovascular Medicine, Wu Lab

Advisor: Joseph Wu, M.D., Ph.D.

- Continuing to use optogenetics to control human pluripotent stem cell lines
- Continuing to use live cell imaging and genetic approaches to observe patterns of stem cell differentiation
- Continuing to use large-scale microfluidics to probe stem cell differentiation landscapes
- Continuing to develop electrically-activated cell sorter for cardiomyocytes

## Teaching Experience

House of Tutors, Austin, TX, 1992-1993

*Tutor*

- Tutored various subjects and published organic chemistry notes

University of Texas, Austin, TX, 1993

*Grader, Design of Thermal-Fluid Systems*

- Graded homework, projects, and exams

Cornell University, New York, NY, 1997

*Teaching Assistant, Brain & Mind Course*

- Prepared prosections and taught head and neck anatomy

Cornell University, New York, NY, 2000

*Mentor, Cornell Science Challenge*

- Led 7th and 8th graders through a semester long science project

Stanford University, Stanford, CA, 2004-2006

*Postdoctoral Fellow/Surgery Resident*

- Taught suturing and knot tying classes for medical students

Stanford University, Stanford, CA, 2004-present

*Postdoctoral Fellow*

---

Teaching Assistant and Lecture Experience:

1. Co-Advisor, ME 342: Microelectromechanical (MEMS) Project, “BioMEMs Differentiation and Characterization of Human Embryonic Stem Cell (hESC)-Derived Cardiomyocytes”, Spring/Summer 2006.
2. Guest Lecturer, MED 223: Cardiovascular and Pulmonary Sciences Seminar, “Aortic Aneurysm Disease”, Autumn 2006.
3. Co-Advisor, E 341: Micro/Nano Systems Design and Fabrication Laboratory Project, “Stretchable Microelectrode Arrays (sMEAs) for Stem Cell Differentiation”, Spring 2007.
4. Guest Lecturer, BioE 361: Biomaterials in Regenerative Medicine, “Multiscale Engineering of a Contractile Tube”, Winter 2008.
5. Teaching Assistant, BioE 300B: Systems Biology and Tissue Engineering, Karl Deisseroth and Markus Covert, Course Instructors, Spring 2009.
6. Guest Lecturer, Stanford Stem Cell Course, “Directed Differentiation and Control of Human Pluripotent Stem Cell-Derived Cardiomyocytes”, March 20, 2012
7. Guest Lecturer, BIO S214: Modeling of Molecular Systems, “Multiscale Computational Models for Optogenetic Control of Heart Function”, May 21, 2013.
8. Guest Lecturer, NIH Progenitor Cell Biology Consortium (PCBC) Differentiation Course, “Novel Techniques for Cardiovascular Differentiation”, June 12, 2013
9. Guest Lecturer, MED 223: Cardiovascular and Pulmonary Sciences Seminar, “Engineering Pluripotent Stem Cells for Cardiovascular Therapy”, Dec 04, 2013
10. Guest Lecturer, NIH Progenitor Cell Biology Consortium (PCBC) Differentiation Course, “Novel Techniques for Cardiovascular Differentiation”, Feb 13, 2014

Students Mentored:

1. Mahncy Mehrotra, Gunn high school student, *2006 Intel Science Talent Search Semi-Finalist Award*, “The Effects of Flow on Differentiation of Stem Cells in a Culture Chamber”, Summer 2005. Stanford undergraduate student, tissue engineering/stem cell literature review, Autumn 2006-Spring 2007.
2. Emiko Miyamoto, Stanford bioengineering graduate student, mouse embryonic stem cell culture techniques, “A Novel Culture System Shows that Stem Cells can be Grown in 3D and Under Physiologic Pulsatile Conditions for Tissue Engineering of Vascular Grafts”, 2004-2006.
3. Adrian Gale, Stanford mechanical engineering graduate student, design and fabrication of a cell culture chamber, “A Novel Culture System Shows that Stem Cells can be Grown in 3D and Under Physiologic Pulsatile Conditions for Tissue Engineering of Vascular Grafts”, 2005-2006.
4. Stephan Goupille, Stanford undergraduate and graduate student, “The Effects of Various pH and Oxygen Levels on the Differentiation of P19-Derived Myocytes”, Summer 2006. Currently growth analyst at Facebook (2010-present).
5. Gretchen Chua, Jennifer Blundo, Yong-Lae Park, and Ali Rastegar, Stanford engineering graduate students, ME342 Microelectromechanical (MEMS) Project, “BioMEMs Differentiation and Characterization of Human Embryonic Stem Cell (hESC)-Derived Cardiomyocytes”, Spring/Summer 2006.
6. Aris Theologis, Stanford undergraduate student, BIO-199X and *American Vascular Association (AVA) Lifeline Student Research Fellowship*, Stanford Senior Thesis: “The Effects of Pulsatile Flow on the Organization of P19-Derived Cardiomyocytes”, Spring 2009. Currently product manager at Crescendo Bioscience (2010-present).
7. Antoine Sindhu, Stanford undergraduate student, BIO-199X, “Development of a Genetic Algorithm to Determine Optimal pH for Stem Cell Viability in a Microfluidic System”, Summer 2006-Spring 2007. Currently graduate student, electrical engineering, Stanford (2010-present).
8. Benjamin Rafii, Stanford medical student, “Lateral Displacement is an Indicator of Stent-Graft Migration in Endovascular Aneurysm Repair”, Summer 2006-Spring 2007. Currently otorhinolaryngology resident, New York University Medical Center (2010-present).

- 
9. Samuel Chen, Stanford undergraduate student, SURG-199X, “Development of an Imaging System for Non-destructively Assessing Characteristics of Human Embryonic Stem-Cell Derived Cardiomyocytes” and “The Effects of Hemodynamic Factors on Arterial Vessel Wall Remodeling in an *in vitro* Tissue-Culture System”, Autumn 2006-Spring 2007. Currently medical student, UC-Irvine (2010-present).
  10. Rebecca Taylor, Stanford mechanical engineering graduate student, “Pulsatile Pressure System for Cellular Mechanical Stimulation” and “Development of a Computational Model for Predicting Cardiomyocyte Growth and Mechanical Properties in Response to Electrical Stimulation”, Autumn 2006-Spring 2007. Currently, graduate student, mechanical engineering, Stanford (2006-present).
  11. Sujay Ramachandra, Stanford mechanical engineering graduate student, development of a device for delivering biphasic electrical stimulation to differentiating stem cells, Autumn 2006-Spring 2007.
  12. Rebecca Taylor, Robert Hanson, Jason Komadina, and Georgios Papadimitriou, Stanford engineering graduate students, E341 Micro/Nano Systems Design and Fabrication Laboratory Project, “Stretchable Microelectrode Arrays (sMEAs) for Stem Cell Differentiation”, Spring 2007.
  13. Erin Dizon, Stanford Summer Undergraduate Research Institute (SURI) student, “Making Muscle: Characterization of Stem Cell-Derived Cardiac Myocytes Subject to Mechanical Strain”, Summer 2007.
  14. Nandita Sriram, Stanford Summer Undergraduate Research Institute (SURI) student, “Making Muscle: Design of a Mechanical Stimulation Array for Stem Cell-Derived Cardiac Myocytes”, Summer 2007.
  15. Himanshu Sharma, research assistant, “A Matrix Micropatterning Platform for Cell Localization and Stem Cell Fate Determination”, Summer 2007. Currently graduate student, UC-Irvine (2007-present).
  16. Bhagat Patlolla, research assistant, “A Matrix Micropatterning Platform for Cell Localization and Stem Cell Fate Determination”, Summer 2007. Currently postdoctoral fellow, Stanford (2009-present).
  17. Amy Kwon, Stanford undergraduate student, stem cell culture and differentiation, Summer-Autumn 2008. Currently Fulbright Scholar, South Korea (2010-present).
  18. Paras Fatemi, Stanford undergraduate student, “Templated Fluorescence Activated Probes that Detect Gene Expression in Live Human Embryonic Stem Cells”, Autumn 2006-Summer 2010. Currently John Gardner Public Service Fellow, Department of Health and Human Services, Washington, DC (2011).
  19. Stacie Vilendrer, Stanford undergraduate student, stem cell differentiation on varying substrates to discern optimal growth environment, Winter 2007-Spring 2008. Currently medical student, Stanford (2011).
  20. Maurice Marnat, Ecole Nationale Supérieure de Physique de Strasbourg graduate student, Master Thesis: “Image Capture, Processing, and Analysis of Differentiating Stem Cells”, Spring-Summer 2008.
  21. Gyanesh Billakanti, research assistant, custom LabVIEW and Matlab software development for bioreactor, multielectrode array, and heart force measurement devices, 2008-2010. Currently software programmer, Paramount Software Solutions (2010-present).
  22. Lionel Guillou, Stanford mechanical engineering graduate student, design and prototyping of cell stretcher and heart force measurement devices, Autumn 2009-Spring 2010. Currently intern at Ardian, Inc. (2011).
  23. Pritam Mathivanan, high school student, “BMP-4, C-KIT, and KDR Levels Change Over Time as Human Induced Pluripotent Stem Cells Differentiate into Cardiomyocytes”, Summer 2010. Accepted to the University of Chicago (2011).
  24. Joy Xu, high school student, “BMP-4, C-KIT, and KDR Levels Change Over Time as Human Induced Pluripotent Stem Cells Differentiate into Cardiomyocytes”, Summer 2010. Currently a senior in high school (2011).
  25. Alex Wang, Stanford Institutes of Medicine Summer Research Program scholar, “BMP-4, C-KIT, and KDR Levels Change Over Time as Human Induced Pluripotent Stem Cells Differentiate into Cardiomyocytes”, Summer 2010. Accepted to Stanford (2011).

- 
26. Josh Baugh, research assistant, “Optogenetic Control of Human Embryonic Stem Cell-Derived Cardiomyocytes”, 2009-2010. Currently medical student, Harvard (2010-present).
  27. Madhu Gorrepati, research assistant, “Optogenetic Control of Human Embryonic Stem Cell-Derived Cardiomyocytes”, 2008-present. Currently clinical and laboratory research assistant, Stanford (2011).
  28. Joseph Carpenter, Stanford medical student, implementation of hardware, firmware, and software for large scale microfluidic system for stem cell culture, 2010-2011.
  29. Frank Myers, UC-Berkeley graduate student, graduate thesis, Luke Lee lab: “Electrically activated cell sorting of induced pluripotent stem cell-derived cardiomyocytes”, 2008-present.
  30. Zane Atteka, Latvian medical student, “Full Optogenetic Control of Human Pluripotent Stem Cell-Derived Cardiomyocytes”, 2010-2011.
  31. Yan Zhuge, research associate, “Time-lapse Imaging Reveals Spatial Patterning Controls Human Pluripotent Stem Cell Cardiovascular Differentiation”, 2010-2011.

## Volunteer Experience

Brackenridge Hospital, Austin, TX, 1992-1993

*Volunteer*

- Emergency and Pediatric Departments

Cornell University, New York, NY, 1996-1997

*Volunteer*

- Adolescent Substance Abuse Program
- High School Health Professions Recruitment and Exposure Program
- Lenox Hill Community Center Holiday Party

Stanford University, Stanford, CA, 2004

*Organizer*

- Division of Vascular Surgery 12th Annual Go-with-the-Flow 5K Fun Run

## Technical Skills

Southern blotting, northern blotting, western blotting, flow cytometry/FACS, immunocytochemistry, ELISA, recombinant DNA work, fusion protein creation, lentivirus production, monoclonal antibody production, cell and tissue culture, murine and human pluripotent stem cell biology, light microscopy, confocal microscopy, fluorescence microscopy, video microscopy, calcium and voltage dye microscopy, live cell imaging, digital image processing and analysis, computer-aided design (SolidWorks, AutoCAD), surgical device design, product prototyping, machining, soft-lithography techniques, product validation and testing, electrical circuit prototyping, data acquisition and control techniques (LabVIEW, Matlab), optogenetics, microfluidics, electrophysiology (whole cell patch clamp physiology, multielectrode array physiology), murine husbandry, animal and human surgery

## Research Support

1. Stanford Cardiovascular Institute (CVI): Seed Grant Program  
*Zarins C, Benharash P, Abilez O, Xu C, Tsao P, Taylor C*  
 “Genomic, Morphometric, Hemodynamic and Mechanical Investigation of Rat Arteries in a Pulsatile Organ-Culture System”  
 (~30% contribution towards preparation)  
Funded Mar 2006-Feb 2007 Total: \$50,000
2. NIH: HL089027, Innovative Application of Nanotechnology to Heart, Lung, Blood, and Sleep Disorders (R21/33 PAR-06-287)  
*Wu J-PI, Pruitt B-CoPI, Zarins C-CoPI*  
 “Nanostructuring and Molecular Imaging of Engineered Cardiovascular Tissues”  
 (~50% contribution towards preparation)  
Funded Jun 2007-May 2012 Total: \$2,000,000

- 
3. NSF: 0735551, Emerging Frontiers In Research and Innovation (EFRI), Cellular and Biomolecular Engineering (CBE) (Program Solicitation 06-596)  
*Pruitt B-PI, Zarins C-CoPI, Wu J-CoPI, Heilshorn S-CoPI, Kuhl E-CoPI*  
 “Engineering of Cardiovascular Cellular Interfaces and Tissue Constructs”  
 (~30% contribution towards preparation)  
Funded Sep 2007-Aug 2011 Total: \$2,000,000
  
  4. California Institute for Regenerative Medicine (CIRM): RC1-00151, Comprehensive Research Grant (RFA 06-02)  
*Zarins C-PI, Wu J-CoPI, Pruitt B-CoPI*  
 “Engineering a Cardiovascular Tissue Graft from Human Embryonic Stem Cells”  
 (~75% contribution towards preparation)  
Funded Jun 2007-May 2011 Total: \$1,600,000
  
  5. DARPA-Nanosys: FA9550-07-1-0563, Surviving Blood Loss/ Biomedical Technologies for Combat Casualty Care (BAA 07-21)  
*Daniels-PI, Zarins-Subcontractor*  
 “Silica Nanofiber Combat Hemostat (SiNCH)”  
 (~75% contribution towards preparation)  
Funded Sep 2007-Oct 2007 Total: \$75,000
  
  6. Stanford Bio-X: Interdisciplinary Initiatives Program (IIP)  
*Heilshorn S-PI, Kuhl E-CoPI, Zarins C-CoPI*  
 “Electromechanical Conditioning of Human Embryonic Stem Cell (hESC)-Derived Cardiac Myocytes for Improved Regenerative Therapy after Myocardial Infarction”  
 (~30% contribution towards preparation)  
Funded Oct 2008-Sep 2011 Total: \$150,000
  
  7. NIH: PA-10-069, Exploratory Developmental Research Grant Program (R21)  
*Beygui R-PI*  
 “Cardiac Differentiation of Adipose Tissue-Derived Stem Cells by Light Stimulation”  
 (~10% contribution towards preparation)  
Funded Apr 2011-Mar 2013 Total: \$440,000
  
  8. NSF: Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE)  
*Kuhl E-PI*  
 “INSPIRE: Optogenetic Control of the Human Heart - Turning Light into Force”  
 (~50% contribution towards preparation)  
Funded Aug 2012-Jul 2015 Total: \$600,000
  
  9. NIH: NIH Pathway to Independence Award (K99/R00)  
*Abilez O-PI*  
 “Using Optogenetics to Predict and Control Cardiac Function”  
 (~100% contribution towards preparation)  
Re-submitting Jul 2013-Jun 2018 Total: \$883,000

## Awards

Junction High School, Junction, TX  
 Valedictorian, 1987

University of Texas, Austin, TX  
 Honors Colloquium Scholarship, 1987  
 Texas Achievement Award, 1987-1992  
 Dean's List, 1988-1991  
 Engineering Honor Roll, 1988-1991  
 Hagggar Foundation Scholarship, 1989  
 General Motors Scholarship, 1989  
 Pi Tau Sigma Mechanical Engineering Honor Society, 1991

---

Biomedical Engineering Scholarship, 1995

Cornell University, New York, NY

NIH Molecular Mechanism of Neurological Disease Predoctoral Training Fellowship, 1996-1997  
Lucille P. Markey Foundation Predoctoral Research Training Fellowship, 1998-1999  
NIH-NHLBI Predoctoral Research Training Fellowship, 1999-2000  
American Austrian Foundation/Max Kade Foundation Fellowship, 2002  
United States-European Medical Education Exchange (US-EUMEE) Fellowship, 2002  
Student Leadership Award (Class President), 2002  
Franklyn Ellenbogen Prize in Hematology/Oncology, 2002

Stanford University, Stanford, CA

Ethicon Endo-Surgery, Inc (Johnson and Johnson) Fellowship, 2005-2006  
Stanford Dean's Postdoctoral Fellowship, 2005-2006  
Laboratory Science, International Endovascular Fellows' Research Award Competition, 1<sup>st</sup> Place, 2006  
Advanced Residency Training at Stanford (ARTS) Program Fellowship, 2007-2011  
California Institute for Regenerative Medicine (CIRM) Travel Award for International Society for Stem Cell Annual Meeting, 2010  
Stanford Bio-X Travel Award, 2010  
Keystone Conference Scholarship, 2011  
Keystone Conference Research Competition Finalist, 2011  
Gordon Research Conference Scholarship, 2011  
Siebel Scholar, 2011  
New York Stem Cell Foundation 6<sup>th</sup> Annual Meeting-1<sup>st</sup> Place Poster, 2011

### **Professional Organizations**

American Society of Artificial Internal Organs (ASAIO), 1995-2000  
American Medical Association (AMA), 1996-2000  
American Society for Cell Biology (ASCB), 1999  
American College of Surgery (ACS), 2005-2008  
Tissue Engineering & Regenerative Medicine International Society (TERMIS), 2005-present  
Biomedical Engineering Society (BMES), 1994-2000, 2006-present  
International Society for Applied Cardiovascular Biology (ISACB), 2007-present  
International Society for Stem Cell Research (ISSCR), 2007-present  
Biophysical Society (BPS), 2010-present

### **Professional Service**

*Ad hoc* Reviewer, Tissue Engineering, 2007-present  
*Ad hoc* Reviewer, Journal of Tissue Engineering and Regenerative Medicine, 2007-present  
*Ad hoc* Reviewer, Sensors & Actuators: B. Chemical, 2011  
*Ad hoc* Reviewer, Journal of Clinical Investigation, 2012  
*Ad hoc* Reviewer, Circulation Research, 2013  
*Ad hoc* Reviewer, Nature Materials, 2013-2014  
*Ad hoc* Reviewer, Nature Protocols, 2014  
*Ad hoc* Reviewer, Science, 2014

### **Medical School Service**

Class President, 1996-1998  
Stimson Surgical Society President, 2000-2002

---

## Other Activities

U.S. Open Golf Championship Volunteer, Bethpage Black, NY, 2002  
U.S. Open Golf Championship Volunteer, Winged Foot, NY, 2006  
San Diego Marathon, 1999  
Boston Marathon, 2000  
New York City Marathon, 1998, 1999, 2001, 2005, 2009, 2012  
San Francisco Marathon, 2013

## References

Christopher K. Zarins, M.D.  
Chidester Professor of Surgery, Emeritus  
Department of Surgery  
Stanford University  
Clark Center E350A  
318 W Campus Dr  
Stanford, CA 94305-5431  
(650) 725-7830 (phone)  
(650) 725-9082 (fax)  
[zarins@stanford.edu](mailto:zarins@stanford.edu)

Joseph C. Wu, M.D., Ph.D.  
Professor  
Departments of Medicine and Radiology  
Stanford University  
265 Campus Dr  
Rm G1120B  
Stanford, CA 94305-5454  
(650) 736-2246 (phone)  
(650) 736-0234 (fax)  
[joewu@stanford.edu](mailto:joewu@stanford.edu)

Sanjiv Sam Gambhir, M.D., Ph.D.  
Virginia and D.K. Ludwig Professor for Clinical  
Investigation in Cancer Research  
Director, Molecular Imaging Program at Stanford  
(MIPS)  
Department of Radiology  
Department of Bioengineering (courtesy) and  
Engineering Materials Science (courtesy)  
Stanford University  
Clark Center E150A  
318 W Campus Dr  
Stanford, CA 94305-5427  
(650) 725-2309 (phone)  
(650) 724-4948 (fax)  
[sgambhir@stanford.edu](mailto:sgambhir@stanford.edu)

Luke P. Lee, Ph.D.  
Arnold and Barbara Silverman Distinguished  
Professor  
Department of Bioengineering  
Co-Director, Berkeley Sensor & Actuator Center  
University of California, Berkeley  
408C Stanley Hall  
Berkeley, CA 94720  
(510) 642-5855 (phone)  
(510) 642-5835 (fax)  
[lplee@berkeley.edu](mailto:lplee@berkeley.edu)

Roy L. Silverstein, M.D.  
Linda and John Mellowes Professor of Medicine  
Chairman, Department of Medicine  
Medical College of Wisconsin  
9200 W. Wisconsin Ave, Suite C-5038  
Milwaukee, WI 53226  
(414) 805-0518 (phone)  
(414) 805-0524 (fax)  
[rsilverstein@mcw.edu](mailto:rsilverstein@mcw.edu)