

Tré Raymond Welch, Ph.D.

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EDUCATION

University of Texas at Arlington, Arlington, TX (Joint Program with UT Southwestern)

2009. Ph.D., Biomedical Engineering

Dissertation: "Advances in Helical Stent Design and Fabrication: Thermal Treatment and Structure Interaction Studies of the Simulated Plaque-Laden Artery" CJC Chuong, adviser

University of Texas at Arlington, Arlington, TX (Joint Program with UT Southwestern)

2005. M.S., Biomedical Engineering

Thesis: "Vascular Stent Analysis", CJC Chuong, adviser

University of Texas at Arlington, Arlington, TX

1998 Dual Major

B.S., Mechanical Engineering

B.A., Chemistry

AWARDS

2017. Kleinman Scholar Award, Pediatric and Adult Interventional Cardiology Symposium Conference for Top Abstract/Presentation.

2015. Nominated ASME Honors Award, International Mechanical Engineering Congress & Exposition for Technical Paper.

2014. Kleinman Scholar Award, Pediatric and Adult Interventional Cardiology Symposium Conference for Top Abstract/Presentation.

2013. Kleinman Scholar Award, Pediatric and Adult Interventional Cardiology Symposium Conference for Top Abstract/Presentation.

2007. Phi Kappa Phi, National Honor Society

2007. Tau Beta Pi, Engineering Honor Society

1997. Pi Tau Sigma, National Mechanical Engineering Honor Society

INTELLECTUAL PROPERTY

2014. Patent: US2016034300- Pending- Biomimetic Fluoroscopic Films.

2009. Patent: US20170020699- Pending-Stent and Method for Manufacturing Thereof.

2009. Patent: US9480586B2- Stent and Method for Manufacturing Thereof.

2009. Patent: US9155640B2 - Stent and Method for Manufacturing Thereof.

GRANTS

2015-2017. American Heart Association Grant in Aid, Co-PI, \$173,000, Awarded

"NOVEL DESIGN BIODEGRADABLE STENT IN PORCINE MODEL OF AORTIC COARCTATION"

2015-2017. National Institute of Health, R21, Co-PI, \$275,000, Awarded

"DEVELOPMENT OF LARGE DIAMETER BIODEGRADABLE STENTS FOR CONGENITAL HEART DISEASE"

2015. National Institute of Health, R01, Co-PI, \$1,500,000, Awarded

"MECHANISMS OF INFECTION-MEDIATED CERVICAL RIPENING"

TEACHING EXPERIENCE

University of Texas Southwestern Medical Center of Dallas, Dallas, TX.

2014-2016. Assistant Professor, Department of Cardiovascular and Thoracic Surgery

I supervised supervised and trained clinical fellow, Nicholas Huggins, in design of experiments for biomimetic films. I supervised bioengineering graduate Amy Goodfriend in design of experiments for drug coating/release for tracheomalacia and polymer development leading to publications.

2012-2014. Instructor, Department of Cardiovascular and Thoracic Surgery

I supervised clinical fellows, Holly Desena, MD, Carrie Herbert, MD, in stent research with animal studies implanting polymeric stents. In addition, I have been involved advising finite element analysis for Salman Khan of deformation mechanics using hyperelastic materials and polymer properties for Ankit Batra for development of 3D printing multiple thermoplastic polymers and injectable materials.

University of Texas at Arlington, Arlington, TX.

2005-2009. Teaching Assistant, Department of Bioengineering

BME 5361 In this Biomaterials and Blood Compatibility course, I gave lectures, advised students, and grade homework on biomaterials.

BME 5370 In this Biomaterial-Living System Interactions course, I helped students with projects, setup and updated webpage for course and lectures, and proctored exams.

BME 5335 Biological Materials, Mechanics, and Processes course, advised students, proctored exams and grade homework.

BME 5340 Finite Element Applications in Biomedical Engineering course where I taught ANSYS, advised students and graded homework.

BME 1225 An Introduction to Biomedical Engineering course is an undergraduate course where I wrote and graded exams.

DISSERTATION AND MASTER THESIS COMMITTEES

University of Texas at Dallas, Richardson, TX.

2017. Keshavarzian, Mazyar, UT Dallas, PhD Dissertation: "A coupled Agent Based- Finite Element Model to Study Progression of Atherosclerosis."

University of Texas at Arlington, Arlington, TX.

2017. Ravi, Prashanth, UT Arlington, PhD Dissertation: "3D Printing of Homogenous and Heterogeneous Constructs with Customized Properties Using Novel Bioresorbable Materials."

2017. Keshavarzian, Mazyar, UT Dallas, PhD Dissertation: "A Coupled Agent Based-Finite Element Model to Study Progression of Atherosclerosis."

2016. Kumat, Shashank UT Arlington. Master of Science in Mechanical Engineering: "A robotic device to assist with in-vivo measurement of human pelvic organ tissue properties."

2016. Salman Nasir Khan, PhD Dissertation: "A study to improve the surgical outcomes of partial thickness corneal endothelial keratoplasty."

2015. Salman Nasir Khan, PhD Dissertation: "A study to improve the surgical outcomes of partial thickness corneal endothelial keratoplasty."

2015. Ankit Batra, Masters of Science in Mechanical Engineering: "On the Customization of a 3D printer for Bio-Fabrication with Multi-Material and Multi-Process Capabilities".

2015. Shahid Faizee, Masters of Science in Mechanical Engineering: "Parametric Analysis of Solarez Ultraviolet Curable Resin using Photo-Polymerization on the Multi-Modality Bioprinter".

2015. Tushar Sunai, Masters of Science in Mechanical Engineering: "Additive Manufacturing Methodologies for MultiProcess and MultiMaterial Scenarios".

PROFESSIONAL EXPERIENCE

University of Texas Southwestern Medical Center of Dallas, Dallas, TX.

2015-2016. Assistant Professor, Department of Cardiovascular and Thoracic Surgery

My mission was to continue development of a large biodegradable stent for use in congenital heart disease on NIH-HLBI R21 grant and in-vivo co-arcuation studies in pig models on AHA grant. I also developed a new biopolymer for multifunctional use in pediatrics, cardiology, cancer treatment, trauma and gynecology. This polymer has the ability for visualization on fluoroscopy, MRI and has drug loading/release. Another project was to further develop a finite element simulation using Solidworks and Abaqus to investigate the stent insertion technique mechanical interactions with a pseudo-artery by structural simulation.

University of Texas Southwestern Medical Center of Dallas, Dallas, TX.

2012-2015. Instructor, Department of Cardiovascular and Thoracic Surgery

My mission was to further my coiled stent design, bench testing and investigations in minipig models for congenital heart disease and tracheomalacia. I set up, from scratch, a lab to design and investigate an array of bioresorbable polymers, drug releasing films/porous coatings and fibers fabricated by hot melt extrusion. Major items of equipment included Dionex Ultimate 3000 HPLC, TA Instruments Differential Scanning Calorimetry Q20 with Liquid Nitrogen Cooling System, BioTek Synergy HT Plate Reader, Nikon Eclipse Ci Light/Fluorescence Microscope with Elements Software, CW Brabender ATR Extruder with Torque Rheometer and Mixer, Rinco Ultrasonics Ultrasonic Welder, Mettler Toledo Scale, Model Number XP205. Stent investigations included mechanical testing, degradation studies, and animal survival studies. I used Abaqus to investigate the mechanical interactions with a pseudo-artery by structural simulation, and was able to verify results by histology analysis.

2009-2012. Senior Research Scientist, Department of Cardiovascular and Thoracic Surgery

My purpose was to develop and bench test a bioresorbable stent to test in a rabbit model for use in pediatric congenital heart disease. This work was published in 2013.

University of Texas at Arlington, Arlington, TX.

2005-2009. Research Assistant, Department of Bioengineering

Foley and Lardner, Milwaukee, WI.

2007-2008. Expert Consultant. Worked on stent analysis for major firm in the field.

Chorum Technologies, Richardson, TX.

2000-2002. Mechanical Engineer. Worked with Research and Development to design new optical switching products using Solidworks, set up pilot lines, and transfer the product from to a manufacturing line for large scale production.

Harris Corporation, Melbourne, FL.

1998-2000. Mechanical Engineer. Performed structural analysis on antenna towers with Pro-Engineer and ANSYS. Worked on government proprietary product line with research and development team. Successfully designed, tested, and validated next generation of proprietary products for defense industry under advisement of Dr. Michael Lange.

REFEREED JOURNAL ARTICLES

1. Yang H, Fortier A, Home K, Welch T, Mohammad A, Banerjee S. Study of Non-Linear Deformation of Peripheral Stent Mechanics Using Computational Approach. *J Biomed Eng* 2016; (1): 1-10.
2. Fishbein I, Welch T, Guerrero DT, Alferiev IS, Adamo RF, Chorny M, et al. Paraffin processing of stented arteries using a postfixation dissolution of metallic and polymeric stents. *Cardiovasc Pathol.* 2016;25(6):483-8.
3. Herbert CE, Veeram Reddy S, Welch TR, Wang J, Richardson JA, Forbess JM, Nugent AW. Bench and initial preclinical results of a novel 8 mm diameter double opposed helical biodegradable stent. *Catheterization and Cardiovascular Interventions : official journal of the Society for Cardiac Angiography & Interventions.* 2016. doi: 10.1002/ccd.26647.
4. Goodfriend AC, Welch TR, Thomas CE, Nguyen KT, Johnson RF, Forbess JM. Bacterial sensitivity assessment of multifunctional polymeric coatings for airway stents. *J Biomed Mater Res B Appl Biomater.* 2016. doi: 10.1002/jbm.b.33754.
5. Welch TR, Eberhart RC, Banerjee S, Chuong CJ. Mechanical Interaction of an Expanding Coiled Stent with a Plaque-Containing Arterial Wall: A Finite Element Analysis. *Cardiovasc Eng Technol.* 2016 (7);58-68. doi: 10.1007/s13239-015-0249-3.
6. Goodfriend AC, Welch TR, Nguyen KT, Johnson RF, Sebastian V, Reddy SV, Forbess J, Nugent A. Thermally processed polymeric microparticles for year-long delivery of dexamethasone. *Materials Science and Engineering: C.* 2016;58:595-600. doi: <http://dx.doi.org/10.1016/j.msec.2015.09.003>.
7. Ravi P, Shiakolas PS, Welch T, Saini T, Guleserian K, and Batra A. On the Capabilities of a Multi-modality 3D BioPrinter for Customized Biomedical Devices. Proceedings of the 14th International Mechanical Engineering Congress & Exposition. IMECE-52204. Technical Paper 2015.
8. Goodfriend AC, Welch TR, Nguyen KT, Wang J, Johnson RF, et al. Design of a MRI-Visible and Radiopaque Drug Delivery Coating for Bioresorbable Stents. Proceedings of the 14th International Mechanical Engineering Congress & Exposition. IMECE-52146. Technical Paper 2015.
9. Goodfriend AC, Welch TR, Nguyen KT, Wang J, Johnson RF, Nugent A, et al. Poly(gadodiamide fumaric acid): A Bioresorbable, Radiopaque, and MRI-Visible Polymer for Biomedical Applications. *ACS Biomaterials Science & Engineering.* 2015;1(8):677-84
10. Veeram Reddy SR, Welch TR, Wang J, Richardson JA, Forbess JM, Riegel M, et al. A novel design biodegradable stent for use in congenital heart disease: Mid-term results in rabbit descending aorta. *Catheterization and Cardiovascular Interventions: Journal of the Society for Cardiac Angiography & Interventions.* 2015 85(4):629-39. (Impact Factor 2.29)
11. Goodfriend AC, Welch TR, Barker G, Ginther R, Riegel MS, Reddy SV, Wang J, Nugent A, Forbess J. Novel bioresorbable stent coating for drug release in congenital heart disease applications. *Journal of Biomedical Materials Research Part A.* 2015;103(5):1761-70. doi: 10.1002/jbm.a.35313. (Impact Factor 2.84)
12. Welch T, Eberhart R, Reisch J, Chuong C-J. Influence of thermal annealing on the mechanical properties of PLLA coiled stents. *Cardiovascular Engineering and Technology (BMES).* 2014; 5(3):270-80. (Impact Factor 1.41)
13. DeSena HC, Veeram Reddy SR, Welch T, Wang J, Forbess J, Nugent AW. Morphology of interatrial defects created by interventional techniques in a neonatal animal model. *Pediatric Cardiology.* 2014; 35(3):381-5. (Impact Factor 1.55)
14. Veeram Reddy SR, Welch TR, Wang J, Bernstein F, Richardson JA, Forbess JM, et al. A novel biodegradable stent applicable for use in congenital heart disease: bench testing and feasibility results in a rabbit model. *Catheterization and Cardiovascular Interventions: Journal of the Society for Cardiac Angiography & Interventions.* 2014;83(3):448-56. (Impact Factor 2.29)
15. Welch T, Eberhart RC, Veeram Reddy SR, Wang J, Nugent A, Forbess J. Novel bioresorbable stent design and fabrication: Congenital heart disease applications. *Cardiovascular Engineering and Technology (BMES).* 2013(4):171-82. (Impact Factor 1.41)
16. Thatcher JE, Welch T, Eberhart RC, Schelly ZA, DiMaio JM. Thymosin beta4 sustained release from poly(lactide-co-glycolide) microspheres: synthesis and implications for treatment of myocardial ischemia. *Annals of the New York Academy of Sciences.* 2012;1270: 112-9. (Impact Factor 4.38)
17. Welch TR, Eberhart RC, Chuong CJ. The influence of thermal treatment on the mechanical characteristics of a PLLA coiled stent. *Journal of Biomedical Materials Research Part B, Applied Biomaterials.* 2009; 90(1):302-11. (Impact Factor 2.14)
18. Welch T, Eberhart RC, Chuong CJ. Characterizing the expansive deformation of a bioresorbable polymer fiber stent. *Annals of Biomedical Engineering.* 2008;36(5):742-51. (Impact Factor 3.23)

REFEREED EXTENDED ABSTRACTS

1. Welch TR, Goodfriend AC, Nair A, Veeram Reddy SR, Nugent A, Guleserian K, Forbess JM. Bioresorbable Grafts for Congenital Heart Disease. 6th International Conference on Mechanics of Biomaterials and Tissues. Number 0222. 2015.
2. Knowles M, Welch TR, Timaran CH, Valentine RJ, Chuong CJ, Eberhart RC, et al. Finite element analysis of a balloon-expandable stent and superior mesenteric arterial wall interaction. *Journal of Vascular Surgery.* 2015; 60(6):1722-3. (Impact Factor 2.98)
3. Oberj J, Shiakolas P, et al. Multi-Polymeric 3D Print Head for Use in Bioprosthetic Research. ASAIO 60th Annual Conference. 2014.
4. Herbert CE, Reddy SV, Welch T, Wang J, Richardson J, Forbess JM, et al. Acute, early and intermediate effects of a novel 8 mm diameter double opposed helical biodegradable stent in porcine arteries. *Journal of the American College of Cardiology.* 2014;63(12_s). (Impact Factor 15.34)

5. DeSena HC, Reddy SV, Welch T, Wang J, Richardson J, Forbess J, et al. Inflammatory response to biodegradable stents in the ductus arteriosus in a neonatal piglet model. *Journal of the American College of Cardiology*. 2013;61(10_S). (Impact Factor 15.34)
6. Barker G, Welch T, D'Souza N, Nugent A, Eberhart RC. Influence of CO2 blowing agent on porous bioresorbable stent structure. *ASME 2013 Summer Bioengineering Conference; 2013 June 26–29; Sunriver, Oregon, USA: published in ASME Proceedings*.

BOOK CHAPTERS

1. Welch, Tre R. and Veeram Reddy, Surendranath R. "Drug Eluting Stents and Polylactide Stents." *Chap 1 in New Developments in Polymeric Acid Research*. Winthrop, Courtney. New York: Nova Science Publishers Inc, 2015, pp1-27.

PROFESSIONAL MEMBERSHIPS

American Society of Mechanical Engineers
Biomedical Engineering Society
American Society for Artificial Internal Organs

SOFTWARE AND ANALYTICAL INSTRUMENT SKILLS

Sixteen years experience with 3D CAD systems, image reconstruction and structural analysis: SOLIDWORKS, ABAQUS, ANSYS, CFX, 3D-DOCTOR, Photoshop.
Ten years experience using polymer characterization equipment, including: HPLC-DIONEX ULTIMATE 3000, FTIR, HNMR, INSTRON 5565, DSC-TA

EXTRACURRICULAR ACTIVITIES

Master Diver Certification
Photography

INTERESTS

I have extensive experience in biomedical translational research, developing cardiovascular devices for implantation and other procedures. I am very familiar with collaborative research procedures involving clinicians, medical staff and students. Also I am experienced in contract research with medical device companies. Academic interests include teaching, research and development of manufacturing processes, laboratory experimental analysis, and numerical simulation, all directed towards the education of students in mechanical engineering and biomedical engineering.