Jason M. Szafron

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Education and Training

Stanford University, Stanford, CA
Postdoctoral Research Scholar in Pediatric Cardiology, January 2021 – Present

Yale University, New Haven, CT
Doctor of Philosophy in Biomedical Engineering, August 2015 – December 2020
Master of Science in Biomedical Engineering, May 2018

Texas A&M University, College Station, TX
Bachelor of Science in Biomedical Engineering, August 2011 - May 2015, Summa cum Laude

Research Experience

Stanford University, Stanford, CA
Postdoctoral Research Scholar, January 2021 - Present
Cardiovascular Biomechanics Computation Laboratory, advised by Alison L. Marsden and Marlene Rabinovitch

- Exploring the multi-scale growth and remodeling of pulmonary arteries in pediatric pulmonary hypertension and its corresponding hemodynamic consequences

Yale University, New Haven, CT
Graduate Research Assistant, September 2015 – December 2020
Continuum Biomechanics Laboratory, advised by Jay D. Humphrey

- Computational modeling of tissue-engineered vascular graft growth and remodeling due to mechanobiological and inflammatory cues

Texas A&M University, College Station, TX
Undergraduate Research Assistant, June 2012 – August 2015
Biomedical Device Laboratory, advised by Duncan J. Maitland

- Development of shape memory endovascular medical devices and characterization of polyurethane-based polymeric biomaterials

National Institute of Biomedical Imaging and Bioengineering, Bethesda, MD
Biomedical Engineering Summer Intern, June - August 2014
Cardiovascular Intervention Program, advised by Anthony Faranesh and John Kakareka

- Signal processing and noise reduction for MRI-guided vascular interventions

Grants and Fellowships

Parker B. Francis Fellowship in Pulmonary and Respiratory Disease, 2022 - 2025
NIH T32 Postdoctoral Training Grant, Mechanisms and Innovations in Vascular Disease, 2021 – 2022
NSF Graduate Research Fellowship, 2015 – 2020
Hertz Foundation Fellowship Finalist, 2015

Honors and Awards

Stanford University
World Congress of Biomechanics Early Career Award Semi-finalist 2022
Cardiovascular Institute Travel Award 2022

Yale University
Goodyear Tire & Rubber Company Graduate Fellowship in Engineering, 2017-2019
Vascular Biology and Therapeutics Retreat, Best Poster Award, 2017
Vascular Biology and Therapeutics Retreat, Best Poster Award, 2016
Image-Based Biomedical Modeling Travel Fellowship, 2016
NAVBO Vasculata Travel Fellowship, 2015
Robert E. Apfel Graduate Fellowship, 2015

Texas A&M University
Honors Fellow, 2015
Engineering Honors, 2015
William Hyman Scholarship in Biomedical Engineering Award, 2014
TAMU Engineering Showcase 1st Place in Undergraduate Research, 2014
TAMU Student Research Week 2nd Place in Medicine, 2014
Research Opportunity for Engineers Grant, 2013
Undergraduate Research Scholar, 2013
Undergraduate Summer Research Grant, 2013

Papers

Published

1. Latorre, M., **Szafron, J.M.**, Ramachandra, A.B., Humphrey, J.D., "In vivo development of tissue engineered vascular grafts: a fluid-solid-growth model." (2022). *Biomechanics and Modeling in Mechanobiology*.
2. Blum, K.M.[*], Zbinden, J.[*], Ramachandra, A.B.[*], Lindsey, S.E.[*], **Szafron, J.M.**[*], …, Humphrey, J.D., Marsden, A.L., Shinoka, T., Breuer, C.K. (2022). "Tissue engineered vascular grafts transform into autologous neovessels capable of native function and growth." *Communications Medicine*, 2(3).
3. Schwarz, E.L., Kelly, J.M., Blum, K., Hor, K., Yates, A.R., Zbinden, J., Verma, A., Lindsey, S.E., Ramachandra, A.B., **Szafron, J.M.**, Humphrey, J.D., Shinoka, T., Marsden, A.L., Breuer, C.K. (2021). "Development and performance of tissue-engineered vascular grafts in Fontan patients." *npj Regenerative Medicine*, 6 (1), 1-17.

4. Giudici, A., Khir., A.W., **Szafron, J.M.**, Spronck, B. (2021). "From uniaxial testing of isolated layers to a tri-layered arterial wall: A novel constitutive modelling framework." *Annals of Biomedical Engineering*, 1-14.

5. Zbinden, J.C., Blum, K.M., Berman, A.G., Ramachandra, A.B., **Szafron, J.M.**, Kerr, K.E., Anderson, J.L., Sangha, G.S., Earl, C.C., Nigh, N.R., Mirhaidari, G.J.M., Reinhardt, J.W., Chang, Y.C., Yi, T., Smalley, R., Gabriele, P.D., Harris, J.J., Humphrey, J.D., Goergen, C.J., Breuer, C.K. (2020). "Effects of braiding parameters on tissue engineered vascular graft development." *Advanced Health Care Materials.* 2001093.

6. Nandadasa, S., **Szafron. J.M.**, Pathak, V., Murtada, S.I., Kraft, C.M. O'Donnel, A., Norvik, C., Hughes, C., Caterson, B., Domowicz, M., Schwartz, N.B., Tran-Lundmark, K.T., Veigel, M., Sedwick, D., Philipson, E.H., Humphrey, J.D., Apte, S.S. (2020). Vascular dimorphism ensured by regulated proteoglycan dynamics favors rapid umbilical artery closure at birth. *eLife,* e60683.

7. Wu. Y.L.*, **Szafron, J.M.***, Blum, K.M.*, Zbinden, J.C., Khosravi, R., Best, C.A., Reinhardt, J.W., Zheng, Q., Yi, T., Shinoka, T., Humphrey, J.D., Breuer, C.K., Wang, Y. (2020). "Electrospun tissue engineered arterial graft thickness affects long-term composition and mechanics." *Tissue Engineering: Part A*. (ja).

8. Ramachandra, A.B., Latorre, M., **Szafron, J.M.**, Marsden, A.L., Humphrey, J.D. (2020). Vascular adaptation in the presence of external support – a modeling study. *Journal of the Mechanical Behavior of Biomedical Materials*, 103943.

9. Eichinger, J.F., Paukner, D., **Szafron, J.M.**, Aydin, R.C., Humphrey J.D., Cyron C.J. (2020). Computer-controlled biaxial bioreactor for investigating cell-mediated homeostasis in tissue equivalents. *Journal of Biomechanical Engineering*, 142(7).

10. Drews, J.D.*, Pepper, V.K.*, Best, C.A.*, **Szafron J.M.***, …, Humphrey, J.D., Shinoka, T., Breuer C.K. (2020). Spontaneous reversal of stenosis in tissue engineered vascular grafts. *Science Translational Medicine*, 12(537).

11. Khosravi, R., Ramachandra, A.B., **Szafron, J.M.**, Schiavazzi, D., Breuer, C.K., Humphrey, J.D. (2020). A computational bio-chemo-mechanical model of in vivo tissue engineered vascular graft development. *Integrative Biology,* 12(3), 47-63.

12. **Szafron, J.M.**, Ramachandra, A.B., Breuer, C.K., Marsden, A.L., Humphrey, J.D. (2019). Optimization of tissue engineered vascular graft design using computational modeling. *Tissue Engineering: Part C,* 25(10), 561-570.

13. Best, C.A.*, **Szafron, J.M**.*, Rocco, K.A.*, Zbinden, J., Dean, E.W., Maxfield, M.W., ... Shinoka, T., Humphrey, J.D., Breuer, C.K. (2019). Differential outcomes of venous and arterial tissue engineered vascular grafts highlight the importance of coupling long-term implantation studies with computational modeling. *Acta biomaterialia*, 94(8), 183-194.

14. **Szafron, J.M.***, Khosravi, R.*, Reinhardt, J., Best, C.A., Bersi, M.R., Yi, T., Breuer, C.K., Humphrey, J. D. (2018). Immuno-driven and mechano-mediated neotissue formation in tissue engineered vascular grafts. *Annals of biomedical engineering*, 46(11), 1938-1950.

15. Steelman, Z.A., Weems, A.C., Traverso, A.J., **Szafron, J.M.**, Maitland, D.J., Yakovlev, V.V. (2017). Revealing the glass transition in shape memory polymers using Brillouin spectroscopy. *Applied Physics Letters*, *111*(24), 241904.

16. **Szafron, J.M.**, Breuer, C.K., Wang, Y., Humphrey, J.D. (2017). Stress analysis-driven design of bilayered scaffolds for tissue-engineered vascular grafts. *Journal of Biomechanical Engineering*, 139(12), 121008.

17. Weems, A.C., **Szafron, J.M.**, Easley, A.D., Herting, S., Smolen, J., Maitland, D.J. (2017). Shape memory polymers with enhanced visibility for magnetic resonance-and X-ray imaging modalities. *Acta Biomaterialia*, 54, 45-57.

18. **Szafron, J.M.**, Muschenborn, A.D., Maitland, D.J. (2014). "Design and characterization of an endovascular mechanical thrombectomy device." *Journal of Medical Devices*, 8(2), 020910.

19. Muschenborn, A.D., Ortega, J.M., **Szafron, J.M.**, Szafron, D.J., Maitland, D.J. (2013). "Porous media properties of reticulated shape memory polymer foams and mock embolic coils for aneurysm treatment." *Biomedical Engineering Online*, 12(1), 103.

Patents

1. Wierzbicki, M.A., Maitland, D.J., Miller, M.W., Muschenborn, A.D., Nash, LD, **Szafron, J.M.**, Landsman, T.L. (2020). "Biocompatible biomedical occlusion device." US Patent 10,555,737.

2. **Szafron, J.M.**, Muschenborn, A.D., Maitland, D.J., Small, W., Buckley, P.R. (2019). "Shape memory embolectomy devices and systems." US Patent 10,499,935

Conference Presentations and Posters (as presenting author only)

Presentations

1. **Szafron. J.M.**, Yang, W., Rabinovitch, M., Marsden, A.L. (2022). "Growth and remodeling of the pulmonary arterial tree with evolving hemodynamic feedback." 9th World Congress of Biomechanics.

2. **Szafron. J.M.**, Matsuzaki, Y., Lindsey, S.E., Breuer, C.K., Humphrey, J.D., Marsden, A.L. (2022). "Effects of scaffold degradation behavior on tissue engineered vascular graft growth and remodeling." Summer Biomechanics, Bioengineering, and Biotransport Conference.

3. **Szafron. J.M.**, Murtada, S.I., Nandadasa, S., Apte, S.S., Humphrey, J.D. (2021). "Assessing umbilical vessel structural effects on contraction-induced buckling using computational modeling." Summer Biomechanics, Bioengineering, and Biotransport Conference.

4. **Szafron. J.M.**, Nandadasa, S., Murtada, S.I., Pathak, V., Kraft, C.M. O'Donnel, A., Norvik, C., Hughues, C., Caterson, B., Lundmark, K.T., Veigel, M., Sedwick, D., Domowicz, M., Schwartz, M., Humphrey, J.D., Apte, S.S. (2019). "Understanding the Structure-Function Relationship of the Umbilical Vessels with Biomedical Modeling." YINQE/CRISP Seminar Series.

5. **Szafron, J. M.**, Khosravi, R., Ramachandra, A. B., Reinhardt, J., Best, C. A., Breuer, C. K., Marsden, A. L., Humphrey, J. D. (2018). "Computational Modeling of the Inflammatory Response to Implanted

Polymeric Scaffolds to Improve Tissue Engineering of Vascular Grafts." 8th World Congress of Biomechanics.

6. **Szafron, J. M.**, Khosravi, R., Breuer, C. K., Marsden, A.L., Humphrey, J. D. (2017). "Numerical Optimization of Scaffold Properties for Tissue Engineered Venous Grafts." Food and Drug Administration/Biomedical Engineering Society Frontiers in Medical Devices Conference.
7. **Szafron, J. M.**, Khosravi, R., Wang, Y., Breuer, C. K., Humphrey, J. D. (2017). "Rational Design of a Tissue Engineered Bilayered Arterial Graft using Parametric Computational Modeling." 5th International Conference on Computational and Mathematical Biomedical Engineering.

Posters

1. **Szafron, J.M.**, Ramachandra, A.B., Breuer, C.K., Marsden, A.L., Humphrey, J.D. (2019). "Computational Growth and Remodeling for Improved Design of Tissue Engineered Vascular Grafts." Biomedical Engineering Society Annual Meeting.
2. **Szafron, J.M.**, Ramachandra, A.B., Breuer, C.K., Marsden, A.L., Humphrey, J.D. (2019). "A Computational Approach for Optimal Design of Tissue Engineered Vascular Grafts." Summer Biomechanics, Bioengineering, and Biotransport Conference.
3. **Szafron, J. M.**, Khosravi, R., Best, C.A., Reinhardt, J., Yi, T., Lee, Y., Zeng, Q., Bersi, M.R., Shinoka, T., Breuer, C. K., Humphrey, J. D. (2017). "Dissecting Roles of Inflammation-Driven and Mechanotransduction-Mediated Neotissue Formation in Tissue-Engineered Vascular Grafts." 7th Annual Vascular Biology and Therapeutics Retreat.
4. Khosravi, R., **Szafron, J. M.**, Breuer, C. K., Humphrey, J. D. (2016). "Computational Models for the Improved Design of Tissue Engineered Vascular Grafts." 6th Annual Vascular Biology and Therapeutics Retreat.
5. **Szafron, J.M.**, Kakareka, J, Faranesh, A.Z., Pursley, R, Lederman, R, Pohida, T (2014). "Adaptive filter optimization of ECG recordings during MRI-guided cardiovascular interventions." National Institutes of Health Summer Poster Session.
6. **Szafron, J.M.**, Muschenborn, A.D., Maitland, D.J. (2014). "Design and characterization of an endovascular mechanical thrombectomy device." American Society of Mechanical Engineers Design of Medical Devices Conference.

Teaching Experience

Cardiovascular Fluid Mechanics, University of California, San Diego MAE261
Guest Lecturer, Spring 2022

Mathematical Modeling of Biological Systems, Stanford University, CME/BIOE 209
Guest Lecturer, Winter 2021, Winter 2022

Introduction to Bioengineering Research, Stanford University BIOE390
Guest Lecturer, Fall 2021

Computational Modeling of the Cardiovascular System, Stanford University, CME/BIOE 285

Guest Lecturer, Summer 2021

Discovery and Design, Yale University, BENG 205
Guest Lecturer/Lab Assistant, Fall 2017, Fall 2018, Fall 2019

Vascular Mechanics, Yale University, ENAS 555
Teaching Fellow, Spring 2018

Introduction to Biomechanics, Yale University, BENG 353
Teaching Fellow, Fall 2016

Mentorship

Stanford University

Ryan Hsu – undergraduate in biomedical engineering, Summer Research Intern, Summer 2022

- Growth and remodeling objective function formulations for improving tissue engineered vascular graft design and systems biological modeling of cell infiltration

John Lee – undergraduate in biomedical engineering, Summer Research Intern, Summer 2022

- Reduced order modeling and uncertainty quantification in pulmonary vascular simulations

Camila Carvalho – undergraduate in biomedical engineering, Summer Undergraduate Research Fellow (SURF) sponsored by Stanford Engineering's Equity and Inclusion initiative, Summer 2021

- Surrogate management framework-based optimizations for improved growth and remodeling outcomes in vascular pathologies

Zinan Hu – graduate student in mechanical engineering, Spring 2021 – present

- Growth and remodeling techniques for understanding vessel evolution resulting from congenital heart disease

Yale University

Rose Bender - undergraduate senior thesis student, Yale University, 2018 – 2019

- Parameter estimation and constitutive modeling for scaffolds in tissue engineered vascular grafts

Daniel Paukner – visiting master's student, Technical University of Munich, 2017 – 2018

- Tissue culture technique, bioreactor design, and fabrication protocols for evaluating biomechanical homeostasis in collagenous tissue equivalents

Kevin James – undergraduate senior thesis student, Yale University, 2016 – 2017

- Biomechanical tissue characterization, parameter estimation, and mechanical testing design for characterizing large animal specimens in various vascular pathologies

Outreach

Stanford University

Stanford EXPLORE Lecturer 2022
Cardiovascular Institute Early Career Committee 2022 – present

Yale University
New Haven Science Fair Mentor, 2017 – 2020
New Haven Science Fair Judge, 2016 – 2019

Texas A&M University
Explorations Undergraduate Research Journal, Editorial Board Member, 2013-2015
Explorations Undergraduate Research Journal, Author, 2013
Biomedical Engineering Ambassador, 2013 – 2015
Engineering Ambassador, 2013 – 2015