Erica L. Schwarz, Ph.D.

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ACADEMIC TRAINING

2023-Present **Yale University** New Haven, CT
Postdoctoral Scholar in the Department of Biomedical Engineering
Advisor: Jay D. Humphrey
Focus: *Integrating gene expression and machine learning methods into growth and remodeling simulation frameworks to predict outcomes in congenital heart patients and aneurysms.*

2019-2023 **Stanford University** Palo Alto, CA
Ph.D. in Bioengineering
Advisor: Alison L. Marsden
Focus: *Creating a coupled framework for simulating full, three-dimensional constrained mixture growth and remodeling of soft tissues in a finite element fluid–structure interaction solver.*

2017-2019 **Stanford University** Palo Alto, CA
M.S. in Bioengineering
Advisor: Alison L. Marsden
Focus: *Quantifying the hemodynamic performance of tissue-engineered vascular grafts in Fontan patients using multiscale computational fluid dynamics.*

2013-2017 **Johns Hopkins University** Baltimore, MD
B.S. in Biomedical Engineering, B.S. of Computer Science
Advisor: Natalia A. Trayanova
Focus: *Utilizing graph theory to identify ablation targets in patients with left atrial flutter.*

GRANTS AND FELLOWSHIPS

American Heart Association Predoctoral Fellowship, 2021-2023
Fellowship supporting doctoral research in cardiovascular or cerebrovascular research.
$63,040 over two years.

National Science Foundation Graduate Research Fellowship, 2017-2022
Fellowship supporting graduate student research in science, technology, engineering, and mathematics.
$138,000 over three years.

RESEARCH EXPERIENCE

2023-Present **Postdoctoral Scholar**, Yale University
Continuum Biomechanics Laboratory
Advisor: Jay D. Humphrey
Integrated gene expression data into a growth and remodeling framework of postnatal pulmonary artery development to predict outcomes in congenital heart disease. Used the fluid-solid-growth framework to generate cohorts of clinically relevant aneurysm simulations to train large-data machine learning models for use in clinical transfer learning.

2017-2019 **Graduate Research Assistant**, Stanford University
Cardiovascular Biomechanics Computation Laboratory
Advisor: Alison L. Marsden
Implemented a fluid-solid-growth framework for modeling vascular geometry changes in response to patient-specific hemodynamics. Modeled cardiac physiology from MRI data with closed-loop boundary conditions to assess the efficacy of surgical interventions.

2017 **Graduate Research Assistant**, Stanford University
CamLab
Advisor: David B. Camarillo
Used neural networks and TensorFlow to improve system accuracy in a pulmonary catheter system for future applications in robotic surgery.

2016-2017 **Undergraduate Research Assistant**, Applied Physics Laboratory
Research and Exploratory Development Department
Advisor: Philippe Burlina
Created a machine learning algorithm to identify breast cancer features in ultrasound samples. Programmed a linear ultrasound machine to capture single-element features.

2014-2017 **Undergraduate Research Assistant**, Johns Hopkins University
Computational Cardiology Laboratory
Advisor: Natalia A. Trayanova
Used patient-specific models to simulate left atrial flutter and predict optimal ablation targets using the flow network "minimum cut" algorithm.

2014 **Research Assistant**, University of Arizona
Soft Tissue Biomechanics Laboratory
Advisor: Jonathan P. Vande Geest
Evaluated coronary artery drug-eluting stent designs using finite element simulations. Designed a device to compress nerves with a biaxial stretching apparatus.

HONORS AND AWARDS

Yale University

Vasculata Novel Insights in Vascular Biology Poster Award 2024

Stanford University

Melosh Medal Finalist 2024

Siebel Scholar Award 2023

Johns Hopkins University

1st Place Tulane Business Model Competition 2017

Generation Google Scholar Award 2015

Vredenburg Scholar Award 2015

1st Place NIH DEBUT Challenge 2014

JOURNAL ARTICLES

Martin R Pfaller, Marcos Latorre, **Erica L Schwarz**, Fannie M Gerosa, Jason M Szafron, Jay D Humphrey, and Alison L Marsden. "FSGe: A fast and strongly-coupled 3D fluid-solid-growth interaction method." arXiv preprint arXiv:2404.13523 (2024).

Mackenzie E Turner, Kevin M Blum, Tatsuya Watanabe, **Erica L Schwarz**, Mahboubeh Nabavinia, Joseph T Leland, Delaney J Villarreal et al. "Tissue engineered vascular grafts are resistant to the formation of dystrophic calcification." *Nature Communications* 15, no. 1 (2024): 2187.

Allyson J Weiss, Aaron O Panduro, **Erica L Schwarz**, Zachary A Sexton, Ingrid S Lan, Thomas R Geisbush, Alison L Marsden, and Nicholas A Telischak. "A matched-pair case control study identifying hemodynamic predictors of cerebral aneurysm growth using computational fluid dynamics." *Frontiers in Physiology* 14 (2023): 1300754.

Erica L Schwarz, Martin R Pfaller, Jason M Szafron, Marcos Latorre, Stephanie E Lindsey, Christopher K. Breuer, Jay D. Humphrey, and Alison L. Marsden. "A fluid–solid-growth solver for cardiovascular modeling." *Computer Methods in Applied Mechanics and Engineering* 417 (2023): 116312.

Erica L Schwarz, Luca Pegolotti, Martin R Pfaller, Alison L Marsden "Beyond CFD: Emerging methodologies for predictive simulation in cardiovascular health and disease." *Biophysics Reviews* 4.1 (2023): 011301.

Abhay B Ramachandra, Hanjay Wang, Alexa Wnorowski, **Erica L Schwarz**, Joshua Pickering, Joseph C Heiler, Haley J Lucian et al. "Biodegradable external wrapping promotes favorable adaptation in an ovine vein graft model." *Acta Biomaterialia* 151 (2022): 414-425.

Kenneth Tran, Kyle B Feliciano, Weiguang Yang, **Erica L Schwarz**, Alison L Marsden, Ronald L Dalman, and Jason T Lee. “Patient-specific changes in aortic hemodynamics is associated with thrombotic risk after fenestrated endovascular aneurysm repair with large diameter endografts.” *JVS-Vascular Science* 3 (2022): 219-231.

Kevin M Blum, Jacob C Zbinden, Abhay B Ramachandra, Stephanie E Lindsey, Jason M Szafron, James W Reinhardt, Megan Heitkemper, Cameron A Best, Gabriel JM Mirhaidari, Yu-Chun Chang, Anudari Ulziibayar, John Kelly, Kejal V Shah, Joseph D Drews, Jason Zakko, Shinka Miyamoto, Yuichi Matsuzaki, Ryuma Iwaki, Hira Ahmad, Robbie Daulton, Drew Musgrave, Matthew G Wiet, Eric Heuer, Emily Lawson, **Erica Schwarz**, et al. “Tissue engineered vascular grafts transform into autologous neovessels capable of native function and growth.” *Communications Medicine* 2, no. 1 (2022): 3.

Erica L Schwarz, John M Kelly, Kevin M Blum, Kan N Hor, Andrew R Yates, Jacob C Zbinden, Aekaansh Verma, Stephanie E Lindsey, Abhay B Ramachandra, Jason M Szafron, et al. “Hemodynamic performance of tissue-engineered vascular grafts in Fontan patients.” *NPJ Regenerative Medicine* 6, no. 1 (2021): 38.

Patrick M Boyle, Michael Murphy, Thomas V Karathanos, Dafang Wang, Sohail Zahid, Kaitlyn N Whyte, **Erica L Schwarz**, Emilia Entcheva, and Natalia A Trayanova. “Pulse duration determines efficacy of arrhythmia termination via targeted optogenetic stimulation.” *Biophysical Journal* 110, no. 3 (2016): 585a.

Sohail Zahid, Hubert Cochet, Patrick M Boyle, **Erica L Schwarz**, Kaitlyn N Whyte, Edward J Vigmond, R´emi Dubois, Meleze Hocini, Michel Ha¨ıssaguerre, Pierre Ja¨ıs, et al. “Patient-derived models link re-entrant driver localization in atrial fibrillation to fibrosis spatial pattern.” *Cardiovascular Research* 110, no. 3 (2016): 443-454.

Sohail Zahid, Kaitlyn N Whyte, **Erica L Schwarz**, Robert C Blake III, Patrick M Boyle, Jonathan Chrispin, Adityo Prakosa, Esra G Ipek, Farhad Pashakhanloo, Henry R Halperin, et al. “Feasibility of using patient-specific models and the “minimum cut” algorithm to predict optimal ablation targets for left atrial flutter.” *Heart Rhythm* 13, no. 8 (2016): 1687-1698.

Patrick M Boyle, Sohail Zahid, **Erica L Schwarz**, Kaitlyn N Whyte, Edward J Vigmond, R’emi Dubois, Michel Ha¨ıssaguerre, Meleze Hocini, Pierre Ja¨ıs, Hubert Cochet, et al. “Local complexity of the fibrosis spatial pattern determines the locations of stable reentrant sources in persistent atrial fibrillation: analysis from patient specific models.” *Heart Rhythm* 12, no. 5 Suppl (2015): S7.

PAPERS IN PREPERATION

Erica L Schwarz, Abhay B Ramachandra, Nicola Yeung, Edward P Manning, Dar Weiss, and Jay D Humphrey. “Postnatal pulmonary artery development: From transcript to mechanics.” In Preparation. *(To be submitted December 2024)*

Erica L Schwarz, Qianying Cao, David S Li, Somdatta Goswami, George Em Karniadakis, and Jay D Humphrey. “Optimal neural operators for forecasting thoracic aortic aneurysms growth.” In Preparation. *(To be submitted January 2025)*

CONFERENCE PRESENTATIONS

Erica L Schwarz, Abhay B Ramachandra, Nicola Yeung, Edward P Manning, Dar Weiss, and Jay D Humphrey. “Postnatal Pulmonary Artery Development from Transcript to Mechanics.” Single Ventricle Investigator Meeting 2024. (Poster Presentation)

Erica L Schwarz, Abhay B Ramachandra, Nicola Yeung, Edward P Manning, Dar Weiss, and Jay D Humphrey. “A Data-Informed Modeling of Murine Pulmonary Artery Development and Disease.” Vasculata 2024. (Poster Presentation)

Erica L Schwarz, Abhay B. Ramachandra, Cristina Cavinato, Bruno V. Rego, Sae-Il Murtada, Dar Weiss, Nicola Yeung, and Jay D. Humphrey. “Developmental Characterization of the Aorta and Pulmonary Arteries.” Additional Ventures Cures Collaborative 2024. (Poster Presentation)

Erica L Schwarz, Martin R Pfaller, Jason M Szafron, Stephanie E Lindsey, Marcos Latorre, Jay D Humphrey, and Alison L Marsden. “A Computational Framework for Simulating the Growth and Remodeling of Patient-Specific Vessels.” World Congress of Biomechanics 2022. (Oral Presentation)

Erica L Schwarz, Martin R Pfaller, Zinan Hu, Zachary A Sexton, Jessica E Herrmann, Mark A Skylar-Scott, and Alison L Marsden. “Simulated Performance of a Pulsatile Fontan Conduit.” Single Ventricle Investigators Meeting 2021. (Oral Presentation)

Erica L Schwarz, Stephanie E Lindsey, Aekaansh Verma, John M Kelly, Kan N Hor, Jason M Szafron, Abhay B Ramachandra, Ethan Kunh, Jay D Humphrey, Christopher K Breuer, and Alison L Marsden. “How Stenosis in Tissue Engineered Vascular Grafts Affects Performance in Fontan Patients.” BioFluids 2020. (Poster Presentation)

Erica L Schwarz, Stephanie E Lindsey, Aekaansh Verma, John M Kelly, Jay D Humphrey, Christopher K Breuer, and Alison L Marsden. “The Effect of Tissue Engineered Vascular Graft Material Properties on Hemodynamics in Fontan Patients during Exercise.” North American Vascular Biology Organization 2019. (Poster Presentation)

Erica L Schwarz, Stephanie E Lindsey, Aekaansh Verma, John M Kelly, Jay D Humphrey, Christopher K Breuer, and Alison L Marsden. “Patient-Specific Performance of Tissue-Engineered Vascular Grafts in Fontan Exercise Under Simulated Exercise Conditions.” Biomedical Engineering Society Annual Meeting 2019. (Oral Presentation)

Erica L Schwarz, Aekaansh Verma, John M Kelly, Jay D Humphrey, Christopher K Breuer, and Alison L Marsden. “Quantifying Energy Loss, Growth, and Remodeling in Fontan Patients with Tissue Engineered Vascular Grafts”. The 6th International Conference on Clinical and Engineering Frontiers in Pediatric and Congenital Heart Disease 2019. (Oral Presentation)

Erica L Schwarz, Seth Billings, Susan Harvey, and Philippe Burlina. “Preliminary Study of Optimal Ultrasound Parameter Selection and Automated Breast Cancer Detection by Lesser Trained Operators” IEEE BHI 2017. (Poster Presentation)

Erica L Schwarz, Sohail Zahid, Kaitlyn Whyte, Patrick Boyle, Jonathan Chrispin, Robert Blake, Adityo Prakosa, Esra Ipek, Henry Halperin, Hugh Calkins, Ronald Berger, Saman Nazarian, and Natalia Trayanova. “Using Graph Theory to Predict Ablation Targets in Patient Specific Models of Left Atrial Flutter” Biomedical Engineering Society Annual Meeting 2016. (Oral Presentation)

TEACHING

2024 **Guest Lecturer**, “Mathematical Methods I”, Yale University
Delivered a two-part series on vector calculus and led application-based examples.

2024 **Guest Lecturer**, “Cardiovascular Fluid Mechanics”, University of California San Diego
Taught soft-tissue growth and remodeling with a focus on mechanotransduction modeling.

2023, 2024 **Guest Lecturer**, “Discover and Design in Biomedical Research”, Yale University
Lectured on biomedical project execution, with a focus on applications in congenital heart defect research.

2021 **Teaching Assistant**, "Computational Modeling in the Cardiovascular System", Stanford University
Led discussion sections with application-based examples on fluid dynamics, structural mechanics, and computational methods.

2018-2019 **Teaching Assistant**, "Bioengineering Senior Capstone Design I" and "Bioengineering Senior Capstone Design II", Stanford University
Conducted lectures, provided feedback on project documents, and assisted in mechanical prototype construction. Guided teams to win national engineering awards.

MENTORSHIP

2024 **Murat Khidoyatov**, Undergraduate Student, Yale University
Implementing novel material models of tissue-engineered vascular graft behavior in the open-source finite element solver FEBio.

2023-2024 **Cole Anderson**, Graduate Student, Ohio State University
Improving tissue-engineered vascular graft performance using computational modeling.

2021-2023 **Zinan Hu**, Graduate Student, Stanford University
Creating a multiphysics finite element framework to evaluate design parameters of a 3D bioprinted, pulsatile conduit.

2021-2022 **Chris Chankyo Kim**, Undergraduate Student, Stanford University
Generating virtual reality models of congenital heart defects from clinical imaging data for use in clinician training.

2020-2023 **Aaron Panduro,** Undergraduate Student, California State University, Fresno
Investigating hemodynamic factors driving cerebral aneurysm growth using computational fluid dynamics. (Joint project with Allyson Weiss)

2020-2023 **Allyson Weiss**, Undergraduate Student, Stanford University
Investigating hemodynamic factors driving cerebral aneurysm growth using computational fluid dynamics. (Joint project with Aaron Panduro)

2020-2022 **Kyle Feliciano**, Undergraduate Student, Stanford University
Simulating aortic hemodynamics after fenestrated endovascular aneurysm repair to assess thrombotic risk.

SERVICE AND OUTREACH

2024 **Yale Postdoctoral Association Committee Member**, Yale University
Organized monthly community and networking events that promote inclusion and diversity in the postdoctoral community

2023-2024 **Women and Gender Minorities In Science At Yale Mentor**, Yale University
Met monthly with a graduate student mentee to support her through challenges faced in her academic career, particularly those around gender in academia.

2020 **SimVascular Tutorial Series Presenter**, Stanford University
Prepared and presented workshops on the open-source research software SimVascular for use in research. Uploaded these as YouTube videos that have been collectively viewed over 14K times.

2018-2019 **BioAIMS Advocacy Chair**, Stanford University
Held open quarterly round table meetings to discuss social issues affecting the biosciences and Stanford community. Organized quarterly events to address initiatives discussed at round table meetings (voter registration drive, all-gender facilities informational meeting, etc.)

2017-2018 **Redwood Peninsula Elementary Tutor**, Stanford University
Tutored elementary school students from low-income school districts weekly and developed activities to promote academic growth and engagement.

2017, 2019 **Counselor and Presenter**, National Youth Science Camp
Organized activities to promote STEM fields to ~120 high school students over a six-week summer session. Presented my original research and led workshops based on cardiac fluid simulations.

2014 **Girls Who Code Instructor**, Johns Hopkins University
Instructed elementary school classes in coding during Computer Science Education Week. Used grade-specific coding activities to introduce students to computer science.