

Jonathan Rodolfo Silva, PhD FAHA

Dennis & Barbara Kessler Career Development Associate Professor

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Positions

Department of Biomedical Engineering
Washington University in St. Louis
Dennis & Barbara Kessler Career Development Associate Professor 2021 - present
Associate Professor 2018 - present
Assistant Professor 2012 - 2018

Department Director of Diversity 2020 – present
Department of Computer Science and Engineering, Adjunct 2020 - present

SentiAR, Inc.
Founder, Director and Chief Technology Officer 2017 – present

Excera, Inc.
Founder, Director and Chief Technology Officer 2021 – present

Education

Washington University in St. Louis, St. Louis, MO
PhD in Biomedical Engineering. 2008

Case Western Reserve University, Cleveland, OH
MS in Biomedical Engineering. 2004

The Johns Hopkins University, Baltimore, MD
BS in Biomedical Engineering. 2000

Pre- and Postdoctoral Research

Washington University in St. Louis, St. Louis, MO
Postdoctoral training. Department of Cell Biology. Colin Nichols, PhD. 2011 to 2012
Measured and modeled physiological effects of K_{ATP} heterogeneity in the heart and the pancreas.

University of Chicago, Chicago, IL
Postdoctoral training. Department of Pediatrics. Steven AN Goldstein MD PhD. 2008 to 2011
Probed Na⁺ channel slow inactivation using simultaneous cut-open oocyte recording and fluorescence.

Washington University in St. Louis, St. Louis, MO
Doctoral program, Department of Biomedical Engineering. Yoram Rudy, PhD 2004 to 2008
Dissertation: Linking Ion-Channel Molecular Dynamics to the Action Potential: Cardiac I_{Ks} Simulations.

Case Western Reserve University, Cleveland, OH
MS program, Department of Biomedical Engineering. Yoram Rudy, PhD 2000 to 2004
Thesis: Subunit interaction determines I_{Ks} Participation in Cardiac Repolarization and Repolarization Reserve.

Honors and Awards

- 2022. American Heart Association Established Investigator Award
- 2018. Fellow American Heart Association
- 2011. Burroughs Wellcome Fund Career Award at the Scientific Interface
- 2007. AAAS/Science Sponsored Membership
- 2005. Cardiac Arrhythmias Gordon Conference: Best Poster
- 2003. Housing and Residence Life Distinguished Service Award, Case Western Reserve University
- 2002. Graduate Dean's Award for Instructional Excellence, Case Western Reserve University
- 1999. Biomedical Engineering Honor Society, The Johns Hopkins University
- 1996. National Merit Scholar

Honors to students:

- 2019. Kathryn Mangold, Best Graduate Poster, Cardiovascular Research Day
- 2019. Kuo Chan Weng, Best Postdoctoral Poster, Cardiovascular Research Day
- 2018. Emily Wagner, Best Poster, CIMED Research Day
- 2018. Wandi Zhu, Washington University Biomedical Engineering Research Award
- 2018. Wandi Zhu, Philip Needleman Pharmacology Prize
- 2018. Wandi Zhu, Biophysical Society Student Research Achievement Award
- 2017. Wandi Zhu, Best Presentation, Gordon Research Seminar
- 2016. Caroline Dong, LMI Aerospace Award for Excellence in Research
- 2015. Wandi Zhu, Best Poster, Cardiovascular Research Day
- 2015. Wandi Zhu, Best Translational Poster, Bo Koster Memorial Symposium
- 2015. Bianca Yu, LMI Aerospace Award for Excellence in Research
- 2014. Eric Hsu, Barry M. Goldwater Scholar
- 2014. Ruben Garcia, Best Pre-College Poster AGMUS Research Symposium

Fellowships

- 2011. Burroughs Wellcome Fund, Career Award at the Scientific Interface
- 2011. NIH Cardiovascular Biology Training Grant
Washington University School of Medicine
- 2008. NIH Cardiovascular Pathophysiology and Biochemistry Training Grant
University of Chicago
- 2001. NIH NRSA Pre-doctoral Fellowship
- 2000. Case Prime Fellowship
Case Western Reserve University
- 1999. Provost's Award for Undergraduate Research
The Johns Hopkins University
- 1998. Research Experience for Undergraduates (REU) Fellowship
University of California, San Diego/San Diego Supercomputing Center
- 1997. Ford Foundation Award for Minority Research
The Johns Hopkins University

Research Funding

Current as PI or MPI

American Heart Association Established Investigator Award \$400,000 7/1/22-6/30/27
Precision Antiarrhythmic Medicine: Using Biophysical Insight to Improve Therapy
Developing molecules that target the cardiac Na⁺ channel voltage sensing domains to improve efficacy of class I antiarrhythmics and assess the role of amiodarone metabolites in determining efficacy.

NIH-NHLBI, R01HL150637 \$2,292,835 7/1/20-6/30/24
Post-Transcriptional Regulation of Myocardial Sodium Channels
Collaborative project to understand how molecular level regulation of Nav channels by intracellular fibroblast growth factors determines myocyte electrophysiology.

NIH-NHLBI, R01HL148803 \$3,169,663 4/1/20-3/31/25
Personalizing Class I anti-Arrhythmic Drug Therapy
Goal is to leverage biophysical insight to predict whether patients with ventricular tachycardia or fibrillation will respond to class I anti-arrhythmic molecules.

NIH-NHLBI, R01HL142301 \$2,149,137 4/1/19-3/31/23 (NCE)
Mechanism of BK Channel Gating
Goal is to delineate mechanisms of the dual regulation of BK channels by membrane potential and intracellular Ca²⁺.

NIH-NHLBI, 1R01HL136553 \$1,906,250 4/1/17-3/31/23 (NCE)
Modulation of Cardiac NaV Channel Function and Electrophysiology by Interacting Molecules
Combines advanced molecular imaging modalities with multi-scale modeling to understand how molecules that interact with cardiac NaV channels affect arrhythmia susceptibility.

Current as Co-I or Preceptor

NIH-NIDDK, T32 DK108742 06/2016-05/2021
Imaging, Modeling and Engineering of Diabetic Tissues
Designed to prepare trainees with engineering backgrounds for research focused on fundamental mechanisms and translational possibilities for diabetes and metabolic diseases.
Role: Preceptor

NIH-NHLBI, T32 HL134635 7/1/17-6/30/22
Training in Integrative and Systems Biology of Cardiovascular Disease
Provide research opportunities; fundamental education and basic training in cardiovascular physiology.
Role: Preceptor

Previous as PI or MPI

NIH-NHLBI, 1R44HL140896 \$2,221,372 2/1/18-7/31/21
Using Augmented Reality to Make Cardiac Ablation Procedures Simpler and Safer
SBIR FastTrack grant is to SentiAR, Inc., a WashU spinout, whose goal is to commercialize an augmented reality platform that was developed in the Silva lab for use in the cardiac catheterization laboratory.

Institute of Clinical and Translational Sciences, 733 \$3,990 10/7/20-10/6/21
Post-translational Mechanisms in the Coordinated Regulation of Cardiac Rhythms
Create mouse models of FGF regulation of Nav channels

Children's Discovery Institute, CH- II-2017-575	\$450,000	2/1/17-1/31/21
Improving Outcomes In The Pediatric Cardiac Catheterization Lab Using Augmented Reality Using mixed reality to guide cardiac ablation (year 1) and catheterization (year 2&3) procedures.		
NIH-NHLBI, R01NS092570	\$333,594	3/1/20 - 2/28/21
KCNQ Channels: Gating and Subunits Modulation Goal is to understand how intracellular and transmembrane subunits regulate KCNQ channel gating.		
NIH, UG3 TR002170-01		7/1/17-4/30/20
A 3D In-Vitro Disease Model of Atrial Conduction Aim is to create a compact system to test new therapies for atrial fibrillation using adenoviral delivery. Role: Co-I		
Skandalaris Center LEAP Inventor Challenge	\$50,000	1/1/19-12/31/19
Using Merged Reality to Improve Cochlear Implant Outcomes Leveraging our experience in creating augmented reality solutions for cardiac ablation to improve cochlear implant outcomes.		
CIMED Center Pilot Grant	\$25,000	1/1/18-12/31/18
Effects of Mechanical Forces on Cardiac Excitability in Heart Disease Pilot grant in collaboration with Michael Greenberg and Jonathan Moreno developing technology to simultaneously assess excitability and contraction in iPSC-derived cardiomyocytes.		
American Heart Association, 16GRNT31200025	\$154,000	7/1/16-6/30/18
Molecular Pathology of Brugada Syndrome Mutations Goal is to use molecular imaging methods to discover the molecular basis for arrhythmia.		
School of Engineering Collaboration Initiation Grant	\$25,000	4/25/17-3/24/18
Applying Mixed Reality to Otolaryngology Procedures Using an augmented reality display to assist surgeons who are performing otolaryngology procedures.		
Bear Cub Grant	\$55,000	6/1/16-5/31/17
Improving Transcatheter Ablation Outcomes with Virtual Reality Goal is to used mixed reality to enhance visualization during catheter ablation procedures.		
Burroughs Wellcome Fund, 1010299	\$500,000	7/1/11-6/30/17
Applying molecular spectroscopy to derive multi-scale cardiac bioelectricity models Goal is to obtain experimental data regarding the molecular motions of the cardiac Na ⁺ channel.		
Institute for Clinical and Translational Sciences, JIT410	\$5,000	7/11/16-7/10/17
The Nav Channel Beta Subunit Role in Chamber-Specific Heart Pharmacology Editing iPSC-derived myocytes to test beta subunits alter Class 1b drug pharmacology.		
CIMED Center Pilot Grant	\$25,000	1/1/14-12/31/14
Fluorescent Unnatural Amino Acid Tracking of Membrane Protein Conformation Develop protocols to use fluorescent un-natural amino acids for voltage-clamp.		
CIMED Center Pilot Grant	\$25,000	1/1/14-12/31/14
ATP binding to the cytosolic domain of KCNQ1 channel proteins Goal is to assess mechanisms of ATP binding to KCNQ1 ion channels.		

Grants to Students

American Heart Association Fellowship to Druv Bhagavan Connecting Molecular Electrophysiology to Patient Arrhythmia: A Case Study of Amiodarone	\$64,072	7/1/15-6/30/17
NIH K08 to Jonathan D. Moreno MD PhD 3-Dimensional virtual ventricles to design precision therapies in hypertrophic cardiomyopathy	\$745,988	7/1/21-6/30/26
American Heart Association Fellowship to Wandu Zhu Discovering molecular mechanisms of how β -subunits regulate cardiac Na ⁺ Channels	\$52,000	7/1/15-6/30/17
CBSE Center Scholarship to Wandu Zhu	\$10,000	7/1/15-6/30/16
American Heart Association Fellowship to Bicong Li	\$4,000	7/1/16-9/1/16
HHMI Summer Research Fellowship (x5) Student(s): Chen Zhao, Eric Hsu, Linxuan Yang, Namit Sambare, Sushruth Manchineella	\$15,000	Summer 2013-22
American Heart Association Scholarship to Alex Goldberg	\$2000	Summer 2016

Publications

Peer Reviewed Publications

1. Oguntuyo K, Schuftan D, Guo J, Simmons D, Bhagavan D, Moreno JD, Kang PW, Miller E, **Silva JR**, Huebsch N. Robust, Automated Analysis of Electrophysiology in iPSC-Derived Micro-Heart Muscle for Drug Toxicity. *Tissue Engineering Part C*. 2022 Jun 7 (online). [PMID: Pending]
2. Mangold KE, Zhou Z, Schoening M, Moreno JD, **Silva JR**. Creating Ion Channel Kinetic Models Using Cloud Computing. *Current Protocols*. 2022 Feb;2(2):e374. [PMID: 35175690]
3. Ransdell JL, Bhagavan D, **Silva JR**, Nerbonne JM. Intrinsic mechanisms in the gating of resurgent Na⁺ currents. *eLife*. 2022 Jan 25;11:e70173. [PMID: 35076394]
4. Moreno JD, Bhagavan D, Li A, Gerstner NC, Miller EW, Huebsch N, Cresci S, **Silva JR**. Pulsus Alternans in Cardiogenic Shock Recapitulated in Single Cell Fluorescence Imaging of a Patient's Cardiomyocyte. *Circulation: Heart Failure*. 2021 Dec 10. [PMID: 34886677]
5. Angsutararux P, Zhu W, Voelker T, **Silva JR**. Molecular pathology of sodium channel beta-subunit variants. *Frontiers in Pharmacology*. 2021 Nov 19:3220. [PMID: 34867379]
6. Jung C, Wolff G, Wernly B, Bruno R, Franz M, Schulze PC, Silva JNA, **Silva JR**, Bhqatt D, Kelm M, "Virtual and augmented reality in cardiovascular care: State of the art and future perspectives", *JACC: Cardiovascular Imaging*, 2021 Mar;15(3):519-532. [PMID: 34656478]
7. Mangold KE, Wang W, Johnson EK, Bhagavan D, Moreno JD, Nerbonne JM, **Silva JR**. "Identification of Structures for Ion Channel Kinetic Models". *PLoS Computational Biology*. 2021 Aug 17. [PMID: 34398881]
8. Zhu W, Wang W, Angsutararux P, Mellor RL, Isom LL, Nerbonne JM, **Silva JR**. "Modulation of the effects of Class-Ib antiarrhythmics on cardiac NaV1.5-encoded channels by accessory NaV β subunits", *Journal of Clinical Investigation: Insight*. 2021 Jun 22. [PMID: 34156986]
9. Gholami Derami H, Gupta P, Weng KC, Seth A, Gupta R, **Silva JR**, Raman B, Singamaneni S. "Reversible Photothermal Modulation of Electrical Activity of Excitable Cells using Polydopamine Nanoparticles". *Advanced Materials*. 2021 Jul 3:2008809. [PMID: 34216406]

10. Angsutararux P, Kang PW, Zhu W, **Silva JR**. “Conformations of voltage-sensing domain III differentially define Nav channel closed-and open-state inactivation.” *Journal of General Physiology*. 2021 Aug 4;153(9):e202112891. [PMID: 34347027]
11. Prakosa A, Southworth MK, Silva JN, **Silva JR**, Trayanova NA. “Impact of augmented-reality improvement in ablation catheter navigation as assessed by virtual-heart simulations of ventricular tachycardia ablation.” *Computers in Biology and Medicine*. 2021 Jun 1; 133:104366. [PMID: 33836448]
12. Silva JN, Southworth MK, Andrews CM, Privitera MB, Henry AB, **Silva JR**. “Design Considerations for Interacting and Navigating with 2 Dimensional and 3 Dimensional Medical Images in Virtual, Augmented and Mixed Reality Medical Applications.” In *International Conference on Human-Computer Interaction 2021* Jul 24 (pp. 117-133). Springer, Cham. [PMID: 35079751]
13. Lorenzini M, Burel S, Lesage A, Wagner E, Charrière C, Chevillard M, Evrard B, Maloney D, Ruff K, Pappu R, Wagner S, Nerbonne J, **Silva JR**, Townsend RR, Maier LS, Marionneau C, “Proteomic and functional mapping of cardiac Nav1.5 channel phosphorylation”, *Journal of General Physiology*, 2021 153 (2): e202012646. [PMID: 33410863]
14. Andrews CM, Henry AB, Soriano IM, Southworth MK, **Silva JR**, “Registration Techniques for Clinical applications of 3-Dimensional Augmented Reality Devices”, *IEEE Journal of Translational Engineering in Health and Medicine*, 2020 Dec 17. [PMID: 33489483]
15. Kang PW, Westerlund AM, Shi J, White KM, Dou AK, Cui AH, **Silva JR**, Delemotte L, Cui J, “Calmodulin acts as a state-dependent switch to control a cardiac potassium channel opening”, *Science Advances*, 2020 Dec 11; 6(50):eabd6798. [PMID: 33310856]
16. Southworth MK, Silva JNA, Blume W, Van Hare GF, Dalal AS, **Silva JR**, Performance Evaluation of Mixed Reality Display for Guidance during Transcatheter Cardiac Mapping and Ablation, *IEEE Journal of Translational Engineering in Health and Medicine*, 2020 Jul 3. [PMID: 32742821]
17. Zhu W, Li T, **Silva JR**, Chen J. Conservation and divergence in NaChBac and Nav1.7 pharmacology reveals novel drug interaction mechanisms. *Scientific Reports*. 2020 Jul 1;10(1):1-1. [PMID: 32612253]
18. Silva JN, Southworth MK, Blume WM, Andrews C, Van Hare GF, Dalal AS, Miller N, Sodhi SS, **Silva JR**. First-In-Human Use of a Mixed Reality Display During Cardiac Ablation Procedures. *Journal of the American College of Cardiology: Clinical Electrophysiology*. 2020 Jul 8. [PMID: 32819517]
19. Silva JN, Privitera MB, Southworth MK, **Silva JR**. Development and Human Factors Considerations for Extended Reality Applications in Medicine: The Enhanced Electrophysiology Visualization and Interaction System (ĒLVIS). *International Conference on Human-Computer Interaction 2020* Jul 19 (pp. 341-356). Springer, Cham. [PMID: 34327520]
20. Salvage SC, Zhu W, Habib ZF, Hwang SS, Irons JR, Huang CL*, **Silva JR***, Jackson AP*. Gating control of the cardiac sodium channel Nav1. 5 by its β 3-subunit involves distinct roles for a transmembrane glutamic acid and the extracellular domain. *Journal of Biological Chemistry*. 2019 Dec 20;294(51):19752-63. *Co-corresponding authors. [PMID: 31659116]
21. Moreno JD, Zhu W, Mangold K, Chung W, **Silva JR**. A molecularly detailed Nav1. 5 model reveals a new class I antiarrhythmic target. *Journal of the American College of Cardiology: Basic to Translational Science*. 2019 Oct 28;4(6):736-51. [PMID: 31709321]
22. Southworth, MK, **Silva JR***, Silva JNA*. Use of Extended Realities in Cardiology. *Trends in Cardiovascular Medicine*. Apr. 2020. *Co-corresponding authors. [PMID: 31076168]
23. Andrews C, Southworth MK, Silva JNA*, **Silva JR***. Extended Reality In Medical Practice. *Current Treatment Options in Cardiovascular Medicine*. 2019 Apr 1;21(4):18. *Co-corresponding authors [PMID: 30929093]

24. Zhu W, Mazzanti A, Voelker T, Hou P, Moreno JD, Angsutararux P, Naegle KM, Priori SG, **Silva JR**, Predicting Patient Response to the Antiarrhythmic Mexiletine Based on Genetic Variation: Personalized Medicine for Long QT Syndrome. *Circulation Research* 2019;124:539:552. [PMID: 30566038]
25. Silva JNA, Southworth M, Raptis C, **Silva JR**, "Emergence of Virtual and Augmented Reality in Cardiology", *Journal of the American College of Cardiology: Basic to Translational Science*, 3(3),420-430, 2018. [PMID: 30062228]
26. McJunkin JL, Jiramongkolchai P, Chung W, Southworth M, Durakovic N, Buchman CA, **Silva JR**. Development of a Mixed Reality Platform for Lateral Skull Base Anatomy. *Otology & Neurotology*. Dec 1;39(10):e1137-42, 2018. [PMID: 30239435]
27. **Silva JR** "How to Connect Cardiac Excitation to the Atomic Interactions of ion channels", *Biophysical Journal*, 114(2),259-266, 2018. [PMID: 29401425]
28. Peters CH, Yu A, Zhu W, **Silva JR**, Ruben PC, "Depolarization of the Conductance-Voltage Relationship in the Nav1.5 Mixed Syndrome Mutant, E1784K, Caused by Modified Fast Inactivation", *PLoS One*, 12(9):e0184605, 2017 [PMID: 28898267]
29. Zhu W, Voelker TL, Varga Z, Schubert AR, Nerbonne JM, **Silva JR** "Mechanisms of non-Covalent β Subunit Regulation of Nav Channel Gating", *J of General Physiology*, August; 149(8), 2017. [PMID: 28720590]
30. Mangold K, Brumback B, Angsutararux P, Zhu W, **Silva JR** "Mechanisms and Models of Cardiac Na⁺ Channel Inactivation", *Channels*, 2017. [PMID: 28837385]
31. Hsu EJ, Zhu W, Schubert AR, Voelker T, Varga Z, **Silva JR** "Regulation of Na⁺ Channel Inactivation by the DIII and DIV Voltage-Sensing Domains", *J of General Physiology*, March; 149(3):389, 2017. [PMID: 28232510]
32. Teed ZR, **Silva JR** "A Computationally Efficient Algorithm for Fitting Ion Channel Gating Parameters", *MethodsX*, 3, 577-588, 2016. [PMID: 27924282]
33. Zhu W, Varga Z, Silva JR. Molecular motions that shape the cardiac action potential: Insights from voltage clamp fluorometry. *Progress in biophysics and molecular biology*. 2016 Jan 1;120(1-3):3-17. [PMID: 26724572]
34. Wang HG, Zhu W, Kanter RJ, **Silva JR**, Honeywell C, Gow RM, Pitt GS "A Novel Nav1.5 Voltage Sensor Mutation Associated with Severe Atrial and Ventricular Arrhythmias", *Journal of Molecular and Cellular Cardiology*, March; 92:52-62, 2016. [PMID: 26801742]
35. Brettmann J, Urusova D, Tonelli M, **Silva JR**, Henzler-Wildman K. "Role of Protein Dynamics in Ion Selectivity and Allosteric Coupling in the NaK Channel", *Proceedings of the National Academy of Science*, 112(50):15366-15371, 2015. [PMID: 26621745]
36. Varga, Z, Zhu W, Schubert AR, Pardieck JL, Hsu EJ, Zaydman MA, Cui J, **Silva JR**. "Direct Measurement of Cardiac Na⁺ Channel Conformations Reveals Molecular Pathologies of Inherited Mutations." *Circulation: Arrhythmia and Electrophysiology*, 8:1228-1239, 2015. [PMID: 26283144]
37. Rudokas MW, Varga Z, Asaro AB, Schubert AR, **Silva JR**. "The *Xenopus* Oocyte Cut-Open Vaseline Gap Voltage-Clamp Technique with Fluorometry" *J of Visualized Exp*, e51040-e51040, 2014. [PMID: 24637712]
38. **Silva JR**, Cooper P, Nichols CG, "Modeling K_{ATP}-dependent Excitability in Pancreatic Islets" *Biophysical Journal*. 107(9), 2016-2026, 2014. [PMID: 25418087]
39. **Silva JR**. "Slow inactivation of Na⁺ channels. Voltage Gated Sodium Channels". *Handbook of Experimental Pharmacology*. Feb. 2014 vol. 221, 33-49.

40. Zaydman MA, **Silva JR**, Delaloye K, Larsson HP, Cui J. "Kv7. 1 ion channels require a lipid to couple voltage sensing to pore opening" *Proceedings of the National Academy of Science*, August;110(32):13180-13185, 2013. [PMID: 23151230]
41. [Zhang HX*, **Silva JR***], Lin YW, Verbsky JW, Lee US, Kanter EM, Yamada KA, Schuessler RB, Nichols CG. "The Heterogeneity and Function of KATP Channels in Canine Hearts" *Heart Rhythm*, *Both authors contributed equally, October; 10(10):1576-1583, 2013. [PMID: 23871704]
42. **Silva JR** and Goldstein SAN. "Voltage Sensor Movements Describe Slow Inactivation of Na_v Channels I: Wild Type" *Journal of General Physiology*. March; 141:309-321, 2013. [PMID: 23401571]
43. **Silva JR** and Goldstein SAN. "Voltage Sensor Movements Describe Slow Inactivation of Na_v Channels II: L689I Mutants" *Journal of General Physiology*. March; 141:323-334, 2013. [PMID: 23401572]
44. Zaydman MA, **Silva JR**, Cui J. "Ion Channel Associated Diseases: Overview of Molecular Mechanisms" *Chemical Reviews*. November; 112(12):6319-6333, 2012. [PMID: 23151230]
45. Silva JNA and **Silva JR**. "Updates on the inherited cardiac ion channelopathies: from cell to clinical" *Current Treatment Options in Cardiovascular Medicine* – October; 14(5):473-489, 2012. [PMID: 22865245]
46. **Silva JR** and Rudy Y. "Multi-scale Electrophysiology Modeling: From Atom to Organ" *Journal of General Physiology*. May; 135:575-581, 2010. [PMID: 20513759]
47. **Silva JR**, Pan H, Wu D, Nekouzadeh A, Decker K, Cui J, Baker N, Sept D, Rudy Y. "A Multiscale Model Linking Ion-Channel Molecular Dynamics and Electrostatics to the Cardiac Action Potential" *Proceedings of the National Academy of Science*. June; 106 (27):11102-11106, 2009. [PMID: 19549851]
48. Decker K, Heijman J, **Silva JR**, Hund T, Rudy Y. "Properties and Ionic Mechanisms of Action Potential Adaptation, Restitution and Accommodation in Canine Epicardium" *Am J Physiol: Heart* 2009 Jan; 296:1017-1026, 2009. [PMID: 19168720]
49. Nekouzadeh A, **Silva JR**, Rudy Y. "Modeling subunit cooperativity in opening of tetrameric ion channels", *Biophysical Journal*. 2008 October;95(7):3510-20. [PMID: 18621838]
50. Rudy Y and **Silva JR**. "Computational biology in the study of cardiac ion channels and cell electrophysiology." *Quarterly Reviews in Biophysics*. 2006 Feb;39(1):57-116. [PMID: 16848931]
51. Faber G, **Silva JR**, Livshitz L, Rudy Y. "Kinetic properties of the cardiac L-type Ca²⁺ channel and its role in myocyte electrophysiology: a theoretical investigation." *Biophysical Journal*. 2007 Mar;92(5):1522-43. [PMID: 17158566]
52. **Silva JR** and Rudy Y. "Subunit Interaction Determines I_{Ks} Participation in Cardiac Repolarization and Repolarization Reserve", *Circulation*. 2005;112:1384-1391.
53. **Silva JR** and Rudy Y. "Mechanism of pacemaking in I(K1)-downregulated myocytes." *Circulation Research*. 2003 Feb 21;92(3):261-3.

Chapters

1. Mangold K, **Silva JR**, "Modeling the Molecular Details of Ion Channels", *Modeling and Simulating Cardiac Electrical Activity*, Ed. Krogh-Madsen, T and Christini, D, 2022.
2. Moreno JD, Kang PW, **Silva JR**, "Connecting Cardiac Excitation to the Atomic Interactions of Ion Channels", *Cardiac Electrophysiology: From Cell to Bedside 8th ed.* Eds Zipes, Jalife, Stevenson, 2021.
3. Cox K, Privitera MB, Alden T, **Silva JR**, Avari Silva JN. "Augmented Reality in Medical Devices". *Applied Human Factors in Medical Device Design*. Academic Press, pp. 327-337, 2019.

4. **Silva JR**. “Slow inactivation of Na⁺ channel”, *Voltage Gated Na⁺ Channels*, Ed. Peter Ruben, Springer, Berlin Heidelberg, 2014.
5. Zhang HX, **Silva JR** and Nichols C. “Cardiac K_{ATP} Channels in Health and Diseases”, *Electrical Diseases of the Heart, 2nd edition*. pp 259-279, Ed. Ihor Gussak et al., Springer London, 2013.
6. **Silva JR** and Rudy Y. “Voltage-Gated Channels and the Heart”, *Molecular Machines*. Ed. B. Roux. World Scientific 2011.
7. **Silva JR** and Rudy Y. “Ionic Mechanisms of Ventricular Action Potential Excitation” *Cardiac Electrophysiology: From Cell to Bedside, 5th edition*, Eds. D.P. Zipes and J. Jalife. Elsevier Science, 2008.

Patents and Licenses

1. Andrews CM, Iqbal Z, Silva JNA, **Silva JR**, “System and Method for Augmented Reality Data Integration and Interaction for Ultrasound Imaging and Ultrasound-Guided Interventional Procedures, PCT/US2021/027064. 2021 – Licensed to SentiAR/Excera Inc.
2. Blume W, Southworth MK, Silva JN, **Silva JR**, inventors; SentiAR Inc, assignee. Gaze based interface for augmented reality environment. United States patent US 11,199,898. 2021 Dec 14.
 - a. Continuation - US Patent App. 17/524,981, 2022
3. Blume W, Southworth MK, **Silva JR**, Silva JN, Soriano I, inventors; SentiAR Inc, assignee. Electrogram Annotation System. United States patent application US 17/078,889. 2021 Apr 29.
4. **Silva JR**, Silva JNA, inventors; Washington University in St Louis WUSTL, assignee. System and method for virtual reality data integration and visualization for 3D imaging and instrument position data. United States patent US 10,258,426. 2019 Apr 16. – Licensed to SentiAR, Inc.
5. **Silva JR**, Zhu W, Priori S, Mazzanti A, Naegle K “Predicting response to sodium channel blockers”, US Patent App 16/708,312

Invited Lectures

1. FASEB SRC Ion Channel Regulation, Halifax, Nova Scotia, Canada 2022
2. Heart Rhythm Society Annual Meeting, San Francisco, CA 2022
3. Society for Mathematical Biology, 2021
4. American Heart Association Scientific Sessions, 2021
5. Washington University Biomedical Engineering Seminar, St. Louis MO 2021
6. Cardiology Grand Rounds, Washington University School of Medicine, St. Louis MO 2020
7. Venture Café, St. Louis MO 2020
8. UC Davis Cardiovascular Symposium, Davis, CA2020
9. Channelopathy 2020, Quebec City, (conference postponed)
10. Ohio State University, Department of Biomedical Engineering 2019
11. Skandalaris Center for Interdisciplinary Innovation and Entrepreneurship, 2019
12. Department of Biochemistry and Molecular Biophysics, Washington Univ School of Medicine, 2019
13. University of Michigan, Ann Arbor, Michigan, 2018
14. CECAM Multiscale Modeling Workshop, Lugano, Switzerland, 2018
15. St. Louis University Biomedical Engineering Society, St. Louis, USA, 2018

16. Center for Cardiovascular Research, Washington University School of Medicine, St. Louis USA, 2018
17. Cardiac Arrhythmia Mechanisms Gordon Research Conference, Ventura, California, USA, 2017
18. Experimental Biology Meeting, Chicago, IL, USA, 2017
19. Biomedical Engineering Seminar, Washington University in St. Louis, St. Louis, MO, USA, 2016
20. Cardiac Bioelectricity and Arrhythmia Center 10th Anniversary Symposium, Washington University in St. Louis, St. Louis, MO, USA, 2015
21. Center for Cardiovascular Research, Cardiovascular Research Day, Junior Faculty Presentation, Washington University in St. Louis, St. Louis, MO, USA, 2014
22. Biochemistry and Molecular Biophysics Chalk Talk, Washington University in St. Louis, St. Louis, MO, USA, 2014
23. Medical Scientist Training Program MAP Talk, Washington University in St. Louis, St. Louis, MO, USA, 2014
24. Cardiac Bioelectricity and Arrhythmia Center Seminar, Washington University in St. Louis, St. Louis, MO, USA, 2014
25. Université de Montréal (GEPROM), Montréal, Québec, Canada, 2013
26. Biophysical Evenings, Washington University in St. Louis, St. Louis, MO, USA, 2013
27. University of British Columbia, Vancouver, British Columbia, Canada, 2012
28. Simon Fraser University, Vancouver, British Columbia, Canada, 2012

Teaching

BME 440 Introductory Python with Biomedical Applications

Role: Co-Instructor

Year Taught: 2021

Enrolled Students: 40 undergrad

BME 301 Quantitative Physiology

Role: Course Master

Year(s) Taught: 2018,2019,2020, 2021

Avg. Enrolled Students: 65 undergrad

BME 401 Senior Design

Role: Team taught (3)

Years taught: 2013, 2014, 2015, 2016

Avg. Enrolled Students: 77 undergrad

BME 450/550 Numerical Methods for Computational Modeling in Biomedicine (Tier 1 Class)

Role: Developed, Instructor

Years taught: 2014, 2015, 2016, 2017, 2018

Avg. Enrolled Students: 19 (25% grad, 75% undergrad)

BME 5901 Integrative Cardiac Electrophysiology

Role: Team-taught (3)

Years taught: 2014, 2016, 2018

Avg. Enrolled Students: 4

Trainees

Graduate

Current PhD:

Martina Marras (2021-)

Thesis Topic: Novel Approaches for Class I Anti-arrhythmic Therapies

Current status: Transitioning from MS program to PhD

Chang Hi Lee (2020-)

Thesis Topic: Using Machine Learning Algorithms to Improve Anti-arrhythmic Therapy

Current status: Transitioning from MS program to PhD

Druv Bhagavan (2020-)

Thesis Topic: Algorithms to connect micro-heart muscle phenotype to patient arrhythmia

Anticipated Graduation: 2023

Lucy Woodbury (2020-)

Thesis Topic: Regulation of Nav1.5 by intracellular fibroblast growth factors

Anticipated graduation: 2024

Emily Wagner (2017 -)

Thesis Topic : Disordered protein regulation of Nav1.5

Anticipated graduation: 2022

Current MS:

Arthur Li (2021-2022)

Thesis topic: Automated construction of meshes for 3D heart simulations.

Past PhD:

Wandi Zhu (2013 - 2018)

Thesis topic: Modulation of Cardiac Na⁺ Channel Gating by Interacting Molecules

Currently a postdoctoral fellow at Harvard Medical School

Kathryn Mangold (2016 – 2021)

Thesis topic: Computational modeling of cardiac Na⁺ channel gating

Currently a post-doctoral trainee at Mayo Clinic

Po Wei Kang (2019 -2021)

Thesis Topic: Calmodulin regulation of cardiac ion channels.

Currently completing medical school.

Paweorn Angsutararux (2017 - 2022)

Thesis topic: Novel methods to monitor ion channel gating in myocytes

Planning to start postdoctoral training at UC Davis

Past MS:

Nicholas Bach (2020 - 2021)

Thesis topic: Tracking algorithm for otolaryngology procedures

Currently working in the lab.

Post-graduate

Current:

Jonathan Moreno MD, PhD (2017 -)

Khrystyna Sukanova, PhD (2021 -)

Past:

Christopher Andrews, PhD (2018-2020), Sr. Systems Engineer, SentiAR Inc.

Divya Kernik, PhD (2019 -2020), Medical Writer, Ashfield MedComms

Kuo-Chan Weng, PhD (2017 - 2020), Director iPSC Core, Washington University

Zoltan Varga, PhD (2013-2014), Asst. Professor, Debrecen Medical School, Hungary

Darya Urusova, PhD (2014-2015), Staff Scientist, Washington University School of Medicine

Arie Krumholz, PhD (2014-2015), Data Scientist,

Undergraduate (>6 months)

Past:

Irene Zhou (2021-2022), Graduate Student at Boston University

Anish Bedi (2019-2022), Applying to Medical School

Namit Sambare (2020-2022), Applying to Medical School

Andrew Whitaker (2019-2020), Graduate Student, Washington University

Michael Rudokas (2012-2013), Postdoctoral Fellow, Yale University

Bicong Li (2015-2017), Medical Student

Eric Hsu (2013-2015), MD/ PhD Candidate UT Southwestern

Zach Teed (2014-2017) – PhD Candidate, Princeton University

Chen Zhao (2013-2014) – PhD Candidate, The Johns Hopkins University

Professional Associations

Member

2018 – Present. American Heart Association

2016 – Present. Biomedical Engineering Society

2015 – Present. Society of Hispanic Professional Engineers

2015 – Present. Society of General Physiologists.

2011 – Present. Heart Rhythm Society

2010 – Present. American Heart Association

2009 – Present. Biophysical Society

2007 – Present. AAAS/Science

University and Professional Leadership

Department

Director of Diversity (2020-)

Undergraduate Studies Committee (2013-2014, 2017-2020)

Graduate Studies Committee (2014-2016, Cardiovascular Engineering Program Leader)

Faculty Search Committee (2014, 2016, 2019, 2021)

Masters Studies Committee (2016-2019)

School

Advancing Data Science for Racial Equity Faculty Recruiting Committee
Faculty Advisor, Society of Hispanic Professional Engineers, Undergraduate Chapter
Representative to Society for the Advancement of Chicanos/Hispanics and Native Americans in Science
Member, Engineering Space Committee
Panel, Society of Hispanic Professional Engineers, Q&A
Panel, Graduate School Forum
Panel, Engineering Visit Day

University

Member, Race and Ethnicity Hiring Initiative, 2020-present
Member, University Public Safety Committee, 2020-2021
Member, Conflicts of Interest Committee, 2018-present
Oversight sub-committee
Member, Danforth COVID-19 Re-opening Committee, 2020
Member, HHMI Gilliam Fellowship Nomination Review Committee, 2019-2020
Member, Ethnicity Cluster Hire Review Committee, 2020
Reviewer, SURF Undergraduate Research Fellowship
Participant, Libraries Data Curation Pilot
Participant, StemFIT Program

External

Grant Review

National Institutes of Health, MPPB Study Section, Standing Member (2021-2026)
National Institutes of Health, ESTA Study Section, Standing Member (2020-2021)
American Heart Association, Career Development Award (2020)
American Heart Association, Strategically Focused Research Network, Sudden Cardiac Death (2019)
National Institutes of Health, ESTA Study Section, Ad Hoc (2018)
American Heart Association, Transformational Project Award (2018-2019)
American Heart Association, Strategically Focused Research Network, Atrial Fibrillation (2018)
American Heart Association, Electrophysiology 1, permanent member (2015 - 2017)
American Heart Association, Biomedical Engineering Basic Science 3, ad hoc reviewer (2x)
FWO, Belgian Research Foundation, Ad hoc reviewer (4x)
Isaac Newton Trust, Ad hoc Reviewer
Israel Science Foundation, Ad hoc Reviewer
Arch Grants Pitch Competition

Oversight

American Heart Association, SFRN: Atrial Fibrillation Oversight Committee (2018 -)
Heart Rhythm Society Journal Subcommittee

Outreach

Aim High St. Louis Career Day
Mentor, Sister Thea Bowman School, Under-represented 8th Grade Students
Invited Speaker, Forsyth School 2nd Grade, Topic: Biomedical Engineering (2016 - 2020)
Coach, Lego League, Forsyth School
Judge, Honors Science Fair, St. Louis

Journal Affiliations

Editorial Board:

Frontiers in Neuroscience

Reviewer:

PLoS ONE

American Physical Society

Chaos

MethodsX

Journal of General Physiology

American Journal of Physiology

Scientific Reports

Circulation Research

Circulation: Arrhythmia and

Electrophysiology

Heart Rhythm Journal

Journal of the American Heart Association

Biophysical Journal

Physical Biology

Journal of Medical and Biological

Engineering

Journal of Biomechanical Engineering

Journal of Molecular and Cellular

Cardiology

Journal of Neuroscience

Cardiovascular Research

Europace

Progress in Biophysics

eLife

Center Affiliations

Center for Cardiovascular Research (CCR)

Center for Science and Engineering of Living Systems (CELS)

Cardiac Bioelectricity and Arrhythmia Center (CBAC)

Center for the Investigation of Membrane Excitability Diseases (CIMED)

Diabetes Research Center (DRC)