

# jonathan moreno md, phd

T: 212 518 1661 • E: jmoreno@wustl.edu • W: jonathanmoreno.com • @MorenoMDPhD

## RESEARCH INTERESTS

My research focuses on utilizing computational approaches to understand and design better treatment strategies for the pharmacological management of heart failure and arrhythmia. Using computational tools and clinical datasets, I also am interested in drug-repositioning – using old drugs for new targets in novel ways.

## POSITIONS

### **Washington University in St. Louis, Barnes Jewish Hospital**

St. Louis, MO

Instructor of Medicine, Division of Cardiology, Department of Medicine

July 2020 - present

- Attending physician, section of Advanced Heart Failure and Cardiac Transplant, Barnes Jewish Hospital
- Faculty member, Cardiac Bioelectricity and Arrhythmia Center, Washington University in St. Louis

## EDUCATION AND TRAINING

### **Washington University in St. Louis, Barnes Jewish Hospital**

St. Louis, MO

*Internship and residency, Internal Medicine*

July 2013 – June 2015

*Fellowship, Cardiovascular Medicine*

July 2015 – June 2017

*Post-doctoral fellow, laboratory of Jonathan Silva, PhD*

July 2017 – present

*Fellowship, Advanced Heart Failure and Transplant Cardiology*

July 2018 – June 2019

### Awards and Honors

- Physician Scientist Training Program pathway – research track in Cardiology
- Intern of the Month, December 2013
- Gregory J. Gurtner, MD Internal Medicine Residency Research Award, December 2014
- Washington University / Barnes-Jewish Hospital Dr. Norman Knowlton, Jr. Incentive for Excellence Award, June 2017
- Burton E. Sobel Award for Excellence in Cardiovascular Research, June 2019

### Board Certifications

- Board certified in Internal Medicine (2016)
- Diplomate (board certified), National Board of Echocardiography (2018)
- Board certified in Cardiology (2019)
- Board eligible, Advanced Heart Failure and Cardiac Transplant (2019)

### **Weill Cornell Medical College**

New York, NY

*MD, with Honors in Service*

2016 - 2013

*PhD, Weill Cornell / Rockefeller University / Sloan-Kettering Tri-Institutional MD/PhD Program*

- 2011 Ida Sophia Scudder, M.D. Award for Excellence in Public Service, a Pioneer in Diversity Award
- Founder and PI, Heart-to-Heart Community Outreach Campaign (myheart2heart.org)
- Cofounder, Weill Cornell Jazz Orchestra, founding member of the Music and Medicine Society
- Cofounder, Weill Cornell Center for Human Rights (asylum clinic for torture survivors)
- Executive Director, XO, Weill Cornell Community Clinic (student-run free clinic for the uninsured)

### **University of Massachusetts, Amherst**

Amherst, MA

*Bachelor of Science in Chemical Engineering, summa cum laude*

May 2006

*Bachelor of Science in Biochemistry and Molecular Biology, summa cum laude*

*Minor in Chemistry*

### Awards and Honors

- Specialized coursework in Biochemical Engineering, Drug Design and Discovery, and Math Modeling
- 21<sup>st</sup> Century Leadership Award
- William F. Field Class of 2006 Alumni Scholar
- Commonwealth Honors College Research Fellowship: 2003, 2004
- Chemical Engineering Teaching Fellowship
- Ombud's Office, Academic Honesty Board Member
- Studio One Jazz Orchestra, 2<sup>nd</sup> Tenor Saxophone

RELEVANT RESEARCH EXPERIENCE

**Post-doctoral fellowship, Laboratory of Dr. Jonathan Silva, Washington University in St. Louis** 2017 - present  
Post-doctoral research fellow St. Louis, MO

- The Silva lab has expertise in voltage clamp fluorometry which allows simultaneous tracking of specific molecular movements of the sodium channel in response to voltage clamp electrophysiology (patch clamping). My research focused on creation of a model to account for a specific molecular regulator of the sodium channel, the domain III (DIII) voltage sensor. The model, to our knowledge, is the first computational model that ties molecular movements to pharmacology. The model predicts that the differential sensitivity of two long-QT3 mutations is directly related to the DIII voltage sensor. Using the model, we developed an *in-silico* pharmacologic “booster” drug to rescue LQT3 phenotypes that are resistant to the common antiarrhythmic drug mexiletine.
- The second area of investigation of my research within the lab is understanding the effects of cellular pathway dysregulation and ultrastructural remodeling in hypertrophic cardiomyopathy. By creating models from the cell to organ, we hope to design precision therapies to treat arrhythmias in these patients.

**PhD, Laboratory of Dr. Colleen E. Clancy, Weill Cornell Medical College (now at UC Davis)** 2008 - 2011  
Research Fellow New York, NY

- My research focused on using experimental function and clinical data to build a theoretical framework to simulate measured properties of drug channel interactions to make predictions about emergent effects of antiarrhythmic drugs on cardiac cells and tissues. Our work was able to accurately predict specific clinical situations for which two prototypical antiarrhythmic drugs would **cause** rather than ameliorate arrhythmia. We have recently extended this framework to understand genotype-specific sodium channel drug blockade (e.g. long-QT3 syndrome). Advances in computational power, and automated electrophysiology will enable the development of virtual drug screens for antiarrhythmic drug therapy.

PUBLICATIONS

25. Mangold, KE; Wang, W; Johnson, E; **Moreno, JD**; Nerbonne, JM; Silva, JR. Identification of optimal structures for ion channel kinetic models. *Manuscript in preparation*.
24. **Moreno, JD**; Kang, PW; Silva, JR. Chapter 19: Connecting cardiac excitation to the atomic interactions of ion channels. Cardiac Electrophysiology: From cell to bedside, 8<sup>th</sup> edition. *Manuscript submitted*
23. **Moreno, JD**; Verma, AM; Kopecky, BJ; Dehner, C; Kostecky, N; Lavine, KM; Vader, JM; Lin, CY; Schilling, JD. Angiotensin II type 1 receptor antibody mediated rejection following orthotopic heart transplant: a single center experience. *Manuscript submitted*.
22. Ransdell, JL\*; **Moreno, JD\***; Silva, JR; Nerbonne, JM. A novel, “blocking-particle independent” mechanism of the resurgent Na<sup>+</sup> current in cerebellar Purkinje neurons: a combined experimental and simulation study. *Manuscript in preparation*.  
\*Co-first authorship
21. **Moreno, JD**; Lavine, KJ. Advanced heart failure therapies: LVAD and orthotopic heart transplant (book chapter). The Washington Manual Cardiology Subspecialty Consult Series. 3<sup>rd</sup> Edition. *Manuscript accepted*
20. **Moreno, JD**; Zhu, W; Mangold, K; Chung, W; Silva, JR. A computational model of the DIII voltage sensor regulation of Nav1.5 reveals a new class I antiarrhythmic target. JACC Basic Transl Sci. 2019 Oct 28;4(6):736-751
19. Zhu, W; Mazzanti, A; Voelker, TL; Hou, P; **Moreno, JD**; 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.
18. **Moreno, JD**; Brown, DL. Chapter 18: Right Ventricular Infarction. Cardiac Intensive Care, 3<sup>rd</sup> Edition. Elsevier Press.
17. Mangold, KE; Brumback, BD; Angsutararux, P; Voelker, TL; Zhu, W; Kang, PW; **Moreno, JD**; Silva, JR. Mechanisms and models of cardiac Na<sup>+</sup> channel inactivation. Channels (Austin). 2017 Nov

2;11(6):517-533.

16. Raymer, DS\*; **Moreno, JD\***; Sintek, MA; Nassif, ME; Sparrow, CT; Adamo, L; Novak, EL; LaRue, SJ; Vader, JM. Combination of TAPSE and HeartMate Risk Score to Predict Right Ventricular Failure after LVAD: Noninvasive Testing is Superior to Invasive Hemodynamic Measurements. *ASAIO Journal*, May 2018.  
\*Co-first authorship
15. Yang, PC; **Moreno, JD**; Jeng, MT, Noskov, S; and Clancy, CE. Response to Williams et al., "Questioning flecainide's mechanism of action in the treatment of catecholaminergic polymorphic ventricular tachycardia." *J Physiol*. 2016 Nov 1;594(21):6433-6435
14. **Moreno, JD**; Cooper, DH. Recipient to donor atrial conduction after orthotopic heart transplant: successful ablation of both the conduction pathway and the ectopic focus within the recipient atrium. *Manuscript under revision*.
13. **Moreno, JD**; Lewis, TJ; Clancy CE. Parameterization for In-Silico Modeling of Ion Channel Interactions with Drugs. *PLoS One*. 2016. March 10;11(3):e0150761
12. Yang, PC\*; **Moreno, JD\***; Vaughn-Behrens, SB; Jeng, MT; Clancy CE. *In silico* prediction of drug therapy in catecholaminergic polymorphic ventricular tachycardia. *J Physiol*. 2016 Feb 1;594(3):567-93.  
\* Co-first authorship
11. **Moreno, JD**; Yang, PC; Bankston, JR; Grandi, E; Bers, DM; Kass, RS; Clancy, CE. Ranolazine for congenital and acquired late  $I_{Na}$  linked arrhythmias: *in silico* pharmacologic screening. *Circ Res*. 2013 Sep 13;113(7):e50-61.
10. **Moreno, JD**; Roberts BN; Clancy CE. Cardiac Excitable Tissue Pathology (Ion Channels). *Encyclopedia of Computational Neuroscience*. SpringerReference.com (2013)
9. Roberts, BN; Yang, PC; Behrens, SB; **Moreno, JD**; Clancy, CE. Computational approaches to understand cardiac electrophysiology and arrhythmias. *AJP Heart and Circulatory Physiology*. *Am J Physiol Heart Circ Physiol*. 2012 Aug 10
8. **Moreno, JD**; Clancy, CE. Pathophysiology of the cardiac late Na current and its potential as a drug target. *Journal of Molecular and Cellular Cardiology*. 2012 Mar;52(3):608-19. Epub 2011 Dec 16
7. **Moreno, JD**; Zhu, Zi; Yang, PC; Bankston, JR; Jeng, MT; Kang, C; Wang, L; Ripplinger, CM; Christini, DC; Kass, RS; Clancy, CE. A multiscale model to predict the effects of class I antiarrhythmic drugs on ventricular rhythms. *Science Translational Medicine* 2011 Aug 31;3(98):98ra83
6. **Moreno, JD**; Clancy, CE. Simulation of Cardiac Action Potentials. In: Tripathi O, Ravens U, Sanguinetti M, eds. *Heart rate and rhythm: molecular basis, pharmacological modulation and clinical implications*. First Edition. Berlin, Springer; 2011: In Press.
5. **Moreno, JD**; Patel, SH. Volunteer Brigades in the Fight Against CVD. *Cornell Daily Sun's "What's Up Doc?"* opinion section. Published November 10, 2010
4. **Moreno, JD**; Clancy, CE. Using computational modeling to predict arrhythmogenesis and antiarrhythmic therapy. *Drug Discovery Today: Disease Models*, 2010 (6)3
3. **Moreno, JD**; Bankston, JR; Kass, RS; Clancy, CE. Cardiac Dynamics In-Silico: Pharmacological Targeting of Long QT3 Syndrome. *Biophysical Journal - BIOPHYS J* 01/2010; 98. DOI:10.1016/j.bpj.2009.12.050
2. **Moreno, JD**; Patel, SH. Insured Need Not Apply. *Cornell Daily Sun's "What's Up Doc?"* opinion section. Published March 18, 2010
1. **Moreno, JD**. Synergistic effects of combined elicitation on the accumulation of taxanes in *Taxus* cell suspension cultures. An Honors Research Thesis for the Commonwealth College, University of Massachusetts, Amherst. 2006

ABSTRACTS, POSTERS, and PODIUM PRESENTATIONS

17. **Moreno, JD**; Verma, AM; Kopecky, B. Dehner, C; Kosetelecky, N; Lin, C; Vader, JM. Angiotensin II type 1 receptor antibody mediated rejection following orthotopic heart transplant: a single center experience. ISHLT 2020 annual meeting (invited podium presentation).
16. **Moreno, JD**; Zhu, WI; Silva, JR. A molecularly detailed Nav1.5 model reveals a new class I antiarrhythmic drug target: designing a mexiletine booster. PSTP Annual Research Day. April, 2019 (Podium).
15. **Moreno, JD**; Zhu, WI; Silva, JR. A model of the cardiac sodium channel DIII voltage sensor: predicting antiarrhythmic drug efficacy from molecular movements. Heart Rhythm Society Annual Scientific Sessions, Boston, MA. May, 2018 (Poster).
14. **Moreno, JD**; Shi, M; Novak, E; LaRue, S. Prediction of LVAD Pump Thrombosis with 30-day LDH Values: Results from a Large-Volume High Acuity Transplant Center. American College of Cardiology Annual Meeting, Orlando, FL. March 2018 (Poster).
13. **Moreno, JD**; Zhu, WI; Silva, JR. A Computational Model of the Cardiac Sodium Channel DIII Voltage Sensor: Connecting Molecular Movements to Tissue Dynamics. Biophysical Society Annual Meeting, San Francisco, CA. February 2018 (Poster).
12. **Moreno, JD**; Zhu, WI; Silva, JR. A Computational Model of the Cardiac Sodium Channel DIII Voltage Sensor: Connecting Molecular Movements to Tissue Dynamics. 6<sup>th</sup> Annual Cardiovascular Research Day, Washington University, St. Louis. November, 2017 (Poster).
11. **Moreno, JD**; Adamo, L; Raymer, DS, Sparrow, CT; Pierce, BR; Larue, SJ. Pulmonary Artery Pulsatility Index predicts RV failure, duration of inotropes and death after LVAD implantation in a large, high acuity cohort. 37<sup>th</sup> meeting of the International Society of Heart and Lung Transplant. San Diego, CA, 2017. (Podium).
10. **Moreno, JD**; Adamo, L; Raymer, DS, Sparrow, CT; Pierce, BR; Larue, SJ. Pulmonary Artery Pulsatility Index predicts RV failure, duration of inotropes and death after LVAD implantation in a large, high acuity cohort. Heart Failure Apprentice Network Annual Meeting. Washington University, St. Louis. 2016 (Podium).
9. **Moreno, JD**; Clancy, CE. Prediction of the emergent effects of drugs on cardiac electrical activity: an *in silico* approach. Heart Failure Apprentice Network Annual Meeting. Washington University, St. Louis. 2013 (Podium).
8. **Moreno, JD**; Clancy, CE. Antiarrhythmic implications of ranolazine. 2013 Gordon Research Conference, "Cardiac Arrhythmia Mechanisms", Ventura, CA (Podium) **\*Plenary speaker invitation**
7. **Moreno, JD**. Heart Disease: Knowing your risk and tips for prevention. CTSC Community Health Interactive Talks, an NIH-sponsored "Telemedicine" Initiative. July, 2012. **\*Invited speaker**
6. **Moreno, JD**; Christianer, KC; Patel, SH; Zhu, J.; Borden, WB. The Heart-to-Heart Community Outreach Campaign: A community-based participatory research study to assess the prevalence of cardiovascular disease in underserved New Yorkers. 2012 Medical Student Research Day, Weill Cornell Medical College (Podium) **\*Awarded 1<sup>st</sup> place presentation**
5. **Moreno, JD**; Christini, DJ; Clancy, CE. *Cardiac Dynamics in silico: Pharmacology through High Performance Computing*. 2011 DuVinugh Symposium, Weill Cornell Medical College (Podium)
4. Vedanthan, R; Marwah, V; **Moreno, JD**; Sachs, S; Pronyk, P; Fuster, VF. Using a Human-Centered Design Approach to Develop and Implement User-Centric Performance Support Tools for Hypertension control in Sub-Saharan Africa. 4<sup>th</sup> NIH Conference on Dissemination and Implementation Research, Washington, DC. (Poster)
3. **Moreno, JD**; Zhu, ZI; Yang, PC; Bankston, JR; Jeng, MT; Kang, C; Wang, L; Christini, DJ; Ripplinger, CM; Kass, RS; Clancy, CE. *A multiscale model to predict antiarrhythmic drug effects on cardiac rhythms*. 2011 Medical Student Research Day, Weill Cornell Medical College (Poster)
2. **Moreno, JD**; Zhu, ZI; Yang, PC; Bankston, JR; Jeng, MT; Kang, C; Wang, L; Christini, DJ; Ripplinger, CM; Kass, RS; Clancy, CE. *A multiscale model to predict antiarrhythmic drug effects on cardiac rhythms*.

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2011 Gordon Research Conference, "Cardiac Arrhythmia Mechanisms", Galveston, TX (Poster)  
**\*Awarded 1<sup>st</sup> place poster**

1. **Moreno, JD**; Bankston, JR; Kass, RS; Clancy, CE. *Cardiac Dynamics in-silico: Pharmacological Targeting of Long QT3 Syndrome*. Voltage Gated Sodium Channels Platform. 2010 Biophysical Society Annual Meeting, San Francisco, CA (Podium)

## GRANTS AND FUNDRAISING

11. **Moreno, JD (PI), Mann, DL (co-I)**. 3-Dimensional virtual ventricles to design precision therapies in hypertrophic cardiomyopathy. Barnes Jewish Hospital Foundation. **\$27,500** (10/1/2020 – 9/30/2021).
10. **Moreno, JD (PI)**. 3-Dimensional virtual ventricles to design precision therapies in hypertrophic cardiomyopathy. NIH-NHLBI K08 (grant submitted July, 2020).
9. Silva, JR (PI); **Moreno, JD (co-I)**. Personalizing class I antiarrhythmic drug therapy. **\$3,494,156** (4/1/20 – 3/31/25). NIH-NHLBI, R01HL148803.
8. 5T32HL007081-42, NIH, Diwan, Abhinav (PI), 07/01/19-07/01/20, Cardiovascular Disease Training Grant. **Moreno, JD** (fellow).
7. **Moreno, JD (PI)**; Silva, JR (PI). Development of a cloud-based, *in-silico* drug testing system for the treatment of cardiac arrhythmia. Amazon Web Services® (AWS) cloud credits for research. **\$40,000** awarded in AWS cloud credits. July, 2018.
6. **Moreno, JD (PI)**; Greenberg, M (PI); Silva, JR (PI). Effects of Mechanical Forces on Cardiac Excitability in Heart Disease. 2018 CIMED Pilot and Feasibility Award, Washington University in St. Louis. **\$50,000** awarded in direct costs. December, 2017.
5. 5T32HL007081-42, NIH, Mann, Douglas Lowell (PI), 07/01/17-07/01/18, Cardiovascular Disease Training **Moreno, JD** (fellow).
4. **Moreno, JD (PI)**; Patel, SH (PI). *The Weill Cornell "Heart to Heart" Community Outreach Campaign: A study to assess the prevalence of cardiovascular disease in underserved, at-risk populations using novel, point-of-care testing devices*. Weill Cornell IRB: 1003010970; joint collaboration with Weill Cornell Medical College and Hunter-Bellevue School of Nursing.
  - AstraZeneca Foundation *Connections for Cardiovascular Health*: **\$181,895** in operational and development costs for 1 year. Awarded: November 2012
  - Weill Cornell Clinical Translational Science Center Director's award: **\$20,000** in operational costs for 1 year. Awarded: June 1, 2011
3. Borden, WB (PI); Frank, M; Wilson-Taylor, M; **Moreno, JD**; Patel, SH. Young Leaders: Heart-to-Heart. AHA/ASA 2010-2011 New York City Community Impact Grant. **\$15, 481.43**. Awarded: Nov. 3, 2010
2. **Moreno, JD (PI)**; Patel, SH (PI). *The Weill Cornell "Heart to Heart" Community Outreach Campaign: A study to assess the prevalence of cardiovascular disease in underserved, at-risk populations using novel, point-of-care testing devices*. Weill Cornell IRB: 1003010970; Weill Cornell CTSC community engagement award: **\$20,000** in operational costs for 1 year. Awarded June, 2010
1. **Moreno, JD (PI)**; Patel, SH (PI). *The Weill Cornell Community Clinic (WCCC): A model continuity of care clinic and service learning*. Aetna Foundation award: **\$24,500** in operational costs for 1 year. Awarded June, 2009

## TEACHING RESPONSIBILITIES and ACADEMIC SERVICE

4. **Landmarks Journal Club**: Founder and organizer of a cardiovascular journal club for the Wash U. fellowship program that examines key collections of landmark clinical trials in the field of cardiology
3. **Washington University Internal Medicine Residency**: Invited as a 2017, 2018, 2019 interview season applicant interviewer

2. **Cardiovascular Diseases** (a course for 2<sup>nd</sup> year medical students), small group mentor. Washington University School of Medicine. Fall 2015, Fall 2016
1. **Practice of Medicine II** (a course of 2<sup>nd</sup> year medical students on history and physical exam skills), course mentor. Washington University School of Medicine. Fall 2015, Fall 2016

AD-HOC SCIENTIFIC REVIEWER

- International Journal of Cardiology
- Action Medical Research Charity
- Circulation Research
- AJP-Heart and Circulatory Physiology
- Frontiers in Pharmacology

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

- American Board of Internal Medicine
- American College of Cardiology
- Heart Rhythm Society
- International Society of Heart and Lung Transplantation

LEADERSHIP EXPERIENCE

**Executive Director, Weill Cornell Community Clinic**

2009 – 2011

- Weill Cornell Community Clinic is a student-run free clinic serving the uninsured population (~200 patients per year) in New York City. I lead a team of 18 medical students who provide comprehensive high quality healthcare and prescription assistance. The Executive Directorship oversees the administrative, financial and strategic operations of the Clinic to ensure stability and growth through extensive fundraising, strengthening partnerships with Weill Cornell Medical College and New York Presbyterian Hospital, and seeking new relationships to enhance the Clinic's services.
- Coauthored an Aetna Foundation Grant for \$24,500, and have raised more than \$100,000 for the 2009 – 2010 year.

**Founder and Co-Director, Weill Cornell Heart-Heart Community Outreach Campaign**

2010 – 2013

- I founded this program in 2010 with the goal of assessing 1000 New York City residents in underserved communities for CVD using innovative point-of-care testing devices. With a team of 20 – 30 medical, physician's assistant, and nursing students, along with 3 physicians, the program sets up monthly screening events at faith-based organizations, community organized health fairs, and street fairs and screens 100 individuals for height, weight, BMI, hemoglobin A1C, lipids, and a limited social history to assess CVD. To date, we have raised over \$250,000, partnered with the NY State Senate, and have screened over 2000 New Yorkers. Further details at [myheart2heart.org](http://myheart2heart.org).

**Cofounder, Weill Cornell Center for Human Rights**

Spring 2010

- The Weill Cornell Center for Human Rights is an asylum clinic for torture survivors. In coordination with Physicians for Human Rights (PHR), clients are given a psychological or medical evaluation to document signs of torture. A legal affidavit is then prepared on behalf of the client for their asylum hearing. Asylum seekers are 3 – 4 times more likely to be granted asylum with a medical legal affidavit attesting to signs of torture and abuse. Further details at [cornellchr.org](http://cornellchr.org).

PERSONAL INTERESTS

Jazz music of the bebop era, saxophone, running, distance cycling, cooking, and presidential politics.