



## Sanjiv Narayan

Professor of Medicine (Cardiovascular Medicine) at the Stanford University Medical Center

Medicine - Cardiovascular Medicine

 NIH Biosketch available Online

### CLINICAL OFFICES

- **Cardiovascular Medicine**

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### ACADEMIC CONTACT INFORMATION

- **Alternate Contact**

Kathleen Mills - Research Manager, EP Research Program

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### Bio

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#### BIO

Dr. Narayan is Professor of Medicine and Co-Founder of the Stanford Arrhythmia Center. His vision is to improve outcomes for patients with complex heart rhythm disorders via translational computational and bioengineering approaches. Dr. Narayan directs the Computational Arrhythmia Research Laboratory, an extramurally funded “bedside-to-bench-to-bedside” unit focused on combining detailed mapping of atrial and ventricular fibrillation with analytic methods including machine learning to define mechanism-based therapy. This work led to the discovery of rotational (rotors) and focal drivers for human cardiac fibrillation via FIRM (Focal Impulse and rotor Mapping), now confirmed by optical mapping in human atria and independent clinical studies. Ablation of fibrillatory drivers and their variation between patients is a major global clinical and research area. Dr. Narayan is a passionate mentor, and many of his trainees in bioengineering, residents/fellows and medical students have received extramural funding, research and clinical prizes and over 80% remain in academic medicine. Dr. Narayan has won teaching prizes for his mentorship and his mentorship program has been supported by the National Institutes of Health (K24 HL103800, 2010 to present).

Dr. Narayan was born in Aylesbury, Buckinghamshire, England, then his family moved to Birmingham where he trained in medicine (MB, ChB) then software engineering (MSc) with a concentration on neural networks. He gained membership (MRCP) then fellowship (FRCP) of the Royal College of Physicians of London. He moved to the renowned neuroimaging/computational laboratory of Arthur Toga, PhD at UCLA where his research in optical mapping/neuroscience led to his research doctorate (MD). He completed U.S. clinical training in Internal medicine at Harvard/Mount Auburn Hospital under Dr. Charles Hatem, and Cardiology/EP at Washington University in St. Louis under Drs Michael Cain and Bruce Lindsay. Dr. Narayan is board-certified in Cardiology and Clinical Cardiac Electrophysiology, and has been voted as a “Top Doctor”. He is a devoted family man, and he and his wife have three children. Together, they enjoy swimming, biking, skiing, music and travel.

**FINANCIAL DISCLOSURES:** The Narayan laboratory is extremely grateful to its funding agencies. Fellows in Dr. Narayan's Lab have been funded by the NIH, Fulbright Foundation, American College of Cardiology, American Heart Association, Heart Rhythm Society, British Heart Foundation. Dr. Narayan's work has been supported by continuous grants over 2001-2020 from the NIH (HL70529, HL83359, HL103800, HL122384 and SBIR grants), the Doris Duke Charitable Foundation and AHA. To further develop technology resulting from this research for wider clinical use, Dr. Narayan co-invented intellectual property from this research owned by the University of California Regents and Stanford. This IP was licensed to a start-up Dr. Narayan co-founded (Topera), in which he held equity and which was acquired

in 2014 by Abbott Laboratories. Dr. Narayan has received consulting income from Abbott Electrophysiology, BeyondLimits.ai, TDK Inc., Uptodate, the American College of Cardiology

## CLINICAL FOCUS

- Clinical Cardiac Electrophysiology

## ACADEMIC APPOINTMENTS

- Professor - Med Center Line, Medicine - Cardiovascular Medicine
- Member, Bio-X
- Member, Cardiovascular Institute

## ADMINISTRATIVE APPOINTMENTS

- Co-Director, Stanford Arrhythmia Center, (2016- present)
- Director, Atrial Fibrillation Program, Stanford Medicine, (2014- present)
- Director, Electrophysiology Research, Stanford Medicine, (2014- present)
- Co-Director, Electrophysiology Program, University of California, San Diego, (2008-2014)
- Director, Clinical Cardiac Electrophysiology Fellowship Training Program, University of California, San Diego, (2008-2012)
- Director, Electrophysiology Program, Veterans Affairs San Diego Healthcare System, (2001-2014)

## HONORS AND AWARDS

- Mentor to Mahmood Alhuseini, MS. Finalist, Young Investigator Award Competition, European Heart Rhythm Association (2019)
- Mentor to Miguel Rodrigo, PhD. Winner, Prystowski Abstract Award, Heart Rhythm Society (2019)
- Mentor to Neal Bhatia, MD. Top Scoring Abstract, European Heart Rhythm Association (2019)
- Mentor to AJ Rogers, MD MBA, Recipient F32 Award, National Institutes of Health (2018-2021)
- Mentor to AJ Rogers, MD MBA, Recipient, Josephson and Wellens Fellowship (Declined in Favor of NIH), Heart Rhythm Society (2018-2019)
- Mentor to G. Leef, MD, 1st Prize, Young Investigator Award, Asia Pacific Heart Rhythm Society (APHRs) (2018)
- Charter Member, ESTA Study Section, National Institutes of Health (2017 - present)
- Mentor to Junaid Zaman, MD, Best Poster Award, European Society of Cardiology Meeting, Barcelona (2017)
- Mentor to Rachita Navara, MD; 1st Prize 2017 Stanford General Internal Medicine Symposium, Stanford University (2017)
- Mentor to Mallika Tomboli, BS (MD class of 2019); Stanford MedScholars Program, Stanford University (2016 - 2017)
- Mentor to Rachita Navara, MD; 2016-7 Stanford Society of Physician Scholars research grant, Stanford University (2016 - 2017)
- Mentor to Christopher Kowalewski; Clinical Prize 2016 Stanford-Karolinska Institute Symposium, Stanford University (2016)
- Mentor to Tina Baykaner, MD, Recipient, Josephson and Wellens Fellowship, Heart Rhythm Society (2015-2016)
- Mentor to Junaid Zaman, MD, Fulbright Scholar, Fulbright Foundation (2015 - 2016)
- Mentor to Junaid Zaman, MD, Finalist Young Investigator Awards Competition, American Heart Association (2015)
- Mentor to Tina Baykaner, MD, Awardee Postdoctoral Fellowship (declined for HRS fellowship), American Heart Association (2015)
- Mentor to Junaid Zaman, MD, Recipient British Heart Foundation Grant 2014, British Heart Foundation (2014 - 2015)
- Mentor to Amir Schricker, MD, Recipient 1st Prize HRS 2013 Young Investigator Awards, Heart Rhythm Society (2013)
- Mentor to Amir Schricker, MD, Recipient, ACC-Merck Fellowship, American College of Cardiology Foundation (2012 - 2013)
- Mentor to Amir Schricker, MD, HRS Max Schaldach Fellow (declined in favor of ACC-Merck), Heart Rhythm Society (2012)
- Mentor to David Krummen, MD, Finalist, Samuel Levine Young Investigator Awards Competition, American Heart Association (2011)
- Mentor to David E. Krummen, MD. AHA Beginning-Grant-In-Aid, American Heart Association (2010 - 2012)

- Mentor to Antonio Moyeda, RCVT, 1st Prize, Allied Professionals, Heart Rhythm Society (2010)
- Ad Hoc Member, ESTA, CCIS, Other Study Section, National Institutes of Health (2008 - 2017)
- Mentor to David Krummen, MD, Finalist Young Investigator Awards Competition, American College of Cardiology Foundation (2008)
- Mentor to Han Bui, MD, Recipient of ACC-Merck Fellowship, American College of Cardiology Foundation (2005 - 2006)
- Mentor to David Krummen, MD, Recipient, ACC-Merck Fellowship, American College of Cardiology Foundation (2003 - 2004)
- Finalist, Astra-Zeneca Cardiovascular Young Investigator Awards Competition, Astra-Zeneca-Competition (2001)
- Finalist, Samuel Levine Young Investigator Awards Competition, American Heart Association (1998)
- Finalist, Young Investigator Awards Competition, North American Society for Pacing and Electrophysiology (NASPE/HRS) (1998)

## **BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS**

- Associate Editor, Journal of the American College of Cardiology (2006 - 2017)
- Section Editor, Journal of the American College of Cardiology (2017 - present)
- Chair, Research Fellowship Committee, Heart Rhythm Society (2016 - present)
- Associate Editor, Journal of the American College Of Cardiology: Clinical Electrophysiology (2014 - present)
- Section Editor, Heart Rhythm Journal (2014 - 2014)
- Member, Editorial Board, Journal of Interventional Cardiac Electrophysiology (2013 - present)
- Coordinator and Co-Coordinator, Electrophysiology Program, American College of Cardiology Scientific Sessions (2013 - 2015)
- Member, Editorial Board, Journal of Cardiovascular Electrophysiology (2012 - present)
- Vice-Chair, Research Fellowship Committee, Heart Rhythm Society (2012 - 2016)
- Scientific Program Committee, Member, American Heart Association Scientific Sessions (2010 - 2012)
- Member, Editorial Board, Heart Rhythm Journal (2007 - present)

## **PROFESSIONAL EDUCATION**

- Fellowship: Washington University School Of Medicine Registrar (2001) MO
- Medical Education: University of Birmingham Medical School Registrar (1987) United Kingdom
- Fellowship: UCLA David Geffen School Of Medicine Registrar (1994) CA
- Board Certification: Clinical Cardiac Electrophysiology, American Board of Internal Medicine (2001)
- Board Certification: Cardiovascular Disease, American Board of Internal Medicine (2000)
- Residency: Barnes and Allied Hospitals/Washington University School of Med (2000) MO
- Internship: Mount Auburn / Harvard Medical School (1996) MA
- MD (Neuroscience Doctorate), University of Birmingham , UK (1994)
- Internship: University of Birmingham (1991) UK
- MSc (Computer Science), University of Birmingham , UK (1990)

## **PATENTS**

- Carey R. Briggs, Sanjiv M. Narayan. "United States Patent 9,392,948 B2 System and Method for Identifying Sources for Biological Rhythms", University of California, Regents., Jul 19, 2016
- Sanjiv Narayan, Ruchir Sehra. "United States Patent 8,868,169 B2 Method and System for Detection of Biological Rhythm Disorders", Regents of the University of California; Topera Inc; US Government represented by Dept of Veterans Affairs, Oct 21, 2014
- Sanjiv M. Narayan, Wouter-Jan Rappel. "United States Patent 8,838,222 B2 Method for Treating Complex Rhythm Disorders", University of California Regents, Sep 16, 2014
- Sanjiv M. Narayan, Wouter-Jan Rappel. "United States Patent 8,838,223 B2 Method for Analyzing Complex Rhythm Disorders.", University of California Regents, Sep 16, 2014

- Sanjiv M. Narayan, Ruchir Sehra. "United States Patent 8,700,140 Methods, system and apparatus for the detection, diagnosis and treatment of biological rhythm disorders", Regents of the University of California; Topera Inc., US Department of Veterans Affairs, Apr 15, 2014
- Sanjiv Narayan. "United States Patent 8,676,303 Machine and Process for Treating Heart Instability", University of California Regents, Mar 18, 2014
- Carey R. Briggs, Sanjiv M. Narayan. "United States Patent 8,594,777 System And Method For Reconstructing Cardiac Activation Information", University of California Regents, Nov 26, 2013
- Sanjiv M. Narayan, Wouter-Jan Rappel. "United States Patent 8,521,266 Methods for the Detection And/Or Diagnosis Of Biological Rhythm Disorders", University of California Regents, Aug 27, 2013
- Carey R. Briggs, Sanjiv M. Narayan. "United States Patent 8,165,666 System And Method For Reconstructing Cardiac Activation Information", University of California Regents, Apr 24, 2012
- Sanjiv Narayan, Valmik Bhargava. "United States Patent 7,123,954 Method and Apparatus for Classifying and Localizing Heart Arrhythmias", University of California Regents, Oct 17, 2006

## LINKS

- My Lab Site: <http://web.stanford.edu/group/narayanlab/cgi-bin/wordpress/contact/>
- Why I Went Into Medicine: <https://www.youtube.com/watch?v=42Um2o2oSJI&feature=youtu.be>
- Video Story: <https://stanfordhealthcare.org/stanford-health-care-now/why-i-got-into-medicine/why-medicine-sanjiv-narayan-md.html>
- FIRM Physician Centered Video: <https://youtu.be/OBozymcv4hI>
- Get a Second Opinion: <https://stanfordhealthcare.org/second-opinion/overview.html>

## Research & Scholarship

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### CURRENT RESEARCH AND SCHOLARLY INTERESTS

Dr. Narayan directs the Computational Arrhythmia Research Laboratory, whose goal is to define the mechanisms underlying complex human heart rhythm disorders, to develop bioengineering-focused solutions to improve therapy that will be tested in clinical trials. The laboratory has been funded continuously since 2001 by the National Institutes of Health, AHA and ACC, and interlinks a disease-focused group of clinicians, computational physicists, bioengineers and trialists.

### CLINICAL TRIALS

- Ablation of Ventricular Arrhythmias By Targeted Ablation of Reentrant Sites (AVATAR), Recruiting
- The Maintenance of Human Atrial Fibrillation, Recruiting
- Substrate Versus Trigger Ablation for Paroxysmal Atrial Fibrillation, Not Recruiting
- The Dynamics of Human Atrial Fibrillation, Not Recruiting

## Teaching

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### COURSES

#### 2018-19

- Introduction to Bioengineering Research: BIOE 390, MED 289 (Aut)

#### 2017-18

- Introduction to Bioengineering Research: BIOE 390, MED 289 (Aut)

#### 2016-17

- Introduction to Bioengineering Research: BIOE 390, MED 289 (Aut)

#### 2015-16

- Introduction to Bioengineering Research: BIOE 390, MED 289 (Aut)

### STANFORD ADVISEES

#### Postdoctoral Faculty Sponsor

A.J. Rogers

**Postdoctoral Research Mentor**

A.J. Rogers

**GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS**

- Cardiac Electrophysiology (Fellowship Program)
- Cardiovascular Medicine (Fellowship Program)

**Publications**

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**PUBLICATIONS**

- **Propagation velocity at atrial fibrillation sources: Go with the flow.** *International journal of cardiology*  
Rogers, A. J., Bhatia, N. K., Brodt, C. R., Narayan, S. M.  
2019
- **MACHINE LEARNING IDENTIFIES SITES WHERE ABLATION TERMINATES PERSISTENT ATRIAL FIBRILLATION**  
Alhousseini, M., Abuzaid, F., Clopton, P., Rogers, A., Rodrigo, M., Baykaner, T., Wang, P., Rappel, W., Narayan, S.  
ELSEVIER SCIENCE INC.2019: 301
- **Deep learning for cardiovascular medicine: a practical primer.** *European heart journal*  
Krittana Wong, C., Johnson, K. W., Rosenson, R. S., Wang, Z., Aydar, M., Baber, U., Min, J. K., Tang, W. H., Halperin, J. L., Narayan, S. M.  
2019
- **New Concepts in Sudden Cardiac Arrest to Address an Intractable Epidemic: JACC State-of-the-Art Review.** *Journal of the American College of Cardiology*  
Narayan, S. M., Wang, P. J., Daubert, J. P.  
2019; 73 (1): 70–88
- **Efficacy of Ablation Lesion Sets in Addition to Pulmonary Vein Isolation for Paroxysmal Atrial Fibrillation: Findings From the SMASH - AF Meta-Analysis Study Cohort.** *Journal of the American Heart Association*  
Cluckey, A., Perino, A. C., Yunus, F. N., Leef, G. C., Askari, M., Heidenreich, P. A., Narayan, S. M., Wang, P. J., Turakhia, M. P.  
2019; 8 (1): e009976
- **Comparison of phase-mapping and electrogram-based driver mapping for catheter ablation in atrial fibrillation.** *Pacing and clinical electrophysiology : PACE*  
Lin, C., Lin, Y., Narayan, S. M., Baykaner, T., Lo, M., Chung, F., Chen, Y., Chang, S., Lo, L., Hu, Y., Liao, J., Tuan, T., Chao, et al  
2018
- **Structurally-based electrical predictors of atrial arrhythmias.** *International journal of cardiology*  
Rogers, A. J., Moosvi, N. F., Brodt, C. R., Narayan, S. M.  
2018
- **Predictability in Complex Atrial Arrhythmias: the N/N-1 Algorithm to Guide Ablation of Atrial Tachycardias.** *Heart rhythm*  
Kaiser, D. W., Rogers, A. J., Narayan, S. M.  
2018
- **Secular trends in success rate of catheter ablation for atrial fibrillation: The SMASH-AF cohort.** *American heart journal*  
Perino, A. C., Leef, G. C., Cluckey, A., Yunus, F. N., Askari, M., Heidenreich, P. A., Narayan, S. M., Wang, P. J., Turakhia, M. P.  
2018
- **Characterizing Electrogram Signal Fidelity and the Effects of Signal Contamination on Mapping Human Persistent Atrial Fibrillation** *FRONTIERS IN PHYSIOLOGY*  
Vidmar, D., Alhousseini, M., Narayan, S. M., Rappel, W.  
2018; 9
- **Integrating mapping methods for atrial fibrillation.** *Pacing and clinical electrophysiology : PACE*  
Rogers, A. J., Tamboli, M., Narayan, S. M.

2018

- **Interaction of Localized Drivers and Disorganized Activation in Persistent Atrial Fibrillation: Reconciling Putative Mechanisms Using Multiple Mapping Techniques** *CIRCULATION-ARRHYTHMIA AND ELECTROPHYSIOLOGY*  
Kowalewski, C. B., Shenasa, F., Rodrigo, M., Clopton, P., Meckler, G., Alhuseini, M. I., Swerdlow, M. A., Joshi, V., Hossainy, S., Zaman, J. B., Baykaner, T., Rogers, A. J., Brachmann, et al  
2018; 11 (6): e005846
- **Interpreting Activation Mapping of Atrial Fibrillation: A Hybrid Computational/Physiological Study** *ANNALS OF BIOMEDICAL ENGINEERING*  
Costabal, F., Zaman, J. B., Kuhl, E., Narayan, S. M.  
2018; 46 (2): 257–69
- **Independent mapping methods reveal rotational activation near pulmonary veins where atrial fibrillation terminates before pulmonary vein isolation.** *Journal of cardiovascular electrophysiology*  
Navara, R., Leef, G., Shenasa, F., Kowalewski, C., Rogers, A. J., Meckler, G., Zaman, J. A., Baykaner, T., Park, S., Turakhia, M. P., Zei, P., Viswanathan, M., Wang, et al  
2018
- **Geographic and racial representation and reported success rates of studies of catheter ablation for atrial fibrillation: Findings from the SMASH-AF meta-analysis study cohort.** *Journal of cardiovascular electrophysiology*  
Leef, G. C., Perino, A. C., Cluckey, A., Yunus, F. N., Askari, M., Heidenreich, P. A., Narayan, S. M., Wang, P. J., Turakhia, M. P.  
2018
- **Clinical Implications of Ablation of Drivers for Atrial Fibrillation: A Systematic Review and Meta-Analysis.** *Circulation. Arrhythmia and electrophysiology*  
Baykaner, T., Rogers, A. J., Meckler, G. L., Zaman, J., Navara, R., Rodrigo, M., Alhuseini, M., Kowalewski, C. A., Viswanathan, M. N., Narayan, S. M., Clopton, P., Wang, P. J., Heidenreich, et al  
2018; 11 (5): e006119
- **Patient and facility variation in costs of catheter ablation for atrial fibrillation.** *Journal of cardiovascular electrophysiology*  
Perino, A. C., Fan, J., Schmitt, S., Kaiser, D. W., Heidenreich, P. A., Narayan, S. M., Wang, P. J., Chang, A. Y., Turakhia, M. P.  
2018
- **Identification and Characterization of Sites Where Persistent Atrial Fibrillation Is Terminated by Localized Ablation** *CIRCULATION-ARRHYTHMIA AND ELECTROPHYSIOLOGY*  
Zaman, J. B., Sauer, W. H., Alhuseini, M. I., Baykaner, T., Borne, R. T., Kowalewski, C. B., Busch, S., Zei, P. C., Park, S., Viswanathan, M. N., Wang, P. J., Brachmann, J., Krummen, et al  
2018; 11 (1): e005258
- **Ablation of Atrial Fibrillation Drivers** *ARRHYTHMIA & ELECTROPHYSIOLOGY REVIEW*  
Baykaner, T., Zaman, J. B., Wang, P. J., Narayan, S. M.  
2017; 6 (4): 195–201
- **Rotational Drivers in Atrial Fibrillation: Are Multiple Techniques Circling Similar Mechanisms?** *Circulation. Arrhythmia and electrophysiology*  
Zaman, J. A., Rogers, A. J., Narayan, S. M.  
2017; 10 (12)
- **Synergistic Anti-arrhythmic Effects in Human Atria with Combined Use of Sodium Blockers and Acacetin** *FRONTIERS IN PHYSIOLOGY*  
Ni, H., Whittaker, D. G., Wang, W., Giles, W. R., Narayan, S. M., Zhang, H.  
2017; 8: 946
- **The continuous challenge of AF ablation: From foci to rotational activity.** *Revista portuguesa de cardiologia : orgao oficial da Sociedade Portuguesa de Cardiologia = Portuguese journal of cardiology : an official journal of the Portuguese Society of Cardiology*  
Narayan, S. M., Vishwanathan, M. N., Kowalewski, C. A., Baykaner, T., Rodrigo, M., Zaman, J. A., Wang, P. J.  
2017; 36 Suppl 1: 9–17
- **Multicentre safety of adding Focal Impulse and Rotor Modulation (FIRM) to conventional ablation for atrial fibrillation.** *Europace*  
Krummen, D. E., Baykaner, T., Schricker, A. A., Kowalewski, C. A., Swarup, V., Miller, J. M., Tomassoni, G. F., Park, S., Viswanathan, M. N., Wang, P. J., Narayan, S. M.  
2017; 19 (5): 769-774
- **Spatial relationship of organized rotational and focal sources in human atrial fibrillation to autonomic ganglionated plexi.** *International journal of cardiology*

- Baykaner, T., Zografos, T. A., Zaman, J. A., Pantos, I., Alhousseini, M., Navara, R., Krummen, D. E., Narayan, S. M., Katritsis, D. G.  
2017
- **Two Independent Mapping Techniques Identify Rotational Activity Patterns at Sites of Local Termination during Persistent Atrial Fibrillation.** *Journal of cardiovascular electrophysiology*  
Alhousseini, M., Vidmar, D., Meckler, G. L., Kowalewski, C., Shenasa, F., Wang, P. J., Narayan, S. M., Rappel, W.  
2017
  - **Electrocardiographic spatial loops indicate organization of atrial fibrillation minutes before ablation-related transitions to atrial tachycardia.** *Journal of electrocardiology*  
Baykaner, T., Trikha, R., Zaman, J. A., Krummen, D. E., Wang, P. J., Narayan, S. M.  
2017
  - **Editorial commentary: What can lung transplantation teach us about the mechanisms of atrial arrhythmias?** *Trends in cardiovascular medicine*  
Baykaner, T., Rogers, A. J., Zaman, J. A., Narayan, S. M.  
2017
  - **Determining conduction patterns on a sparse electrode grid: Implications for the analysis of clinical arrhythmias** *PHYSICAL REVIEW E*  
Vidmar, D., Narayan, S. M., Krummen, D. E., Rappel, W.  
2016; 94 (5)
  - **Determining conduction patterns on a sparse electrode grid: Implications for the analysis of clinical arrhythmias.** *Physical review. E*  
Vidmar, D., Narayan, S. M., Krummen, D. E., Rappel, W.  
2016; 94 (5-1): 050401-?
  - **Challenging the complementarity of different metrics of left atrial function: insight from a cardiomyopathy-based study.** *European heart journal cardiovascular Imaging*  
Kobayashi, Y., Moneghetti, K. J., Boralkar, K., Amsallem, M., Tuzovic, M., Liang, D., Yang, P. C., Narayan, S., Kuznetsova, T., Wu, J. C., Schnittger, I., Haddad, F.  
2016
  - **Mechanisms linking electrical alternans and clinical ventricular arrhythmia in human heart failure.** *Heart rhythm*  
Bayer, J. D., Lalani, G. G., Vigmond, E. J., Narayan, S. M., Trayanova, N. A.  
2016; 13 (9): 1922-1931
  - **Comparison of Detailed and Simplified Models of Human Atrial Myocytes to Recapitulate Patient Specific Properties.** *PLoS computational biology*  
Lombardo, D. M., Fenton, F. H., Narayan, S. M., Rappel, W.  
2016; 12 (8)
  - **Can Cardiac Conduction System Disease Be Prevented?** *JAMA internal medicine*  
Narayan, S. M., Baykaner, T., Maron, D. J.  
2016; 176 (8): 1093-1094
  - **Organized Sources Are Spatially Conserved in Recurrent Compared to Pre-Ablation Atrial Fibrillation: Further Evidence for Non-Random Electrical Substrates** *JOURNAL OF CARDIOVASCULAR ELECTROPHYSIOLOGY*  
Lalani, G. G., Coysh, T., Baykaner, T., Zaman, J., Hopper, K., Schricker, A. A., Trikha, R., Clopton, P., Krummen, D. E., Narayan, S. M.  
2016; 27 (6): 661-669
  - **Mechanistically based mapping of human cardiac fibrillation** *JOURNAL OF PHYSIOLOGY-LONDON*  
Narayan, S. M., Zaman, J. A.  
2016; 594 (9): 2399-2415
  - **Intracoronary Gene Transfer of Adenylyl Cyclase 6 in Patients With Heart Failure: A Randomized Clinical Trial.** *JAMA cardiology*  
Hammond, H. K., Penny, W. F., Traverse, J. H., Henry, T. D., Watkins, M. W., Yancy, C. W., Sweis, R. N., Adler, E. D., Patel, A. N., Murray, D. R., Ross, R. S., Bhargava, V., Maisel, et al  
2016; 1 (2): 163-171
  - **The precise timing of tachycardia entrainment is determined by the postpacing interval, the tachycardia cycle length, and the pacing rate: Theoretical insights and practical applications** *HEART RHYTHM*  
Kaiser, D. W., Hsia, H. H., Dubin, A. M., Liem, L. B., Viswanathan, M. N., Zei, P. C., Wang, P. J., Narayan, S. M., Turakhia, M. P.  
2016; 13 (3): 695-703



- **The precise timing of tachycardia entrainment is determined by the postpacing interval, the tachycardia cycle length, and the pacing rate: Theoretical insights and practical applications.** *Heart rhythm*  
Kaiser, D. W., Hsia, H. H., Dubin, A. M., Liem, L. B., Viswanathan, M. N., Zei, P. C., Wang, P. J., Narayan, S. M., Turakhia, M. P.  
2016; 13 (3): 695-703
- **New Mechanism-based Approaches to Ablating Persistent AF: Will Drug Therapy Soon Be Obsolete?** *JOURNAL OF CARDIOVASCULAR PHARMACOLOGY*  
Zaman, J. A., Baykaner, T., Narayan, S. M.  
2016; 67 (1): 1-8
- **New Mechanism-based Approaches to Ablating Persistent AF: Will Drug Therapy Soon Be Obsolete?** *Journal of cardiovascular pharmacology*  
Zaman, J. A., Baykaner, T., Narayan, S. M.  
2016; 67 (1): 1-8
- **Phase synchrony reveals organization in human atrial fibrillation** *AMERICAN JOURNAL OF PHYSIOLOGY-HEART AND CIRCULATORY PHYSIOLOGY*  
Vidmar, D., Narayan, S. M., Rappel, W.  
2015; 309 (12): H2118-H2126
- **Mechanisms for the Termination of Atrial Fibrillation by Localized Ablation Computational and Clinical Studies** *CIRCULATION-ARRHYTHMIA AND ELECTROPHYSIOLOGY*  
Rappel, W., Zaman, J. A., Narayan, S. M.  
2015; 8 (6): 1325-1333
- **Mechanisms for the Termination of Atrial Fibrillation by Localized Ablation: Computational and Clinical Studies.** *Circulation. Arrhythmia and electrophysiology*  
Rappel, W., Zaman, J. A., Narayan, S. M.  
2015; 8 (6): 1325-1333
- **Modifying Ventricular Fibrillation by Targeted Rotor Substrate Ablation: Proof-of-Concept from Experimental Studies to Clinical VF** *JOURNAL OF CARDIOVASCULAR ELECTROPHYSIOLOGY*  
Krummen, D. E., Hayase, J., Vampola, S. P., Ho, G., Schricker, A. A., Lalani, G. G., Baykaner, T., Coe, T. M., Clopton, P., Rappel, W., Omens, J. H., Narayan, S. M.  
2015; 26 (10): 1117-1126
- **Ablation of atrial fibrillation** *TRENDS IN CARDIOVASCULAR MEDICINE*  
Wright, M., Narayan, S. M.  
2015; 25 (5): 409-419
- **Ablating Atrial Fibrillation: Customizing Lesion Sets Guided by Rotor Mapping.** *Methodist DeBakey cardiovascular journal*  
Zaman, J. A., Narayan, S. M.  
2015; 11 (2): 76-81
- **The role of rotors in atrial fibrillation.** *Journal of thoracic disease*  
Krummen, D. E., Swarup, V., Narayan, S. M.  
2015; 7 (2): 142-151
- **Rotor mapping and ablation to treat atrial fibrillation** *CURRENT OPINION IN CARDIOLOGY*  
Zaman, J. A., Peters, N. S., Narayan, S. M.  
2015; 30 (1): 24-32
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