

# Cardiology Faculty

# Research Spotlights

# 2023

# Introduction to Cardiovascular Medicine Research Spotlights

January 2023

Dear Colleagues,

Reading through these faculty spotlights and the sheer breadth of work that you are leading has been nothing but amazing – a testament of how vibrant, creative, and deeply committed to the academic mission our BIDMC cardiology community is. We are incredibly grateful to work with all of you every day.

We hope that you, too, enjoy browsing through some of the research and academic pursuits that your colleagues are passionate about! Please also check out our [2022 publications](#).

All our best,

**Jennifer E. Ho, MD**

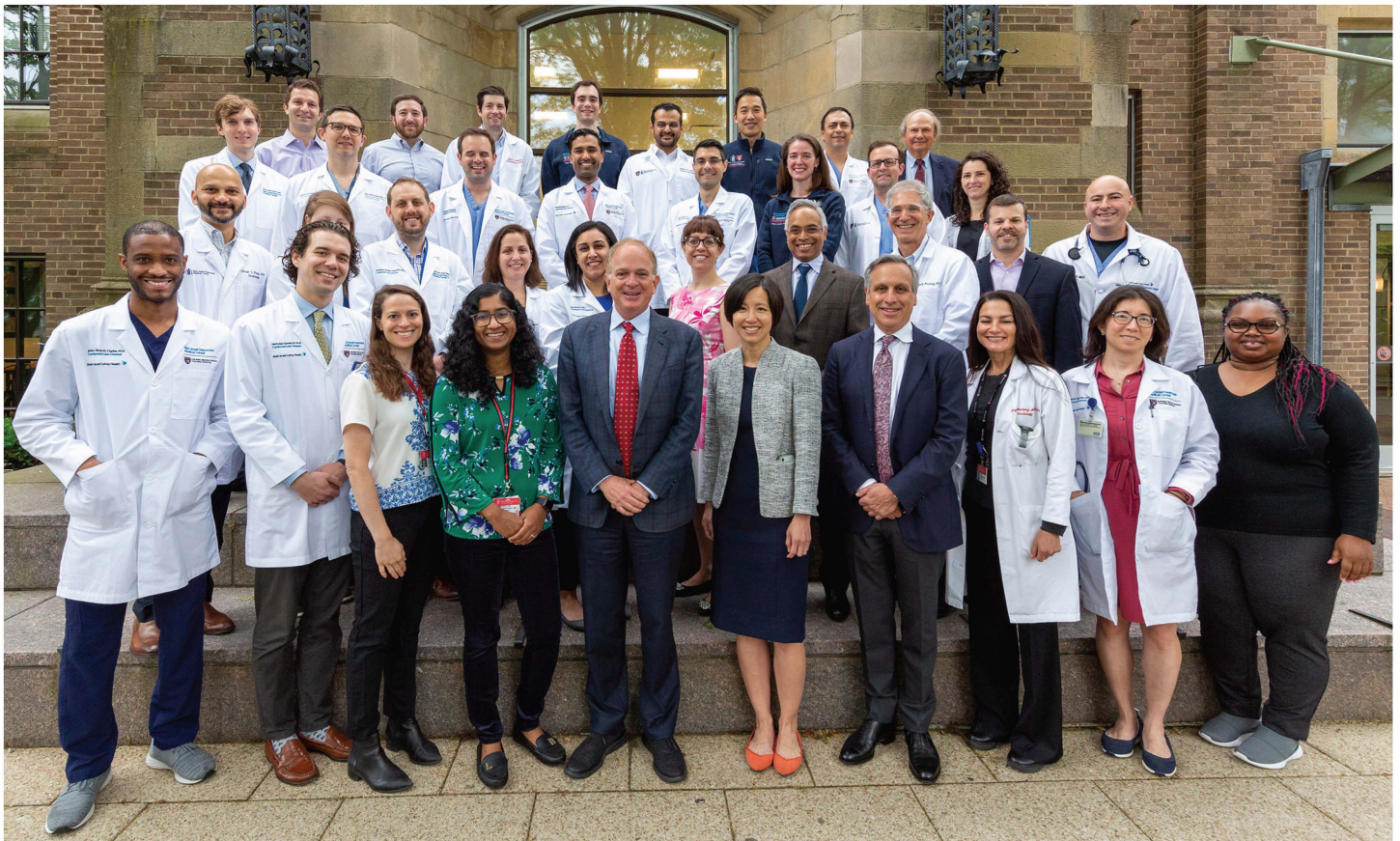
*Director of Research*

*BIDMC Cardiovascular Medicine*

**Robert E. Gerszten, MD**

*Chief of Cardiology*

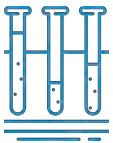
*BIDMC Cardiovascular Medicine*



# How do cancer therapies cause cardiovascular toxicity?



## Aarti Asnani, MD



### What have you found so far?

Using zebrafish, mouse, and human translational studies, we identified two molecular pathways that contribute to the pathogenesis of anthracycline cardiotoxicity - Cytochrome P450 family 1-mediated metabolism and hemopexin signaling. We are now working to develop new biomarkers and cardioprotective therapies based on these findings. The ultimate goal of our research is to minimize heart toxicity in patients treated with anthracyclines.



### Publication Highlight

***Circulating hemopexin modulates anthracycline cardiac toxicity in patients and in mice.*** Liu J, Lane S, Lall R, Russo M, Farrell L, Debreli Coskun M, Curtin C, Araujo-Gutierrez R, Scherrer-Crosbie M, Trachtenberg BH, Kim J, Tolosano E, Ghigo A, Gerszten RE, Asnani A. *Sci Adv.* 2022 Dec.



### What else are you trying to figure out?

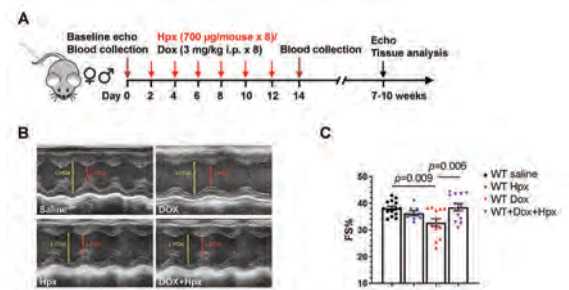
We are using chemical and genetic approaches in zebrafish models to understand how estrogen receptor degraders (a new treatment modality for breast cancer) cause bradycardia in patients.



### What active grants, projects, or trials are you leading?

- NIH K08 HL145019
- NIH R01 HL163172
- Sponsored research agreement with Genentech
- ATRIUM trial (site PI)

### Figure Highlight



*Treatment with hemopexin protects against anthracycline cardiotoxicity in mice.*



### Leadership Roles

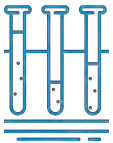
- Director of Cardio-Oncology
- Director of Cardiology Grand Rounds and Cardiovascular Research Seminar Series
- Associate Program Director for Resident Research, Department of Medicine, BIDMC



# How can we best apply emerging proteomics and metabolomics approaches to identify novel therapeutic targets in preventive cardiology?

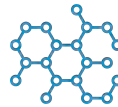


## Mark Benson, MD, PhD



### What have you found so far?

The integration of plasma proteomics, metabolomics, and genomics profiling data from population studies can be used to identify novel biological pathways that can be experimentally tested at the bench. Using this approach, we have identified new roles for human plasma proteins and metabolites in the regulation of glucose, insulin, and lipid metabolism.



### What else are you trying to figure out?

How can we leverage emerging large-scale functional genomic screening methods to "retro-translate" observations made in humans back to the bench more systematically? How can we use human proteomics and metabolomics findings to find new drug targets in preventive cardiology more efficiently?



### Leadership Role

Director, Preventive Cardiology, BIDMC



### What active grants, projects, or trials are you leading?

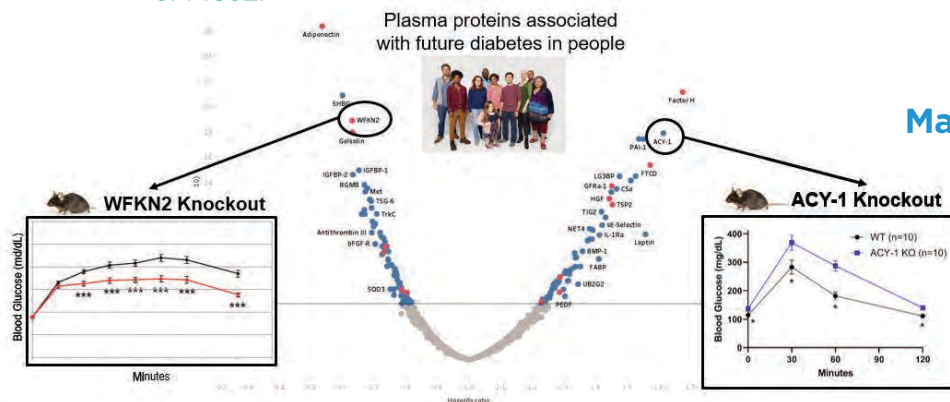
- NHLBI K08 (Role of PPM1G in apolipoprotein E metabolism)
- Boehringer-Ingelheim investigator initiated grant (Real world barriers to the use of SGLT2i/GLP-1RA for cardiovascular disease prevention)
- Amgen investigator initiated grant (Proteomic and metabolomic characterization of PCSK9)



### Publication Highlight

***Proteomic profiling reveals biomarkers and pathways in type 2 diabetes risk.***

Ngo, D, et. al. (2021). *JCI insight*, 6(5), e144392.



Two top plasma proteins associated with future diabetes risk in humans demonstrate novel functional roles in regulating glucose metabolism when knockout mouse models were tested using intraperitoneal glucose tolerance tests.

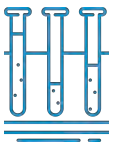
### Main Mentors / Collaborators

Robert Gerszten, MD

# What are effects of TAVR on the cardiac conduction system?



## Alfred Buxton, MD



### What have you found so far?

We are conducting a study to characterize the changes in AV node and His-Purkinje conduction in patients undergoing TAVR in order to reduce the current 10% risk of developing complete heart block currently associated with this procedure. We have enrolled 318 of the planned 400 patients in the study and anticipate completion in Spring 2023.



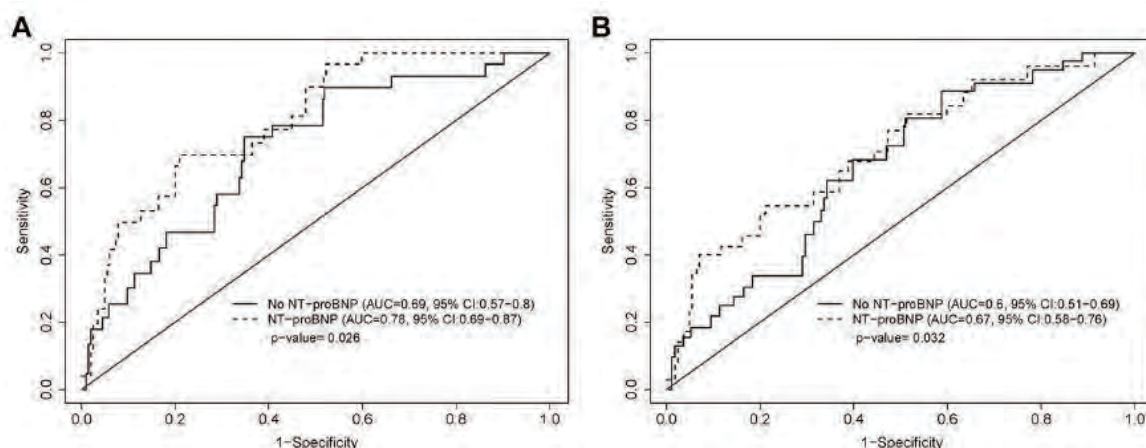
### What else are you trying to figure out?

We are interested in prospective analysis of BNP in patients undergoing primary prevention ICD implants. We are studying spherical remodeling of the LV as a risk factor for sudden cardiac death.



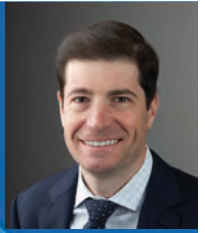
### Publication Highlight

***N-terminal pro-B-type natriuretic peptide is a specific predictor of appropriate device therapies in patients with primary prevention implantable cardioverter-defibrillators.*** Sroubek J, Matos J, Locke A, Kaplinskiy V, Levine YC, Shen C, Buxton AE. *Heart Rhythm*. 2021 Jan;18(1):71-78.



Receiver operating characteristic of the multivariable prediction model of appropriate implantable cardioverter-defibrillator therapy taken at 2-year (A) and 3-year (B) follow-up timepoints. In both cases, inclusion of N-terminal pro-B-type natriuretic peptide (NT-proBNP) in the model (dashed line) significantly improves the area under the curve (AUC) compared to a model in which NT-proBNP is excluded (solid line). CI 5 confidence interval.

# What is the role of catheter-directed therapy for the management of acute pulmonary embolism?



**Brett Carroll, MD**



## What have you found so far?

Catheter-directed thrombolysis is associated with a lower bleeding risk than systemic thrombolysis. The utilization of catheter-directed therapy has increased over the last several years.



## Publication Highlight

*National trends in utilization of thrombolytic therapy for acute pulmonary embolism.* Beyer S, et al. *Vasc Med* 2022; 27(1): 75-76.



## What else are you trying to figure out?

Determine the most appropriate patient selection for advanced PE therapy and which specific catheter-based therapy is most likely to be beneficial.



## What active grants, projects, or trials are you leading?

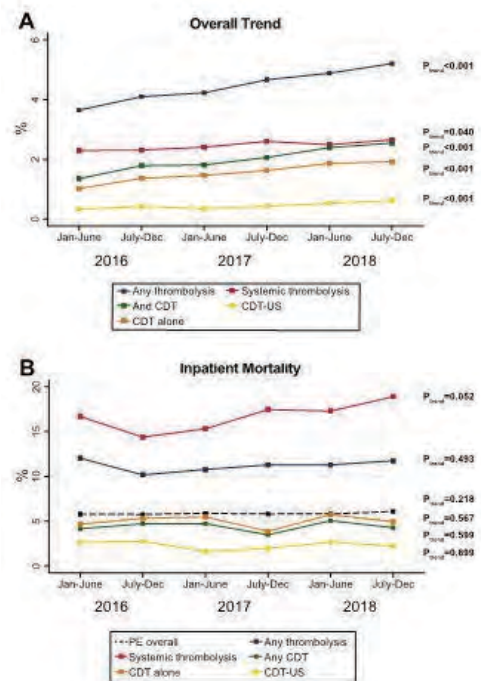
- Site-PI: PEERLESS trial



## Main Mentors / Collaborators

- Eric Secemsky, MD

## Figure Highlight

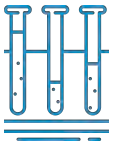


Rates of advanced therapy for acute pulmonary embolism increased, predominantly driven by an increase in catheter-directed therapies, but with no change in mortality.

# Which circulating metabolites and proteins are associated with incident coronary heart disease in African Americans?



## Daniel E. Cruz, MD



### What have you found so far?

Some metabolites may be differentially associated with incident coronary heart disease based on self-identified race.



### What active grants, projects, or trials are you leading?

- BIDMC URIM Faculty Career Development Award



### What else are you trying to figure out?

How does genetic ancestry influence health and disease through its influence on circulating proteins and metabolites?



### Leadership Roles

- Health Disparities Research Scholar; Health Disparities Research Institute; NIH, NIMHD



### Publication Highlight

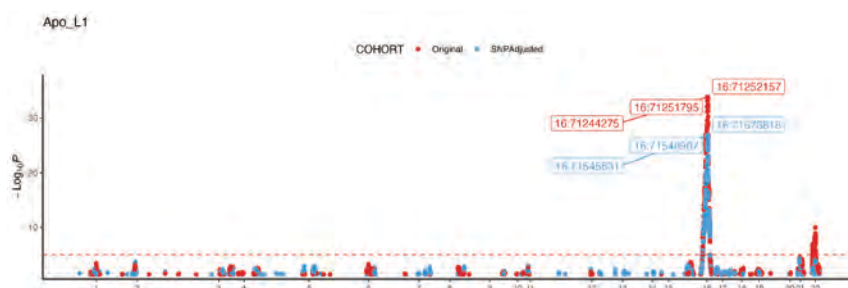
***Metabolomic Analysis of Coronary Heart Disease in an African American Cohort From the Jackson Heart Study.*** Cruz DE et al. *JAMA Cardiol.* 2022;7(2):184-194.



### Main Mentors / Collaborators

- Robert Gerszten, MD
- James Wilson, MD
- Laura Raffield, PhD

### Figure Highlight



Local admixture mapping (red) reveals genomic regions of African origin associated with levels of circulating Apolipoprotein L1. Conditional analysis (blue) reveals traditional GWAS may not fully explain levels of circulating proteins in non-European populations.



# Will angioplasty balloons coated with sirolimus reduce restenosis and ischemic PCI complications compared with drug-eluting stents?



## Donald Cutlip, MD



### What have you found so far?

We have just started the first randomized clinical trial to address this question. This trial will study outcomes for patients with previous restenosis of a coronary stent. A subsequent study will test the drug-coated balloon compared with drug-eluting stents for de novo lesions in small vessels, where avoidance of an initial stent may be beneficial.



### Publication Highlight

**Atrial shunt device for heart failure with preserved and mildly reduced ejection fraction (REDUCE LAP-HF II): a randomised, multicentre, blinded, sham-controlled trial.** Shah SJ, Borlaug BA, Chung ES, Cutlip DE, et al. Lancet. 2022;399:1130-1140.



### What else are you trying to figure out?

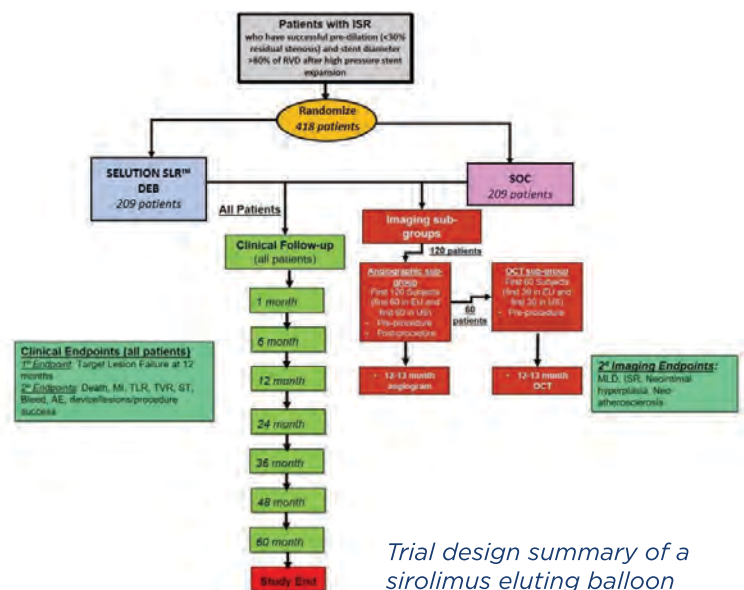
What is the optimal biomarker and threshold for defining peri-procedural myocardial infarction after PCI? Using a central laboratory and sampling multiple biomarkers at time of PCI we hope to demonstrate the best biomarker and threshold for defining this complication of PCI.



### Leadership Roles

- Chief Medical Officer, Baim Institute for Clinical Research
- Academic Research Consortium, Steering Committee

Figure Highlight



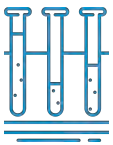
*Trial design summary of a sirolimus eluting balloon versus drug eluting stent for treatment of intracoronary stent restenosis (ISR).*



# Are there innovative approaches to treat and ablate ventricular tachycardia?



## Andre d'Avila, MD



### What have you found so far?

There is a new way to map and ablate ventricular tachycardia without VT induction.



### Publication Highlight

***Patient Selection, Techniques, and Complication Mitigation for Epicardial Ventricular Tachycardia Ablation.***

*Card Electrophysiol Clin. 2022 Dec;14(4):657-677.*



### What else are you trying to figure out?

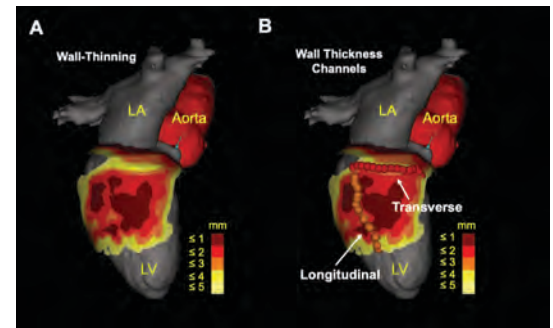
Long-term outcome of patients who had a VT ablation without VT induction.



### Leadership Roles

- Director - Cardiac Arrhythmia Service and the Harvard Thorndike EP Institute

### Figure Highlight



CTA-derived wall thickness features of an example ICM patient showing the inferior wall of the LV. A) Wall thickness segmentation shows an area of thinned myocardium ranging from 1-5 mm. B) Two example WTCs depicted in orange and red. Abbreviations: ICM: infarct-related cardiomyopathy; WTC: wall thickness channels.

# How frequently is intravascular imaging used during PCI in the US, and how does its use impact clinical outcomes?



## Reza Fazel, MD, MSc



### What have you found so far?

Use of intravascular imaging guidance over the past decade has been low but there is a trend for more frequent use of it in recent years. Intravascular imaging during PCI is associated with decrease in mortality, acute MI, repeat PCI, and MACE (death/MI/repeat PCI/CABG).

*The abstract for this project has been accepted as a poster presentation at ACC Scientific Sessions 2023.*



### What else are you trying to figure out?

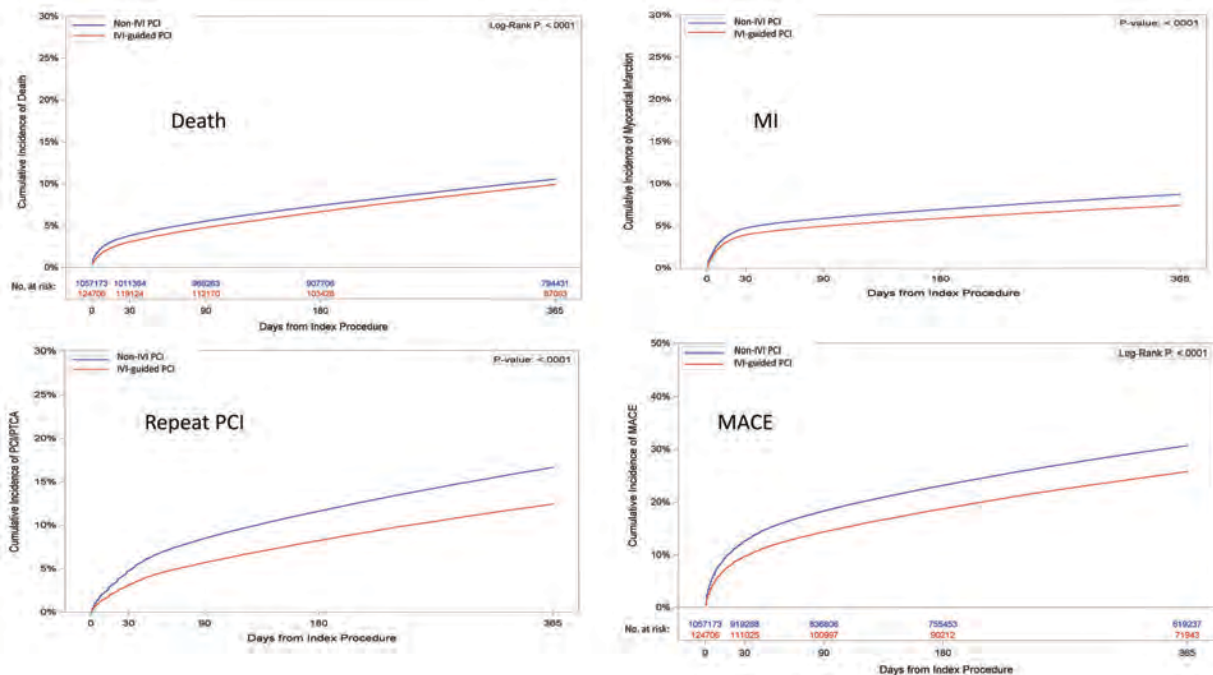
The cost-effectiveness of intravascular imaging during PCI. We are also looking at temporal trends and clinical outcomes associated with radial versus femoral access during PCI in the US.



### Mentors / Collaborators

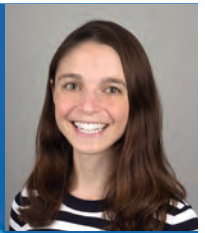
- Robert Yeh
- Eric Secemsky

### Figure Highlight



*Kaplan-Meier curves of 1-year outcomes of intravascular imaging-guided PCI compared to non-intravascular imaging PCI.*

# What are the real world SGLT2 inhibitor prescribing practices across different disease states?



Lisa Fleming, MD



## What have you found so far?

We have sent the data analysis plan to the registry (PINNACLE) and are waiting to hear back if our proposal is accepted.

## What else are you trying to figure out?

Real world assessment of SGLT2 prescription in CKD/ESRD.

## Figure Highlight

Table 1. Characteristics of patients with HFpEF and HFrEF (based on the last visit)

Characteristic	HFpEF		P-value	HFrEF		P-value
	No SGLT-2 inhibitor	Any SGLT-2 inhibitor		No SGLT-2 inhibitor	Any SGLT-2 inhibitor	
Demographic information	No. (%) of patients	No. (%) of patients		No. (%) of patients	No. (%) of patients	
Age, years <sup>2020</sup> [Mean (SD)]						
Sex <sup>2020</sup> , male						
Race <sup>2010-2014</sup>						
White <sup>2010</sup>						
Black <sup>2011</sup>						
Asian <sup>2012</sup>						
Other <sup>2013-2014</sup>						
Hispanic ethnicity <sup>2015</sup>						
Insurance payer						
Private <sup>2020</sup>						
Medicare/Medicaid <sup>2020, 2022, 2023, 2024</sup>						
Other public <sup>2021-2023</sup>						
Other or self pay <sup>2026, 2027</sup>						
Patient history and risk factors						
Ejection fraction [Mean (SD)]						

Data Collection Tool: Characteristics of patients with HFpEF and HFrEF (based on the last visit).



## Collaborators

- Reshad Garan (Mentor/Collaborator)
- Edward Grandin (Collaborator)
- Tom Maddox (Collaborator)
- Alireza Ghajar (Collaborator)

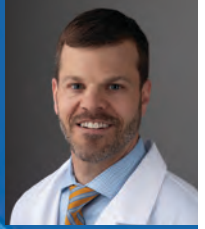


## Leadership Roles

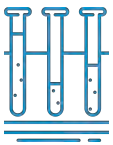
- Director, Advanced Heart Failure BID-Needham



# How can care for cardiogenic shock patients be optimized?



## A. Reshad Garan, MD



### What have you found so far?

Through large datasets (e.g. Cardiogenic Shock Working Group registry, ELSO) colleagues and I have identified some important insights into the optimal management of this population. We have highlighted differences in different etiologies of cardiogenic shock to help tailor therapies to the underlying etiology and have also identified tools to improve outcomes (e.g. early PA catheter use in heart failure patients).



### Publication Highlight

**Complete Hemodynamic Profiling with Pulmonary Artery Catheters in Cardiogenic Shock is Associated with Lower In-Hospital Mortality.** Garan AR, Kanwar M, Thayer KL, Whitehead E, Zweck E, Hernandez-Montfort J, Mahr C, Haywood JL, Harwani NM, Wencker D, Sinha SS, Vorovich E, Abraham J, O'Neill W, Burkhoff D, Kapur NK. *J Am Coll Cardiol HF.* 2020;8(11):903-13.



### What else are you trying to figure out?

How can networks optimize outcomes of patients with cardiogenic shock who present to "spoke" hospitals as opposed to "hub" hospitals?



### What active grants, projects, or trials are you leading?

Executive steering committee member for the Cardiogenic Shock Working Group (Industry Funding From Abbott, Abiomed, Boston Scientific, LivaNova, and Getinge).



### Leadership Roles

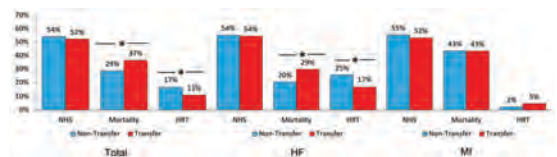
- Section Chief, Advanced Heart Failure Program at BIDMC
- Executive steering committee member for the Cardiogenic Shock Working Group



### Main Mentors / Collaborators

Ulrich Jorde, Nir Uriel, Navin Kapur, Dan Burkhoff, Manreet Kanwar, Shashank Sinha, Jaime Hernandez-Montfort

### Figure Highlight



Outcomes among patients with cardiogenic shock following acute myocardial infarction and cardiogenic shock related to decompensated heart failure presenting directly to a shock "hub" hospital vs. those presenting to "spoke" hospitals and transferred to the "hub."

# What is the cost effectiveness and operational impact of Cardiac Direct Access Unit (CDAc)?



Michael Gavin, MD, MPH



## What have you found so far?

Our data suggests that a cardiology-directed observation unit serves as a high-value alternative to the ED for appropriately selected patients. We've seen reduced admissions and use of observation compared to historical ED based numbers.



## Leadership Roles

- Medical Director, CDAc
- Medical Director CNP Service
- Medical Director, Farr 5



## Main Mentors / Collaborators

Mentor: Peter Zimetbaum, MD  
Working on future collaboration with  
Tim Anderson, MD, & Rishi Wadhera, MD



## What else are you trying to figure out?

I would like to update the data out to five years on utilization and impact of the CDAc on admission patterns through the COVID pandemic. Following that the plan would be to examine cost effectiveness of the CDAc..

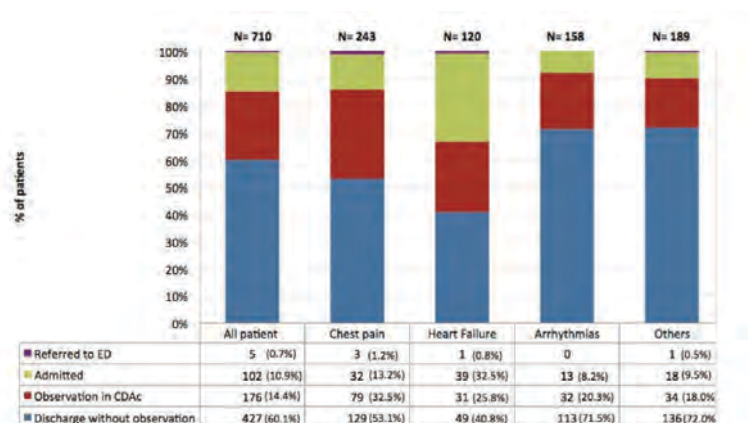


## Publication Highlight

***Impact of an Outpatient Cardiology-managed Urgent Access and Observation Unit on Hospital Admissions.*** Wallins JS, Cajiao KM, McCarthy KJ, Estrada-Roman A, Gavin MC. *Crit Pathw Cardiol.* 2019 09; 18(3):113-120.

## Figure Highlight

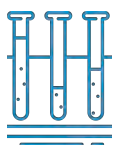
*Disposition of same-day/urgent referrals to the CDAc.*



# Can novel genomics tools be leveraged to identify new risk factors for cardiometabolic diseases?



## Robert Gerszten, MD



### What have you found so far?

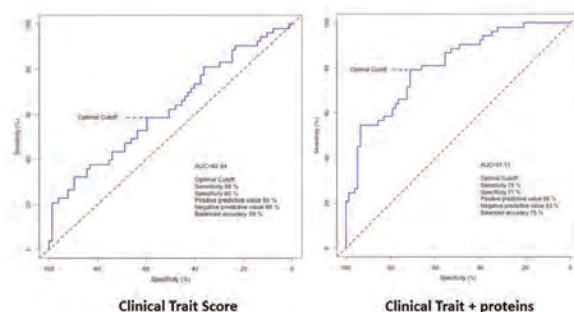
We have identified dozens of circulating biomarkers that predict the onset of cardiometabolic disorders over a decade before patients manifest clinical disease. In experimental studies, our work has also illuminated how different organs communicate on a molecular basis in the context of cardiac and metabolic diseases - or in the context of beneficial activities such as exercise. For example, we have shown that exercising muscle triggers the release of a novel metabolite that activates the burning of adipose tissue and improves glucose homeostasis in mice.



### Publication Highlight

**Human plasma proteomic profiles indicative of cardiorespiratory fitness.** Robbins, JM, et. al. *Nature Metabolism*. 2021 Sep;3(9):1275.

### Figure Highlight



Protein biomarkers in pre-training samples identify who will respond to an exercise training intervention: Receiver-Operating Characteristic Curves for Relative VO2max Changes (i.e., peak oxygen utilization) with Exercise Training.



### What else are you trying to figure out?

We are using large scale human genetics to parse whether novel circulating factors are "mere" disease biomarkers or whether they also contribute in a causal way to cardiovascular disease pathogenesis.



### What active grants, projects, or trials are you leading?

- NIH U24DK112340 (MPI: Gerszten, Carr, Clish, Newgard): A Biochemical Roadmap of Exercise Signaling (NIH MoTrPAC consortium)
- HHSN26820160 0 0341 (PI: Gerszten): Proteomic and Metabolomic Profiling for the NIH TOPMed consortium (Framingham Heart Study, Jackson Heart Study, Multi-Ethnic Study of Atherosclerosis, and other cohorts)



### Leadership Roles

- Chief, Cardiovascular Medicine
- Senior Associate Member, Broad Institute



# Can noninvasive measures of cardiac neuroautonomic control be used to predict major adverse cardiovascular events, including atrial fibrillation, as well as to assess biological vs. chronological aging?



## Ary L. Goldberger, MD



### What have you found so far?

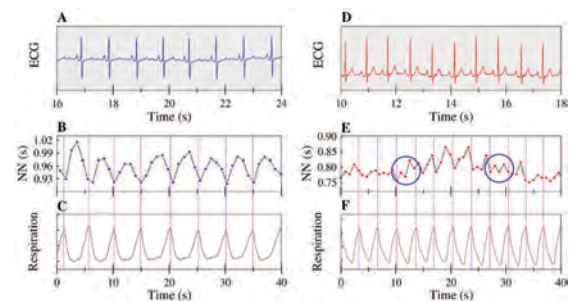
Recently, we introduced the concept of heart rate fragmentation (HRF) and a set of computational metrics for its quantification based on analysis of heart rate dynamics. HRF reflects the integrity of cardiac autonomic control, overcoming intrinsic limitations of traditional heart rate variability (HRV) analysis. In the Multi-Ethnic Study of Atherosclerosis (MESA), we showed that the degree of HRF was predictive of major adverse cardiovascular events, atrial fibrillation, and cognitive decline. Independent studies have confirmed that HRF is associated with incident MACE and predictive of all-cause mortality.



### Publication Highlight

***Fragmented sinoatrial dynamics in the prediction of atrial fibrillation: the Multi-Ethnic Study of Atherosclerosis.***  
Costa MD, Redline S, Soliman EZ, Goldberger AL\*, Heckbert SR\*. *Am J Physiol Heart Circ Physiol.* 2021;1:H256-H271 (\*joint senior authors).

### Figure Highlight



Non-fragmented (left panels) vs. fragmented (right panels) heart rate dynamics. ECG (A); normal-to-normal (NN) interval time series (B); and respiration signals (C) during N2 sleep from a healthy 55 yr-old female and a 75-yr-old female with advanced cardiovascular disease (D to F). Note physiologic respiratory sinus arrhythmia in the healthy individual (B and C). Blue circles (E) highlight periods of marked sinus fragmentation, despite an ECG consistent with "normal sinus rhythm."



### What else are you trying to figure out?

We are investigating translational aspects of the relationship between cardiac neuroautonomic dysfunction, manifesting as HRF, and predisposition to Alzheimer's disease and related dementias. We hypothesize that HRF precedes clinical evidence of brain structural/ functional abnormalities.



### Leadership Roles

- Chief, Division of Interdisciplinary Medicine & Biotechnology, BIDMC
- Co-Director, Margret and H.A. Rey Institute for Nonlinear Dynamics in Medicine, BIDMC
- Program Director, PhysioNet, NIH-sponsored Research Resource for Complex Physiologic Signals



### What active grants, projects, or trials are you leading?

- R01EB030362

# Do patients supported with venoarterial extracorporeal membrane oxygenation (VA ECMO) benefit from having a concomitant mechanical left ventricular unloading device?



## E. Wilson Grandin, MD, MPH, MEd



### What have you found so far?

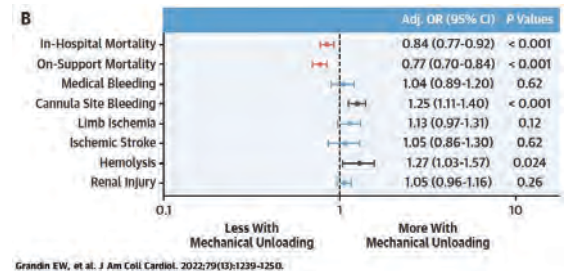
In observational data from the Extracorporeal Life Support Organization (ELSO), the concomitant use of IABP or pVAD was associated with lower inpatient mortality but higher rates of certain complications including cannula site bleeding and hemolysis.



### Publication Highlight

**Mechanical Left Ventricular Unloading in Patients Undergoing Venoarterial Extracorporeal Membrane Oxygenation.** Grandin, EW *J Am Coll Cardiol.* 2022 Apr 5;79(13):1239-1250.

### Figure Highlight



Left Ventricular Mechanical Unloading During VA ECMO: Association with Outcomes



### What else are you trying to figure out?

We are trying to determine whether the use of a smaller arterial return cannula for VA ECMO can provide adequate hemodynamic support while reducing the need for concomitant left ventricular unloading devices (e.g. IABP or pVAD) and the incidence of severe limb ischemia.



### What active grants, projects, or trials are you leading?

#### ELSO Research Grant 2021:

Association of arterial cannula size with clinical outcomes in pts supported with VA ECMO



### Leadership Roles

- Director, VA ECMO and Temporary Mechanical Circulatory Support
- Site Director, BIDMC/Tufts Advanced Heart Failure and Transplant Cardiology Fellowship
- Scientific Oversight Committee, Extracorporeal Life Support Organization



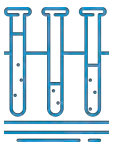
### Mentors / Collaborators

Reshad Garan, MD, Shahzad Shaefi, MD (BIDMC), Michael Kiernan, MD (Tufts), Joseph Tonna, MD (University of Utah)

# Why do people with obesity develop heart failure and preserved ejection fraction (HFpEF)?



Jennifer E. Ho, MD



## What have you found so far?

Using population-based studies, we have found that obesity predisposes women to HFpEF more so than men, and that this may be due to greater evidence of inflammation in women. We are now investigating the role of eicosanoids (bioactive lipid metabolites that regulate systemic inflammation) in the pathobiology of HFpEF.



## What else are you trying to figure out?

We are trying to understand how prior COVID-19 infection may predispose to greater cardiovascular risk and future HFpEF by studying molecular pathways that underlie endothelial dysfunction across different vascular beds.



## What active grants, projects, or trials are you leading?

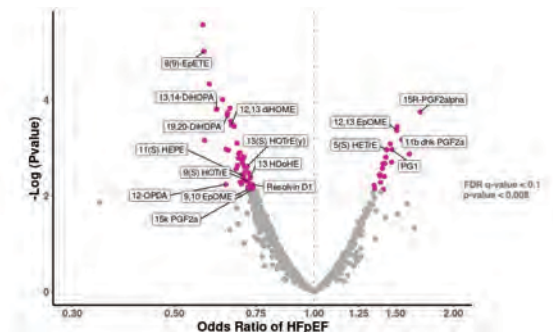
- NIH R01 HL134893
- NIH R01 HL140224
- NIH K24 HL153669
- American Heart Association Collaborative Sciences Award



## Publication Highlight

***Infertility and risk of heart failure in the women's health initiative.*** Lau ES, Wang D, Roberts M, Taylor CN, Murugappan G, Shadyab AH, Schnatz PF, Farland LV, Wood MJ, Scott NS, Eaton CB, Ho JE. *J Am Coll Cardiol.* 2022 Apr 26;79(16):1594-1603.

## Figure Highlight



Association of eicosanoids and other bioactive lipids with HFpEF status among 510 individuals who underwent cardiopulmonary exercise testing.

Unpublished work, Lau ES and Roshandelpoor A.



## Leadership Roles

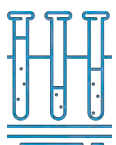
- Director of Research, Division of Cardiology, BIDMC
- President, Board of Directors, Equity in Heart Transplant Project
- Board of Directors, Sarnoff Endowment for Cardiovascular Research



# Could we develop novel drug therapies that specifically target oxidative stress, such as ischemia/reperfusion and heart failure?



## Peter Kang, MD



### What have you found so far?

So far, we have used targeted therapeutics in various different animal models as proof-of-concept experiments. These targeted therapeutics show great efficacy with significantly decrease off target effects.



### Publication Highlight

***Bilirubin Nanoparticles Protect Against Cardiac Ischemia/Reperfusion Injury in Mice.*** Ai W, Bae S, Ke Q, Su S, Li R, Chen Y, Yoo D, Lee E, Jon S, Kang PM. *J Am Heart Assoc.* 2021;10:e021212.



### What else are you trying to figure out?

We are currently developing targeted drug therapy to get approval as an investigative new drug (IND). Eventually, we would like to use these therapeutics for human application.



### What active grants, projects, or trials are you leading?

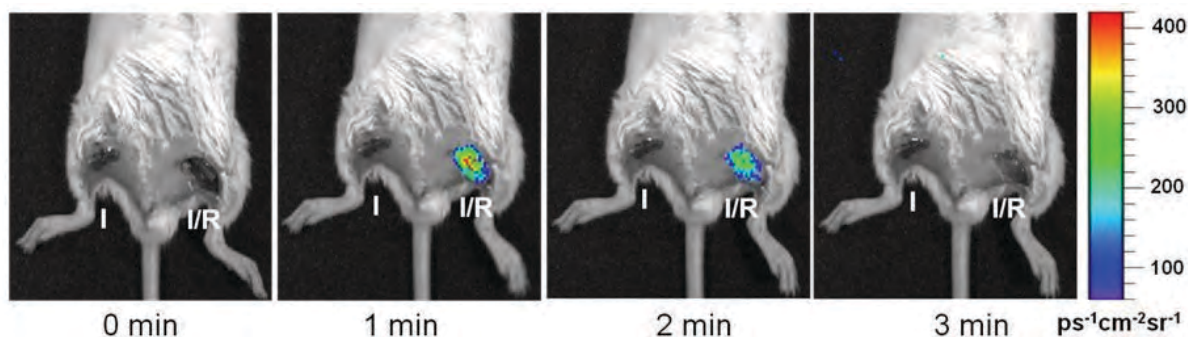
- NIH/NIDDK1 R44 DK103389-01
- Pfizer sponsored research grant



### Collaborators

- KAIST
- Jeonbuk National University
- Pfizer
- Celdara Medical

### Figure Highlight



*In vivo imaging of the nanoparticle we developed loaded with fluorophore being activated after ischemia/reperfusion in mouse hind-limbs model. Reperfusion at different time points as indicated.*

# What is the real-world clinical and economic value of novel strategies for cardiovascular prevention through the lens of population health equity?



## Dhruv S. Kazi, MD, MSc, MS



### What have you found so far?

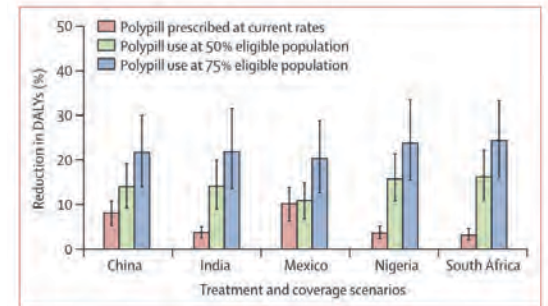
In studies based in the US as well as those based in low- and middle-income countries, we have shown that the cost-effectiveness of cardiovascular prevention varies substantially based on the risk of the target population, heterogeneity of treatment effect, and cost of the intervention. Remarkably, prioritizing uptake based on cost-effectiveness does not compromise health equity as commonly suspected: targeting the highest-risk populations with novel therapeutics is typically cost-effective, in addition to being equity-enhancing. Thus, quantifying real-world population health outcomes and costs can help scale up effective interventions to equitably improve population cardiovascular health.



### Publication Highlight

**Cost-effectiveness of a fixed-dose combination pill for secondary prevention of cardiovascular disease in China, India, Mexico, Nigeria, and South Africa: a modelling study.** Lin, J. K., et. al. *The Lancet. Global health*, 7(10), e1346–e1358.

#### Figure Highlight



We assessed the incremental cost-effectiveness of the polypill compared with current care for the secondary prevention of atherosclerotic cardiovascular disease at retail market pharmaceutical prices in five low- and middle-income countries.



### What else are you trying to figure out?

Would the availability of a fixed-dose combination polypill that combines guideline-directed medical therapy for ASCVD or HF into a single pill help improve population-level outcomes? If so, what is the underlying mechanism of benefit (increased physician adherence to guidelines vs. increased patient adherence to medications) and what would be the effect on health disparities?



### Leadership Roles

- Associate Director, Smith Center for Outcomes Research
- Director, Cardiac Critical Care
- Co-Chair, International Committee, AHA



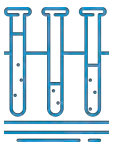
### Main Mentors / Collaborators

Bobby Yeh, Stephen Juraschek, Issa Dahabreh, Andrew Moran (Columbia), Kirsten Bibbins-Domingo (UCSF)

# What are new approaches to modeling treatment heterogeneity among recipients of cardiac implantable electrical devices?



**Daniel B. Kramer, MD, MPH**



## What have you found so far?

Using secondary datasets, we have characterized survival and health resource utilization burdens among ICD and CRT recipients, while exploring the feasibility of applying a "semi-competing-risks" framework to jointly model ICD shocks and survival. We have also demonstrated, using an instrumental variable approach leveraging facility-level variation in treatment choices, that CRT-D implantation offers little or no benefits to most older patients compared with CRT-P alone.



## Publication Highlight

***Frailty in patients undergoing percutaneous left atrial appendage closure.*** Wang, A., Ferro, E. G., Song, Y., Xu, J., Sun, T., Yeh, R. W., Strom, J. B., & Kramer, D. B. (2022). *Heart Rhythm*, 19(5), 814–821.



## What else are you trying to figure out?

We are using prospective cohort studies of new ICD recipients as well as patients enrolled at least 5 years post ICD implantation to explore clinical trajectories and apply previous modeling work to patients receiving current standards of care. We also aim to characterize palliative and end-of-life care experiences for patients with ICDs, as well as their families.



## Leadership & Other Roles

- Director, Pacemaker and ICD Clinic at BIDMC
- Section Head, Electrophysiology and Digital Health, Smith Center for Outcomes Research
- Faculty at HMS Center for Bioethics and Adjunct Scientist at the Hinda and Arthur Marcus Institute for Aging Research



## Main Mentors / Collaborators

- Bobby Yeh
- Issa Dahabreh
- Susan Mitchell



# How can we improve structural heart disease (SHD) treatment?



## Roger Laham, MD



### What have you found so far?

- Imaging is crucial for structural heart disease treatment and we have defined imaging pathways for SHD.
- Shared decision making is essential in SHD therapy and may address health care disparities.
- New device development and novel therapies for SHD conditions.



### What else are you trying to figure out?

We are developing and testing new devices and therapies for cardiac conditions. We are also examining outcomes of various SHD interventions in specific disease conditions.



### What active grants, projects, or trials are you leading?

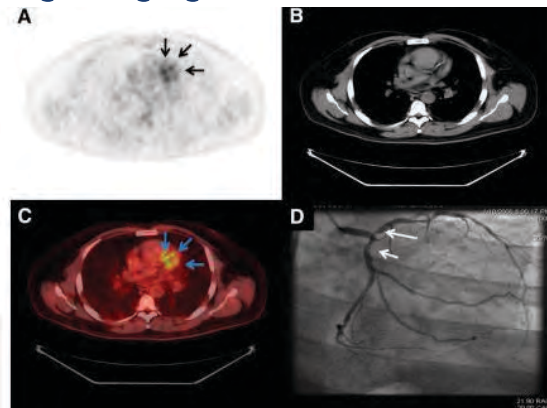
- Medtronic/Abbott/Edwards Structural Fellowship Training Grant
- Edwards PASCAL TrAnScatheter Mitral Valve RePair System: CLASP IID/IIF Trial
- Tricuspid Valve Repair System Pivotal Triluminate Study
- Evoque Valve transcatheter valve: TRISCEND Trial
- Tendyne mitral valve for mitral valve disease: Summit Trial
- Transcatheter Mitral valve replacement: Appollo Trial



### Publication Highlight

***Lessons for Treating Structural Heart Patients during the COVID-19 Pandemic and Beyond.*** Tuttle MK, et. al. *Struct Heart*. 2021 Jun;5(6):591-595. Epub 2022 Mar 21.

### Figure Highlight



Representative images of 18F-FDG PET (A), CT (B), PET/CT (C), and coronary angiography (D) from patient with good myocardial suppression and coronary 18F-FDG uptake (arrows).



### Leadership Roles

Director, Structural Heart Center



### Collaborators

Mahmoud Feroze, MD, and David Liu, MD, BIDMC; Robert Lederman, MD, NIH; Core 320 study team, John Hopkins University

# What are risk factors for the development of ventricular arrhythmias in cardiac sarcoidosis?



## Andrew Locke, MD



### What have you found so far?

I have found that a pseudoinfarct pattern on 12 lead ECG may predict future development of ventricular arrhythmias.



### Publication Highlight

***Toward a Consensus for the Prevention of Sudden Death in Cardiac Sarcoidosis.***  
Locke AH, Zimetbaum P. *JACC Clin Electrophysiol.* 2021 Nov;7(11):1419-1421.



### What else are you trying to figure out?

I would like to investigate additional risk markers for ventricular arrhythmias in cardiac sarcoidosis.



### What active grants, projects, or trials are you leading?

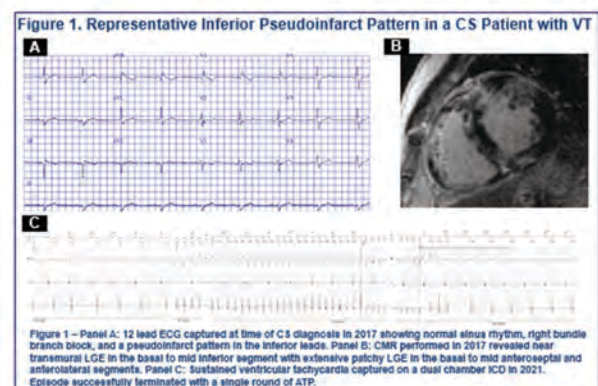
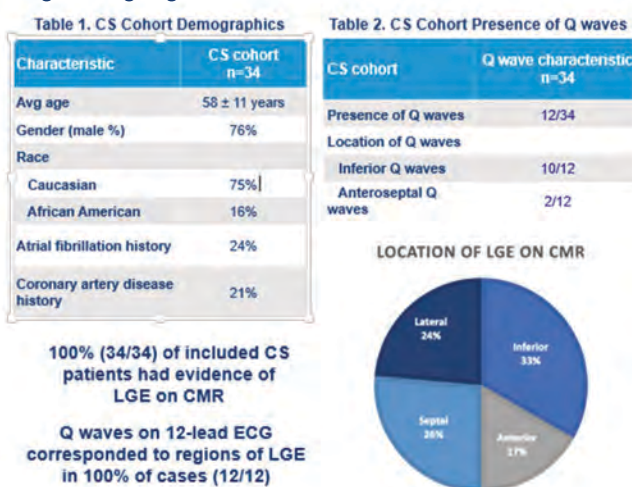
- Left vs. Left PCORI Trial (His/Left Bundle Pacing vs. LV Epicardial Pacing in Patients with CHF)
- eCOOL (RCT evaluating active esophageal cooling in PVI ablation)
- AIM-HIGHER: Cardiac Contractility Modulation for Patients with CHF



### Mentors

- Peter Zimetbaum, MD
- Andre d'Avila, MD

### Figure Highlight



Abstract presented at Heart Rhythm Society

# How do we best tailor anticoagulation for post-CABG atrial fibrillation?



Jason Matos, MD



## What have you found so far?

We examined prescription patterns of anticoagulation use and amiodarone and 30 day outcomes for new atrial fibrillation after bypass surgery. We found that post-bypass anticoagulation was associated with increased bleeding without difference in stroke at 30 days.



## Leadership Roles

- Firm Chief- Blumgart Firm, Internal Medicine Residency Program
- Director of Inpatient Cardiology Education



## Main Mentors / Collaborators

- Peter Zimetbaum, MD

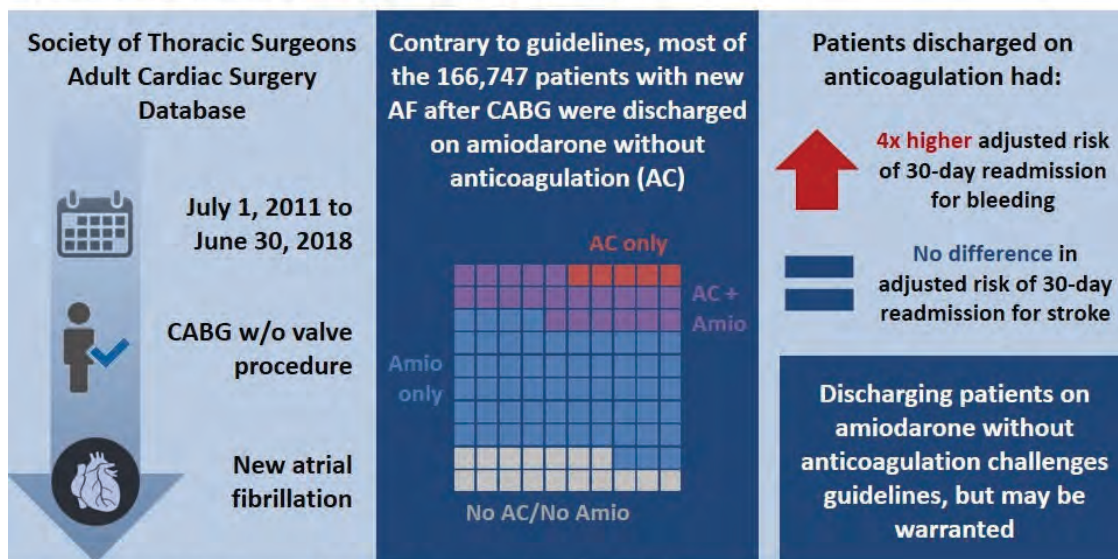


## Publication Highlight

***Post-Cardiac Surgery Atrial Fibrillation: Risks, Mechanisms, Prevention, and Management.***

Matos, J. D., Sellke, F. W., & Zimetbaum, P. (2021). *Cardiac electrophysiology clinics*, 13(1), 133-140.

### Prescription Patterns in Post-CABG Atrial Fibrillation



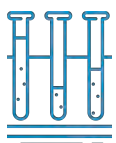
Matos JD, McIlvaine S, Grau-Sepulveda M, Jawitz OK, Brennan JM, Khabbaz KR, Sellke FW, Yeh RW, Zimetbaum P. *J Thorac Cardiovasc Surg.* 2019



# Our goal is to develop small molecules that modulate cardiometabolic diseases.



## Anjali K. Nath, PhD



### What have you found so far?

Despite the widely recognized importance of kinases in human biology, a significant portion of the human kinome remains poorly characterized. We are assigning functions to the remaining understudied kinases which has revealed many new insights into human biology. To accomplish this, we systematically identified connections between these understudied kinases and the human biology they regulate through the integration of genomics, proteomics, and metabolomics data.



### What else are you trying to figure out?

To next translate these human associations to therapeutics, we are developing high-throughput genome editing and chemical screening platforms in zebrafish and human cell lines.



### What active grants, projects, or trials are you leading?

- R21HG010392
- U54NS112107

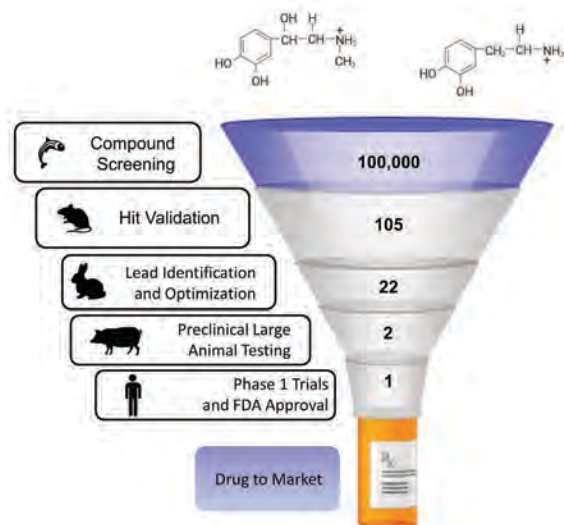


### Publication Highlight

***Genetic deletion of gpr27 alters acylcarnitine metabolism, insulin sensitivity, and glucose homeostasis in zebrafish.***

Nath AK, et. al. *FASEB J.* 2020 Jan;34(1):1546-1557.

### Figure Highlight



**Drug Discovery Pipeline.** The Nath lab works at multiple points along the drug development pipeline spanning discovery to phase I trials. Currently, they are advancing 2 optimized leads to the FDA, including a first-in-class drug that acts via metabolic modulation.



### Collaborators

Seward Rutkove (BIDMC), Vik Bebart (UColorado), Calum MacRae (BWH), Sadaf Farooqi (UCambridge)

# How to build the next-generation of cardiovascular MRI imaging technologies for precision phenotyping of cardiovascular disease?



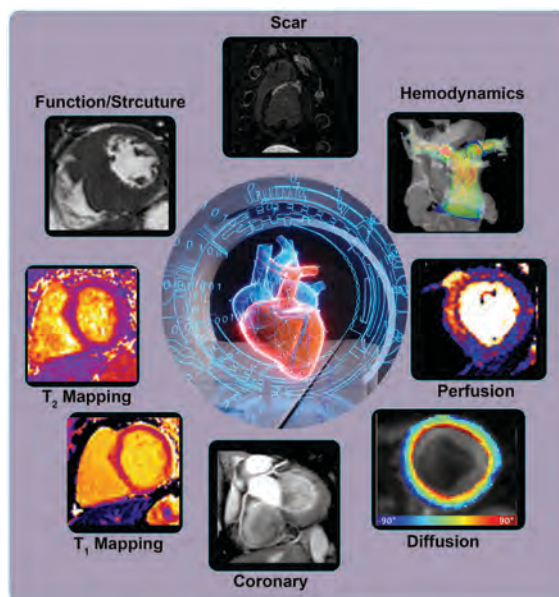
## Reza Nezafat, PhD



### What have you found so far?

Our research focuses on the development and application of cardiovascular magnetic resonance imaging and artificial intelligence-based solutions for improving imaging efficiency, quality, image analysis, interpretation, diagnosis, and prognosis of heart disease. My laboratory uses a multi-pronged approach based on engineering, physics, and cardiovascular medicine to fulfill our mission of advancing cardiovascular imaging through innovative research.

### Figure Highlight



Cardiac MR imaging provides a comprehensive assessment of the structure, function, perfusion, viability, hemodynamics, microstructure, and myocardial mapping via T1, T2, and T2\*. The imaging protocol typically includes basic function, structure, flow, and the remaining necessary sequences are tailored based on the patient indication with a typical scan time of 45–60 minutes.



### Publication Highlight

***An Explainable Machine Learning Approach Reveals Prognostic Significance of Right Ventricular Dysfunction in Non-ischemic Cardiomyopathy.*** Fahmy, AS, et. al. *JACC. Cardiovascular imaging*, 15(5), 766–779.



### What active grants, projects, or trials are you leading?

- National Institutes of Health
- American Heart Association



### What else are you trying to figure out?

Our current research activities include developing and applying AI-based CMR solutions and value-based AI in heart disease, novel exercise cardio-pulmonary MRI phenotyping of cardiovascular, pulmonary, and skeletal muscle physiology tissue composition, and energetics in heart failure, leveraging new imaging and AI techniques to understand mechanisms of ventricular arrhythmia and heart failure, developing non-gadolinium MRI techniques to reduce cost, environmental pollution, and improve patient safety.

# How does inflammation impact coronary artery plaque progression and stent healing?



**Eric A. Osborn, MD, PhD**



## What have you found so far?

In preclinical models of coronary artery disease, our work utilizes high-resolution optical intravascular molecular-structural imaging catheters to quantitatively characterize inflammation residing within atherosclerotic plaques and to evaluate the healing response of implanted metal stents. Our recent work has established that local plaque inflammation is linked to atherosclerotic plaque growth and an abnormal stent healing response.



## Publication Highlight

***Intravascular Molecular-Structural Assessment of Arterial Inflammation in Preclinical Atherosclerosis Progression.***  
Osborn EA, et. al. (2021). *JACC Cardiovasc Imaging.* Nov;14(11):2265-2267.



## What active grants, projects, or trials are you leading?

NIH/NHLBI K08 HL130465; NIH SBIR 1R43 HL158342-01; REFINE PCI; Software for stent failure prevention using intravascular OCT images; Intracoronary Acetylcholine Stability: Overcoming Barriers to Coronary Vasospasm Testing Programs; Physio-Anatomy Clinical Study.



## What else are you trying to figure out?

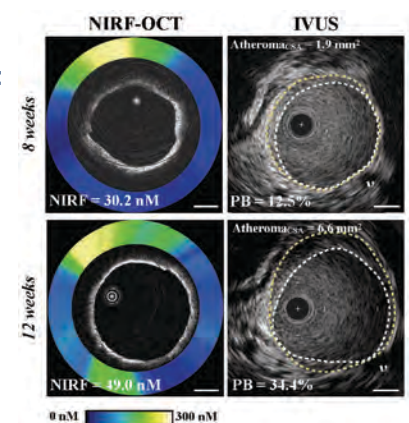
How does the administration of anti-inflammatory agents such as colchicine impact atherosclerosis inflammation and stent healing? How do new generation coronary stent designs with bioresorbable polymers influence the healing response?



## Leadership Roles

- Program Director, Interventional Cardiology Fellowship;
- Medical Director, Cardiovascular Imaging Core Laboratory;
- Director, Intravascular Imaging

## Figure Highlight



Baseline near-infrared fluorescence (NIRF) inflammation is associated with change in plaque burden plaque progression. Representative axial image slice at 8 weeks showing high NIRF inflammatory protease activity followed by high intravascular ultrasound (IVUS) plaque progression from 8 to 12 weeks.



# What are feasibility and safety profiles of novel heart pumps in high-risk individuals?



**Duane Pinto, MD, MPH**



## What have you found so far?

We have conducted the first human studies to confirm safety and efficacy of high-flow, low-profile transcatheter heart pumps among high risk PCI patients. Larger pivotal trials are in planning stages.



## Publication Highlight

***Pinto DS. The Magenta Elevate™ High-Output, Low-French Size Percutaneous Left Ventricular Support Device: FIH Results Presented at TCT 2022, Boston, MA.***



## What else are you trying to figure out?

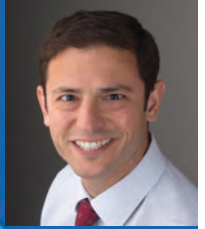
The next question is whether this new transcatheter-based heart pump may be safe to use in a broader population.



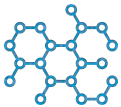
## What active grants, projects, or trials are you leading?

Principal Investigator EFS Impella ECP Microaxial Flow Pump

# Can we use biochemical profiling to understand how exercise leads to cardiometabolic health benefits?



## Jeremy Robbins, MD



### What have you found so far?

We have identified both biologic pathways and systems (i.e. angiogenesis and the extracellular matrix), as well as individual small molecules that are modulated by exercise training and/or associated with cardiometabolic adaptations to training (i.e. maximal oxygen uptake [VO<sub>2</sub>max]).



### What else are you trying to figure out?

In parallel, we are applying the same tools to identify genetic and plasma markers of exercise responsiveness in order to better understand what underlies inter-individual differences in exercise training. Ultimately, these efforts may help inform more specific exercise recommendations.



### Publication Highlight

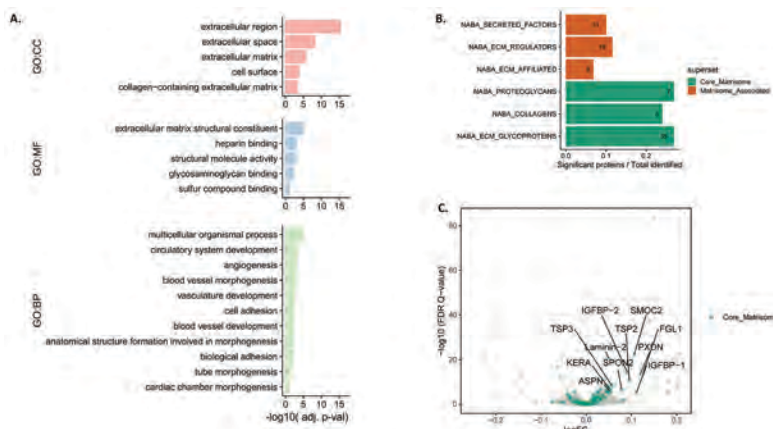
**Human plasma proteomic profiles indicative of cardiorespiratory fitness.**  
Robbins JM, et. al. *Nat Metab.* 2021 06; 3(6):786-797.



### What active grants, projects, or trials are you leading?

- K23 HL150327
- U24 DK112340

### Figure Highlight



Extracellular matrix (ECM) and ECM-related ("Matrisomal") proteins are overrepresented in pathway enrichment analyses of the proteomic changes after endurance exercise training.

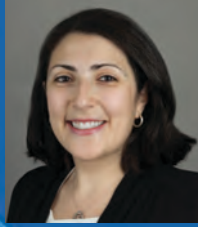
### Leadership Roles

- Associate Director, Clinical Physiology Laboratory, BIDMC
- Member, MoTrPAC Consortium

### Main Mentors / Collaborators

Robert Gerszten (BIDMC), Mark Sarzynski (MUSC), Claude Bouchard (Pennington Biomedical Research Center), Jim Wilson (JHS), Charles Burant (UMich), William Kraus (Duke)

# Do pre-implant and residual mitral regurgitation contribute to early and late RHF in patients with LVADs?



## Marwa Sabe, MD, MPH



### What have you found so far?

We are currently gathering data from CCF, TMC, and BIDMC.



### Publication Highlight

***Predictors and Prognostic Significance of Right Ventricular Ejection Fraction in Patients With Ischemic Cardiomyopathy.***

Sabe MA, Sabe SA, Kusunose K, Flamm SD, Griffin BP, Kwon DH. *Circulation*. 2016 Aug 30;134(9):656-65.

### What else are you trying to figure out?

Does mitral valve repair either before or at the time of LVAD implantation improve the incidence of RHF and survival in this patient population?



### Main Mentors / Collaborators

- Debbie Kwon, Cleveland Clinic Foundation
- Michael Kiernan and Gaurav Gulati, Tufts Medical Center



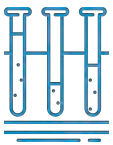
### Leadership Roles & Recognition

- Associate Director, Advanced HF/MCS Program
- Director, VAD Program
- Course Director, HMS Cardiology Rotation at BIDMC
- Shore Fellowship, 2019

# How does the endothelium contribute to pathologic blood clotting during inflammatory disease?



**Alec Schmaier, MD, PhD**



## What have you found so far?

We have identified that externalization of negatively charged phospholipid (e.g. phosphatidylserine) contributes to prothrombotic changes on endothelial cells. We have identified protein channels that regulate this process, some of which are unique to the endothelium. We have found drugs that block these channels and prevent thrombosis in animal models.



## Publication Highlight

**COVID-19 Collection and Processing Team, Peters K, Flaumenhaft R, Parikh SM. Tie2 activation protects against prothrombotic endothelial dysfunction in COVID-19.**  
Schmaier AA, Hurtado GP, Manickas-Hill ZJ, Sack KD, Chen SM, Bhambhani V, Quadir J, Nath AK, Collier AY, Ngo D, Barouch DH, Shapiro NI, Gerszten RE, Yu XG; MGH JCI Insight 2021 Sept 10.



## What else are you trying to figure out?

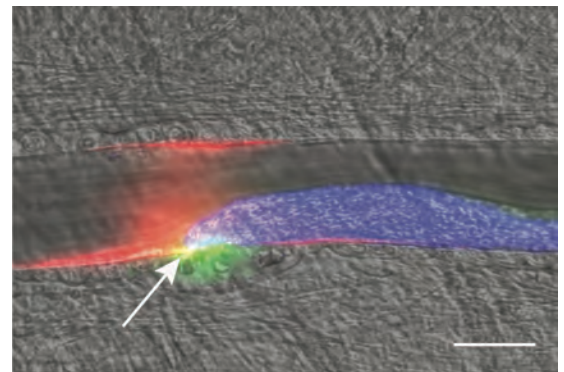
We are trying to understand the mechanism these lipid channels use to regulate procoagulant function in endothelial cells. We are also studying how these channels regulate other endothelial processes like pathologic extracellular vesicle release.



## What active grants, projects, or trials are you leading?

- NHLBI K08HL161259
- Career Development Grant, American Heart Association
- Miles Shore Award, HMS

## Figure Highlight



Laser injury mouse thrombosis model with intravital microscopy. Thrombus formation can be measured in real-time following laser ablation of vessel wall (arrow). Externalization of procoagulant phosphatidylserine is detected with fluorescent annexin V (red), along with antibodies against platelets (blue) and fibrin (green).



## Main Mentors / Collaborators

- Robert Flaumenhaft
- Sol Schulman

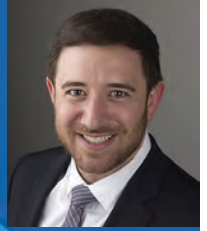
## Leadership Roles

- LMA Cardiovascular Research Conference - leader, organizer

Beth Israel Lahey Health   
Beth Israel Deaconess Medical Center



# How do we evaluate cardiovascular devices post-FDA approval, in particular when safety concerns exist?



## Eric A. Secemsky, MD, MSc



### What have you found so far?

Although a prior meta-analysis demonstrated harm associated with drug-coated devices, we have currently found no evidence of long-term safety signals associated with drug-coated device use, at almost 4 years of follow-up. There was also no difference between the groups in the risk of amputation.



### Publication Highlight

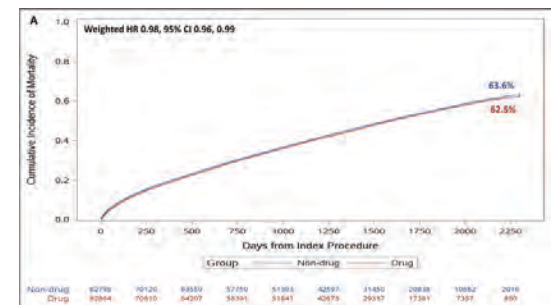
**Update From the Longitudinal Assessment of Safety of Femoropopliteal Endovascular Treatment With Paclitaxel-Coated Devices Among Medicare Beneficiaries: The SAFE-PAD Study.** Secemsky EA, et.al. *Circ Cardiovasc Interv.* 2022 Jun;15(6):e012074.



### What else are you trying to figure out?

This current work has served as a template for additional post-market device evaluation studies. As an extension, we are now continuing our collaboration with the FDA to examine whether there are any long-term differences in outcomes among specific groups of patients receiving endovascular aortic repair for abdominal aortic aneurysm.

### Figure Highlight



Weighted cumulative incidence of mortality curves stratified by treatment with or without drug-coated devices



### What active grants, projects, or trials are you leading?

- NIH K23 HL150290-02
- FDA - Safety Outcomes Associated with EVAR for AAA
- Boston Scientific, Variation in Device Selection & Outcomes for PVI
- Philips, Trends & Outcomes w/ IVUS during CV Intervention
- Cardiovascular Systems Inc., Variation in Institutional Atherectomy Use and Major Amputations
- Boston Scientific, Medtronic, Philips, Cook, Bard, SAFE PAD study (CORE)



### Leadership Roles

- Director of Vascular Intervention, CardioVascular Institute, BIDMC
- Section Head, Interventional Cardiology and Vascular Research
- Board of Directors, Vascular InterVentional Advances

# What is the impact of aging and frailty on outcomes in aortic stenosis (AS)?



Jordan Strom, MD, MSc



## What have you found so far?

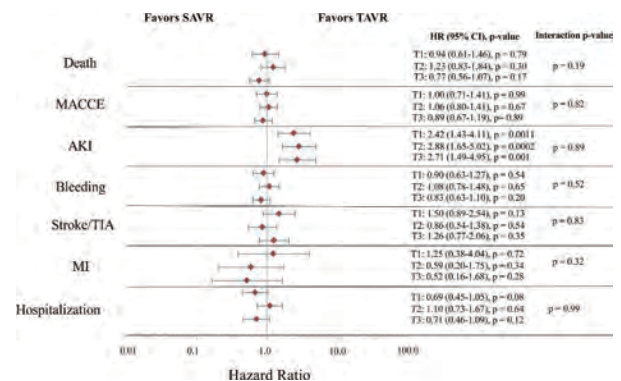
Using clinical trials linked to claims data, we have found that frailty importantly increases an individual's risk of dying from AS, more than age and other clinical conditions alone, but that frailty in itself does not identify a benefit from one particular type of treatment for AS versus another (i.e. surgery or transcatheter therapies).



## Publication Highlight

**COVID-19 Collection and Processing Team, Development and validation of an echocardiographic algorithm to predict long-term mitral. Strom, J, et. al. (2022). and tricuspid regurgitation progression. European Heart Journal Cardiovascular Imaging, 23(12), 1606-1616.**

## Figure Highlight



Relative treatment effect for surgical versus transcatheter aortic valve replacement by frailty index tertile. While rates of acute kidney injury were higher in surgical than transcatheter treatments, increasing frailty did not favor any treatment choice for any outcome.



## What else are you trying to figure out?

Though we know that frailty tracks with age, we are trying to disaggregate the clinical and biochemical features that separate chronologic age and biologic age to isolate why some individuals develop frailty at an early age and the mechanisms underlying this.



## What active grants, projects, or trials are you leading?

1K23HL144907, Ultrasonics EchoGoHF, EchoIQ Automated Detection of Aortic Stenosis



## Main Mentors / Collaborators

- Robert W. Yeh, MD, MSc



## Leadership Roles

- Director of the Echocardiography Laboratory, BIDMC
- Board of Directors, American Society of Echocardiography
- Chair, ImageGuideEcho Registry

# How can genetic studies in diverse populations help uncover mechanisms of cardiovascular disease?



## Usman Tahir, MD, MBI



### What have you found so far?

Ancestry specific genetic variants linked to cardiovascular disease in Black individuals are associated with circulating proteins and metabolites. These associations potentially highlight new pathways in genetic heart disease.



### What active grants, projects, or trials are you leading?

K08 HL161445-01A1: The Role of SECTM1 in Monocyte Biology and Atherosclerosis



### Leadership Roles

- Director, Center for Cardiovascular Genetics
- Co-Director, Hypertrophic Cardiomyopathy Clinic



### Main Mentors / Collaborators

Robert E. Gerszten, Pradeep Natarajan, Carolyn Ho



### What else are you trying to figure out?

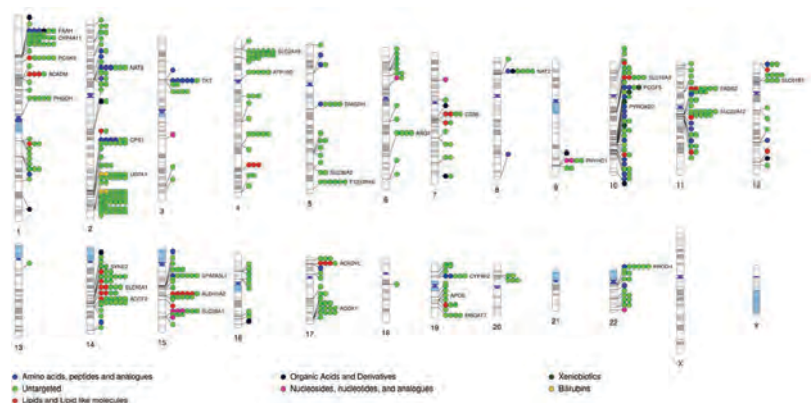
How can we leverage findings from GWAS to find proteins and metabolites that are causal in cardiometabolic disease using mendelian randomization studies?



### Publication Highlight

**Whole Genome Association Study of the Plasma Metabolome Identifies Metabolites Linked to Cardiometabolic Disease in Black Individuals.** Tahir UA, Katz DH, Avila-Pachecho J, et. al. *Nat Commun.* 2022 Aug 22;13(1):4923.

### Figure Highlight



Whole genome association study of plasma metabolites.

# What are acute and chronic effects of physical activity on aortic compliance measured by cardiovascular MRI?

## Is this different in individuals with heart failure versus in the general population?



## Connie Tsao, MD, MPH



### What have you found so far?

Acute exercise is associated with greater aortic stiffness in individuals with heart failure. In exploratory subgroup analysis, this finding was observed in individuals with HFrEF (LVEF<50%), but not HFpEF.



### Publication Highlight

***Cross-Sectional Relationships of Proximal Aortic Stiffness and Left Ventricular Diastolic Function in Adults in the Community***; led by BI cardiology fellow Nick Spetko, MD. JAHA 2022; in press.

### Figure Highlight

	Controls, n=26			HF, n=26		
	Rest	Exercise	P value, rest vs. exercise	Rest	Exercise	P value, rest vs. exercise
SBP, mm Hg	122 ± 16	160 ± 20	<0.001	115 ± 18	151 ± 23	<0.001
DBP, mm Hg	74 ± 11	91 ± 11	<0.001	66 ± 13	83 ± 16	<0.001
HR, bpm	64 ± 10	111 ± 14	<0.001	71 ± 10	100 ± 18	<0.001
MEIs	--	4.8 ± 0.9		--	3.9 ± 1.0	
AA AoD, x 10 <sup>3</sup> mmHg <sup>-1</sup> (95% CI)	3.71 (2.89, 4.52)	2.57 (1.99, 3.14)	0.076	2.99 (2.40, 3.58)	2.40 (1.91, 2.89)	0.023
DA AoD, x 10 <sup>3</sup> mmHg <sup>-1</sup> (95% CI)	4.56 (3.65, 5.47)	4.03 (3.12, 4.93)	0.557	4.24 (3.42, 5.08)	3.09 (2.47, 3.71)	0.023

Aortic distensibility at rest and exercise in controls and individuals with HF.



### What else are you trying to figure out?

We will be evaluating the long-term association of varying levels of physical activity with aortic stiffness in individuals with heart failure, as well as those without CVD.



### What active grants, projects, or trials are you leading?

- NIH Myocardial radiomics and mechanics in the pathology and prognosis of CVD
- NIH grant with Joslin Diabetes Center to study myocardial characterization in longterm T1 diabetes



### Leadership Roles

- Director of Clinical Cardiac MRI Research and Education, BIDMC
- Associate Editor, J Cardiovascular Magnetic Resonance
- Past Chair, American Heart Association Statistics Committee



# What biophysical and procedural factors influence the success of atrial fibrillation ablation and do these factors affect long-term arrhythmia outcomes?



## Patricia Tung, MD



### What have you found so far?

We know that strategies such as high frequency jet ventilation and higher ablation power increase lesion stability and quality and result in higher rates of first pass isolation. Electrical isolation of the posterior left atrial wall, in addition to pulmonary vein isolation, can be useful in management of persistent atrial fibrillation. In a retrospective analysis of our cases, predictors of first pass posterior wall isolation were lower absolute voltage and longer lesion duration.



### What else are you trying to figure out?

If lack of first pass isolation is due to increased left atrial wall thickness and lack of transmural lesions, and if first pass isolation affects freedom from AF. We would like to assess prospectively the rate of first pass isolation of the pulmonary veins and posterior wall, to compare the effectiveness of various ablation strategies and to assess the relationship between first pass isolation and durability of isolation.



### Leadership Roles

- Cardiac Electrophysiology Fellowship Program Director
- Heart Rhythm Society Research Award Selection Committee

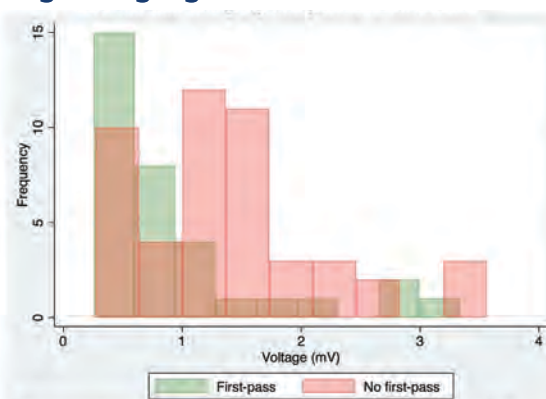


### Publication Highlight

***Hemodynamic intolerance and pericardial effusion associated with high-frequency jet ventilation during pulmonary vein isolation.***

Tung P, et. al. *Heart Rhythm* 02. 2021 May 21;2(4):341-346.

### Figure Highlight



Frequency of first pass isolation by posterior wall voltage.



### What active grants, projects, or trials are you leading?

- NODE 303 - trial of inhaled etripamil for acute termination of SVT
- Abbott Tacticath post market approval study
- Hemodynamic Effects of High Frequency Jet Ventilation during PV



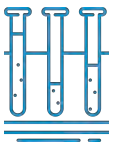
### Mentors / Collaborators

Andre D'avila, Peter Zimetbaum, Alfred Buxton, and Jon Waks

# What ECG markers/characteristics are suitable to support clinical decision-making in management of atrial and ventricular arrhythmias?



**Richard L. Verrier, PhD**



## What have you found so far?

We found that T-wave alternans and T-wave heterogeneity (TWH) on ambulatory ECG or exercise testing identify high-risk individuals who are at greater risk for cardiovascular mortality and sudden cardiac death across numerous studies (including Verrier and Ikeda 2013, Schomer et al 2014, Libbus et al 2016; Nearing et al 2021, Kentta et al 2016, Verrier et al 2013 and others) with patents assigned to BIDMC.



## Publication Highlight

**Regadenoson-induced T-wave heterogeneity complements coronary stenosis detection by myocardial perfusion imaging in men and women.**  
Araujo Silva, B., et. al. *Eur Heart J Cardiovasc Imaging* 2021;22(11):1341-1349.  
doi: 10.1093/ehjci/jeaa128.



## What else are you trying to figure out?

Understanding the mechanisms and utility of reduction in P-wave heterogeneity (PWH) and TWH by pulmonary vein isolation.



## What active grants, projects, or trials are you leading?

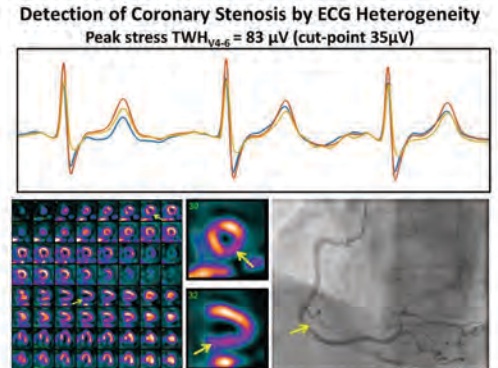
Analysis of 24-Hour Ambulatory EKGs from Patients with Heart Failure and Reduced Left Ventricular Ejection Fraction at Baseline and after Vagus Nerve Stimulation in the ANTHEM-HF Pivotal Study. Sponsor: LivaNova USA, Inc., Individual investigator-initiated grant



## Leadership Roles

- Laboratory director of basic and translational research in cardiac electrophysiology.
- Mentor of fellows in cardiology and epileptology.
- Section editor for *Journal of Heart Rhythm*

## Figure Highlight



# How have health policies enacted under the Affordable Care Act impacted quality of care, health outcomes, and health equity?



**Rishi K. Wadhera, MD, MPP, MPhil**



## What have you found so far?

We have leveraged real-world data and quasi-experimental methods, to show that the expansion of the Medicaid program under the ACA reduced uninsured hospitalizations, increased access to medications, and improved care delivery, particularly for cardiovascular disease. We also evaluated national value-based programs that aimed to improve quality of care and reduce spending, and have shown that these policies have largely not been successful, at times had unintended consequences, and most concerning, have widened inequities.



## What else are you trying to figure out?

Important national policy questions, including (1) Understanding whether Medicare Advantage plans improve care and outcomes for older adults, (2) Determining how the Inflation Reduction Act effects out-of-pocket prescription drug costs, and (3) Exploring how lowering the Medicare eligibility age might impact access to care, affordability, and CV health of adults in the US.



## What active grants, projects, or trials are you leading?

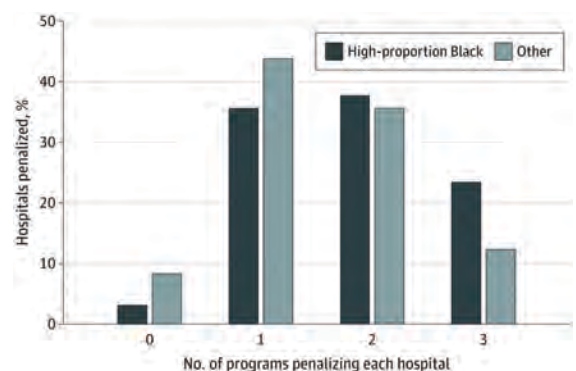
- PI of R01HL164561(NHLBI/NIH)
- PI of K23HL148525 (NHLBI/NIH)
- Co-I of U01 (NINR) and R01 (NHLBI)



## Publication Highlight

***Hospitals and Health Equity - Translating Measurement into Action.*** C Sandhu S, Liu M, Wadhera RK. *N Engl J Med.* 2022 Dec 29;387(26):2395-2397.

## Figure Highlight



*National value-based programs enacted by Medicare have disproportionately penalized hospitals caring for a high proportion of Black adults (Aggarwal, Wadhera. JAMA 2021).*



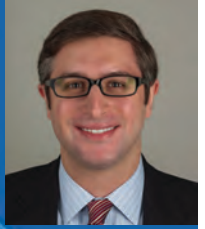
## Leadership Roles

- Section Head of Health Policy and Equity, Smith Center for Outcomes Research
- Associate Program Director, Cardiovascular Medicine Fellowship
- Senior Associate Editor, Health Services Research Journal

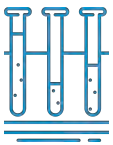
Beth Israel Lahey Health   
Beth Israel Deaconess Medical Center



# How are vectorcardiographic assessments of myocardial electrical heterogeneity associated with adverse cardiovascular outcomes?



## Jonathan Waks, MD



### What have you found so far?

We have developed open-source software (BRAVEHEART) to allow calculation of various parameters for ECG based research. One such parameter, the spatial ventricular gradient (SVG) is predictive for sudden cardiac death and ventricular arrhythmias in community patients and patients with heart failure and implantable cardioverter-defibrillators. The SVG also rapidly changes after administration of anti-arrhythmic drugs and is associated with the risk of drug induced TdP.



### Publication Highlight

**Competing risks in patients with primary prevention implantable cardioverter-defibrillators: Global Electrical Heterogeneity and Clinical Outcomes study.** Waks et al. *Heart Rhythm*. 2021 Jun;18(6):977-986.

### Figure Highlight



User interface for BRAVEHEART, the open-source ECG/VCG analysis software suite we developed.

If you are interested in using our software for an ECG analysis project, please contact us!



### What else are you trying to figure out?

Analyzing the SVG in other patient populations to assess cardiovascular risk; assessing the link between ECG parameters and cardiovascular imaging.



### Main Mentors / Collaborators

- Hans Stabenau, MD



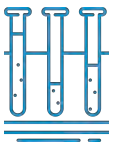
### Leadership Roles

- Director, ECG Lab

# What are the predictors of regression of coronary fatty (lipid-rich) plaque and the coronary artery calcium score?



Francine Welty, MD, PhD



## What have you found so far?

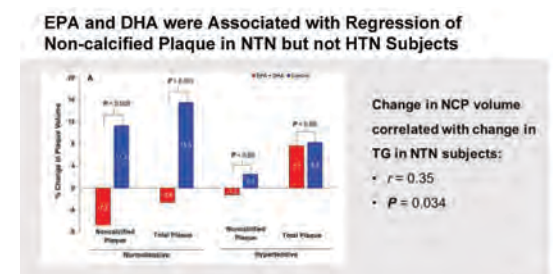
The omega-3 fatty acids, EPA and DHA, are precursors of specialized pro-resolving lipid mediators (SPMs) - resolvins and maresins - which actively resolve chronic inflammation. In a randomized trial of EPA and DHA, subjects with low plasma EPA+DHA levels had a low ratio of (18-HEPE+resolvin E1)/leukotrieneB4 (LTB4 is a proinflammatory mediator) and significant coronary plaque progression, whereas those with a high ratio of (18-HEPE+resolvin E1)/LTB4 had significant plaque regression. These findings suggest that an imbalance between pro-resolving and proinflammatory lipid mediators is associated with plaque progression and potentially mediates the beneficial effects of EPA and DHA.



## Publication Highlight

**Regression of Human Coronary Artery Plaque Is Associated with a High Ratio of (18-hydroxy-eicosapentaenoic acid + Resolvin E1) to Leukotriene B4.** Welty FK, Schulte F, Alfaddagh A, Elajami TK, Bistrian BR, Hardt M. *FASEB J.* 2021;35:e21448.

## Figure Highlight



Normotensive subjects randomized to EPA+DHA (in red) had regression of noncalcified plaque compared to control (in blue) whereas hypertensive subjects had no difference. The regression in normotensive subjects on EPA+DHA correlated with the reduction in triglyceride level.



## What else are you trying to figure out?

We have found that the regression of coronary plaque is affected by blood pressure status such that normotensive subjects have regression of coronary plaque, whereas hypertensive subjects do not. The next step is to do proteomic and genomic profiling to examine for differences that may allow for precision medicine applications.



## Leadership Roles

- Chair, Diversity Committee, Arteriosclerosis, Thrombosis and Vascular Biology Council, American Heart Association
- Chair, Data Safety Monitoring Committee, International Empagliflozin Heart Failure Trials

# What are the best methods for evaluating cardiovascular devices using real-world evidence?



**Robert W. Yeh, MD, MSc**



## What have you found so far?

The most commonly used methods in observational analysis are vulnerable to bias when evaluating cardiovascular devices. Less frequently used approaches, including "transportability analyses" and quasi-experimental methods may be more suitable alternatives. We have a deep collaboration with the Harvard School of Public Health, allowing us to utilize novel and cutting-edge methodologies. Our team uses these approaches to evaluate cardiovascular devices with ongoing safety concerns, working closely with the US FDA.



## What active grants, projects, or trials are you leading?

- NHLBI: R01HL136708 (EXTEND Study), R01HL157530 (AHA COVID-19 CVD Registry, MPI: Ger-szten/Kazi/Yeh), K24HL150321
- American College of Cardiology: Data Analytic Center, National Cardiovascular Data Registry
- National PI for the AGENT Trial assessing a drug-coated balloon for coronary restenosis



## What else are you trying to figure out?

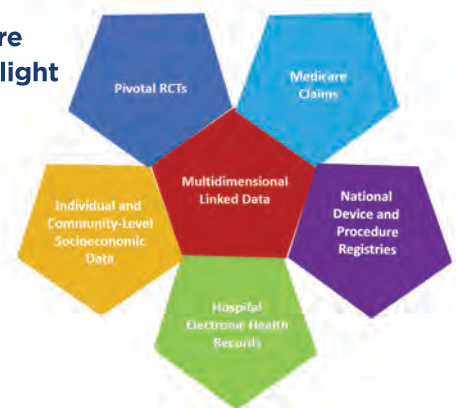
We are working with the AHA to evaluate the long-term consequences of COVID-19 hospitalization, particularly for individuals with baseline cardiovascular disease or who experience acute cardiovascular complications during hospitalization.



## Publication Highlight

*Estimation of DAPT Study Treatment Effects in Contemporary Clinical Practice: Findings from the EXTEND-DAPT Study. Butala NM\*, et. al. Circulation. 2021 Nov 8.*

### Figure Highlight



*Much of our research is enabled by the creation of unique "multi-dimensional" datasets, established through the linkage of data from an eclectic mix of sources.*



## Leadership Roles

- Director, Richard A. and Susan F. Smith Center for Outcomes Research in Cardiology
- Section Chief, Interventional Cardiology, BIDMC
- Standing Member, Circulatory Devices Advisory Panel, US FDA



# How can we recruit more women into a career in cardiology?



## Meghan York, MD



### What have you found so far?

Women report having same gender role models as important in choosing a career in cardiology. The majority of women residents report that they are more likely to choose a subspecialty if they are encouraged to go into that specialty. A higher percentage of women residents than men have never considered a career in cardiology.



### Leadership Roles

- Chair of Medicine at Beth Israel Deaconess Hospital-Needham
- Chair of Advancement of Women Committee, Department of Medicine, BIDMC



### Main Mentors / Collaborators

- Malissa Wood, MD, MGH

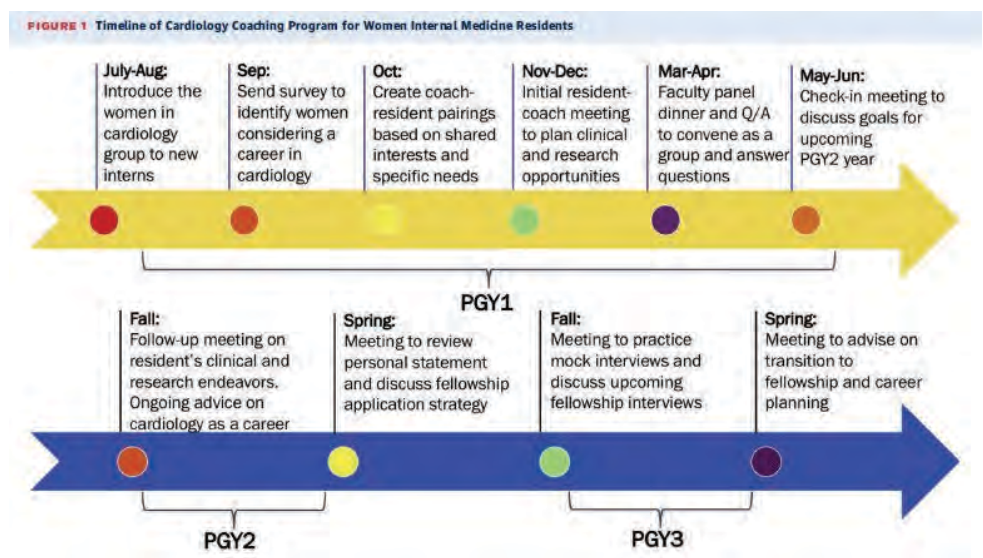


### Publication Highlight

**Professional Preferences and Perceptions of Cardiology Among Internal Medicine Residents: Temporal Trends Over the Past Decade.** York M, Douglas PS, Damp JB, et al. *JAMA Cardiol.* Published online October 12, 2022.

### Figure Highlight

The timeline and structure of the coaching program over a 3-year internal medicine residency. During post-graduate year (PGY) 1, the resident-coach pairings are created, and the initial meetings take place to discuss cardiology as a career and to plan clinical and research opportunities. The PGY2 and PGY3 meetings focus on the fellowship application process and the transition to fellowship. Q/A ¼ question and answer.



# How can we improve outcomes for patients with lead-related venous obstruction (LRVO) caused by their cardiac implantable electronic devices?



## Peter Zimetbaum, MD



### What have you found so far?

Among 650,000 Medicare patients who received a pacemaker or defibrillator between 2016 and 2020 in the US, we found that 1 of every 20 patients developed symptomatic LRVO. Only 15% received an intervention to address their symptoms, primarily device extraction and, less often, percutaneous revascularization (i.e. balloon or stenting). Device extraction was found to significantly reduce subsequent healthcare utilization for LRVO symptoms.



### What else are you trying to figure out?

While extraction of a pacemaker or defibrillator may alleviate symptoms of LRVO, this is not a feasible strategy by itself – as patients are often dependent on these devices. We will investigate if leadless devices can reduce LRVO, and whether drug-coated balloons can reduce symptoms when extraction is not possible.



### Leadership Roles

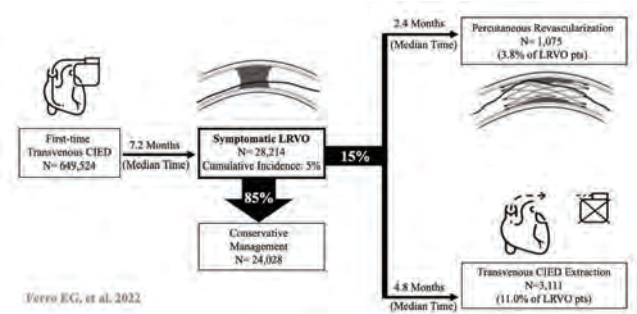
- Associate Chief and Director of Clinical Cardiology, BIDMC
- Director, ECG and Arrhythmia Core Laboratory, Baim Institute for Clinical Research



### Publication Highlight

**Lead-Related Venous Obstruction in Patients With Implanted Cardiac Devices: JACC Review Topic of the Week.** Zimetbaum P, Carroll BJ, Locke AH, Secemsky E, Schermerhorn M. *J Am Coll Cardiol.* 2022 Jan 25;79(3):299-308.

### Figure Highlight



*Natural history of LRVO: incidence, treatment and outcomes among Medicare patients with cardiac implantable electronic devices in the United States*



### Collaborators

- Enrico G. Ferro, MD
- Eric A. Secemsky, MD, MSc
- Daniel B. Kramer, MD, MPH
- Yang Song, MSc
- Robert W. Yeh, MD, MSc