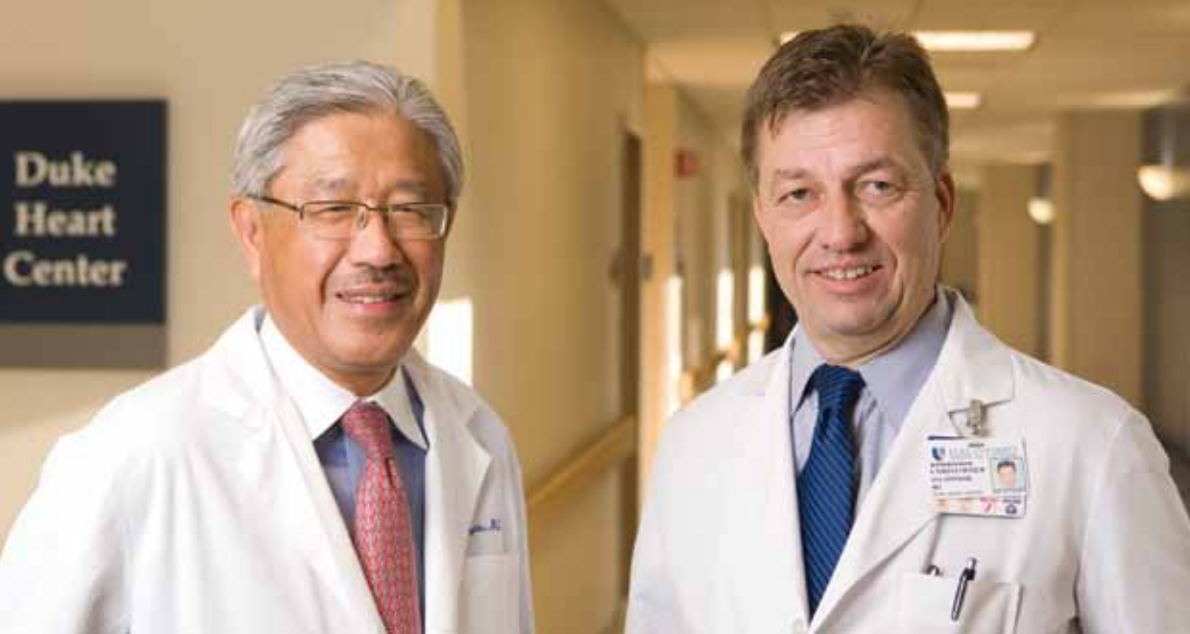




## Duke Heart Report 2010-11

HIGH TECH. HIGH TOUCH. HIGH QUALITY.





We at Duke Heart Center are committed to our patients and partners near and far—and continually strive to advance the prevention and treatment of cardiovascular disease to improve the lives of all we serve.

In the past year alone, we launched pioneering cell-therapy trials for peripheral vascular disease and heart failure that are yielding exciting results; opened North Carolina's first hybrid OR; founded a unique clinic to optimize resynchronization devices; performed two first-ever aortic replacements for patients with connective-tissue disorders; developed information technology to give our patients and providers unprecedented online access to clinical cardiac images; and continued expanding our network of community-based practices.

Long renowned for basic-science, outcomes, and clinical research, Duke today leads or participates in virtually every major heart-related investigation network, clinical trial, and registry—work that influences national treatment guidelines for a range of cardiac conditions. We strive to quickly translate scientific discoveries into novel therapies that bring hope to even the sickest patients, offering patients access to hundreds of clinical trials—many of which are coordinated by the Duke Clinical Research Institute, the world's largest academic research organization.

Over the past year, Duke Heart Center research findings generated scores of peer-reviewed articles, from new research linking metabolic profiles to cardiovascular disease risk to a trial showing that heart failure patients on LVAD destination therapy fare much better with continuous-flow devices than with pulsatile devices.

Whether it's through disseminating the latest research findings, designing better ways to deliver cardiovascular care, or training the next generation of cardiovascular specialists who will lead the way toward future advances, we at Duke Heart Center are dedicated to improving cardiac care on a global scale—while bringing the best care home to each individual.

It is an honor to share our most recent efforts and accomplishments with you in these pages.

Christopher M. O'Connor, MD  
Director, Duke Heart Center  
Acting Chief, Division of Cardiology  
Professor of Medicine

Victor J. Dzau, MD  
Chancellor for Health Affairs, Duke University  
President and CEO, Duke University Health System  
Director, Molecular and Genomic Vascular Biology

---

Duke Heart Center unites the science and delivery of cardiovascular medicine through an integrated, evidence-based, multidisciplinary approach. Our mission is to improve the health of people of all ages in communities across the region, throughout the country, and around the world by achieving and sustaining excellence, innovation, and leadership in all aspects of patient care, research, and education.



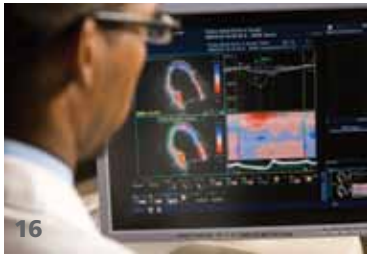
# INNOVATIONS



## VENTRICULAR ASSIST DEVICES (VADs)

CERTIFIED BY THE JOINT COMMISSION IN DESTINATION VAD THERAPY

Temporary bridges to transplant and permanent therapy for heart failure  
A pioneer in developing, testing, and implanting next-generation devices  
North Carolina's only program offering the HeartWare device  
Ongoing studies strive for continued improvements



## ARRHYTHMIA MANAGEMENT

CONDITION-SPECIFIC EXPERTISE, HIGH VOLUMES, OUTSTANDING OUTCOMES

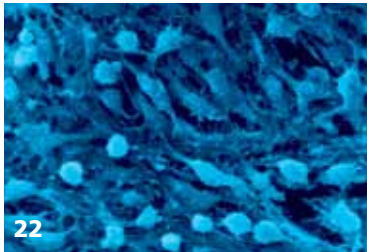
Dedicated center delivers expert AFib care  
Among the Southeast's busiest lead-extraction services  
Unique new clinic fine-tunes implanted devices  
Studies help elucidate risk, better target interventions



## VALVULAR HEART DISEASE

FOR 20-PLUS YEARS, A WORLD LEADER IN MINIMALLY INVASIVE PROCEDURES

A frontrunner in percutaneous interventions, including valve replacement  
Mitral-valve outcomes excellent for nearly four decades  
World's highest volumes of minithoracotomy valve repair, replacement  
Pioneering transcatheter valve trial



## PERIPHERAL VASCULAR DISEASE (PVD)

PIONEERING RESEARCH OPENS NEW OPTIONS FOR PATIENTS

Pluristem stem-cell trial showing great promise  
First-in-man studies test novel critical limb ischemia therapies  
Limb "salvage center" reducing PVD-related amputations  
A range of catheter-based and hybrid therapies

## CONTENTS

- 2 Duke Heart Center at a Glance
- 4 Faculty Contributions
- 6 Locations Across the Southeast
- 7 Global Initiatives
- 8 Clinical Services
  - 10 Imaging and Diagnostic Services
  - 11 Acute Cardiac Care
  - 12 Percutaneous Interventions
  - 13 Coronary Artery Bypass Grafting
  - 14 Heart Failure, Ventricular Assist Devices, and Heart Transplant
  - 16 Arrhythmia Management
  - 18 Valvular Heart Disease
  - 20 Thoracic Aortic, Thoracic, and Lung Transplant Surgery
  - 22 Peripheral Vascular Disease
  - 24 Specialized Clinical Programs
  - 25 Personalized and Genomic Cardiology
  - 26 Congenital Cardiology
  - 27 Pediatric and Congenital Heart Surgery
  - 28 Cardiothoracic Anesthesiology
  - 29 Cardiac Prevention and Rehabilitation
  - 30 Cardiac Nursing
  - 31 Information Technology
  - 32 Outreach
  - 33 Affiliations: The Duke Heart Network
- 34 Education and Training
- 36 Basic, Clinical, and Collaborative Research
- 38 Heart Center Leadership
- 39 Heart Center Faculty Physicians
- 40 Resources for Clinicians and Patients

## DUKE HEART CENTER AT A GLANCE

Consistently ranked among the top heart programs in the nation by *U.S. News & World Report*, Duke Heart Center serves more than 50,000 patients every year—and is a globally recognized leader in cardiovascular care, research, and education.

### Nationally Recognized

One of the nation's...

- Top units for myocardial infarction care
- Only dedicated programs for advanced coronary artery disease
- Largest pediatric EP services
- Largest adult valvular heart disease programs
- Largest and longest-running cardiac rehabilitation programs
- Handful of centers offering cardiac resynchronization therapy and epicardial catheter ablation
- Highest volumes and best outcomes for ventricular assist device (VAD) implantation and cardiac transplantation
- Largest cardiovascular nursing research programs

### The Southeast's Leading Heart Center

Among the Southeast's...

- Highest cardiothoracic surgical volumes
- Busiest implantable-device lead-extraction services
- Highest-volume interventional cath labs
- North Carolina's...
  - Highest volume of catheter ablations for atrial fibrillation
  - Largest, most specialized pediatric cardiac ICU
  - Largest pediatric heart failure program
  - First hybrid OR

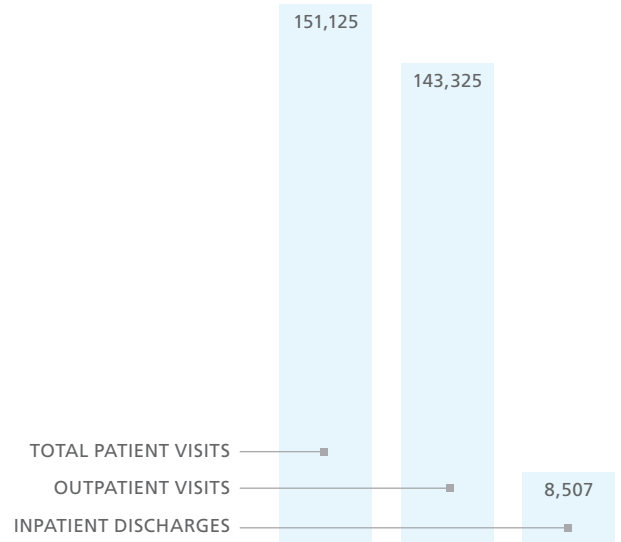
Nation's top heart failure program based on outcomes, volumes, and research

Nation's first and largest dedicated cardiovascular MRI service

Nation's top 1 percent in thoracic aortic surgical outcomes

Birthplace of RACE-ER, the model for the AHA-funded, nationwide *Mission: Lifeline*

One of only six U.S. programs dedicated to adult congenital heart disease



Figures are for calendar year 2009. Procedure volumes are for Duke University Hospital, Duke Raleigh Hospital, Durham Regional Hospital, and hospital-based locations.

### Advancing the Quality of Cardiovascular Care

Duke Heart Center leads a range of efforts to define best practices and improve the quality of care delivered to cardiac patients worldwide. Examples include:

- Leading the creation of **national quality standards** through work with entities including the Centers for Medicare and Medicaid Services, the Food and Drug Administration, and the National Academy of Sciences' Institute of Medicine
- Coordinating center and analytic engine for national quality initiatives that collect data from U.S. hospitals to improve treatment and outcomes:
  - *Expecting Success: Excellence in Cardiac Care*
  - Society of Thoracic Surgeons' National Database
  - AHA's *Get With the Guidelines* initiative
  - ACC's National Cardiovascular Data Registry percutaneous coronary intervention registry and the NCDR-ACTION acute coronary syndromes registry—each the world's largest clinical registry in its class
  - CRUSADE National Quality Improvement Initiative
- Pioneering **new models of care delivery**, such as RACE-ER (page 11) and an effort to make cardiac rehabilitation (page 29) a standard of care
- Serving on the ACC committee to develop the **first appropriateness guidelines for cardiovascular imaging**

### Research Leadership

- Home of the Duke Clinical Research Institute, the **world's foremost academic research organization**, and the Duke Databank for Cardiovascular Disease—the world's largest and oldest repository of cardiac outcomes data
- A **founding site** of the NIH-funded Heart Failure Clinical Research Network and the Clinical and Translational Science Awards Consortium
- **One of nine U.S. sites** in the NIH-funded Cardiothoracic Surgical Trials Network
- **One of eight U.S. centers** in the NIH-funded Pediatric Heart Network

#### VITAL STATISTICS

Faculty and staff: **More than 700**, including **100-plus board-certified cardiologists, cardiac surgeons, and cardiothoracic anesthesiologists**

Clinical trials under way: **270+**  
Annual cardiovascular research funding: **\$85+ million**

Number of unique patients in all locations: **57,250**



Duke is home to the acclaimed Duke Clinical Research Institute (page 37), led by cardiologist Robert A. Harrington, MD (left), shown here with cardiologist and faculty associate director Eric D. Peterson, MD, MPH.

## FACULTY CONTRIBUTIONS

### Among the Duke Heart Center faculty members who hold national and international leadership positions are:

**Karen P. Alexander, MD**

PCPI CAD/HTN Committee; PCPI Quality Measures Committee; AMA  
Member, AHA Older Populations Committee  
Member, ACC Committee for Cardiovascular Care of Older Adults

**Sana M. Al-Khatib, MD, MHS**

Vice Chair, ACCF Electrophysiology Committee  
Vice Chair, Heart Rhythm Society Health Policy Committee  
Chair, Heart Rhythm Society Quality Improvement Sub-Committee

**Solomon Aronson, MD**

President-Elect, Society of Cardiovascular Anesthesiologists

**Thomas M. Bashore, MD**

Chair, Cardiac Catheterization Laboratory Standards  
Consensus Document, ACC/ Society for Cardiovascular Angiography and Interventions

**Robert M. Califf, MD**

Distinguished Scientist Award 2009, AHA  
Editor-in-Chief, *American Heart Journal*

**Thomas A. D'Amico, MD**

Chair, Board of Directors, National Comprehensive Cancer Network  
Chair, General Thoracic Biology Club, American Association for Thoracic Surgery  
Secretary, Board of Directors, Thoracic Surgery Foundation for Research and Education

**Victor J. Dzau, MD**

Research Achievement Award 2010, AHA

**Geoffrey S. Ginsburg, MD, PhD**

Board of External Experts, NHLBI  
Secretary of Veterans Affairs Advisory Council on Genomic Medicine  
Institute of Medicine's Roundtable on Genome-Based Research to Human Health  
National Advisory Council for Human Genome Research, NHGRI  
External Advisory Committee, Pharmacogenetics Research Network, NIGMS

**Christopher B. Granger, MD**

Chair, AHA *Mission: Lifeline Advisory Working Group*  
Member, AHA Scientific Publication Committee  
Member, ACC AHA STEMI Guidelines Committee  
Member, NHLBI Board of External Advisors

**David H. Harpole Jr., MD**

Director, American Board of Thoracic Surgery  
Chair, Thoracic Diseases Steering Committee, National Cancer Institute

**Robert A. Harrington, MD**

Chair, FDA Cardiovascular and Renal Drugs Advisory Committee 2009-2010  
Member, ACC Board of Trustees, 2010-15  
Chair, ACC Education Oversight Committee  
Vice Chair, AHA Scientific Sessions 2011-12  
Chair, AHA Scientific Sessions 2013-14

**James G. Jollis, MD**

Chair, D2B *Sustain the Gain* Initiative, ACC  
Chair, *Mission: Lifeline Science* Task Force, AHA

**Ronald J. Kanter, MD**

International Board of Heart Rhythm Examiners

**William E. Kraus, MD**

American College of Sports Medicine, Board of Trustees, 2010-2013

**Mitchell W. Krucoff, MD**

Special Government Employee, U.S. FDA  
Co-Director, Japan-USA Harmonization By Doing Program  
Co-Director, Cardiac Safety Research Consortium Critical Path Programs

**Robert J. Lefkowitz, MD**

Research Achievement Award 2009, AHA

**Jennifer S. Li, MD**

Executive Committee, NHLBI Pediatric Heart Network  
Co-Chair, Pediatric Heart Network Finance Committee  
Sub-Board of Pediatric Cardiology, American Board of Pediatrics

**Daniel B. Mark, MD, MPH**

Editor, *American Heart Journal*

**L. Kristin Newby, MD, MHS**

Vice Chair (Chair-Elect), Council on Clinical Cardiology, AHA

**Christopher M. O'Connor, MD**

Program Chair, Heart Failure Society of America  
FDA Working Group: Acute Heart Failure Syndromes—Clinical Trials  
NIH/NHLBI Working Group: Emergency Department Management of Heart Failure  
NIH/NHLBI Working Group: Cardiac Transplantation Workshop and Guidelines Committee

**Manesh R. Patel, MD**

Vice Chair, AHA Diagnostic and Invasive Cath Committee  
Chair, Writing Committee, ACCF/SCAI/STS/AATS/ASNC Appropriateness Criteria for Coronary Revascularization  
Member, ACC Task Force, Appropriate Use Criteria  
Writing Committee, AHA/ACC CABG Guidelines Committee  
Writing Committee, AHA/ACC Performance Measures for PCI

**Eric D. Peterson, MD, MPH**

Chair, Quality of Care and Outcomes Research Interdisciplinary Council, AHA  
Incoming Chair, ACC/AHA Performance Measures Task Force  
Vice Chair, 2020 Strategic Planning Committee, AHA

**Mihai V. Podgoreanu, MD**

Presidential Scholar Award 2009, American Society of Anesthesiologists (ASA); Member, Committee on Excellence in Research, ASA

**Sunil V. Rao, MD**

SCAI Representative, National Quality Forum  
Member, TCT Scientific Committee

**John F. Rhodes Jr., MD**

Manuscript Committee, CCISC Science Registry; Society for Cardiovascular Angiography and Interventions Representative/Training Guideline Reviewer, Structural Heart Disease Council  
Member, ACC Structural Sessions Organizing Committee

**Matthew T. Roe, MD, MHS**

ACC Positions:  
National Cardiovascular Data Registry (NCDR)—ACTION Registry, Chairman of Research and Publications Sub-Committee, 2007-2010  
NCDR—Cath/PCI Registry  
NCDR—Scientific Oversight Committee: 2010-Present  
NCDR—National Cardiovascular Research Infrastructure Data Standards Workgroup Committee Member: 2010-Present  
NCDR—Public Reporting Measurement Workgroup: 2010-Present

**Peter K. Smith, MD**

Vice Chair, ACC/AHA CABG Guidelines Committee  
Writing Committee, ACCF/SCAL/STS/AATS/ASNC Appropriateness Criteria for Coronary Revascularization  
Relative Value Update Committee, AMA  
ACCF/AHA/PCPI CAD/HTN Committee; PCPI Quality Measures Committee, AMA

**James Tcheng, MD**

Co-Chair, ACC Informatics Committee  
Vice Chair, ACC/AHA Data Standards and Terminology Writing Committee, Cardiovascular Vocabulary for Electronic Health Records





## High-Impact Papers

Hundreds of papers sharing Duke Heart Center research findings, reviews, and analyses are published in peer-reviewed journals each year. Some recent highlights:

### Metabolic profiles linked to heart conditions, early death

The largest of its kind for cardiovascular disease, this Duke-led study is the first to identify specific metabolic profiles linked to coronary artery disease, heart attacks, and early death among patients who have undergone coronary catheterization. (*Shah SH et al. Circ Cardiovasc Genet. 2010 Apr;3(2):207-14*)

### Stem-cell therapy improves exercise capacity in some patients

Phase 2/3 of the Duke-led MARVEL trial showed that injecting myoblast cells into damaged cardiac tissue enabled post-MI patients with advanced HF patients to walk significantly farther in six minutes than they could before undergoing the therapy. Similar patients treated with placebo walked less than their initial distance. (*Presented at the September 2009 Heart Failure Society of America meeting*)

### Metabolic monitoring, improved protective methods recommended for surgical patients

This Duke-led study suggests significant changes in cardiac fuel uptake during bypass surgery depend upon preexisting ventricular function—and recommends perioperative metabolic monitoring and optimization of multimodal cardioprotective strategies for cardiac surgical patients. (*Turer AT et al. Circulation. 2009 Apr 7;119(13):1736-46*)

### Longer hospital stays may benefit heart failure patients

The Duke-led OPTIMIZE-HF study of hospital-based care linked shorter hospital stays with increased readmissions and at-home death among heart failure patients who receive Medicare. (*Hernandez AF et al. JAMA. 2010 May 5;303(17):1716-22*)

### Patients with connective-tissue disorders undergo first-ever aortic replacements

Duke thoracic aortic surgeons performed the first-ever two-stage total cardioaortic replacement for the Marfan syndrome<sup>1</sup>, as well as the first two-stage total aortic replacement for Loeys-Dietz syndrome<sup>2</sup>.

<sup>1</sup>Rajagopal K et al. *J Heart Lung Transplant. 2009 Sep;28(9):958-63*

<sup>2</sup>Williams ML et al. *J Card Surg. 2010 Mar;25(2):223-4*

### Heart failure patients benefit greatly from continuous-flow LVAD destination therapy

Advanced HF patients who participated in the Heart-Mate II Destination Therapy Trial, co-authored by Duke Heart Center faculty, suffered significantly fewer strokes and underwent far fewer device-replacement surgeries after two years when compared to patients implanted with pulsatile devices. (*Slaughter MS et al. N Engl J Med. 2009 Dec 3;361(23):2241-51*)

### ICDs can be clinically effective among older HF patients

This Duke-led study showed lower risk-adjusted long-term mortality among Medicare recipients hospitalized with heart failure (maximum left ventricular ejection fraction of 35 percent) chosen for ICD therapy compared to similar patients who did not receive ICDs.

(*Hernandez AF et al. Circ Heart Fail 2010;3;7-13*)

### Hybrid repair may represent a key advance in treating aortic-arch aneurysms

At mid-term patient follow-up of this Duke-led study, hybrid repair of transverse aortic-arch aneurysms appeared safe and effective—and may be an important advancing in treating these life-threatening events.

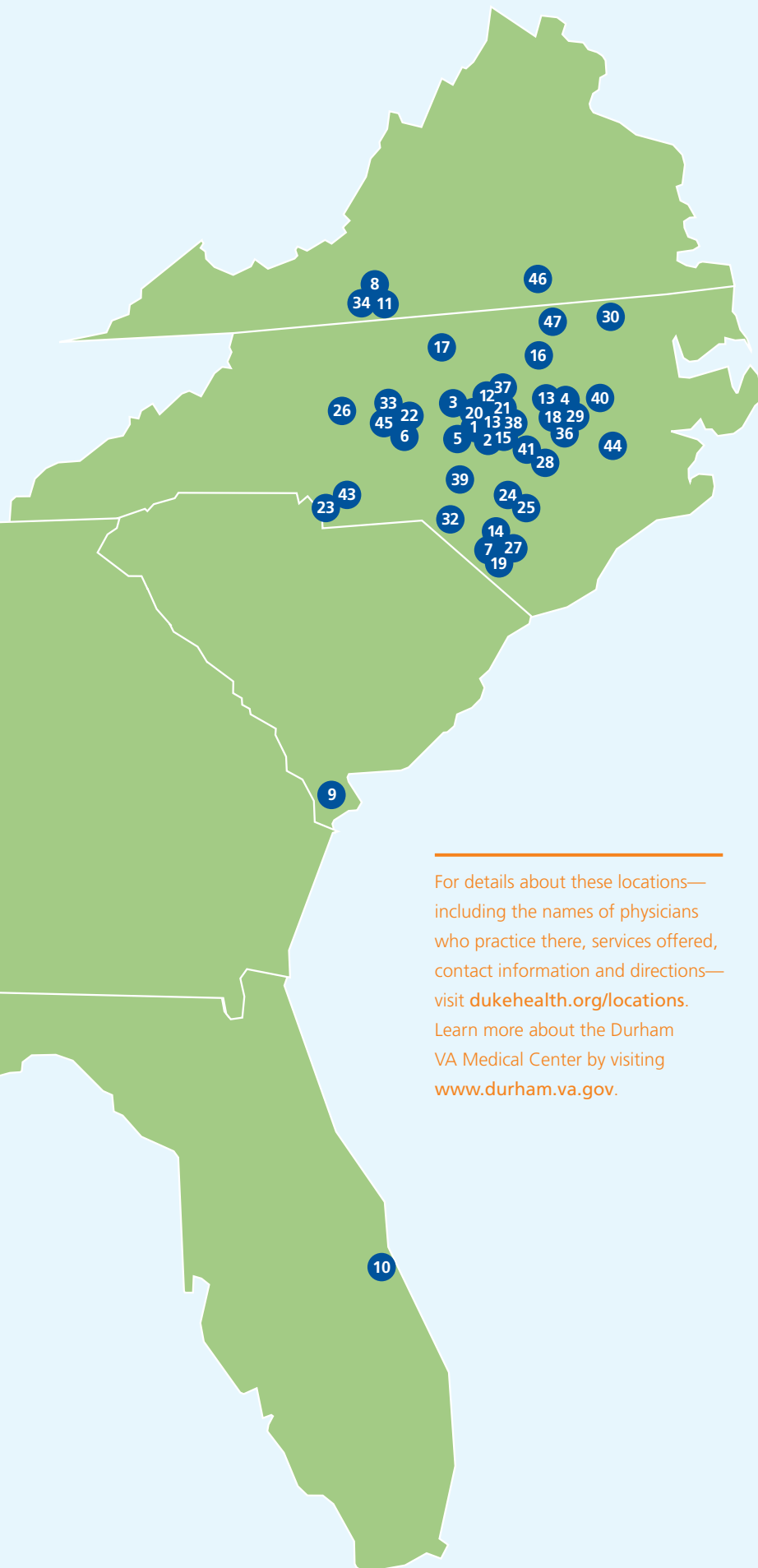
(*Hughes GC et al. Ann Thorac Surg. 2009 Dec;88(6):1882-7*)

### Better pre-angiography triage needed to detect CAD risk

A four-year study showed that only one-third of the 398,978 patients who underwent elective catheterization to assess their risk for coronary artery disease (CAD) had the disease—suggesting that better clinical strategies are needed to stratify risk and increase the diagnostic yield of non-invasive methods among suspected CAD patients.

(*Patel MR et al. N Engl J Med. 2010 Mar 11;362(10):886-95*)

# LOCATIONS ACROSS THE SOUTHEAST



For details about these locations—including the names of physicians who practice there, services offered, contact information and directions—visit [dukehealth.org/locations](https://dukehealth.org/locations). Learn more about the Durham VA Medical Center by visiting [www.durham.va.gov](https://www.durham.va.gov).

## DUKE UNIVERSITY HEALTH SYSTEM HOSPITALS

1. Duke University Hospital, Durham NC<sup>1,2</sup>
2. Duke Children's Hospital & Health Center, Durham NC<sup>1</sup>
3. Durham Regional Hospital (NC)<sup>2</sup>
4. Duke Raleigh Hospital (NC)

## MEDICAL CENTER STAFFED BY DUKE HEART CENTER PHYSICIANS

5. Durham VA Medical Center (NC)

## DUKE HEART CENTER-AFFILIATED MEDICAL CENTERS

6. Alamance Regional Medical Center, Burlington NC
7. Southeastern Regional Medical Center, Lumberton NC<sup>2</sup>
8. Danville Regional Medical Center, Danville VA<sup>2</sup>
9. Beaufort Memorial Hospital, Beaufort SC
10. Indian River Medical Center, Vero Beach FL<sup>2</sup>

## CARDIOLOGY AND CARDIOTHORACIC SURGERY COMMUNITY-BASED PRACTICES

11. Cardiothoracic Surgery of Danville (VA)
12. Duke Adult Congenital Heart Disease Clinic at North Duke Street, Durham NC
13. Duke Adult Congenital of Raleigh at Wake Heart & Vascular Associates (NC)
14. Duke Cardiology and Cardiovascular Surgery of Lumberton (NC)
15. Duke Cardiology Consultative Clinic (Duke Clinic 2J)
16. Duke Cardiology Consultative Clinic at Granville Medical Center, Oxford NC
17. Duke Cardiology Consultative Clinic at Person Memorial Hospital, Roxboro NC
18. Duke Cardiology of Raleigh (NC)
19. Duke Cardiology Subspecialty Clinic, Lumberton NC
20. Duke Cardiothoracic Surgery (Duke Clinic 2B)
21. Duke Center for Living (Wallace Clinic), Durham NC
22. Duke Children's Cardiology of Burlington, Alamance Regional Medical Center (NC)<sup>1</sup>
23. Duke Children's Cardiology of Charlotte at Presbyterian Pediatric Cardiology (NC)<sup>1</sup>
24. Duke Children's Cardiology of Fayetteville (NC)<sup>1</sup>
25. Duke Children's Cardiology of Fort Bragg at Womack Army Medical Center (NC)<sup>1</sup>
26. Duke Children's Cardiology of Greensboro (NC)<sup>1</sup>
27. Duke Children's Cardiology of Lumberton at Lumberton Children's Clinic (NC)<sup>1</sup>
28. Duke Children's Cardiology of Morrisville (NC)<sup>1</sup>
29. Duke Children's Cardiology of Raleigh (NC)<sup>1</sup>
30. Duke Children's Cardiology of Roanoke Rapids at Halifax Regional Medical Center (NC)<sup>1</sup>
31. Duke Children's Hospital & Health Center, Durham NC<sup>1</sup> (see #2)
32. Duke Children's Cardiology of Laurinburg at Scotland Memorial Hospital (NC)<sup>1</sup>
33. Duke Electrophysiology Consultative Clinic at Kernodle Clinic, Burlington NC
34. Duke Electrophysiology Consultative Clinic at Danville Regional Medical Center (VA)
35. Duke Electrophysiology Clinic (Duke Clinic 2J) (see #15)
36. Duke Electrophysiology Consultative Clinic of Raleigh (NC)
37. Duke Health Center at North Duke Street, Durham NC
38. Duke Health Center at Southpoint, Durham NC
39. Duke Health Center of Sanford (NC)
40. Duke Medical Plaza Knightdale (NC)
41. Duke Medical Plaza Morrisville (NC)
42. Duke Vascular Surgery (Duke Clinic 2B) (see #20)
43. NorthEast Cardiovascular, Concord, NC <sup>2</sup>

<sup>1</sup>Serves pediatric patients <sup>2</sup>Performs cardiovascular surgery

## LIFE FLIGHT SATELLITE LOCATIONS

44. Johnston Memorial Hospital (Johnston County Airport), Smithfield NC
45. Alamance Regional Medical Center (Burlington-Alamance Regional Airport), Burlington NC

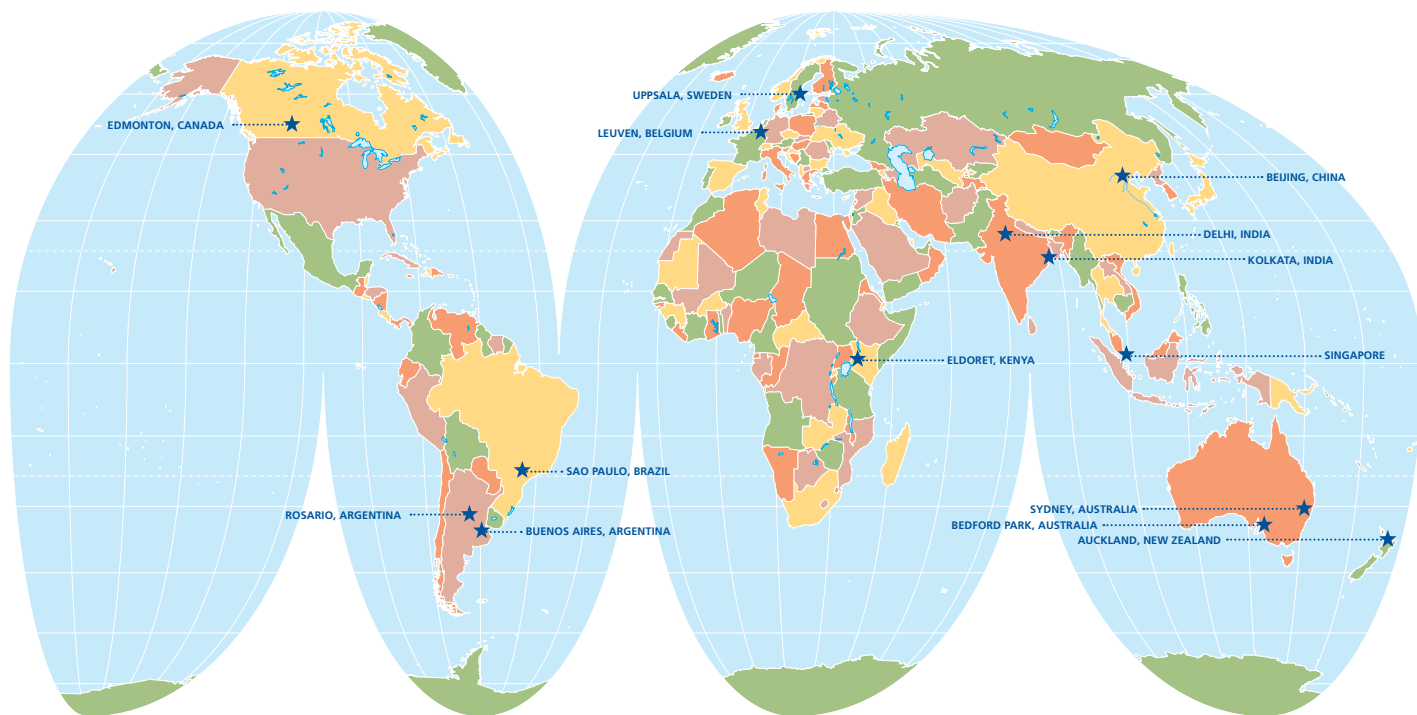
## MOBILE CARDIAC CATHETERIZATION SITES

46. Community Memorial Healthcenter, South Hill VA
47. Maria Parham Medical Center, Henderson NC



## GLOBAL INITIATIVES

Duke Heart Center has forged robust clinical and research collaborations to combat the growing international epidemic of cardiovascular disease—part of Duke Medicine’s ongoing commitment to improve global health.



- The Duke-National University of Singapore Graduate Medical School ([duke-nus.edu.sg](http://duke-nus.edu.sg)) is building key research and clinical areas, including a cardiovascular program housed in Singapore General Hospital where Duke Heart Center faculty will offer cardiovascular subspecialty training.
- The Duke-Peking University Health Science Center (PUHSC) Cardiovascular Training Center comprises research and clinical programs jointly supported by the China Medical Board and Duke Heart Center. The effort is part of a broader Duke-PUHSC partnership to advance clinical care

- and medical management practices in the Beijing, China region.
- The Virtual Coordinating Centre for Global Collaborative Cardiovascular Research ([vigour.dcri.duke.edu](http://vigour.dcri.duke.edu)) is a clinical research collaboration co-founded by the Duke Clinical Research Institute, with partners in Canada, Europe, South America, Australia, and New Zealand.
- Duke Clinical Research Institute faculty members are co-leading Brazilian Clinical Research Institute (BCRI) cardiovascular initiatives, while other Duke faculty serve on BCRI’s advisory board.

- With grants from the NHLBI, Duke Heart Center faculty, in conjunction with the George Institute for International Health, are establishing Centers of Excellence in Kenya and China to prevent and treat cardiovascular and pulmonary disease in rural areas.
- Heart Center faculty are engaged in additional international efforts through the Duke Global Health Institute ([dghi.duke.edu](http://dghi.duke.edu)), including cardiovascular disease research and education initiatives in India, China, and Kenya.

### DUKE HEART CENTER LOCATIONS BY THE NUMBERS

#### 5 HOSPITALS

Duke University Hospital  
 Duke Children’s Hospital & Health Center  
 Durham Regional Hospital  
 Duke Raleigh Hospital  
 Durham VA Medical Center\*

\*Not part of Duke University Health System

#### 33 COMMUNITY-BASED PRACTICES

#### 5 AFFILIATED MEDICAL CENTERS

#### 4 GLOBAL OUTREACH SITES

National Heart Centre, SingHealth, Singapore—Research collaborations and physician training in clinical research ([www.nhcs.com.sg](http://www.nhcs.com.sg))

National University Heart Centre, National University Health System, Singapore—Research collaborations, physician training in subspecialty clinical cardiology and research ([www.nuhcs.com.sg](http://www.nuhcs.com.sg))

First Hospital, Peking University, Beijing, China—Research collaborations, clinical and research training for physicians and staff (<http://english.bjhb.gov.cn>)

ASANTE Cardiopulmonary Center of Excellence, Eldoret, Kenya—In partnership with the Moi University School of Medicine, Duke Heart Center fellows and consulting faculty are conducting research with and training faculty and staff.



An internationally recognized leader in cardiovascular care, research, and education, Duke Heart Center delivers innovative, evidence-based care to inpatients and outpatients of all ages across Duke University Health System and at 33 community-based practices and five affiliated medical centers throughout the Southeast.

Duke Heart Center volumes are among the nation's highest, and despite the complex patient populations we serve, outcomes are outstanding. Our patients benefit from expert care, state-of-the-art technologies, and

access to an array of novel therapies through Duke's active clinical trials program.

Learn more about Duke Heart Center's clinical services and site-based research in the pages that follow.

### PROCEDURE VOLUMES

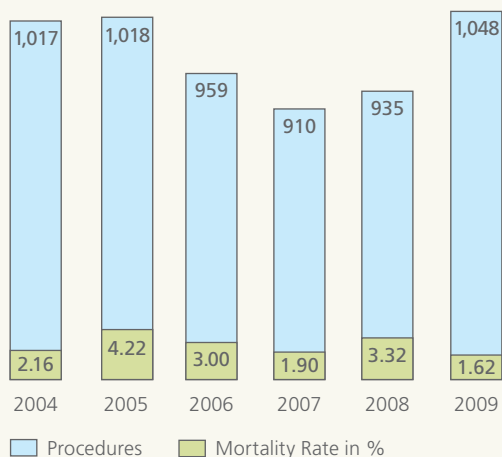
Duke University Health System, CY09



\*Diagnostic and interventional \*\*Non-invasive arterial and carotid, plus diagnostic and interventional peripheral and carotid. For details, see pages 10, 12, 17, and 23.

### HEART SURGERY VOLUMES AND MORTALITY

Duke University Medical Center, 2004-09

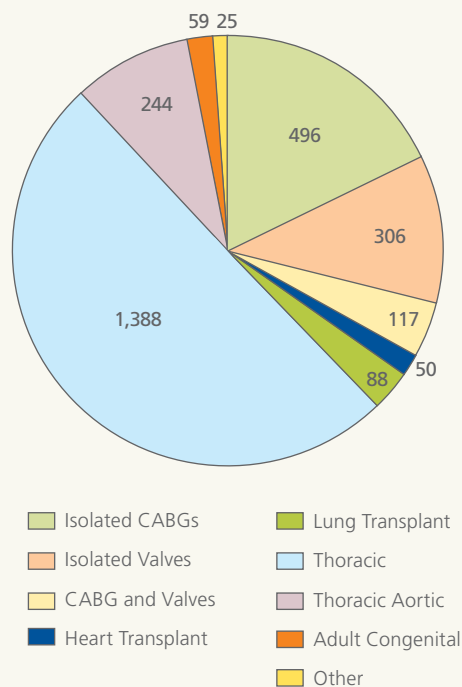


With more than 1,000 open-heart procedures annually, Duke's volumes far exceed those suggested by national guidelines—and survival rates consistently exceed Society of Thoracic Surgeons benchmarks. See page 33 for procedure volumes at Duke Heart Center affiliate sites.

See pages 26-27 for pediatric surgery volumes.

### CARDIOVASCULAR AND THORACIC SURGERY VOLUMES

Duke University Medical Center, CY09



**Duke's Division of Cardiovascular and Thoracic Surgery surpasses all national minimum-volume recommendations.**



# 26,374 adult echocardiography studies in 2009, one of the nation's highest volumes.

Includes all transesophageal and stress echocardiograms performed and interpreted by Duke cardiology faculty at Duke-operated labs in calendar year 2009, including OR and research studies. Does not include intracardiac, pediatric, or VA Medical Center procedure volumes.

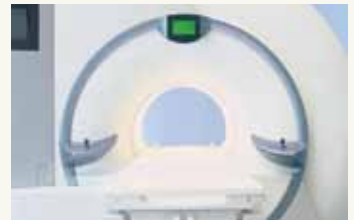
## IMAGING AND DIAGNOSTIC SERVICES Co-Medical Directors: Raymond J. Kim, MD, and Eric J. Velazquez, MD

A vast array of modalities, some of the world's highest volumes

Duke Heart Center offers a complete range of cardiovascular imaging and diagnostic techniques—and more than 30 specialists in all areas of non-invasive and invasive cardiac imaging. In addition to 3-D echocardiography (available in all Duke ORs), positron emission tomography (PET), computed tomography (CT), and CT angiography (CTA), we offer innovative modalities such as:

- **Echocardiography**—Includes intracardiac and intracoronary echo, chest-wall echo, and real-time 3-D transesophageal echo (TEE)—all with Doppler flow
- **Virtual histology coronary imaging**—Available during cardiac catheterization, along with optical coherence tomography, to assess endothelial growth. Recent advances in measures of ventricular contraction patterns and function include the use of stress-strain imaging and speckle tracking.
- **Nuclear imaging**—Includes gated myocardial perfusion single-photon emission computed tomography (SPECT-MPI); gated-pool blood scanning (MUGA radionuclide angiography studies); and novel pharmacologic agents, such as selective A2A receptor agonists. Home to a PET facility dedicated to assessing myocardial metabolic activity and perfusion.
- **Low-radiation studies** of coronary, cardiac, and vascular angiography
- **Peripheral vascular imaging**—Includes invasive and non-invasive x-ray angiography with radiographic dye; CT and MR angiography; vascular ultrasound; ankle-brachial index (ABI) measurement; evaluation of carotid, renal, abdominal, and leg vasculature; and peripheral-flow studies

In addition, our physicians have a growing interest in the use of **metaiodobenzylguanidine (MIBG) imaging** in helping to assess arrhythmia risk.



The Duke Cardiovascular Magnetic Resonance (MR) Center, **the nation's first and largest dedicated program of its kind**, performs about 3,200 procedures each year—among the world's highest annual volumes—including cine, stress-testing, velocity-flow quantification, and MR angiography techniques that do not require gadolinium contrast and are safe in patients with kidney disease. **Duke developed the pioneering delayed-enhancement imaging technique**, which can distinguish irreversible damage from damage with potential for recovery when used in conjunction with cardiac MR.

### HIGHLIGHT

#### Images at clinicians' fingertips

Heart Center clinicians now have secure access to every cardiac image rendered at every Duke hospital, clinic, and affiliated medical center. Viewing software on virtually all of the health system's 5,000 workstations offers providers a clear, comprehensive clinical picture of patients whenever and wherever they need it.

### RESEARCH

- Duke is one of three U.S. "Visions" sites developing and evaluating the Volcano Corporation's new **catheter-based, non-radiographic vascular imaging** technologies.
- Several studies are evaluating the use of **cardiac MRI** for improved diagnosis and prognostic implications of "silent" heart attacks and rare diseases of the heart muscle.
- An analysis of more than 400,000 digital echocardiographic studies performed at Duke since the early 1990s aims to improve quantitative reference values for **echo imaging** among a

diverse range of patients with and without significant heart disease.

- In collaboration with Duke Biomedical Engineering, an ongoing project aims to develop the **next generation of full-volume, high-frequency, real-time 3-D ultrasound technology**.
- The nuclear imaging and arrhythmia management teams are collaboratively testing novel methods of dyssynchrony evaluation—and have developed a risk-stratification algorithm for sudden cardiac death.

**SITE-BASED RESEARCH DIRECTOR**  
Eric J. Velazquez, MD

### STRESS-IMAGING PROCEDURE VOLUMES, CY2009

Stress Echos	3,943
Cardiovascular MRIs	2,813
Nuclear Imaging Tests	8,495

Stress echo and nuclear imaging volumes for Duke University Hospital, Duke Clinic, and Duke Health Centers at Southpoint and North Duke Street. MRI volumes for Duke University Hospital and Duke Clinic.



## ACUTE CARDIAC CARE Co-Medical Directors: Christopher B. Granger, MD, and L. Kristin Newby, MD

Nation's top MI unit, an innovator in expediting national care in the field

Duke Heart Center boasts an Acute Cardiac Care team that is advancing the field and improving outcomes through improvements in care—such as **routine use of therapeutic hypothermia** and new models of care delivery, including RACE-ER and a hotline (page 40) that expedites treatment.

### Continued growth for RACE-ER\*

Launched in 2003 by Duke Heart Center and named a 2007 **AHA top-10 research advance**, RACE-ER was the first statewide initiative to bring about significant system-wide improvement in heart-attack care. The effort advanced MI care in North Carolina by creating a statewide system of rapid coronary artery reperfusion delivery to patients with ST-elevation MI (STEMI).

Now involving 120 hospitals and 540 EMS agencies in all 100 NC counties, RACE-ER ([race-er.org](http://race-er.org)) has improved virtually all “initial medical contact to re-establishing blood flow” times.

RACE-ER began **rolling out nationwide in 2009 as *Mission: Lifeline***, thanks to a **\$20 million-plus AHA grant**. And with support from the Medtronic Foundation, the program will soon incorporate therapeutic hypothermia and primary PCI in a bid to improve cardiac-arrest survival in North Carolina by 50 percent.

\* Reperfusion of Acute Myocardial Infarction in North Carolina Emergency Departments-Emergency Response

**RACE-ER ([race-er.org](http://race-er.org)) has improved virtually all “initial medical contact to re-establishing blood flow” times. Notably, increasing numbers of North Carolinians identified as having suffered MIs are immediately transported to the most appropriate center after they dial 911.**

Duke University Hospital's 16-bed Cardiac Care Unit (CCU) is one of the nation's top MI care units, serving some 1,700 critically ill patients each year.

Duke Heart Center implants muscular ventricular septal defect devices and offers a ventricular septal-rupture device to select acute MI patients.

## RESEARCH

Duke faculty are engaged in a number of research studies to develop and evaluate best practices for managing acute coronary syndromes and heart attacks.

- Current clinical trials include **Appraise 2** and **SOLSTICE**, which are evaluating the use of novel anticoagulant apixiban and enzyme inhibitor losmapimod, respectively, after acute MI.
- **TRANSLATE-ACS**, an observational registry study, will evaluate ADP receptor therapy after acute coronary syndrome.
- RACE-ER program members created the **Cath-Lab Activation Registry**, and

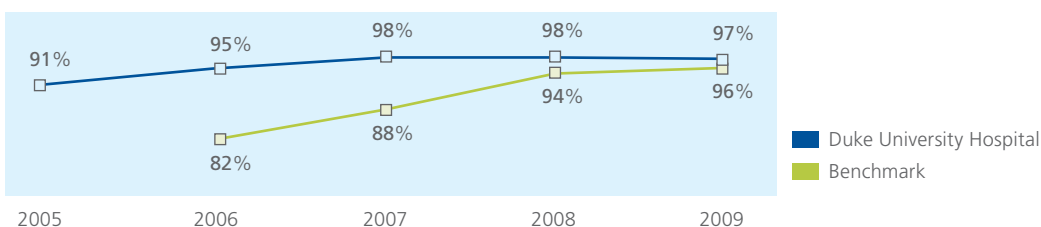
Duke is **the only U.S. center investigating how to best minimize inappropriate cath-lab activations.**

- Follow-up studies of a 2007 Duke discovery of a gene variant strongly linked to early heart attack

### SITE-BASED RESEARCH DIRECTOR

L. Kristin Newby, MD, MHS

## OPTIMAL CARE QUALITY SCORE FOR ACUTE MYOCARDIAL INFARCTION



Ninety-seven percent of eligible acute MI patients treated at Duke University Hospital between Q4 2008 and Q4 2009 received “optimal care,” measures of high-quality care tracked by the Centers for Medicare and Medicaid Services. Duke's score is substantially higher than the benchmark, the average score for all reporting North Carolina hospitals. Learn more at [dukehealth.org/quality](http://dukehealth.org/quality). Source: NC Hospital Quality Performance Report. Benchmark data not available for 2005.



J. Kevin Harrison, MD (right), and interventional cardiology fellow Sandeep Hindupur, MD, perform a catheterization.

## PERCUTANEOUS INTERVENTIONS (PCI) Co-Medical Directors: J. Kevin Harrison, MD, and Manesh R. Patel, MD

Among the nation's largest, most experienced interventional catheterization programs

Duke Heart Center's nationally recognized PCI team performs approximately 3,200 interventional cardiac catheterizations every year, using the most advanced, evidence-based technologies.

- 24-hour immediate access to interventional cardiologists for regional physicians and patients
- Hybrid PCI-plus-valve repair and replacement, performed in Duke's state-of-the-art hybrid OR (page 19)
- Transradial catheterization
- Aortic and mitral balloon valvuloplasty
- Intracardiac, transthoracic, and transesophageal echocardiography
- Laser ablation and rotoblator atherectomy for total coronary and peripheral occlusions
- Intravascular ultrasound and coronary pressure-wire assessment
- Percutaneous treatment of congenital cardiac defects (page 26)
- AngioJet thrombectomy and extraction catheters
- Dedicated Hypertrophic Obstructive Cardiomyopathy Clinic offers medical management, catheter-based alcohol septal ablation, and surgery
- Percutaneous left ventricular support devices, including Impella and Tandem-Heart.

### In 2009, *Medical Economics* named Duke Heart Center an interventional cardiology Center of Excellence



In April 2009, only six months after Wes Brown had passed a routine stress test, a blood clot blocked his proximal left anterior descending

coronary artery. The resulting ventricular fibrillation put the 57-year-old into cardiac arrest twice before he arrived at Duke University Hospital. There he was rushed to the cath lab for placement of an arterial stent—and later had an ICD implanted, as well. Today, after completing cardiac rehabilitation at Duke, he is fully recovered. "I enjoyed compassionate, professional care at every turn," says Brown, an associate dean at Duke Divinity School. "There is an Irish proverb that says, 'God likes help when helping people.' Divine intervention through Duke expertise continues to amaze me and to sustain the quality of my life."

#### RESEARCH

Duke takes part in scores of major clinical trials for novel cardiac-catheterization drugs and devices, including:

- **EXCEL**—A first-of-its kind evaluation of left main stenting as an alternative to open-heart surgery, performed in conjunction with Duke cardiothoracic surgeons
- **Volcano "Visions"**—One of only three U.S. sites developing novel catheter-based, non-radiographic vascular imaging technologies (page 10)
- **EVEREST II**—One of only two NC sites comparing surgical intervention with percutaneous mitral-valve repair (page 18)
- **PROTECT 2**—Comparing Impella 2.5 VAD to intra-aortic balloon pump
- **CRISP-AMI**—Comparing ventricular balloon pump to standard of care

To learn more, dial 919-660-6604.

**SITE-BASED RESEARCH DIRECTOR**  
Manesh R. Patel, MD

#### CARDIAC CATHETERIZATION LAB PROCEDURE VOLUMES

Diagnostic (coronary and peripheral)	12,593
Interventional (coronary and peripheral)	3,185
Valve/Congenital	619

Volumes for Duke University Health System and affiliate sites; calendar year 2009



## CORONARY ARTERY BYPASS GRAFTING (CABG) Chief: Peter K. Smith, MD

Outstanding outcomes, more than 20,000 patients

Since performing North Carolina's first CABG surgery in 1966, Duke Heart Center's cardiac surgeons have produced consistently exceptional patient outcomes—with survival rates significantly higher than what is expected in a patient population as complex as ours. Our surgeons perform an array of proven minimally invasive procedures, each of which offers different benefits to carefully chosen patients. These procedures include:

- **Hybrid CABG**—Part minimally invasive surgery, part percutaneous transluminal coronary angioplasty, this innovative procedure is now being performed in the new hybrid OR (page 19).
- **Port-access (“keyhole”) CABG**—Performed with a heart-lung bypass machine through small ports or incisions
- **Minimally invasive direct coronary artery bypass (MIDCAB)**—Beating-heart bypass performed through small ports or incisions
- **Robotic CABG**—Beating-heart bypass performed endoscopically with a surgical robot
- **Off-pump CABG**—Beating-heart bypass, without a heart-lung bypass machine. About 10 percent of Duke's CABG procedures are off-pump.

Duke is a U.S. leader in arterial grafting, a complex procedure that extends the life of CABG surgery. Ninety-seven percent of our patients with blockages of the left anterior descending coronary artery undergo arterial grafting—with vessels typically harvested via minimally invasive endoscopy, not open incisions. Our surgeons endoscopically perform nearly all saphenous-vein harvesting with “Band-Aid incisions”—and also offer endoscopic radial-artery harvesting and robotic thoracic-artery harvesting.

### RESEARCH

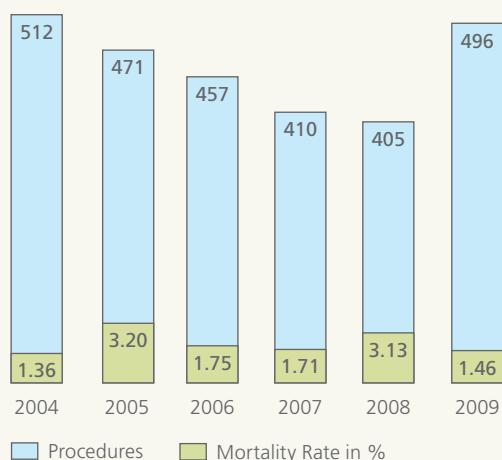
- **STICH 2**, now under way, is comparing CABG to medical therapy in patients with ischemic HF.
- Duke has been awarded an NHLBI Challenge Grant to establish the role of **hybrid coronary revascularization\*** in joint cardiology-surgery practice—a transformational approach that will promote optimal care among patients with coronary artery disease.
- Currently enrolling patients in trials to determine the best surgical approach to **ischemic mitral regurgitation** associated with operable coronary disease.

\*Minimally invasive off-pump arterial grafting of the left anterior descending artery and simultaneous stenting of other coronary lesions

**SITE-BASED RESEARCH DIRECTOR**  
Peter K. Smith, MD

Duke surgeons perform bypass grafting at Duke University Hospital, Durham Regional Hospital, and Heart Center affiliates Danville Regional Medical Center, Southeastern Heart Center, and Indian River Medical Center (page 6).

### PRIMARY ISOLATED CABG VOLUMES AND MORTALITY



Data are for Duke University Medical Center, 2004-2009. Duke's annual CABG volumes consistently exceed those recommended by the AHA and ACC as indicators of care quality.



Cardiothoracic surgeon Peter K. Smith, MD, scrubs up before a procedure.

# STATE-OF-THE-ART THERAPIES FOR FAILING HEARTS

Co-Medical Directors: Carmelo A. Milano, MD, and Joseph G. Rogers, MD

From evidence-based medical management to customized destination ventricular assist device therapy

## Heart Failure

Number one in the nation in outcomes, volumes, and research

The Duke Heart Failure (HF) Program treats more than 3,600 HF patients each year, using a renowned disease-management approach shown to increase the use of evidence-based treatments while reducing inpatient admissions, length of stay, and cost. We offer a range of state-of-the-art therapies and technologies tailored to each patient's illness and preferences, including innovative ventricular assist devices, ultrafiltration therapy for managing cardiorenal syndrome, and a collaborative clinic dedicated to optimizing cardiac resynchronization devices.

### HIGHLIGHT

#### MARVEL: Stem cells show therapeutic potential

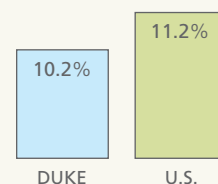
Phase 2/3 results\* of the Duke-led MARVEL trial showed that injecting myoblast cells into damaged heart tissue dramatically improves exercise capacity for post-MI patients with advanced heart failure. Patients who received the therapy walked 91 meters further in six

minutes than they did before receiving the injections—while similar patients treated with placebo walked nearly four meters less than they did initially. Duke is now designing similar studies for patients with refractory angina and ischemic cardiomyopathy.

\*Presented, September 2009 Heart Failure Society of America meeting

Duke University Hospital has been recognized at the Gold Level for success in implementing the American Heart Association's Get With the Guidelines quality initiative for heart failure care.

### 30-DAY RISK-STANDARDIZED MORTALITY FOLLOWING HOSPITALIZATION FOR HEART FAILURE



Data for July 1, 2008, to June 30, 2009. These percentages were calculated from Medicare data on patients discharged from Duke University Hospital and do not include patients with Medicare Advantage plans or those without Medicare. Source: Hospital Quality Alliance.

### RESEARCH

- The Duke Heart Failure Program is one of only nine U.S. sites of the NIH-sponsored **Heart Failure Clinical Research Network**. Recent Duke-led studies include:
  - **HF-ACTION**<sup>1</sup>—A landmark trial showing that exercise is safe and improves quality of life for many HF patients
  - **OPTIMIZE-HF**<sup>2</sup>—Shorter hospital stays linked to more readmissions and at-home death
  - **DOSE**—Results (under peer review) indicate that high diuretic doses can reduce fluid retention without renal damage or reduction in life span in hospitalized HF patients

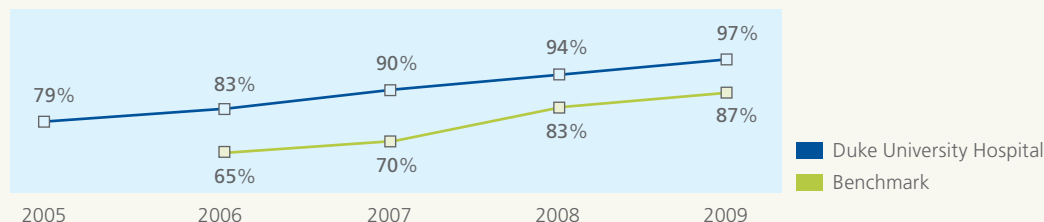
Studies under way at Duke include:

- **COMPARE-HF**—An AHRQ-funded study, conducted in collaboration with the AHA and ACC, comparing the efficacy of aldosterone antagonists, anticoagulants, cardiac resynchronization therapy, and other HF treatments
- **ASCEND-HF**—Largest-ever trial to evaluate the nesiritide efficacy in patients with decompensated HF
- **STICH 2**—See page 13.

<sup>1</sup>JAMA. 2009 Apr 8;301(14):1439-50  
<sup>2</sup>JAMA. 2010 May 5;303(17):1716-22

**SITE-BASED RESEARCH DIRECTOR**  
 G. Michael Felker, MD, MHS

### OPTIMAL CARE QUALITY SCORE FOR HEART FAILURE



97 percent of eligible HF patients treated at Duke between Q4 2008 and Q4 2009 received "optimal care," measures of high-quality care tracked by the Centers for Medicare and Medicaid Services. Duke's score is significantly higher than the benchmark, the average score for all reporting North Carolina hospitals. To learn more, visit [dukehealth.org/quality](http://dukehealth.org/quality). Benchmark data not available for 2005. Source: NC Hospital Quality Performance Report

## Ventricular Assist Devices (VADs)

Duke's Mechanical Circulatory Support Program is certified by The Joint Commission for destination ventricular assist device (VAD) therapy—and was among the first U.S. programs approved by the Centers for Medicare and Medicaid Services to offer it.

We offer VADs both as a temporary bridge to transplant and as permanent HF therapy. Both applications have resulted in excellent outcomes, with a 2009 analysis showing a 75.4 percent two-year survival rate for patients implanted with non-pulsatile devices.

### RESEARCH

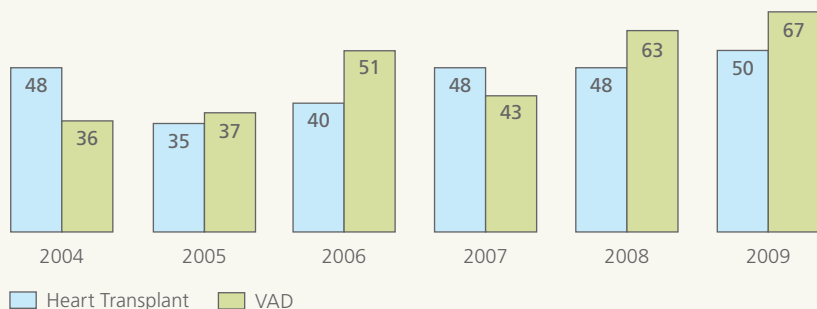
Current protocols include:

- Trials evaluating the use of the **HeartMate II** and **Levitronix CentraMag** LVADs in HF patients
- A trial of the novel centrifugal-flow **HeartWare LVAD** in patients awaiting transplantation. (A trial of this device in patients ineligible for transplant will begin enrolling Duke patients in late 2010.)
- **REVIVE-IT**—NIH-funded trial examining VAD use in patients with less severe HF.

#### SITE-BASED RESEARCH DIRECTORS

Carmelo A. Milano, MD; Joseph G. Rogers, MD; Laura J. Blue, NP

### HEART TRANSPLANT AND VAD\* VOLUMES AT DUKE UNIVERSITY HOSPITAL



In the past decade, Duke has performed 524 adult and 35 pediatric heart transplants—and our surgeons have implanted more than 300 LVADs since 2003, when they implanted North Carolina's first. \*VAD volumes include both bridge-to-transplant and permanent-therapy procedures.

## Heart Transplant

Among the nation's highest volumes and best outcomes, year after year

The top-ranked Duke Heart Transplant Program has performed more than 770 cardiac transplant procedures in both adults and children (page 27) since 1985, with excellent outcomes.

The **Extended Criteria Cardiac Transplant Program** offers transplantation to select patients who do not meet standard criteria. More than 70 performed since 2000, with complication rates and lengths of hospital stays comparable to standard-list transplants.

### RESEARCH

In an effort to increase the number of suitable hearts for transplantation, Duke is conducting pioneering NIH-funded research examining the feasibility of recovering hearts from severely brain-injured patients who experience cardiac arrest after life support has been terminated by their families. Organ donation following cardiac death has successfully increased the number of abdominal organs available

for transplantation, but the hearts are typically discarded. Researchers are utilizing an *ex vivo* perfusion device to serially assess cardiac metabolism and function in hopes of demonstrating cardiac recovery sufficient to allow transplantation.

#### SITE-BASED RESEARCH DIRECTORS

Carmelo A. Milano, MD; Joseph G. Rogers, MD; Laura J. Blue, NP

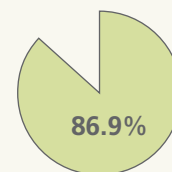
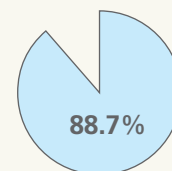


The night she delivered her second set of twins, Durham, NC, attorney Leonor Ortiz Childers, 45, developed acute heart failure.

Soon after, in November 2008, her Duke Heart Center team emergently implanted the HeartMate II LVAD, a sophisticated heart pump that saved her life—and now maintains it. Two years later, Childers continues to do well, regularly sees her Duke LVAD team, and looks forward to the future, when she will be eligible for a heart transplant.

"Duke Heart Center is so much like a second home to me that I recently joined its volunteer program," says Childers. "Helping other patients is the least I can do to repay Duke for giving me more time with my precious children."

### CARDIAC TRANSPLANT: EXCELLENT OUTCOMES



DUKE U.S.

Average patient survival at one year, 1998-2008. 73 percent of patients are alive five years post-transplant (equal to the U.S. average) and 59 percent survive ten years out (U.S. average of 54 percent). For the most current data, visit [ustransplant.org](http://ustransplant.org).





Using the state's only Hansen Sensei X Robotic Catheter System, Patrick M. Hranitzky, MD, performs a catheter ablation on a patient with atrial fibrillation.

## ARRHYTHMIA MANAGEMENT Chief: James P. Daubert, MD

Expertise, experience, and multidisciplinary care found at few other centers

A primary referral center in the Southeast, Duke Heart Center's Electrophysiology (EP) Program offers:

- **Special expertise in complex catheter ablation procedures**, including those used to treat atrial fibrillation (AFib), ventricular tachycardia (VT), and other tachyarrhythmias
- **Four state-of-the-art labs** equipped with the most advanced technologies, including 3-D mapping and recording systems, and actively cooled radiofrequency ablation and percutaneous cryoablation technologies
- A range of minimally invasive procedures, proven medical therapies, cardiac resynchronization therapy, and screening for hereditary disorders
- **The Center for the Prevention of Sudden Cardiac Death**, where research aims to better stratify those at risk
- **Ventricular Tachycardia (VT) Ablation Program** performs catheter ablations for ischemic and non-ischemic VT—and is one of only a handful of centers to offer epicardial catheter ablation, a complex procedure used to treat the 15 to 20 percent of patients whose ventricular arrhythmias occur on the heart's outer surface.
- **Duke Center for Atrial Fibrillation (DCAF)**, where a dedicated multidisciplinary team of specialists is able to manage the symptoms of some 80 percent of our patients with AFib. The center delivers the complete spectrum of AFib therapies—and performs North Carolina's highest volume of catheter ablations for the condition. To learn more, dial 888-HRT-DUKE (888-478-3853) toll-free.

---

Every year, Duke EP performs about **1,600** diagnostic and interventional procedures—and implants more than **480** ICDs and **350** single- and dual-chamber pacemakers.



## HIGHLIGHTS

### Volumes soar for specialized lead-extraction service

Removing the leads from implantable cardiac devices—often due to infection or fractured or dysfunctional leads—requires complex procedures and specialized expertise.

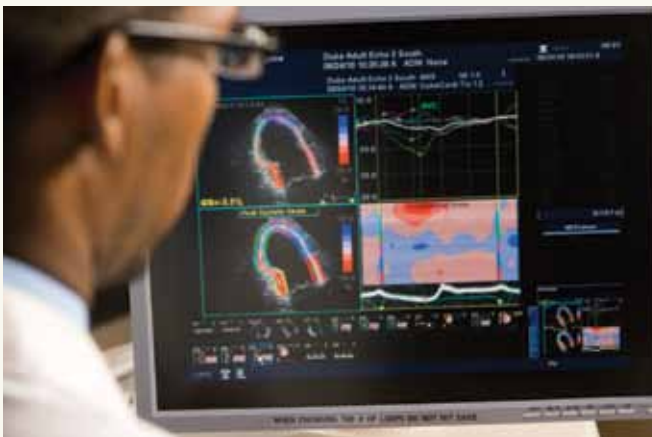
Duke EP houses **one of the Southeast’s busiest** implantable-device lead-extraction programs. In addition to performing “standard” extractions—by advancing a sheath over the lead—the service also performs **laser extractions**.

Lasers easily ablate dense adhesions of scar tissue that can cause leads to stick to tissue and vascular walls, making them difficult to remove. The EP team replaces removed leads when appropriate.

**About 95 percent of patients have their leads removed without the need for open-heart surgery.**

### Unique clinic keeps cardiac resynchronization therapy (CRT) working its best

Duke heart failure, EP, and echocardiography specialists unite in the CRT Optimization Clinic, a new program dedicated to fine-tuning the implanted devices that keep many failing hearts working as they should—and one of only a handful in the nation.



A cardiology fellow monitors the performance of a patient’s pacemaker in the CRT Optimization Clinic.

The clinic sees some of the 35 percent of HF and/or cardiomyopathy patients who develop dyssynchrony that calls for CRT—and helps keep their hearts running smoothly by regularly tuning up (“optimizing”) their devices, as well as by researching methods for doing that better. A key goal is to improve pacemaker function in the approximately one-third of HF patients who don’t respond to the devices.

## RESEARCH

Duke EP research activities include:

- **CABANA\***—Largest-ever clinical trial of its kind will compare catheter ablation to anti-arrhythmic drug therapy in AFib patients. Now enrolling.
- **LAPTOP-HF**—Multi-center trial aims to reduce HF-related hospitalizations. Will employ implantable sensors, hand-held computers, and wireless Internet to monitor patients’ left atrial pressure, the best indicator of HF status and predictor of acute decompensation. Enrolling soon.
- **MADIT-RIT**—International clinical trial will assess the impact of different programming strategies on reducing inappropriate shocks from ICDs and CRT devices. Now enrolling.
- **ROCKET-AF\***—International 1,100-site trial is comparing rivaroxaban to warfarin in preventing thromboembolism among AFib patients.
- **EPGEN**—Biorepository of blood samples and database of clinical information from Duke EP patients that uses genomic, proteomic, and metabolomic data to identify risk factors for sudden cardiac death, AFib, and other arrhythmias.

*\*Coordinated by the Duke Clinical Research Institute.*

### SITE-BASED RESEARCH DIRECTOR

Sana M. Al-Khatib, MD, MHS

### PROCEDURE VOLUMES, Duke University Hospital, CY09

Total EP Procedure Volumes	1,651
Catheter EP Studies	561
Ablations	493
ICD	481
Lead Extractions	101
Biventricular Devices	167
Pacemakers	351

Many valve procedures are performed in Duke's brand-new, state-of-the-art hybrid OR, the first in North Carolina.

**VALVULAR HEART DISEASE** Co-Medical Directors: Thomas M. Bashore, MD, and Donald D. Glower, MD

Leading the world in minimally invasive procedures for more than 20 years

Duke's Valvular Heart Disease Program, among the nation's largest, offers the most innovative, minimally invasive approaches to valve repair and replacement—and has made Duke a global leader in percutaneous valve interventions.

- Robot-assisted surgeries
- Adjunctive and primary minithoracotomy Maze procedures—more than 300 of which have been performed in conjunction with valve surgery
- Percutaneous balloon aortic and mitral valvuloplasty performed for 20-plus years, with one of the nation's highest volumes of balloon valvuloplasty for patients with mitral stenosis
- Aortic valve repair and valve-sparing aortic-root replacement (page 22) for connective-tissue disorders such as the Marfan syndrome

**Renowned mitral-valve service sees consistently excellent outcomes**

Duke Heart Center surgeons have performed more than 5,200 mitral-valve procedures since 1962—experience that translates into remarkably low mortality rates. Offerings include:

- Hybrid procedures uniting percutaneous valve surgery and minimally invasive stent placement—beneficial for patients with both valve and coronary disease
- Investigational percutaneous mitral repair, often for patients at increased surgical risk or who have mitral regurgitation or severe cardiomyopathy
- Balloon valvuloplasty for rheumatic mitral stenosis

**HIGHLIGHT**

**On the forefront of percutaneous pulmonary valve replacement**

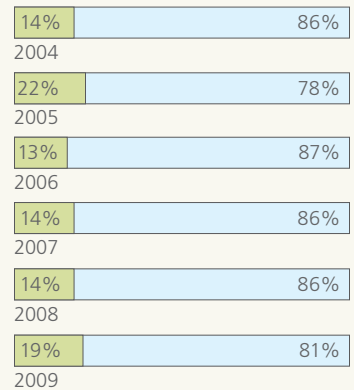
Duke is one of only three U.S. centers participating in the **COMPASSION** trial—implanting the Edwards SAPIEN valve in the pulmonary valve position—for which Phase 2 enrollment will soon begin. Duke is also

among only several centers implanting the **Medtronic Melody transcatheter pulmonary valve**, an FDA-approved Humanitarian Use Device. **Duke is currently the nation's only center with access to both valves.**

Duke Heart Center will soon take part in a pioneering transcatheter valve trial that will potentially provide a percutaneous option for high-risk patients with aortic stenosis.

**PRIMARY AND ISOLATED MITRAL VALVE REPAIR AND REPLACEMENT**

Duke University Medical Center, 2004-09

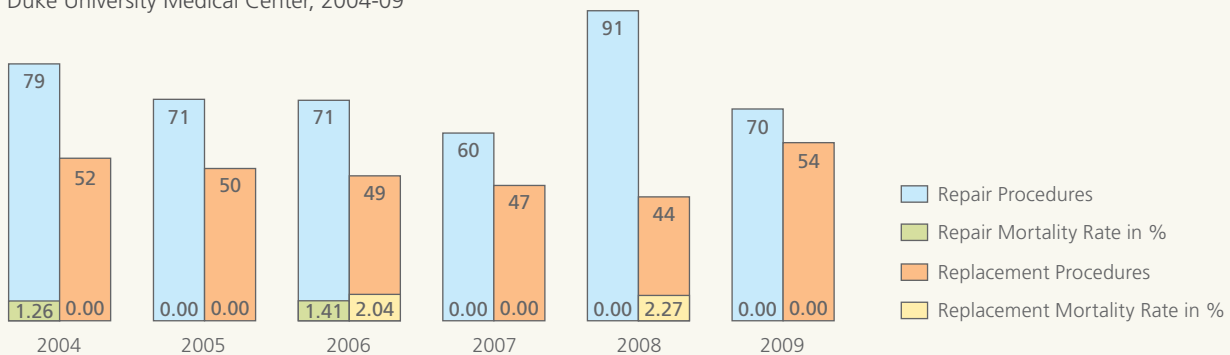


Minimally Invasive (light blue) Conventional (light green)

Duke surgeons use minimally invasive techniques to repair and replace mitral valves in most cases.

**ISOLATED MITRAL VALVE REPAIR AND REPLACEMENT VOLUMES AND MORTALITY**

Duke University Medical Center, 2004-09



The majority of Duke's degenerative or ischemic mitral-disease patients undergo valve repair, not replacement. Patients with disease etiologies such as rheumatic or calcified valves typically do better with valve replacement.





In May 2010, North Carolina's first hybrid OR opened in Duke University Hospital. This state-of-the-art facility enables our cardiologists and cardiothoracic surgeons to simultaneously perform percutaneous and open procedures in a sterile environment; deliver timely, supportive percutaneous treatment for cardiogenic shock and acute MI; perform revascularization procedures with coronary stenting and percutaneous valve repair; and endovascularly repair abdominal aortic aneurysms.

### A global leader in minithoracotomy valve repair and replacements

Duke Heart Center is a leader in these sophisticated, small-incision procedures.

- World's highest volumes—more than 1,050—of minithoracotomy mitral procedures without femoral arterial cannulation
- World's highest reported volumes of repeat mitral surgery (approximately 400) and tricuspid surgery (about 200) as minithoracotomy
- World's third-highest volumes of minithoracotomy mitral procedures, with more than 1,230 performed
- More than 350 minithoracotomy aortic valve replacements—among the nation's top five volume leaders

### RESEARCH

Outcomes research is informed by the Duke Valve Surgery Database, with data from more than 11,000 patients. Highlights include:

- **REALISM**, a trial investigating percutaneous mitral repair using the Abbott MitraClip. Under way at Duke since 2006, the study has evolved from a randomized surgical-comparison trial to a continued-access registry. Duke is one of only 40 North American sites with access to MitraClip.
- Two trials aimed at defining the role of **surgical mitral-valve repair** in moderate and severe ischemic mitral regurgitation, respectively

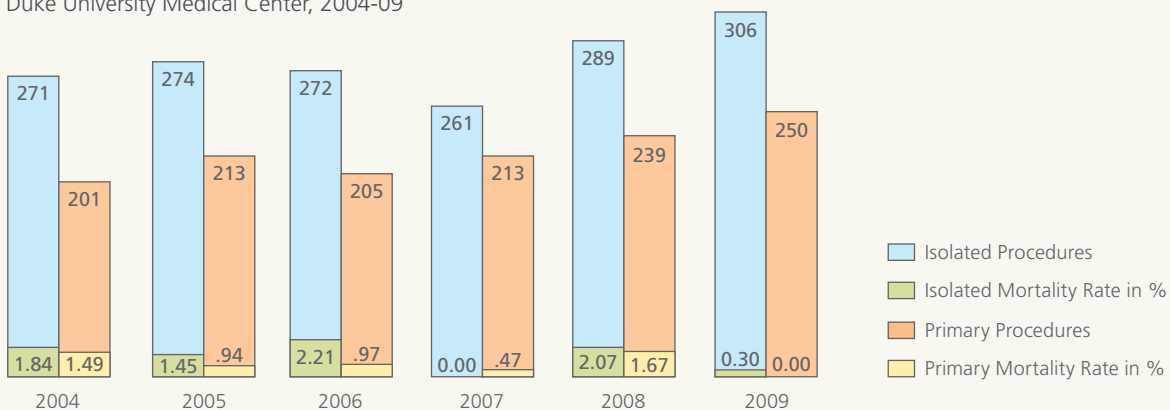
- A trial that seeks to determine the best method to surgically treat **atrial fibrillation** in patients undergoing mitral-valve surgery
- World's largest amount of published research in **mitral re-operations via minithoracotomy**
- Membership in the **International Collaboration on Endocarditis**, a research alliance with high numbers of participating patients worldwide

#### SITE-BASED RESEARCH DIRECTORS

Donald D. Glower, MD; J. Kevin Harrison, MD

### ISOLATED AND PRIMARY VALVE SURGERY VOLUMES AND MORTALITY

Duke University Medical Center, 2004-09



Patients who undergo valve surgery at Duke see outstanding outcomes.



G. Chad Hughes, MD (center)—along with Richard L. McCann, MD (left), and a surgical fellow—perform a hybrid aortic arch repair.

## THORACIC AORTIC, GENERAL THORACIC, AND LUNG TRANSPLANT SURGERY

Experienced surgeons, world-class patient outcomes

### Thoracic Aortic Surgery Medical Director: G. Chad Hughes, MD

A pioneer in endovascular procedures

Duke's Thoracic Aortic Surgery Program is an internationally recognized, high-volume service with expertise in repairing aortic aneurysms, dissections, dissection variants, and congenital aortic defects, including those in patients with connective-tissue disease.

- Among the nation's largest services for open aortic surgeries and deep hypothermic circulatory arrest for aortic-arch aneurysms
- A leader in valve-sparing aortic-root replacement and "hybrid" aortic-arch and thoracoabdominal procedures, which Duke surgeons helped to develop
- Expert management of genetic conditions—particularly connective-tissue disorders associated with thoracoaortic conditions, in collaboration with Duke's Pediatric Cardiovascular Genetics Clinic (page 25)
- Most descending thoracic aneurysms repaired endovascularly
- One of the only U.S. centers using online central nervous system monitoring with EEG and evoked potentials to protect the CNS during aortic repair
- Most insufficient aortic valves are now repaired, not replaced

Duke thoracic aortic surgeons performed the first-ever two-stage total cardioaortic replacement for the Marfan syndrome<sup>1</sup>, as well as the first two-stage total aortic replacement for Loeys-Dietz syndrome<sup>2</sup>.

<sup>1</sup>J Heart Lung Transplant. 2009 Sep;28(9):958-63  
<sup>2</sup>J Card Surg. 2010 Mar;25(2):223-4

Patient outcomes for Duke's Thoracic Aortic Surgery Program equal or exceed other centers' published results for all types of aortic surgery.

### RESEARCH

Participating in **virtually all major thoracic endovascular stent graft-related clinical trials**, we are among the country's leading centers to implement new techniques and technologies. Findings of recent Duke-led studies include:

- Excellent 30-day and mid-term outcomes in patients with descending thoracic aneurysms who underwent "on-label" thoracic endovascular aneurysm repair<sup>1</sup>.

- Endovascular repair for complex acute and chronic type B dissection is safe and effective at early mid-term follow-up<sup>2</sup>.
- Hybrid repair of transverse aortic-arch aneurysms appears safe and effective at mid-term follow-up and may be an important treatment advance<sup>3</sup>.

<sup>1</sup>Ann Thorac Surg. 2010 Jul;90(1):83-9 <sup>2</sup>Ann Thorac Surg. 2010 Jan;89(1):97-102 <sup>3</sup>Ann Thorac Surg. 2009 Dec;88(6):1882-7

#### SITE-BASED RESEARCH DIRECTOR

G. Chad Hughes, MD

### THORACIC AORTIC SURGERY VOLUMES, DUKE UNIVERSITY HOSPITAL, 2009

Ascending Aorta/Root	80
Arch (Open and Hybrid)	79
Descending (Open and Endovascular)	47
TAAA (Open and Endovascular)	25
Other	13

## General Thoracic Surgery Chief: Thomas A. D'Amico, MD

A high-volume leader in minimally invasive techniques

Duke's general thoracic surgeons have broad experience with all types of surgical procedures used to treat both malignant and benign thoracic conditions, as well as an **internationally recognized thoracoscopic lobectomy program**.

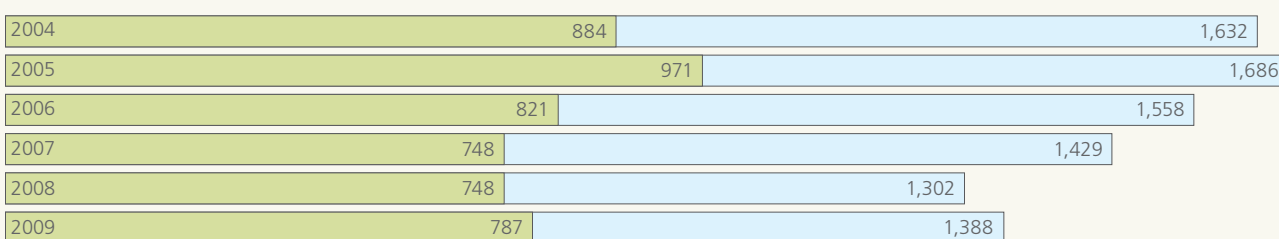
Experts in treating conditions that range from plural effusion to esophageal cancer to congenital chest deformities, these surgeons perform procedures that include lung volume-reduction surgery, minimally invasive esophagectomy, and bronchoscopy. In addition, the General Thoracic Surgery Program leads many **clinical trials aimed at perfecting techniques and improving outcomes**, and serves as a global training resource.

### SITE-BASED RESEARCH DIRECTOR

Thomas A. D'Amico, MD

Duke performs one of the world's highest volumes of thoracoscopic lobectomies and now offers minimally invasive procedures for conditions such as esophageal cancer and myasthenia gravis—incorporating the latest thoracoscopic and robotic technologies.

### GENERAL THORACIC SURGERY VOLUMES



Legend: Total Thoracic Procedures (light blue), Minimally Invasive Thoracic Procedures (light green)

More than 75 percent of the approximately 1,500 general thoracic surgeries performed at Duke annually use video-assisted, minimally invasive techniques—compared to 20-30 percent of those performed nationally—enabling some patients who are not conventional-surgery candidates to undergo resection, and resulting in fewer post-operative complications, less pain, shorter hospital stays, and quicker return to activity.

## Lung Transplant Surgery Chief: R. Duane Davis, MD

Nation's second-largest program offers shortest wait times, outstanding outcomes

Since 2000, the Duke Lung Transplant Program—the Southeast's largest—has performed more than 900 transplants and more double lung transplants than any other U.S. center. Our patients' short- and long-term survival rates, as well as graft-survival rates, are significantly better than national averages, despite increasingly sicker patients. The program offers both living-donor transplants and multi-organ transplants.

The program has seen excellent outcomes in transplanting patients who have not historically been candidates for lung transplantation, including adolescents 14 and older; people 70 and older; patients with cystic fibrosis (including those whose lungs are colonized with resistant pathogens), coronary artery and/or valvular heart disease; and people who require mechanical ventilation, including ECMO.

In 2009, Duke's median wait time for lung transplant was only 12 days, thanks to aggressive organ-recovery strategies.

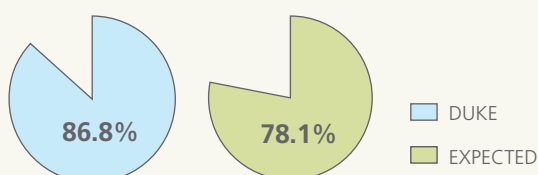
### RESEARCH

Faculty are engaged in **innovative basic and clinical research** studies that aim to prevent infection and injury, reduce the risk of graft rejection, and expand the pool of viable donor lungs.

### SITE-BASED RESEARCH DIRECTOR

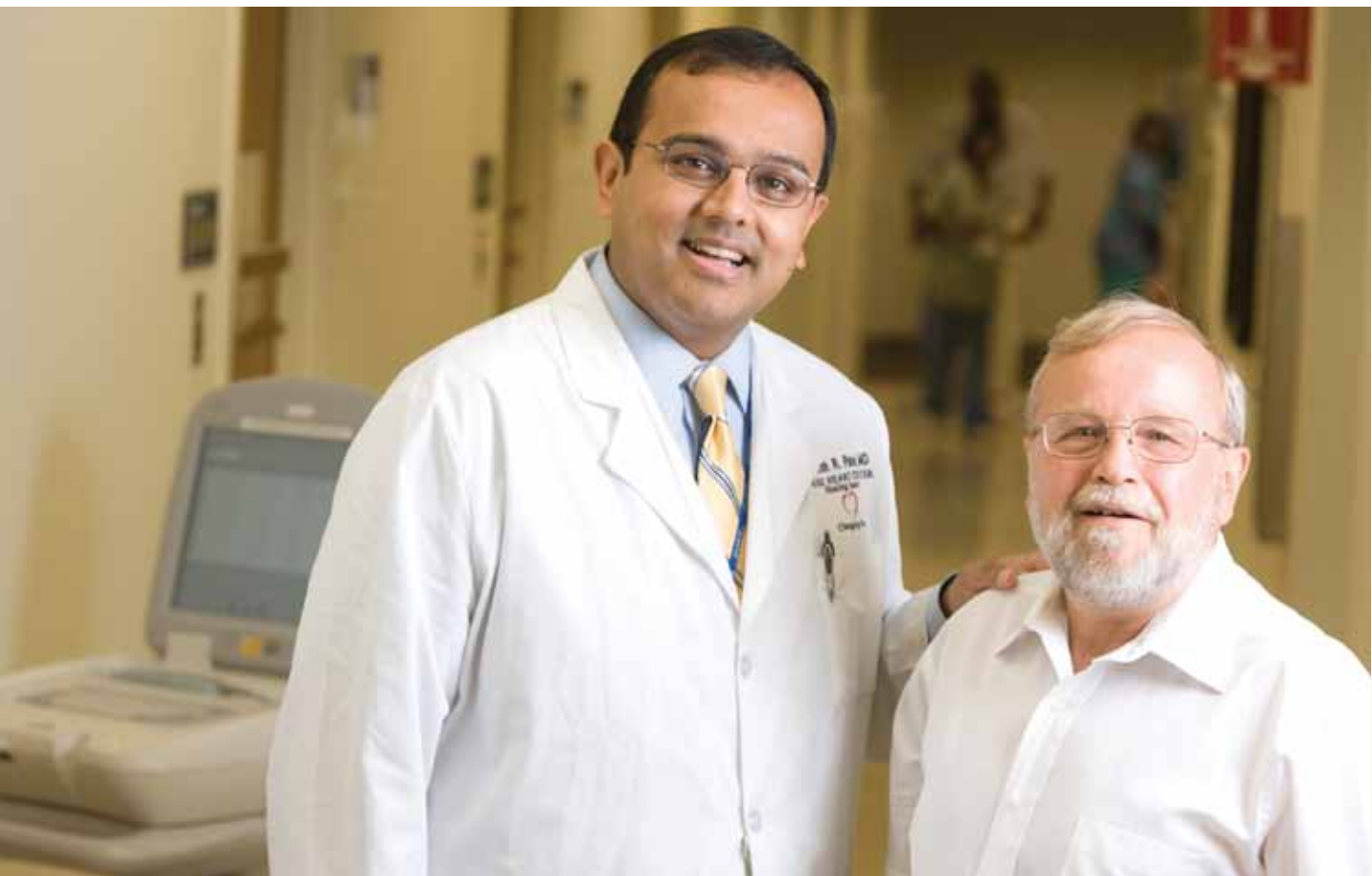
R. Duane Davis, MD

### ONE-YEAR LUNG TRANSPLANT PATIENT SURVIVAL RATE



For adults receiving their first transplant between 11/1/07 and 6/30/09. Visit [ustransplant.org](http://ustransplant.org) for most current data.





Ronald Davis, 60, (pictured above with Manesh R. Patel, MD, lead investigator of the Pluristem trial at Duke) of Rocky Mount, VA, had a long history of cardiovascular disease when he developed a blockage in his right leg late last year. After vascular bypass surgery failed to relieve the constant pain, Davis came to Duke, where in February he underwent a catheterization on his leg—and was accepted into the Pluristem trial. In March, his Duke cardiologist injected stem cells into his leg, above and below the blockage. “Three days later, walking down the steps at home, I realized I wasn’t in pain anymore,” says Davis, who was soon able to resume his normal activities. “I feel like a human being again, and it’s glorious. Everything about coming to Duke has been positive, and everyone we’ve met has treated us like family.”

## PERIPHERAL VASCULAR DISEASE (PVD) Medical Director: Manesh R. Patel, MD

Innovative research opens new options for patients

Duke Heart Center’s PVD experts take a team-based approach to evaluating and treating this serious condition, which encompasses disease states such as intermittent claudication, critical limb ischemia, and atherosclerosis of the carotid artery and other vascular beds.

We offer the full range of diagnostic techniques, from state-of-the-art intravascular ultrasound to x-ray angiography with contrast dye, CT and MR angiography, and the ankle-brachial index. Faculty are also developing novel diagnostics such as a serum test to evaluate genetic biomarkers for critical limb ischemia.

In addition to novel therapies available through clinical trials, treatment options include:

- Catheter-based therapies
- Endovascular procedures such as laser ablation, orbital and directional atherectomy, and cryoplasty
- Stenting, angioplasty, and lower-extremity bypass surgery
- Hybrid revascularization procedures with vascular surgeons and cardiologists
- State-of-the-art wound management, including hyperbaric therapy, for patients with non-healing wounds resulting from critical limb ischemia
- Medical management and lifestyle-modification programs to help patients mitigate factors that contribute to PVD and heart disease, offered through the Duke Center for Living (page 29)
- A design and testing center for catheters, stents, and steerable guide wires used in some PVD therapies.

---

Duke is one of only three U.S. centers participating in the Pluristem study, a clinical trial investigating the use of placental stem cells (image at right) in select patients with no revascularization options. The undifferentiated cells are injected into patients’ calves, with the goal of growing new blood vessels that bypass vascular blockages and damage.

## PVD PROCEDURE VOLUMES

Duke University Health System, CY09

### Non-Invasive Procedures

Arterial	460
Carotid	709

### Diagnostic and Interventional Procedures

Peripheral	1,527
Carotid	88

## HIGHLIGHTS

### Building better imaging technologies

Duke is one of three U.S. sites working with the Volcano Corporation to develop novel catheter-based, non-radiographic vascular-imaging technologies (page 10).

### Multiple locations serve a growing patient base

The PVD team serves patients at locations across central North Carolina, including Duke University Hospital, Duke Raleigh Hospital, and Durham Regional Hospital—where a brand-new cath lab is part of an expansion of the hospital's vascular program, offering on-site vascular angiography and interventions including lasers, balloon stenting, and other atherectomy devices.

### Novel options for limb-threatening PVD

#### "Salvage center" goal: Reduce PVD-related amputations by 50 percent

Duke Heart Center has established a "salvage center" in an effort to prevent the amputation of limbs (typically the legs) among patients with PVD-related gangrene and ulcers who are not candidates for other interventions. Patients may qualify to participate in experimental therapies that employ genes, angiogenesis strategies utilizing vascular endothelial growth factors, and stem cells. Faculty are striving to reduce by one-half the number of PVD-related amputations in North Carolina in the next five years.

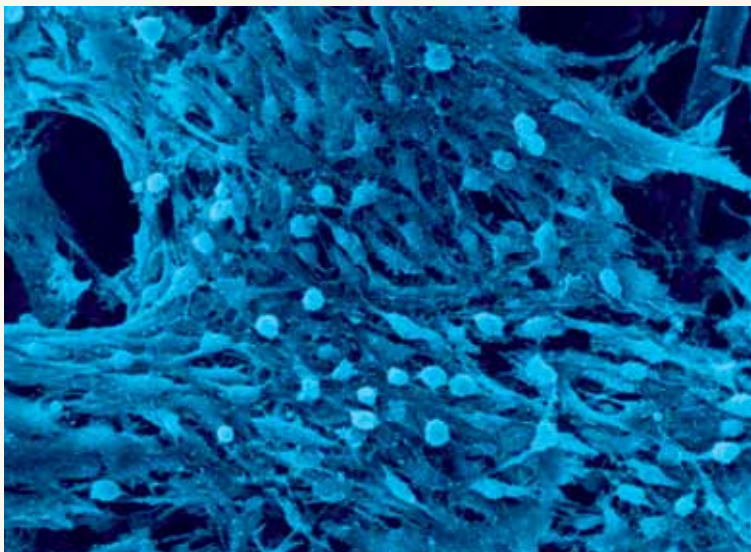
## RESEARCH

In addition to the groundbreaking Pluristem trial (opposite page), Duke PVD clinical research includes:

- **Choices, CAPTURE 2, and SAP-PHIRE Worldwide Registries**—Protocols documenting and assessing outcomes of high-risk patients after carotid-artery stenting
- **ZEN**—Duke Raleigh Hospital is one of only eight U.S. centers participating in this first-in-man pilot study evaluating the effect of a drug-eluting stent placed in the pudendal arteries of atherosclerotic men with erectile dysfunction refractory to standard ED drugs
- **Two first-in-man trials** at Duke Raleigh Hospital testing new treatment options for patients with critical limb ischemia, including spinal stimulation and portable hyperbaric therapy for distal wound beds.
- **ACT 1**—This trial will compare carotid stenting with carotid endarterectomy in treating asymptomatic patients with standard surgical risk

### SITE-BASED RESEARCH DIRECTORS

Manesh R. Patel, MD, and George L. Adams, MD, MHS (Duke Raleigh Hospital)



In patients with critical limb ischemia who are taking part in the Pluristem trial, PLX-PAD placenta-derived stem cells are injected intramuscularly into the affected limb to improve blood flow. Image courtesy of Pluristem Therapeutics, Inc.



Duke is a leader in defining best-care practices for heart patients over age 65—a group projected to comprise one-fifth of the U.S. population by 2030.

## SPECIALIZED CLINICAL PROGRAMS

Specialized care for special populations

**Geriatric Cardiology**—With clinical and research strengths in geriatric cardiology, Duke Heart Center is a leader in preventing and treating heart disease in people 65 and older. (Also see nursing efforts on page 30.) Patient care is enhanced by our close ties to the acclaimed Duke University Center for the Study of Aging and Human Development and two of its components, the Geriatric Evaluation and Treatment (GET) Clinic and the NIA-funded Claude Pepper Older Americans Independence Center.

In addition to conducting population research on aging and heart disease, Heart Center faculty sit on the ACC's new Council on the Cardiovascular Care of Older Adults—and several worked with Duke geriatrics faculty to develop "The Essentials of Cardiovascular Care in Older Adults," an online ACC curriculum for cardiology fellows. Dial 919-668-8871 to learn more.

Co-Medical Directors: Karen P. Alexander, MD, and Douglas D. Schocken, MD

**Program for Advanced Coronary Artery Disease (CAD)**—One of only a handful of its kind, this program serves patients with debilitating chest discomfort for which few novel therapies exist—and focuses largely on older people for whom treatments can be limited. Using minimally invasive techniques and enhanced revascularization technologies whenever possible, we employ sophisticated angina therapies such as enhanced external counterpulsation—a non-invasive treatment that increases the flow of oxygenated blood to the heart—and spinal-cord stimulation, a pain-blocking therapy used in some chronic and severe cases. **Some 85 percent of patients improve to the extent that they can return to performing most daily activities.** Dial 919-660-6604 for an appointment.

Medical Director: E. Magnus Ohman, MD

**Duke Heart-Mind Center**—The country's first dedicated program of its kind, the center is built upon three decades of collaborative Duke Heart Center and Department of Psychiatry and Behavioral Health research—and hundreds of Duke studies linking emotion and cardiac health. Faculty, who are engaged in a variety of clinical protocols, have developed a pioneering "mental stress test" that can help assess the impact of stress on cardiac health. To learn more, call Jennifer Wilson at 919-681-4367.

Co-Medical Directors: Wei Jiang, MD, and Christopher M. O'Connor, MD

**Women's Heart Care**—Duke Heart Center faculty are committed to raising awareness about the factors unique to women's cardiovascular health and delivering multidisciplinary, evidence-based care. Many conduct related research, compile evidence for incorporation into the practice of women's cardiac care, and help to establish national clinical guidelines. We are now investigating topics that include gender disparities in the use of cardiovascular therapies; women's stress testing; pregnancy complications among women with heart disease; and low trial participation among women. To learn more about women's heart care at Duke, dial 919-681-5816.

Co-Medical Directors: Radha G. Kachhy, MD, and L. Kristin Newby, MD



Finney Greggs, 70, of Jacksonville, NC, has really been through it with his heart. Over the past 15 years, the retired U.S. Marine Corps first sergeant

has suffered a heart attack and an aortic aneurysm, for which he was transferred to Duke for surgical repair. He also has lived for years with advanced coronary artery disease, which his Duke cardiologist medically manages so well, Greggs is able to serve as director of the Montford Point Marines Museum, one of his passions.

"My cardiologist has always been there for me, and that's meant so much—especially when I've been flat on my back, not knowing which way was up," says Greggs, also an ordained minister. "He's not only been a great doctor, he's been a great friend, and if he's ever in need, you better believe I'll be there for him."



## PERSONALIZED AND GENOMIC CARDIOLOGY

Co-Medical Directors: Geoffrey S. Ginsburg, MD, PhD; Svati H. Shah, MD, MHS; and Stephanie Burns Wechsler, MD

Advances lead to patient-specific risk-assessment, prevention, and treatment services

Duke remains on the leading edge of investigating the genomic, genetic, proteomic, and metabolomic factors that influence cardiovascular disease, related conditions, and drug efficacy—with the goal of discovering highly targeted methods of predicting, preventing, and treating heart disease that are informed by the unique characteristics of individuals.

This work is leading to breakthroughs such as the discovery of a gene linked to early-onset heart disease<sup>1</sup>, a gene that raises patients' risk of clotting after coronary stent placement<sup>2</sup>, a genotype that helps target patients most likely to benefit from the beta-blocker bucindolol<sup>3</sup>, and a blood test (now commercially available) that analyzes gene expression to diagnose advanced coronary artery disease<sup>4</sup>.

<sup>1</sup>PLoS Genet. 2009 Jan;5(1):e1000318 <sup>2</sup>Atherosclerosis. 2008 Feb 12 <sup>3</sup>J Card Fail. 2008 Aug. Vol. 14, Issue 6, Page 569

<sup>4</sup>Circ Cardiovasc Genet. 2008 Oct;1(1):31-8

A Duke-led study, the largest of its kind for cardiovascular disease, is the first to identify specific metabolic profiles linked to coronary artery disease, heart attacks, and early death among patients who have undergone coronary catheterization.

Circ Cardiovasc Genet. 2010 Apr;3(2):207-14

Duke's unique resources contain robust, standardized phenotypes, adjudicated events, and outcomes of acute cardiovascular events along with high-quality DNA, RNA, and plasma samples used for genome-scale molecular analyses.

### RESEARCH

Our efforts are informed by databases and biorepositories of thousands of consenting Duke heart patients whose clinical data and blood has been gathered throughout the past decade. In addition to the pioneering Duke Databank for Cardiovascular Disease (page 37), these include:

- **CATHGEN**—Biorepository of some 9,000 cardiac cath patients
- **EPGEN**—Biorepository of blood samples and database of clinical information, EPGEN uses genomic, proteomic, and metabolomic data to identify risk factors

for sudden cardiac death, AFib, and other rhythm disorders

- **GENECARD**—Biorepository of more than families with early-onset CAD
- **PEGASUS**—Data from 6,500 cardiac surgery patients
- Biorepository of patients and families referred to the Adult Cardiovascular Genetics Clinic (below) for genetic evaluation

#### SITE-BASED RESEARCH DIRECTOR

William E. Kraus, MD

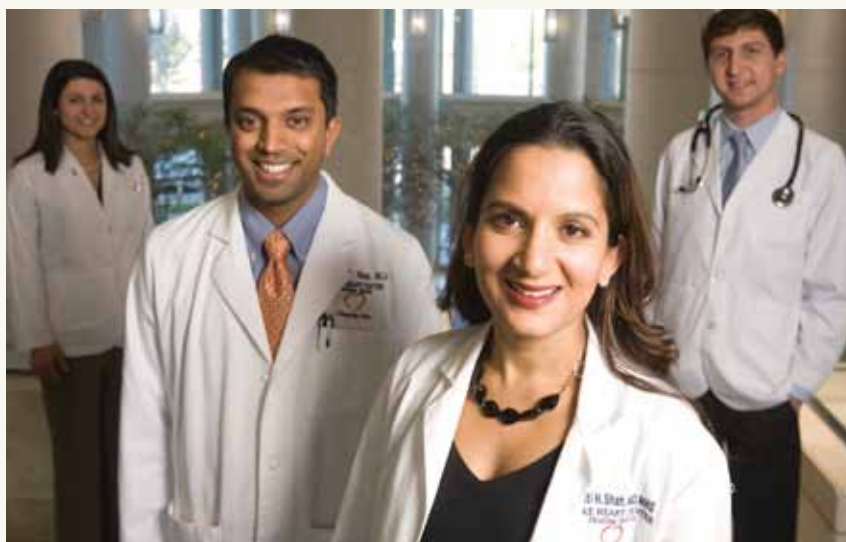
### Clinical Services

**Duke Pediatric Cardiovascular Genetics Clinic**—Serves patients of all ages by offering genetic evaluations for rare and/or inherited medical and developmental conditions, and assessing family histories of genetic conditions. In addition to participating in clinical trials, the clinic houses dedicated programs for cardiovascular genetics, congenital heart defects, connective-tissue disorders such as the Marfan syndrome, and metabolic genetics, among others. Dial 919-668-2196 to learn more.

**Duke Adult Cardiovascular Genetics Clinic**—Offers novel methods of identifying and diagnosing adults with suspected inherited cardiovascular conditions (including hypertrophic and familial cardiomyopathy, early-onset CAD, and long QT and Brugada syndromes), vascular diseases, and clotting disorders such as Factor V Leiden. The clinic also offers (to patients and family members) genetics education and counseling services, and access to related Duke genetic studies and clinical trials. Learn more by calling 919-681-5816.

**Duke Executive Health Program**—Offers comprehensive non-invasive vascular-health assessment packages. Call 919-660-6606 for details.

**Duke Center for Living**—See page 29.



Medical students Emiline M. Aviki and Patrick G. Pilie (back) with Bimal R. Shah, MD (front left), and Svati H. Shah, MD, MHS, at the Duke Adult Cardiovascular Genetics Clinic.



John F. Rhodes Jr., MD, examines one of the approximately 10,000 pediatric heart patients Duke sees every year.

## **PEDIATRIC AND CONGENITAL CARDIOLOGY** Co-Chiefs: Thomas M. Bashore, MD, and John F. Rhodes Jr., MD

Serving children with congenital and acquired heart disease—and adults with congenital cardiac conditions

Duke's Division of Pediatric Cardiology is among the nation's premier programs for cardiovascular diagnostic and treatment—and one of the Southeast's busiest.

- Home to one of the largest pediatric EP services in the U.S., a dedicated pediatric echocardiography suite, and North Carolina's largest pediatric heart failure program
- Nationally recognized for patient safety and care-quality initiatives, including decreased readmission rates and surgery-to-ICU turnaround times
- A growing network of locations throughout the region (page 6)
- Fetal interventions for conditions that include hypoplastic left heart syndrome

### **One of the state's busiest interventional cath labs**

Duke's experienced cardiologists perform catheter-based treatments of congenital heart defects that have historically required open-heart surgery, including atrial septal defects (ASD). Since 2001, our physicians have performed nearly 1,100 catheter-based device closures for ASDs, with patients experiencing low rates of related complications and mortality.

**Pediatric cardiac anesthesiologists deliver ultra-specialized care. These skilled, specially trained physicians serve every Duke pediatric cardiac patient undergoing any procedure that requires sedation or anesthesia, not just cardiac surgery.**

---

**In 2010, *U.S. News & World Report* once again named Duke's congenital cardiology program one of the nation's best. The program offers the full range of comprehensive diagnostic and treatment options for patients with congenital heart disease.**

---

In 2009, Duke performed 662 electrophysiology, diagnostic, and interventional catheterizations in pediatric patients and adults with congenital heart disease.

---

One of only six U.S. centers with a service dedicated to evaluating and treating adults with congenital heart disease, Duke's Adult Congenital Heart Disease Clinic is a top referral center in the Southeast—and one of the world's only Adult Congenital Heart Association-certified training centers.

The doctor is always in for the sickest pediatric heart patients. Duke is home to North Carolina's largest and most specialized pediatric cardiac ICU, which is staffed 24/7 by in-house attending physicians who are board-certified in cardiology and critical care.

## PEDIATRIC AND CONGENITAL HEART SURGERY Co-Chiefs: Robert D.B. "Jake" Jaquiss, MD, and Andrew J. Lodge, MD

High volumes, excellent outcomes

With an overall mortality rate of less than 2 percent, Duke's Pediatric and Congenital Cardiovascular Surgery Program continues to produce outcomes that meet or exceed Society of Thoracic Surgeons benchmarks—even in patients with the most complex malformations.

Our specialized surgeons strive for early and complete repair of even the most complex malformations—often in the neonatal period.

- A rapidly growing, Society of Thoracic Surgeons-designated "high-volume center"
- Minimally invasive and hybrid procedures—such as minimally invasive ASD repair and hybrid per-ventricular muscular VSD device closure—many of which are performed in the Heart Center's new hybrid OR (page 19)
- Aortic valve repair and valve-sparing root replacement for Marfan syndrome
- Surgery for the complete spectrum of complex neonatal heart defects, including arterial-switch procedures for transposition of the great arteries and Norwood procedures for hypoplastic left heart syndrome

### Sophisticated surgical options for children with heart failure

In addition to standard reconstructive surgeries for heart failure caused by congenital malformations, surgical options include:

- **Implantation of sophisticated devices**, including pacemakers, defibrillators, and temporary mechanical circulatory support technologies such as ventricular assist devices (VADs), including the Berlin Heart for small children and "adult" VADs including the HeartMate II for larger children and teenagers
- **North Carolina's largest pediatric heart-transplant program**, which offers outstanding outcomes, coordinated care, family support, and long-term follow-up.

## RESEARCH

Duke is one of only eight U.S. centers in the prestigious NIH-funded Pediatric Heart Network (PHN), a clinical research program aimed at improving the lives of children with congenital and acquired heart disease. Duke was a top enroller in the ESCAPE and RESPECT studies—both multi-center clinical trials for patients with patent foramen ovale (PFO). Areas of cur-

rent clinical research include percutaneous catheter-based therapies such as pulmonary stent valves (COMPASSION trial, page 18); aortic coarctation (COAST); septal occluder devices such as Helex; and the evaluation of novel surgical techniques.

### SITE-BASED RESEARCH DIRECTOR

Jennifer S. Li, MD

All of Duke's pediatric cardiac surgeons hold American Board of Thoracic Surgery Certificates of Special Competence in congenital cardiac surgery.



As a child, now-15-year-old Marzya Abdul Habib would lie next to her sleeping mother and try to match the pace of her breathing. But Marzya's breaths came much faster than her mother's, and over time, her skin took on a bluish tint. Marzya suffered from congenital heart defects, including L-transposition of the great arteries and a ventricular septal defect.

Nonprofit Solace for the Children arranged Marzya's trip from her native Afghanistan to the U.S., but due to concerns that she suffered from pulmonary hypertension (PH), she was declined for surgery at a number of centers before a pediatric cardiologist referred her to Duke. After careful review of Marzya's case, the Heart Center team performed a catheterization that showed she did not have PH and was in fact able to undergo an August 2009 surgery to repair her heart.

"Before my time at Duke, I couldn't run, jump, or play because it would make me tired, but now I can do anything because my heart is much better," she says. "Life is good if you feel good. I put God first and Duke second; Duke is special for giving me a chance."

Thanks to her Duke team and her Mooresville, North Carolina, host family, Marzya is now thriving in Afghanistan.

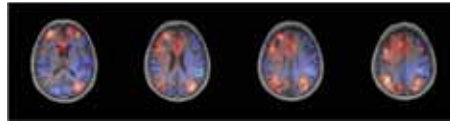
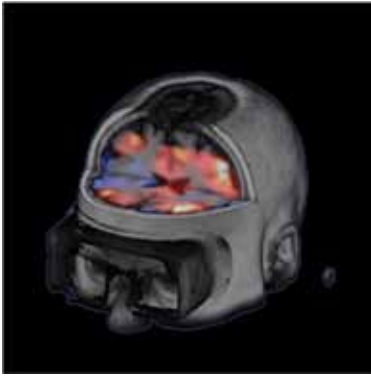
## CONGENITAL SURGERY VOLUMES\*

Duke University Hospital, 2006-09

2006	372
2007	378
2008	387
2009	417

\*Pediatric and adult





Functional MRI (fMRI) assessment of brain activity enables clinicians to better understand the cognitive deficits some patients experience after cardiac surgery. These fMRI “slices,” taken during a preoperative scan of a single patient, reveal no abnormality prior to surgery.

## CARDIOTHORACIC ANESTHESIOLOGY Chief: Joseph P. Mathew, MD, MHSc

Advanced monitoring, innovative research to improve outcomes

Duke’s Division of Cardiothoracic Anesthesiology and Critical Care Medicine is on the forefront of efforts to improve patient safety and outcomes. A distinguishing feature of the program is its focus on both the intraoperative and post-operative care of cardiothoracic patients. In addition to the vital roles they play in each of the approximately 2,800 cardiothoracic surgical procedures performed at Duke each year, our physicians care for these often complex patients in the intensive care unit.

That care is informed by a robust research program that employs a systems-biology paradigm to elucidate the complex mechanisms underlying perioperative organ injury (particularly to the brain, kidneys, and heart); identify organ-dysfunction biomarkers; and prioritize novel cardio- and neuroprotective compounds.

**A Duke-led study suggests that there are significant changes in cardiac fuel uptake during bypass surgery that depend upon preexisting ventricular function—and recommends perioperative metabolic monitoring and optimization of multimodal cardioprotective strategies for cardiac surgical patients.**

*Circulation.* 2009 Apr 7;119(13):1736-46.

At the 2010 meeting of the Society of Cardiovascular Anesthesiologists, 17 percent of the presented abstracts were authored by Duke faculty members.

Cardiothoracic anesthesiologist G. Burkhard Mackensen, MD, PhD, and fellow Timothy Mooney Jr., MD, perform a transesophageal echocardiography (TEE) exam to monitor heart and valve function during cardiac surgery.

### RESEARCH

A faculty-created patient database, the cornerstone of our research, enables investigation of relationships among genetic biomarkers and risk of post-operative organ injury and/or cognitive impairment. Current and ongoing research areas include:

- Functional MRI assessment of brain activity (see image above)
- The role of genetics in determining patients’ risk of organ injury during and after cardiac surgery

- The use of lidocaine as a neuroprotective agent during cardiac surgery
- The impact of renal recovery on survival after cardiac surgery-associated acute kidney injury
- Post-surgical myocardial infarction and vein-graft thrombosis
- Genetic and environmental determinants of pain after thoracic surgery

**SITE-BASED RESEARCH DIRECTOR**  
Joseph P. Mathew, MD, MHSc



PHOTO: ELIZABETH PEREZ



The acclaimed Duke Center for Living is the cornerstone of Duke University Hospital's medical, behavioral, and wellness activities—with offerings ranging from medically supervised exercise to nutritional counseling to weight-loss programs. Our experienced faculty are experts in working with high-risk cardiac patients, such as those with heart failure.

Duke physicians are working to make cardiac-rehabilitation referrals a standard of care—and are preparing to launch a pilot program called Seamless Rehab that will shorten the time between hospital discharge and cardiac rehab participation.

## CARDIAC PREVENTION AND REHABILITATION Medical Director: William E. Kraus, MD

Improving heart health before and after a cardiac event

Duke Heart Center's cardiac prevention and rehabilitation services integrate evidence-based medical management with proven behavioral strategies and leading-edge research to help people improve their heart health and lower the risk of serious heart events.

We evaluate patients for a range of risk factors (including traditional ones, such as serum lipids, and new markers such as vascular reactivity, metabolic syndrome, carotid intimal medial thickness); provide them with comprehensive, personalized plans using evidence-based medical and lifestyle therapies; and help them integrate those therapies into their lives.

### HIGHLIGHTS

#### Duke Program for Prevention and Treatment of Heart and Vascular Disease

Serves patients diagnosed with or at high risk for cardiovascular disease by offering comprehensive, customized plans to improve heart health and minimize the risk for cardiac events. Dial 919-660-6604 for more information.

#### Duke recruited by ACC to produce cardiac rehab video

The American College of Cardiology (ACC) asked Duke faculty to help produce a video ([cardiosmart.org/cardiarehab.aspx](http://cardiosmart.org/cardiarehab.aspx)) designed to educate viewers about cardiac rehabilitation and its benefits, and address

barriers such as motivation and access. While it targets patients, the video is being promoted as a tool to encourage physicians to prescribe cardiac rehab to their patients.

Duke's Cardiac Rehabilitation Program serves about 300 new patients each year and has worked with more than 9,000 patients since 1976. Patients young and old, frail and relatively healthy, benefit from our medically supervised setting, and we offer the country's longest-running programs for those who have undergone bypass surgery and heart transplantation.



Don Fick, 42, was vacationing with his family in March when he suffered a serious heart attack. After being treated at a Florida hospital and returning home

to North Carolina, Fick sought follow-up care at Duke and was referred to the Cardiac Rehabilitation Program, where he has significantly improved his heart function with regular, monitored exercise. "I'd never been a gym person, and I was concerned about my new limitations and capabilities, but the cardiac rehab staff has been very encouraging and helpful," Fick says. "They help me choose activities I'm comfortable with, so it's gone very well and I've really thrived in my recovery."

#### Duke University Health System offers three cardiac rehab programs:

Duke Center for Living (Durham)  
Cardiac Rehabilitation Program  
919-660-6724

Duke Raleigh Hospital  
Cardiac Rehabilitation and Wellness Center  
919-954-3174

Durham Regional Hospital  
The Wellness Institute  
919-470-8152

### RESEARCH

- A groundbreaking Duke-led study—the largest of its kind for cardiovascular disease—is the first to identify specific metabolic profiles linked to coronary artery disease, heart attacks, and early death among patients who have undergone coronary catheterization.

(Circ Cardiovasc Genet. 2010 Apr;3(2):207-14)

- Duke physicians continue to lead pioneering studies that define best practices. Recently published standouts include HF-ACTION<sup>1</sup> and STRRIDE<sup>2</sup>.

(<sup>1</sup>JAMA. 2009 Apr 8; 301(14):1439-50 <sup>2</sup>J Appl Physiol. 2005 Oct;99(4):1613-8)

#### SITE-BASED RESEARCH DIRECTOR

William E. Kraus, MD



Cardiac nurse Joel Valente, RN, cares for a Duke Heart Center patient.

## CARDIAC NURSING Co-Leaders: Wanda Bride, RN, and Bradi B. Granger, PhD, RN

Duke Heart Center's 500-plus cardiac and cardiothoracic surgical nurses provide first-rate care and support to our inpatients, outpatients, and families; educate students and community members; and conduct research that continues to advance cardiovascular care.

### Awards and Recognitions

Programs and individuals within Duke University Health System's cardiac-care units are consistently recognized for exceptional performance. Recent kudos include:

- Duke University Hospital is **one of three U.S. hospitals to receive the 2009 American Hospital Association-McKesson Quest for Quality Prize Citation of Merit**, which honors hospitals for leadership and innovation in quality, safety, and commitment to patient care.
- Units in each of Duke University Health System's three hospitals have earned **Hallmarks of Healthy Workplace designations** from the North Carolina Nurses Association's Professional Practice Advocacy Coalition.
- Many cardiac and cardiothoracic nurses are American Association of Critical-Care Nurses **Circle of Excellence** winners, while others have been recognized by the **North Carolina Great 100** and Duke's Friends of Nursing Program
- Frequent patient-satisfaction awards include the **Service Excellence Award** and **Strength, Hope, and Caring Awards**, which recognize individuals and units whose work exceeds expectations and reflects Duke's core values.

In addition, our nurses have recently authored chapters in cardiac surgery books, published articles in national journals, and presented posters at the American Nurse Credentialing Center's Magnet Conference, the American Association of Critical-Care Nurses' National Teaching Institute & Critical Care Exposition, the American Association of Heart Failure Nurses Meeting, and the Nurses Improving Care for Healthsystem Elders Conference, among other events.

**Twenty-five percent of Duke University Hospital cardiac nurses are certified in progressive care, critical care, cardiology medicine, and/or cardiothoracic surgical nursing. All nurses are trained in basic life support and advanced cardiac life support, with many serving as health system and community instructors.**

## RESEARCH

The **Duke Heart Center Nursing Research Program**, established in 2004, unites research, education, and patient care—and is the nation's only program that offers funded fellowships, giving staff nurses protected research time while they remain in patient-care roles. **Duke cardiac nurses currently lead 23 clinical research studies**, with topics including the evaluation of in-home monitoring systems to

improve patients' ability to spot changes in cardiac symptoms; management of fatigue and assessment of the impact of weight monitoring in HF patients; and evaluation of cleaning solutions to improve patient safety and decrease infection risk. Call 919-684-1622 to learn more.

### SITE-BASED RESEARCH DIRECTOR

Bradi Granger, PhD, RN





Each of Duke University Health System's three hospitals—Duke University Hospital, Duke Raleigh Hospital, and Durham Regional Hospital—has earned Magnet status for nursing excellence from the American Nurses Credentialing Center, an honor earned by fewer than 5 percent of U.S. hospitals.

## HIGHLIGHTS

### Special expertise in caring for geriatric heart patients

Duke is a member of Nurses Improving Care for Healthsystem Elders (NICHE), a national network that uses scientific evidence to evaluate and improve geriatric care and clinical capacity. The 24 Duke Heart Center nurses who have completed the program serve as care experts for the older patients on their units. ([nicheprogram.org](http://nicheprogram.org))

### High patient-satisfaction scores reflect exceptional nursing care

Patient satisfaction scores reflect Duke Heart Center's commitment to high-quality care. From July 1, 2009, to March 31, 2010, Duke Heart Center inpatient units scored in the **top 10 percent** of Council of Teaching Hospitals facilities for patients who said they would recommend Duke to others, according to a Press Ganey survey.



## INFORMATION TECHNOLOGY (IT) Director: James E. Tcheng, MD

Innovative, integrated use of IT benefits Duke Heart Center patients

### Duke heart patients get online access to customized content

Faculty from the Duke Heart Center and the Fuqua School of Business's Health Sector Management program are adding a novel suite of tools to HealthView ([healthview.dukehealth.org](http://healthview.dukehealth.org)), Duke Medicine's online patient portal. Designed to help patients better understand and manage their health, the addition includes tools that will let patients:

- Manage their prescriptions
- Trend, copy, and print their laboratory results
- Review their procedure reports
- Enter their vital signs and other data acquired through home-monitoring devices

The application is just part of Duke's ongoing, health system-wide effort to give patients access to customized content via HealthView. It will include multimedia procedure descriptions, as well as disease-specific information about six prevalent cardiac conditions.

Although **the new HealthView portfolio will initially be available only to Duke Heart Center patients**, its development has created the infrastructure that will enable other clinical programs to implement their concepts over time.

### Portal expansion includes novel image-management tool

The HealthView expansion has enabled Duke patients to do something that patients at no other medical center can: view and print their own cardiac images.

Duke University Health System contracted with IBM Research Laboratories to employ a suite of novel imaging software—which IBM has fine-tuned to Duke's specifications—making Duke the **first institution to give patients electronic access to their electrocardiograms, cardiac cath, and other cardiac images**. The hope is that seeing actual images of their hearts will motivate patients to do the work necessary to reach their health goals.

---

In 2010, Duke became the first institution to give patients secure online access to their electrocardiograms, cardiac cath, and other cardiac images.



More than 1,000 Duke Medicine employees and families participated in the October 2009 Triangle Metro Heart Walk, which raised \$70,000 for American Heart Association research and education efforts. Duke was the top fund raiser of the participating local health care institutions.

## OUTREACH

Easing the burden of heart disease locally, regionally, and beyond

In an ongoing effort to help reduce the growing burden of cardiovascular disease, Duke Heart Center is dedicated to reaching out to the communities on a number of fronts.

### Formal partnerships

Duke-Durham collaborations such as **Project Access of Durham County** and **Local Access to Coordinated Healthcare (LATCH)** help Duke and community physicians (including heart specialists) care for the underserved and uninsured.

In addition, the **Duke Center for Community Research (DCCR)**, a component of the Duke Translational Medicine Institute, helps to rapidly deliver research-based solutions to community practice.

### Community activities and events

Duke Heart Center helps to improve heart health in communities across the region through activities that include:

- **Risk-assessment screenings** at health fairs, churches, work sites, and malls across North Carolina. Duke clinicians screened 7,000 people in 2009, making referrals when appropriate.
- **Scores of Duke cardiologist-led classes**—most free or low-cost—educate community members about topics such as risk factors, implantable cardiac devices, and ischemic heart disease. CPR and defibrillator instruction, as well as risk-assessment screenings, also are offered.
- **Local events for Duke patients, friends, and donors** include the annual Duke-sponsored Fiesta De La Salud (which served more than 2,000 members of the Latino community in 2009); learning luncheons; the annual Red Dress Tea, Duke Integrative Medicine educational sessions, and walking programs at two area malls, which currently have 1,100 registered walkers.
- **Worksite wellness-education programs**, including one in Blairs, Virginia, in partnership with Danville Regional Medical Center.
- **Regional faculty-led presentations**, such as a 2009 forum in Linville, NC, educate hundreds about prevention and heart health.

Dial 919-419-5505 to learn more about Duke Heart Center outreach efforts.

Duke Medicine serves area residents through charity care and other contributions. Our combined community benefit investments (as defined by the IRS) and other investments in regional health care delivery totaled more than \$252 million in the fiscal year that ended June 30, 2009.



A group of Duke heart transplant recipients gathered for an August 2010 reunion.



**THE DUKE HEART NETWORK** Chief Medical Officer: Harry R. Phillips III, MD  
 Advancing cardiovascular care in communities throughout the Southeast

The Duke Heart Network, comprising more than 30 affiliated programs, offers residents in communities throughout the Southeast access to the highest level of cardiovascular care. Our mission is to collaborate with our affiliates to expand specialized services locally—providing patients with options for quality care as close to home as possible. When care needs cannot be met locally, we ensure seamless access to the quaternary services of one of the top 10 cardiovascular centers in the nation.

The Duke Heart Network is supported by a dedicated team of clinicians and administrators with over 100 cumulative years of experience in building and enhancing cardiovascular programs—including mobile cath lab sites, outpatient clinics staffed by Duke physicians, and hospital-based cardiovascular affiliations which comprise our most comprehensive relationships, including five affiliated hospitals throughout the Southeast. These unique affiliations facilitate community and academic partnerships through intensive clinical and programmatic guidance, including development of new services, implementation of evidence-based standards of care, strategic growth planning, regional differentiation, marketing, and clinical business and operational management.

Quality oversight is a hallmark of the network, with the goal of participating in and meeting and exceeding the benchmark measures of national cardiac registries, including the National Cardiovascular Data Registry and the Society of Thoracic Surgeons National Database.



**Cardiovascular Program Development Sites**

**Alamance Regional Medical Center (Burlington, NC)**

Interventional cardiology procedures, including primary percutaneous coronary interventions, backed up by off-site Duke cardiothoracic surgeons. An innovative model based on excellent outcomes and quality oversight by Duke.

**Beaufort Memorial Hospital (Beaufort, SC)**

Cardiovascular program, including a diagnostic catheterization lab, with quality oversight and program development provided by Duke.

**Danville Regional Medical Center (Danville, VA)**

Fully affiliated heart center that offers open-heart (performed by a Duke surgeon) and interventional procedures with Duke-provided quality oversight and program development.

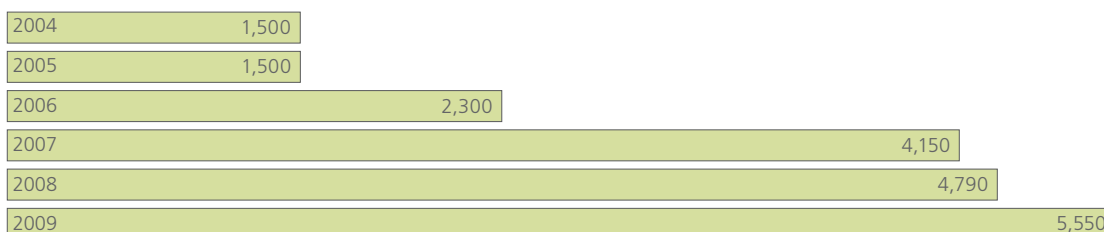
**Indian River Medical Center (Vero Beach, FL)**

Fully affiliated heart center that offers open-heart and interventional procedures with Duke oversight.

**Southeastern Regional Medical Center (Lumberton, NC)**

Fully affiliated Duke-managed heart center that offers open-heart and interventional procedures performed by Duke physicians.

**CARDIOVASCULAR PROCEDURES AT DUKE HEART CENTER AFFILIATED SITES**







Anna Lisa Crowley, MD, trains cardiology fellow Gerald Bloomfield, MD (center), and anesthesiology fellow Ron H. Rawlings, MD, on the HeartWorks TEE patient simulator, an educational tool shared by the Cardiology and Cardiothoracic Anesthesiology programs.

## EDUCATION AND TRAINING Director: Andrew Wang, MD

Duke Heart Center prepares talented young physicians to be leaders in cardiovascular care, research, education, and policy-making. Both cardiology and surgical trainees have opportunities to conduct original research and publish articles in leading journals, with many earning research grants and national recognition. Areas of training include:

- General cardiovascular disease
- General pediatric cardiology
- Clinical cardiac electrophysiology
- Pediatric electrophysiology
- Heart failure and transplantation
- Adult congenital heart disease
- Valvular heart disease
- Advanced cardiovascular imaging
- Cardiovascular MRI
- Advanced research training in clinical, translational, and basic cardiology
- Advanced pediatric cardiology
- Pediatric cardiac and critical care
- Cardiothoracic anesthesiology
- Cardiothoracic surgery

---

**Three successful procedures—placement of a bifurcation iliac stent; recanalization and PCI of a dominant right coronary artery; and a laser-assisted intervention of a superficial femoral artery—were broadcast live in June to trainees in Montreal.**

---

Learn More—Visit [cardiology.duke.edu](http://cardiology.duke.edu) or [cardio.surgery.duke.edu](http://cardio.surgery.duke.edu) and click on “Education”

## HIGHLIGHTS

### Training residents and fellows worldwide

Duke educates scores of cardiology and cardiothoracic surgery trainees at centers around the globe, including the Montreal Heart Institute, the National University of Singapore, Peking University Health Science Center, and Laval University—with many training at both Duke Heart Center and Duke Clinical Research Institute.

### Cardiovascular Disease Fellowship Training Program

Among the nation's largest, Duke's program provides comprehensive clinical training in invasive and non-invasive cardiovascular medicine to about 40 fellows. The ACGME-accredited program is focused on developing clinician-scientists, and requires a two-year commitment to advanced basic science, translational, and clinical research—with NIH training grants available during that time. In 2009, our fellows published approximately 20 original journal articles.

### Cardiothoracic Surgical Residency Program

Duke's three-year Cardiothoracic Surgical Residency Program is among the nation's most highly respected. Faculty mentors help students develop expertise in all clinical aspects of adult cardiac, congenital cardiac, and general thoracic surgery—and teach them to pursue advanced original clinical research. Unique (elective) third-year rotations include these specialties:

- Myocardial revascularization
- Valve repair and replacement
- Minimally invasive cardiac surgery
- Minimally invasive thoracic surgery
- Atrial fibrillation surgery
- Surgery for end-stage cardiac and pulmonary disease
- Ventricular assist device surgery
- Lung cancer surgery
- Surgery for malignant and benign esophageal disease
- Lung-volume reduction surgery



Of the program's 46 alumni from 2003-2010, 66 percent of four-year graduates pursued academic positions, while 34 percent entered private practice.



Co-directors of cardiovascular research at the Duke Clinical Research Institute John H.P. Alexander, MD, MHS (front), and Kenneth W. Mahaffey, MD

## BASIC, CLINICAL, AND COLLABORATIVE RESEARCH

Advancing the science of cardiovascular care

Drawing on robust partnerships with basic scientists and collaborative researchers across Duke University and beyond, Duke Heart Center is internationally known for translating scientific discoveries into well-designed clinical and epidemiological trials aimed at developing novel therapies for heart disease. As study findings are integrated into patient care, we monitor their impact through quality-of-care studies (page 3) that expand the evidence base for clinical practice worldwide.

Read more about our research collaborations below, as well as online at [cardiology.medicine.duke.edu/research](http://cardiology.medicine.duke.edu/research) and [surgery.duke.edu](http://surgery.duke.edu) (click on “Research”).

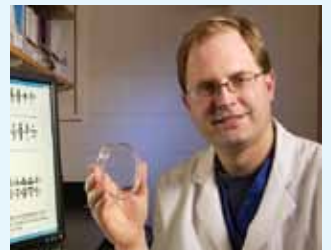
### Basic Research

Duke’s translational and clinical cardiovascular research efforts are rooted in our robust basic research program, through which investigators study cardiovascular genetic and genomic sciences, vascular biology, cardiac biochemistry, molecular approaches to heart disease, and cardiac electrophysiology.

Topics include novel compounds to block harmful signaling pathways and activate protective pathways, which could lead to more effective heart-failure therapies; genetic factors that contribute to cardiovascular disease (page 25); and analysis of cardiac ion channels to identify molecular mechanisms of arrhythmias and sudden cardiac death.

### Site-Based Research

More than 200 cardiology and nearly 70 cardiothoracic surgery trials are currently under way at Duke Heart Center—including a number of “first-in-man” studies—giving Duke patients access to leading-edge therapies, procedures, and devices. (See clinical chapters throughout this report for details on current studies.)



Matthew J. Wolf, MD, PhD, and other Duke cardiologists have determined that the common fruit fly is an excellent model for learning more about the genetic causes of heart disease in humans.



With information on 200,000-plus patients, the Duke Databank for Cardiovascular Disease is the world's largest and oldest outcomes registry of its kind.

## Collaborative Research Entities

Duke Heart Center faculty participate in and collaborate with numerous multidisciplinary institutes and centers engaged in cardiovascular disease research at Duke:

### Duke Clinical Research Institute (DCRI)

The world's foremost academic research organization, the DCRI conducts many of Duke's clinical cardiovascular research studies—and since its 1969 inception, has conducted studies in 64 countries at nearly 3,600 sites, which have enrolled more than one million patients. DCRI faculty published 653 papers in peer-reviewed journals in 2009.

Landmark trials conducted by the DCRI include the HF-ACTION study—which showed that exercise improves quality of life among heart-failure patients—and GUSTO-I, a megatrial that analyzed four thrombolytic treatments in 41,021 heart-attack patients, and set the standard for the modern clinical trial. ([dcri.org](http://dcri.org))

### Duke Translational Medicine Institute (DTMI)

Duke Medicine's academic home for clinical and translational research, the DTMI serves as the umbrella for the DCRI, the Duke Translational Research Institute, the Duke Clinical Research Unit, the Duke Translational Nursing Institute, and the Duke Center for Community Research.

Engaged in scientific discovery, care delivery, and global health, the DTMI assists investigators and partners in conducting human-challenge studies, clinical research, and community-based studies—including the pioneering MURDOCK study, a large-scale epidemiologic study that aims to identify genomic factors of cardiovascular disease and other chronic illnesses. ([dtmi.duke.edu](http://dtmi.duke.edu))

### Duke Institute for Genome Sciences & Policy (IGSP)

The IGSP drives Duke's effort to examine the global impact of genome sciences on life, human health, and social policy—and conducts genome-based investigations ranging from micro-level sequencing studies to population research, with the goal of applying the findings to clinical practice. The institute unites an array of multidisciplinary experts and students from Duke with collaborating institutions, and government entities, and comprises seven centers, including the Center for Genomic Medicine. ([genome.duke.edu](http://genome.duke.edu))

### Duke Global Health Institute (DGHI)

DGHI addresses health disparities worldwide through multidisciplinary research, education, policy engagement, and service. Through its signature cardiovascular disease research initiative, DGHI is currently coordinating research faculty in Africa, India, and China. ([globalhealth.duke.edu](http://globalhealth.duke.edu))

### Duke Center for Human Genetics

Faculty work to discover genetic influences on human health, to characterize the relationship between genetic and environmental influences, and to foster the application of this knowledge to the practice of medicine. ([www.chg.duke.edu](http://www.chg.duke.edu))

### Sarah W. Stedman Nutrition and Metabolism Center

Basic and clinical investigators generate metabolic profiles that help to diagnose and inform the treatment of conditions with strong metabolic links, including cardiovascular disease—and perform metabolic/biomarker profiling using a Duke-developed technology platform. ([stedman.mc.duke.edu](http://stedman.mc.duke.edu))

### Mandel Center for Hypertension and Atherosclerosis at Duke

Established in 2007 with support from the Edna and Fred L. Mandel Jr. Foundation, the center is dedicated to advancing the understanding of these key cardiovascular disease risk factors through rigorous investigation. Dial 919-668-4778 to learn more.

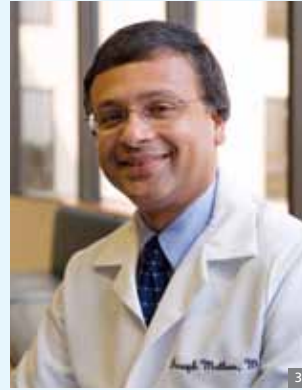
### Duke University Cooperative Cardiovascular Studies (DUCCS) Group

Led by Duke cardiology alumni, this network of community- and academic-based clinical study sites coordinates participation in large clinical trials. DUCCS regularly collaborates with the DCRI and participates in NIH-sponsored and industry-, academic-, and community investigator-initiated studies. Established in 1987, DUCCS now comprises more than 200 members in 37 states. ([ctnbestpractices.org/duccs](http://ctnbestpractices.org/duccs))

---

Duke Heart Center faculty receive more than \$85 million in cardiovascular research funding each year from government and private sources, including more than \$15 million for basic research and more than \$70 million—much of it through the Duke Clinical Research Institute—for clinical research.

## HEART CENTER LEADERSHIP



**Christopher M. O'Connor, MD<sup>1</sup>**  
 Director, Duke Heart Center  
 Acting Chief, Cardiology  
[oconn002@mc.duke.edu](mailto:oconn002@mc.duke.edu)

**Peter K. Smith, MD<sup>2</sup>**  
 Chief, Cardiovascular  
 and Thoracic Surgery  
[smith058@mc.duke.edu](mailto:smith058@mc.duke.edu)

**Joseph P. Mathew, MD<sup>3</sup>**  
 Chief, Cardiothoracic Anesthesiology  
[mathe014@mc.duke.edu](mailto:mathe014@mc.duke.edu)

**Thomas M. Bashore, MD<sup>4</sup>**  
 Vice Chief, Cardiology  
[thomas.bashore@duke.edu](mailto:thomas.bashore@duke.edu)

**John F. Rhodes Jr., MD<sup>5</sup>**  
 Chief, Pediatric Cardiology  
[john.rhodes@duke.edu](mailto:john.rhodes@duke.edu)

**Robert D.B. "Jake" Jaquiss, MD<sup>6</sup>**  
 Chief, Pediatric Cardiothoracic Surgery  
[robert.jaquiss@duke.edu](mailto:robert.jaquiss@duke.edu)

**Harry R. Phillips III, MD<sup>7</sup>**  
 Chief Medical Officer,  
 Duke Heart Network  
[phill014@mc.duke.edu](mailto:phill014@mc.duke.edu)

**Robert A. Harrington, MD<sup>8</sup>**  
 Director, Duke Clinical  
 Research Institute  
[robert.harrington@duke.edu](mailto:robert.harrington@duke.edu)

**Eric D. Peterson, MD, MPH<sup>9</sup>**  
 Associate Director, Duke Clinical  
 Research Institute  
[peter016@mc.duke.edu](mailto:peter016@mc.duke.edu)

**Mark Leithe, MD<sup>10</sup>**  
 Director, Cardiovascular Services,  
 Duke Raleigh Hospital  
[mark.leithe@duke.edu](mailto:mark.leithe@duke.edu)

**Lawrence E. Crawford, MD<sup>11</sup>**  
 Director, Duke Cardiology of Danville (VA)  
[crawf036@mc.duke.edu](mailto:crawf036@mc.duke.edu)

**Marti Taylor, RN, MSN<sup>12</sup>**  
 Associate Vice President,  
 Duke University Health System  
[marti.taylor@duke.edu](mailto:marti.taylor@duke.edu)

**Kirk Bradley, MBA<sup>13</sup>**  
 Chair, Duke Heart Center Advisory Board  
 Member, Duke University Medical  
 Center Board of Visitors

## HEART CENTER FACULTY PHYSICIANS

### CARDIOLOGY

#### DUKE UNIVERSITY MEDICAL CENTER-BASED PHYSICIANS (DURHAM, NC)

John H.P. Alexander, MD  
Karen P. Alexander, MD  
Sana M. Al-Khatib, MD, MHS  
Tristram D. Bahnson, MD  
Thomas M. Bashore, MD  
Richard C. Becker, MD  
Michael A. Blazing, MD  
Salvador Borges-Neto, MD  
Robert M. Califf, MD  
Lawrence E. Crawford, MD  
Anna Lisa C. Crowley, MD  
Michael S. Cuffe, MD  
James P. Daubert, MD  
Sandesh Dev, MD  
Pamela S. Douglas, MD  
Victor J. Dzau, MD  
G. Michael Felker, MD, MHS  
Terry A. Fortin, MD, MS  
Camille G. Frazier-Mills, MD, MHS  
Neil J. Freedman, MD  
Thomas Gehrig, MD  
Geoffrey S. Ginsburg, MD, PhD  
Christopher B. Granger, MD  
Augustus O. Grant, MD  
Ruth Ann Greenfield, MD  
Michael D. Gunn, MD  
Robert A. Harrington, MD  
J. Kevin Harrison, MD  
Donald D. Hegland, MD  
Adrian F. Hernandez, MD  
Patrick M. Hranitzky, MD  
Kevin P. Jackson, MD  
James G. Jollis, MD  
Robert M. Judd, PhD  
Han W. Kim, MD  
Raymond J. Kim, MD  
Joseph A. Kisslo, MD  
Igor Klem, MD  
David F. Kong, MD  
Christopher D. Kontos, MD  
William E. Kraus, MD  
Robert Lefkowitz, MD  
Kenneth W. Mahaffey, MD  
Daniel B. Mark, MD  
L. Kristin Newby, MD, MHS  
Kent R. Nilsson Jr., MD  
Christopher M. O'Connor, MD  
E. Magnus Ohman, MD  
Chetan Patel, MD  
Manesh R. Patel, MD  
Eric D. Peterson, MD, MPH  
Harry R. Phillips III, MD  
Jonathan P. Piccini, MD  
Geoffrey S. Pitt, MD, PhD  
Thomas J. Povsic, MD  
Howard A. Rockman, MD  
Matthew T. Roe, MD, MHS  
Joseph G. Rogers, MD  
Paul B. Rosenberg, MD  
Zainab Samad, MD  
Douglas D. Schocken, MD  
Bimal R. Shah, MD

Svati H. Shah, MD, MHS  
Michael H. Sketch, MD  
Jonathan A. Stiber, MD  
James E. Tcheng, MD  
Kevin L. Thomas, MD  
Pierluigi Tricoci, MD, PhD, MHS  
Eric J. Velazquez, MD  
Deepak Voora, MD  
Andrew Wang, MD  
Tracy Yu-Ping Wang, MD, MHS  
Cary C. Ward, MD  
Mark A. Winchester, MD  
Matthew J. Wolf, MD, PhD

#### DURHAM REGIONAL HOSPITAL-BASED PHYSICIAN (NC)

Lawrence E. Crawford, MD

#### DUKE RALEIGH HOSPITAL-BASED PHYSICIANS (NC)

George L. Adams, MD, MHS  
Radha G. Kachhy, MD  
Mark E. Leithe, MD  
Lawrence Liao, MD  
James S. Mills, MD  
James W. Peterson, MD  
Stephen E. Robinson, MD

#### DURHAM VAMC-BASED PHYSICIANS (NC)

Brett D. Atwater, MD  
Mark P. Donahue, MD  
Joseph C. Greenfield, MD  
William S. Jones, MD  
Mitchell W. Krucoff, MD  
Kenneth G. Morris, MD  
Sunil V. Rao, MD  
Robert A. Waugh, MD

#### SOUTHEASTERN REGIONAL MEDICAL CENTER-BASED PHYSICIANS (LUMBERTON, NC)

Scott J. Denardo, MD  
Melvin Echols, MD  
Robert G. Everhart, MD  
Sydney G. Short, MD  
Christopher R. Walters, MD

### CARDIOTHORACIC SURGERY

#### DUKE UNIVERSITY MEDICAL CENTER-BASED PHYSICIANS (DURHAM, NC)

Mark F. Berry, MD, MSE  
Thomas A. D'Amico, MD  
R. Duane Davis, MD  
Jeffrey G. Gaca, MD  
Donald D. Glower, MD  
David H. Harpole Jr., MD  
G. Chad Hughes, MD  
Robert D.B. "Jake" Jaquiss, MD  
Shu S. Lin, MD, PhD  
Andrew J. Lodge, MD  
Carmelo A. Milano, MD  
Mark W. Onaitis, MD  
Peter K. Smith, MD  
Betty C. Tong, MD, MHS

#### DANVILLE REGIONAL MEDICAL CENTER-BASED PHYSICIAN (VA)

Alan A. Simeone, MD

#### DUKE RALEIGH HOSPITAL-BASED PHYSICIANS (NC)

Albert S.Y. Chang, MD  
David C. White, MD

#### DURHAM REGIONAL HOSPITAL-BASED PHYSICIAN (NC)

Cyrus J. Parsa, MD, MHS

#### NORTHEAST CARDIOVASCULAR-BASED PHYSICIANS (CONCORD, NC)

Ralph S. Christy Jr., MD  
Christopher K. Cicci, MD  
Medhat W. Takla, MD

#### SOUTHEASTERN REGIONAL MEDICAL CENTER-BASED PHYSICIAN (NC)

Terry S. Lowry, MD

#### DURHAM VAMC-BASED PHYSICIANS (NC)

Broadus Z. Atkins, MD  
James E. Lowe, MD  
Walter G. Wolfe, MD

### PEDIATRIC CARDIOLOGY

Brenda E. Armstrong, MD  
Frederique C. Bailliard, MD  
Piers C.A. Barker, MD  
Michael J. "Jay" Campbell, MD  
Michael G.W. Camitta, MD  
Michael P. Carboni, MD  
Ira M. Cheifetz, MD  
Gregory A. Fleming, MD  
G. William "Bill" Henry, MD  
Kevin D. Hill, MD, MS  
Salim F. Idriss, MD, PhD  
Ronald J. Kanter, MD  
Jon M. Meliones, MD, MS  
Jennifer S. Li, MD  
Angelo S. Milazzo, MD  
Stephen G. Miller, MD  
Sara K. Pasquali, MD  
John F. Rhodes Jr., MD  
Stephanie Burns Wechsler, MD

### CARDIOTHORACIC ANESTHESIOLOGY

#### DUKE UNIVERSITY MEDICAL CENTER-BASED PHYSICIANS (DURHAM, NC)

Nicolas Aeschlimann, MD  
Solomon Aronson, MD  
Jose Mauricio del Rio, MD  
Katherine P. Grichnik, MD  
Steven E. Hill, MD  
Richard J. Ing, MB BCH  
Jorn Karhausen, MD  
Miklos D. Kertai, MD  
F. Willem Lombard, MB ChB  
G. Burkhard Mackensen, MD, PhD  
Joseph P. Mathew, MD, MHS  
Andre S. Motie, MD  
Mark F. Newman, MD  
Alina Nicoara, MD  
Mihai V. Podgoreanu, MD  
Scott R. Schulman, MD  
Mark Stafford-Smith, MD  
Madhav Swaminathan, MD  
Ian J. Welsby, MB BS



Visit [dukemedicine.org/heartreport](http://dukemedicine.org/heartreport) for a list of Duke heart care-related Web sites.

## RESOURCES FOR CLINICIANS

### Consultations and Referrals

Schedule appointments and access information by calling:

- **Duke Consultation and Referral Center**  
800-MED-DUKE (633-3853). 7:30 a.m. – 6:00 p.m. (EST)
- **Duke Heart Center**  
888-HRT-DUKE (478-3853) or 919-681-5816. 8:00 a.m. – 5:00 p.m. (EST)
- **Duke University Hospital (After Hours)**  
Dial 919-684-8111 and ask for the on-call cardiologist.

### Acute Care Services

- **Acute Chest Pain Clinic**  
Same-day appointments for patients with urgent (not emergent) chest pain. Area physicians can dial 888-HRT-DUKE (478-3853) for details.
- **Acute Myocardial Infarction (MI) Hotline**  
When ECG indicates ST-elevation MI, regional physicians and EMS personnel can contact a Duke cardiologist, activate the cath lab, and arrange transport to the nearest Duke Heart Center or affiliate site for PCI. Dial 919-627-0485 to learn more.

### Continuing Medical Education and Professional Development

Educational opportunities for clinicians, educators, and researchers include:

- **Office of Continuing Medical Education**  
Offers live courses; Web- and CD-ROM-based seminars; and remote real-time training. Visit [cme.mc.duke.edu](http://cme.mc.duke.edu) and/or [cardiology.duke.edu](http://cardiology.duke.edu), call 919-401-1200, or e-mail [cme@mc.duke.edu](mailto:cme@mc.duke.edu).
- **Duke Clinical Research Institute's Clinical Medicine Series**  
Offers an array of courses and conferences. Visit [dcri.org/education-training/dcms](http://dcri.org/education-training/dcms) or e-mail [dcms@dcri.duke.edu](mailto:dcms@dcri.duke.edu).
- **Training in the use of the most current cardiac-assist, bypass, and imaging technologies.** Dial 919-681-4081 to learn more.

### Clinical Trials

- **Duke Clinical Research Institute**  
Interested researchers may visit [dcri.org/trial-participation](http://dcri.org/trial-participation).
- **Clinical Trials Networks Best Practices**  
For clinical research resources, visit [ctnbestpractices.org](http://ctnbestpractices.org). Co-sponsored by DCRI and NIH.
- **Duke Heart Center**  
Visit [dukehealth.org/clinicaltrials/heart](http://dukehealth.org/clinicaltrials/heart) for a partial list of current trials.

Access the Duke Heart Center Report Online

Visit [dukemedicine.org/heartreport](http://dukemedicine.org/heartreport) for a PDF of this report. While care was taken to ensure the accuracy of data and information in this publication, any necessary updates or corrections will also be available via this Web page.

## RESOURCES FOR PATIENTS

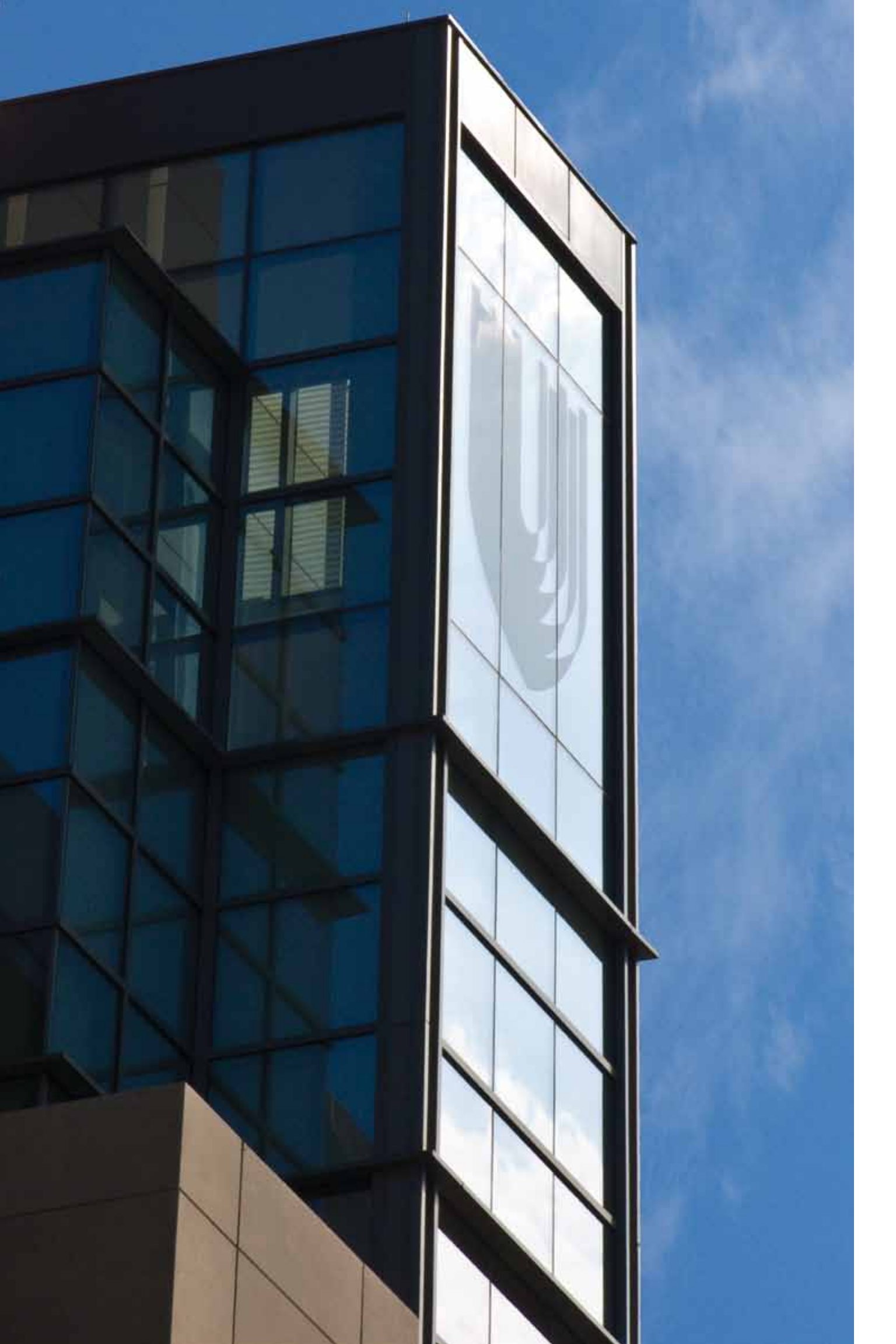
- **Duke Consultation and Referral Center**  
888-ASK-DUKE (275-3853)
- **Heart Center Patient Support Program**  
Unites recovered Duke Heart Center patients with current patients. Dial 919-681-5031.
- **Special Constituent Patient Program**  
Patient Navigators serve patients with unique needs or who require special assistance. Learn more at 919-684-6919.
- **International Patient Center**  
Dial 919-681-3007 for details.



This report is printed on Utopia Two: Xtra Green, 100-lb. text stock. Environmental savings realized by using this paper are summarized below:

Lbs of Paper used <b>38,861.375</b>	Landfill Waste Reduced in Lbs <b>6,924</b>
Trees Saved <b>115</b>	Net Greenhouse Emissions Saved in Lbs <b>39,223.82</b>
Water Saved in Gallons <b>41,852</b>	Energy Consumption Reduced in BTU <b>79.4 million</b>

Produced by the Office of Marketing and Creative Services © Duke University Health System, 2010 MCOC-7677



# AWARDS & RECOGNITION

Ranked ninth among the nation's best heart programs by *U.S. News & World Report* in 2010 —and in the **top ten since 1993**

---

American College of Cardiology Foundation's 2010 ACTION Registry—*Get With the Guidelines* **Gold Performance Achievement** Award earned by Duke University Hospital and Durham Regional Hospital

---

Named among the country's **highest-performing heart transplant centers** by the U.S. Department of Health and Human Services

---

**Gold Level recognition** earned by Duke University Hospital for complying with the core standards of care for heart failure, as outlined by the American Heart Association and American College of Cardiology

---

Named by *Medical Economics* as a **Center of Excellence** for interventional cardiology

---

Mechanical Circulatory Support Program is **certified by The Joint Commission** for destination VAD therapy

---

Duke University Hospital is one of three U.S. hospitals to earn the 2009 American Association-McKesson **Quest for Quality Prize** Citation of Merit

---

All three Duke University Health System hospitals have earned **Magnet status** for nursing excellence from the American Nurses Credentialing Center

---

Duke University Hospital ranked **number one in the U.S. for five of the six acute MI process measures** when compared to a national group of academic medical centers, according to the University HealthSystem Consortium's September 2010 quality measures report

---

Duke University Health System is recognized by the American Heart Association as a "**Start! Fit-Friendly Company**"



**Duke**Medicine

**Duke Heart Center**  
DUMC 3525 Durham, NC 27710

888-HRT-DUKE  
800-MED-DUKE  
[dukehealth.org/heart](http://dukehealth.org/heart)