

## ***TO THE APPLICANT***

The Cardiovascular Division of Brigham and Women's Hospital maintains both clinical and research fellowship programs. The primary goal of the training program is to prepare trainees to be outstanding academic cardiologists involved in research, education, and/or clinical activities. This description is designed to introduce prospective applicants to the breadth and depth of cardiovascular training available at the Brigham and to serve as a guide for fellows in the program.

The primary purpose of the clinical fellowship is the training of physicians, previously trained in internal medicine, in four major areas of cardiology: inpatient and outpatient clinical care and consultation, invasive cardiac procedures, coronary intensive care, and noninvasive diagnostic techniques. As required by the ACGME, 24 months is spent in these required clinical rotations. A central goal of the program is to prepare physicians to be outstanding cardiovascular clinicians to enable an academic career. Virtually all clinical fellows become eligible for, take, and pass the Subspecialty Board Examination in Cardiovascular Disease. Minimum requirements for Board eligibility include 24 months of full-time clinical training and 12 months of research experience. Clinical activities of the Brigham and Women's Hospital program include training experiences at Brigham and Women's Hospital, VA Boston Healthcare/West Roxbury Campus, and the Massachusetts General Hospital.

The primary purpose of the research component of the fellowship is to develop expertise in a specific area of basic or clinical investigation. This work may be pursued in molecular or cellular biology, physiology, cardiac catheterization, noninvasive imaging, clinical trials/epidemiology, or any of a number of combinations thereof. In most instances, 12-24 months will be spent in this type of training, although exact time commitments are flexible. All fellows will be encouraged to write for extramural funding as part of their research training. It is anticipated that such training will prepare fellows for productive careers in academic cardiology. All fellows entering the program will participate in both clinical and research training. Research training may be based at the BWH, the VA/West Roxbury, Harvard Medical School, MIT or other associated Harvard University laboratories.

The combined clinical and research cardiovascular medicine fellowship at the Brigham is a three year program; trainees in this program are assured of three years of financial support. In addition to the general cardiology training, programs in interventional cardiology, clinical cardiac electrophysiology, heart failure/transplant, noninvasive imaging and vascular medicine are available.

In this description we provide more detailed information on the structure of the training program and faculty. The fellowship program provides training in "cutting-edge" technology and research that will form the basis for cardiovascular research in the coming decades. We hope you enjoy this introduction to the Cardiovascular Division at Brigham and Women's Hospital and we invite you to consider joining us if your career objectives correspond with program offerings.

Peter Libby, Patrick O'Gara & Joshua Beckman

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## ***HISTORY AND PRESENT ORGANIZATION OF THE CARDIOVASCULAR DIVISION OF BRIGHAM AND WOMEN'S HOSPITAL***

The Hospital has been a center for training in cardiovascular medicine and research virtually since it was founded in 1913 under the leadership of outstanding physicians and investigators such as Drs. Henry Christian, Soma Weiss, Samuel Levine, Lewis Dexter and Richard Gorlin. Until 1971, there was no single administrative chief of the Cardiovascular Division; Drs. Dexter, Gorlin and Lown maintained separate clinical services and research facilities. Following the appointment of Dr. Eugene Braunwald as Chairman of the Department of Medicine, Dr. Thomas W. Smith was appointed Chief of the Cardiovascular Division. Under Dr. Smith's leadership, there was a dramatic growth in the number of faculty as well as in the depth and breadth of research investigation. In 1980, three Harvard teaching hospitals, the Robert B. Brigham Hospital, the Peter Bent Brigham Hospital and the Boston Hospital for Women merged to form Brigham and Women's Hospital. Dr. Libby was appointed Chief of the Cardiovascular Division in December 1997 following the death of Dr. Thomas Smith. In 2005 Joseph Loscalzo, M.D., Ph.D. was appointed as the Chairman of the Department of Medicine. Dr. Libby continues to maintain the Brigham and Women's Hospital commitment to academic cardiovascular medicine while meeting the challenges of the current medical climate.

A review of the 230 Brigham cardiology training program graduates since 1976 showed that of the trainees completing training in clinical and research aspects of cardiology, 75% were in full time academic positions, and 44% of those in academic positions held the academic rank of associate or full professor. During the most recent 5 year period of our training grant from the NIH, of individuals completing the training program 49 of 63 are in full-time academic posts and 47 of 49 have university appointments in leading academic centers.

### ***THE BOSTON AREA***

Boston is considered by many to be one of the most desirable cities in this country. In addition to its world-renowned educational institutions, numerous cultural activities and museums are available including the Boston Symphony Orchestra, Boston Pops, Boston Ballet, Museum of Fine Arts, and Museum of Science. Many historical sites may be found locally and it is only a short drive to surrounding areas including Plymouth, Salem, Lexington, and Concord. Boston is a one hour drive by car from the beaches of Cape Cod and 2-3 hours from the ski slopes in Maine, Vermont and New Hampshire. The city is the home of the Boston Red Sox, Bruins, and Celtics, and the home of the New England Patriots in nearby Foxboro. The city provides stimulating and exciting educational and cultural activities for all.

### ***PARTNERS IN CARDIOLOGY***

In 1993, Brigham and Women's Hospital and the Massachusetts General Hospital joined forces to become Partners HealthCare. The cardiovascular training programs of the two institutions have now integrated in such a manner that clinical rotations at the "partner" institution are now required and the ability to pursue elective clinical work at either institution remains available. Currently, Brigham and Women's Hospital cardiovascular fellows rotate through Nuclear

Cardiology, the Cardiac Catheterization Laboratory, the Echocardiography Laboratory, the Bigelow Consultative Service, Coronary Care Unit and Electrophysiology at Massachusetts General Hospital. Fellows from the Massachusetts General Hospital similarly rotate through the Brigham and Women's Hospital and the West Roxbury VA Hospital. Fellows from both institutions become close colleagues and are highly regarded by the attending cardiovascular staff from both institutions.

## **CLINICAL TRAINING IN THE CARDIOVASCULAR DIVISION**

The clinical services of the Cardiovascular Division are extremely active with over 4000 admissions, 7500 invasive cardiac procedures, 20,000 outpatient visits, and 13,000 echocardiograms annually. The clinical training in cardiology consists of a minimum of 24 months of clinical rotations. The first twelve months of this experience constitute the "core" training requirements, experiences that every trainee needs to be a skilled cardiologist. A unique aspect of our training program is the opportunity to work one on one with an experienced, talented staff member.

**During the “core year” first year fellows will rotate through the following rotations:**

### **Clinical Inpatient Service (BWH - B Team)**

This service admits cardiology patients for diagnostic work-up and/or management of cardiac disease. These patients may be admitted to the hospital by staff or referring physicians. Fellows will be exposed to the cardiovascular indications for hospitalization and the management of patients with cardiovascular diseases in an inpatient setting. Fellows will learn to care effectively for patients with unstable angina pectoris, myocardial infarction, chest pain syndromes, heart failure, hypertension, valvular heart disease, pulmonary vascular and thromboembolic disease, pericardial disease and arrhythmias. In managing these patients fellows will be taught the use, benefits and risk of pharmacologic, mechanical, noninvasive and invasive therapy in patients with these disorders. Fellows will work directly with an attending staff member to deliver medical care to these patients and provide teaching to the medical house staff and students.

### **Coronary Care Unit (BWH – Levine Cardiac Unit)**

During the CCU rotation, fellows will participate in the evaluation and management of patients with cardiovascular disorders hospitalized in an intensive care unit setting and to understand the indications for hospitalization in a cardiac intensive care unit. Fellows will provide care for patients with acute coronary syndromes, cardiogenic shock, severe congestive heart failure, malignant arrhythmias, cardiac-transplant related complications, hypertensive emergencies, advanced congenital heart disease, aortic dissection and other severe cardiovascular disorders. Fellows will learn the use, risks and benefits of invasive monitoring, mechanical cardiac support, and intravenous inotropic and pressor agent. They will develop their skills in performing CCU procedures including temporary pacing wires, swan-ganz catheter lines, arterial lines, and intra-aortic balloon pump placement.

### **Veteran's Administration Consultation Service**

Fellows rotate through the consultation service of the VA Boston Healthcare System/West Roxbury Campus during their core year. The patient population at the VA Hospital is ubiquitously affected by coronary and peripheral vascular disorders. The first year fellow evaluates all cardiology consults along with a staff cardiologist. This consultative service provides the trainee with a well-rounded general consultative experience, facilitating integration of noninvasive and invasive data into patient management. Although an intensive experience, it uniformly wins high praise by trainees for the breadth and complexity of cardiovascular illness encountered.

### **Cardiac Catheterization Laboratory (BWH and MGH)**

Cardiac catheterization is performed for the diagnosis and therapy of coronary artery, pulmonary vascular, valvular, and myocardial cardiac diseases. Fellows will learn how to complete a precatheterization evaluation, to perform and interpret right heart catheterization and to become proficient in left heart catheterization. The limitations, complications and interpretation of angiographic tests will be explained. Fellows will learn to perform pericardiocentesis during this rotation. They will be trained in placement of intra-aortic balloon counterpulsation devices and placement of temporary pacing wires. Fellows will be trained in achieving hemostasis at the groin entry sites and will learn the management of groin complications. Fellows will be exposed to the pharmacology of anticoagulants and antithrombotics used in the catheterization laboratory. Fellows will also be kept up to date regarding the latest developments in interventional cardiology.

### **Echocardiography Laboratory (BWH and MGH)**

During this rotation, fellows will be taught the indications and appropriateness for transthoracic echo (TTE) and will learn to perform autonomously a standard comprehensive TEE, tailored to the indication for the exam. Fellows will be exposed to cardiac emergencies diagnosed by echocardiography and will learn to recognize and manages these emergencies. Fellows will learn to interpret the significant findings in a TTE and understand the appropriateness and indication for transesophageal echocardiography (TEE) compared with other imaging tests (e.g., radiologic or nuclear) to complement echocardiography. Fellows will gain an understanding of the principles, utility and practice of exercise stress testing and stress echo.

### **Cardiac Rehabilitation/Preventive Cardiology (MGH)**

This rotation provides training in clinical preventive cardiology that will allow the fellow to understand the principles and practice of preventing heart disease in individuals at risk. Fellows will become familiar with the principles of management of exercise-based cardiac rehabilitation, lipid abnormalities, noninvasive imaging and blood biomarkers for cardiovascular risk assessment, nicotine addiction, resistant hypertension and stress-related disorders. Fellows will learn general strategies for the primary and secondary prevention of atherosclerotic vascular disease and will learn the integration of preventive measures into the practice of general cardiology.

### **Bigelow Consult (MGH)**

This rotation will provide fellows with an understanding of the principles of preoperative evaluation of noncardiac surgery and cardiac surgery. They will develop the skills to become an

effective consultant and to collaborate and communicate effectively with colleagues in radiology, surgery, anesthesia, pulmonology and obstetrics and gynecology. Fellows will learn to synthesize data from the patient history, examination and laboratory results and provide appropriate medical recommendations to consulting services.

### **Nuclear Cardiology (MGH)**

In this rotation fellows will achieve competence in cardiac stress testing and nuclear cardiology imaging including cardiac PET-CT. During their rotation fellows are expected to participate in all aspects of cardiac stress testing associated with nuclear cardiology imaging procedures including Single Photo Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET).

**The second year of clinical training is composed of 12 months in advanced cardiac rotations.** These rotations include:

### **Electrophysiology/Pacing (BWH and MGH)**

The Electrophysiology rotation provides fellows with a firm foundation of knowledge about the evaluation and management of patients with disturbances of cardiac rhythm. Fellows will become familiar with the assessment and management of documented or suspected arrhythmias as a General Consultative Cardiologist. They will learn about antiarrhythmic medicines and the indications, contraindications, risks and benefits of invasive EP procedures, including diagnostic EP studies and ablations and the evaluation of intracardiac electrograms. Fellows will also be exposed to the indications, contraindications, risks and benefits of device implantations, including permanent pacemakers, ICDs and CRT devices. They will also gain knowledge of the risks and benefits for lead extractions, interrogation of pacemakers and ICDs and will further enhance their understanding of surface electrocardiograms.

### **Heart Failure/Cardiac Transplant (BWH)**

Fellows will learn the natural history and appropriate evaluation of patients with heart failure. They will learn the indications for hospitalization and use of pulmonary arterial lines in patients with heart failure. Fellows will gain an understanding of hemodynamics in heart failure. They will become familiar with pharmacology and mechanical therapy used in heart failure and will learn methods of prevention of deterioration in LV function in patients following myocardial infarction. Fellows will also learn the indications for cardiac transplantation. Brigham and Women's Hospital established the first cardiac transplantation program in New England in 1983, and currently serves as the leading transplantation program in the six New England states. The Cardiac Transplant Program is designed so that a cardiology fellow may become involved in any phase of this intense clinical process.

### **Brigham and Women's Consultation Service**

During this second consultative rotation fellows will hone their skills of preoperative evaluation of patients undergoing noncardiac and cardiac surgery and refine their effectiveness as a consultant and collaborator. Moreover, they will be exposed to the care of patient with non-coronary arterial disease, venous thromboembolism, and lymphatic diseases.

### **Cardiac Catheterization (VA Boston Healthcare/West Roxbury Campus)**

Second year fellows spend two months performing cardiac catheterization at the VA Hospital. Fellows are involved in the precatheterization assessment of patients as well as the catheterization procedure. This is a popular rotation since the fellows have the opportunity to expand on the basic skills acquired in the first year of training by serving as the primary angiographer.

### **Noninvasive Cardiology (VA Boston Healthcare/West Roxbury Campus)**

Second year fellows also spend two months at the VA Hospital focusing on noninvasive imaging modalities and their use in patients with a variety of cardiovascular disorders. The rotation integrates exercise testing, nuclear imaging, and echocardiographic imaging, allowing the trainees to better appreciate the strengths and weaknesses of each modality. The fellows are actively involved in the performance of transesophageal echocardiograms on patients undergoing cardiac surgery.

### **Nuclear Cardiology (BWH)**

All fellows spend one month in Nuclear Cardiology at BWH. This rotation provides instruction in radioventriculography as well as thallium and sestamibi perfusion scans. Fellows are also introduced to positron emission tomography and magnetic resonance scanning during this rotation.

### **CCU (MGH)**

Second year fellows will spend a second month in the CCU setting at MGH. Fellows will build on their first CCU rotation, gaining additional experience in the management of acutely ill patients and the performance of CCU procedures.

### **Boston Adult Congenital Heart Service (BACH)**

The Boston Adult Congenital Heart Service (BACH) is a multi-institutional, multi-disciplinary group dedicated to the advancement of care for adolescents and adults born with heart disease. In this rotation fellows will become familiar with the anatomy and physiology and current therapies of patients with congenital heart disease, and/or pulmonary hypertension. They will learn the use of noninvasive and invasive diagnostic modalities in patients with congenital heart disease and/or pulmonary hypertension.

## **AMBULATORY CARDIAC EXPERIENCE**

The ambulatory cardiovascular experience is a weekly commitment that extends over the three years of fellowship training. Fellows provide ambulatory care at two sites: 1) Brigham Medical Group and 2) VA Continuity Clinic. Fellow alternate on a weekly basis between sites.

### **The Brigham Medical Group**

Located in the Ambulatory II building at Brigham and Women's Hospital, the Cardiac Diagnostic Center of Brigham Medical Group serves as the private offices of the cardiology staff physicians and the cardiothoracic surgeons. Facilities for a comprehensive ambulatory cardiovascular

evaluation are present. Office hours are generally from 8:30 a.m. to 6:00 p.m. daily. Staff members see their own patients as well as referrals from general practitioners, internists, or surgeons in the community or from surrounding areas for evaluation and management of diagnostic and/or therapeutic problems. Fellows evaluate new ambulatory patients and follow patients acquired from the in-patient setting longitudinally in preceptor-supervised sessions. Fellows are responsible for the entire cardiovascular care of these patients, including the dictation of letters to referring physicians and the arrangement of diagnostic and/or therapeutic procedures as needed.

Fellows may also gain experience in cardiovascular subspecialty clinics, such as lipid disorders, vascular medicine, congestive heart failure, pacemakers, electrophysiology, and heart transplantation.

### **VA Continuity Clinic**

At this site fellows participate for a three year period in the continuity clinics at the West Roxbury Campus of the VA Boston Healthcare System. Each fellow works with a "team" (a staff member, a nurse manager and other fellows) in seeing new ambulatory patients and following them longitudinally. Fellows encounter a wide variety of disease processes including coronary and peripheral atherosclerosis, valvular heart disease, and arrhythmias. Again, the primary cardiovascular care of the veteran becomes the responsibility of the fellow.

## ***ROUNDS AND CONFERENCES***

There are daily teaching rounds for all of the major subsections of the Cardiovascular Division at the Brigham and Women's Hospital and at the West Roxbury campus of VA Boston Healthcare. There are also weekly conferences that cover a broad range of subjects including anatomy, physiology, genetics, physical diagnosis, therapeutics, clinical trials/outcomes, epidemiology, and pharmacology.

The following **GENERAL CARDIOLOGY CONFERENCES** are held at Brigham and Women's Hospital and are open to all:

### **Fellows Report**

Mondays from 12:00-1:00 p.m. in the Dexter Library. Fellows Report includes presentations of cases to senior staff members (including Drs. Braunwald, Thibault, Libby, and O'Gara). All fellows are expected to attend.

### **Clinical Conference**

Tuesdays from 7:30 a.m. to 8:30 a.m. in the Bornstein Amphitheater. This is a well-attended conference during which cases of particular interest from the clinical service, catheterization lab, consultation, coronary care unit, and the noninvasive lab are presented. Cardiac and vascular surgical colleagues attend and participate actively in this conference. Once a month, cardiac pathology formally reviews clinicopathologic correlations including histology and gross specimens along with imaging studies obtained antemortem. The monthly Morbidity and Mortality Conference is also held during this time.

### **Noninvasive Conference**

Tuesdays from 12:00 p.m. to 1:00 p.m. in the Dexter Library. Cases are prepared by fellows in the Noninvasive Lab. This conference is attended by community cardiologists, our own cardiac anesthesiologists, and the Brigham attending staff. The emphasis is on the understanding of noninvasive cardiovascular assessment, particularly echocardiography.

### **Core Curriculum Lecture Series**

Wednesdays from 7:00 a.m. to 8:00 a.m. in the Dexter Library. This is a "fellows only" conference. Lectures topics include pharmacology, clinical issues, imaging, interventions, heart failure, electrophysiology, transplantation, clinical trials, epidemiology and ethics. Attendance by first year fellows is required. Speakers are taken from the attending staff, many of who are considered leading experts in these areas.

### **ECG Conference**

Wednesdays from 12:00 to 1:00 p.m. in the Dexter Library. This is a weekly conference for fellows and serves as a systematic review of all major topics in electrocardiography and electrophysiology. ECGs of unusual interest are discussed. Hemodynamics rounds and Journal Club also take place once a month during this conference in lieu of the ECG conference.

### **Cardiovascular Work-in-Progress Seminar**

Wednesdays from 4:30 to 5:30 PM in the Dexter Library. This weekly seminar presents the ongoing work the diverse basic, translational, and clinical research interests within the Division for discussion among scientific colleagues.

### **Cardiovascular Grand Rounds**

Thursdays at 1:00 p.m. in the Anesthesia Conference Room. This is a combined lecture-seminar-case presentation series that extends from mid-September to mid-June and features local as well as invited speakers.

### **SUBSPECIALTY CONFERENCES INCLUDE:**

#### **Cardiac Catheterization Teaching Conference**

Held weekly in the cath lab conference room on Monday at 7:00 a.m.

#### **Electrophysiology Conference Series**

Fridays from 7:30-8:30 am in the Dexter Library. In-depth discussions and reviews of topics in the clinical cardiac electrophysiology curriculum are reviewed for the electrophysiology fellows.

#### **Cardiomyopathy/Cardiac Transplant Conference**

Fridays from 1:00-2:00 pm in the Dexter Library. Speakers present original research or state-of-the-art reviews on a variety of topics relevant to heart failure and transplant medicine.

#### **Vascular Medicine Conference**

On the 4th Tuesday of the month from 12:00 noon to 1:00 p.m. in the Dexter Library. This is a monthly clinical conference that reviews timely topics in Vascular Medicine including the evaluation and management of peripheral arterial disease, hypertension, dyslipidemia, venous thromboembolism, and vasospastic disorders.

#### **Nuclear Cardiology Conference**

Daily (10:00 a.m. to 11:00 a.m.) in the Clinical Nuclear Medicine Unit. Cardiovascular studies are interpreted and reviewed at this session.

#### **Interventional Cardiology Conference**

Fridays from 7:00-8:00 am, review of coronary and peripheral interventions from the week with an emphasis toward standard and unconventional techniques, adjuvant therapies, and complications.

#### **Fellows Research Report**

First Friday of the month from 11:30 -12:30 pm. This is a monthly forum for fellows to present work in progress to colleagues and staff.

#### **Annual Poster Session**

Provides an opportunity for clinical and research fellows to display posters prepared during the year for presentation at various meetings to Division members, faculty and fellows alike. This occasion affords beginning fellows an opportunity to appreciate the full spectrum of research projects ongoing in the division.

## **WEST ROXBURY CAMPUS, VA BOSTON HEALTH CARE: CONFERENCES AND ROUNDS**

**Daily ICU/CCU Rounds** with Cardiology and Pulmonary Attending and housestaff.

**Daily Cardiac Cath Rounds** with Cath Lab team, Cardiology Attending and housestaff.

### **Cardiac Surgical Conference**

Mondays 3:00-4:00 pm. Fellows meet with CT surgical team and Cardiology Attending to review all CAD and valve cases diagnosed in the prior week.

### **M&M Conference**

Monthly conference in which the Medical Service reviews all M&M cases from the prior month.

### **Cardiology Grand Rounds**

Didactic sessions held each Thursday from 8:00 to 9:00 am.

### **Echo/Non-invasive Teaching Conference**

Held biweekly on Thursdays from 12:00 - 1:45 pm. Consists of both didactic and interactive conferences, review of unusual and interesting echocardiograms and electrocardiograms.

### **Professor's Rounds**

Friday afternoons from 4:00 - 5:00 pm. A visiting Senior Staff member meets with fellows to review interesting and challenging inpatient cases at bedside.

### **Surgical Grand Rounds**

Held weekly on Fridays from 8:00 - 9:00 am.

## ***RESEARCH OPPORTUNITIES***

Each Cardiovascular Division trainee spends a minimum of 12 months devoted to research training. Many trainees from the traditional cardiovascular training program spend 24 months focused on research pursuits. In addition to fellows in the traditional cardiovascular training program, 60-70 research fellows receive research training from Cardiovascular Division staff members annually. These postdoctoral fellows include those with prior PhD, MD, or MD/PhD degrees.

The research laboratories of the Cardiovascular Division occupy a total of about 20,000 square feet, with an additional area of approximately 5,000 square feet devoted to clinical research activities including cardiac catheterization - angiography laboratories, facilities for radionuclide studies, and the Echocardiography Laboratory.

The structure of the research portion of the cardiology fellowship program is based upon the premise that the most important aspect of postdoctoral research training is the intense involvement of fellows with faculty preceptors. Fellows entering the program will have the opportunity to choose among a wide range of active research programs for their investigative efforts. Individual experiences and interest, together with discussions with staff and faculty members, will provide the necessary basis for fellows to make their initial choices of research project and preceptor. It is expected that by the spring of the principal clinical year, fellows will have identified a preceptor with whom to work on investigative projects during the ensuing research period. Flexibility will be maintained, however, allowing trainees the latitude to change projects and/or preceptors if this is in the best interests of the trainee. It should be stressed that in most instances, trainees will have close involvement with other faculty participants in addition to the primary preceptor. This is inevitable in view of substantial overlapping of interests and collaboration among involved laboratories.

Formal advanced education has been obtained by fellows interested in epidemiology by attending the "Program in Clinical Effectiveness" offered by the Harvard School of Public Health each summer. This course is focused on statistics, trial designs, ethics, and epidemiologic techniques. Fellows interested in basic science have participated in the Introduction to Lab Medicine, a six-week course offered annually to familiarize the trainee with basic laboratory techniques.

Specific research interests of faculty members within the Division may be found by returning to the initial Cardiovascular Medicine – Training Programs page and selecting the "Research Opportunities". Expand the "Our Research" option on the left to explore different areas such as clinical trials or basic research.

Please do not hesitate to contact us at [cvdfellowship@partners.org](mailto:cvdfellowship@partners.org) with any questions.