Cardiovascular Fellowship Program Educational Curriculum

Developed by: Steven Werns, MD
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I. GENERAL INFORMATION	
Program Director	Steven Werns, MD
Duration	36 months
Location	Beaumont-Dearborn, Dearborn, Michigan

II. OVERALL EDUCATIONAL GOALS

The overall educational goal of the cardiovascular disease fellowship program at Beaumont-Dearborn Hospital is to provide comprehensive training in general cardiology that meets or exceeds the standards promulgated by both the Accreditation Council for Graduate Medical Education (ACGME) and the American College of Cardiology (ACC) and specified in the following documents: the ACGME Program Requirements for Graduate Medical Education in Cardiovascular Disease (Internal Medicine) and the ACC 2015 Core Cardiovascular Training Statement (COCATS 4). As stated in the former document, the fellowship program's goals are to assure the provision of safe and effective care to the individual patient, to assure that each fellow develops the skills, knowledge, and attitudes required to enter the unsupervised practice of cardiology, and to establish a foundation for continued professional growth.

The ultimate goal of the program is to provide the fellows with an educational experience that fosters attainment of the following ACC-defined Entrustable Professional Activities:

- **Cardiovascular Consultation**: initially evaluate, diagnose, and develop a treatment plan for patients at risk for or with cardiovascular disease
- **Acute Cardiac Care**: manage acute cardiac conditions, including management of team-based care
- **Chronic Cardiovascular Disease Management**: manage chronic cardiovascular diseases, including direction of team-based care
- **Cardiovascular Testing**: utilize cardiovascular testing
- **Disease Prevention and Risk Factor Control**: carry out disease prevention and risk factor control measures, addressing morbidities
- **Lifelong Learning**: engage in lifelong learning

The cardiovascular disease fellowship training program strives to provide the fellows with an educational curriculum that is based on the six core competencies as defined by the ACGME: medical knowledge, patient care, systems-based practice, practice-based learning and improvement, professionalism, and interpersonal and communication skills. The competency-based objectives enumerated below are derived from the ACC 2015 COCATS4 Competency Tables (revision date March 13, 2015)(accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources) and the milestone graduation targets that define when a fellow is ready for unsupervised practice according to the July 2015 draft of the document "Internal Medicine Subspecialty Milestones Project" (accessed at http://www.acgme.org/acgmeweb/Portals/0/PDFs/Milestones/InternalMedicineSubspecialtyMilestones.pdf).

III. SPECIFIC COMPETENCIES

Medical Knowledge

Goal: Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care.

Competencies

MK1: Possesses Clinical Knowledge

- Possesses the scientific, socioeconomic, and behavioral knowledge required to provide care for complex medical conditions and comprehensive preventive care

MK2: Knowledge of diagnostic testing and procedures

- Interprets complex diagnostic tests accurately while accounting for limitations and biases
- Knows the indications for, and limitations of diagnostic testing and procedures
- Understands the concepts of pre-test probability and test performance characteristics
- Teaches the rationale and risks associated with common procedures and anticipates potential complications of procedures

MK3: Scholarship

- Formulates ideas worthy of scholarly investigation
- Collaborates with other investigators to design and complete a project related to clinical practice, quality improvement, patient safety, education, or research
- Critiques specialized scientific literature effectively
- Dissects a problem into its many components parts and identifies strategies for solving
- Uses analytical methods of the field effectively
- Presents scholarly activity at local or regional meetings, and/or submits an abstract summarizing scholarly work to regional/state/national meetings, and/or publishes non-peer-reviewed manuscript(s)(reviews, book chapters)

Patient Care

Goal: Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.

Competencies

PC1: Gathers and synthesizes essential and accurate information to define each patient's clinical problem(s)

- Obtains relevant historical subtleties, including sensitive information that informs the differential diagnosis
- Identifies subtle or unusual physical exam findings
- Efficiently utilizes all sources of secondary data to inform differential diagnosis
- Effectively uses history and physical examination skills to minimize the need for further diagnostic testing

PC2: Develops and achieves comprehensive management plan for each patient

- Appropriately modifies care plans based on patient's clinical course, additional data, patient preferences, and cost-effectiveness principles
- Recognizes disease presentations that deviate from common patterns and require complex decision-making, incorporating diagnostic uncertainty
- Manages complex acute and chronic conditions

PC3: Manages patients with progressive responsibility and independence

- Independently manages patients across applicable inpatient, outpatient, and ambulatory clinical settings who have a broad spectrum of clinical disorders, including undifferentiated syndromes
- Seeks additional guidance and/or consultation as appropriate
- Appropriately manages situations requiring urgent or emergency care

- Effectively supervises the management decision of the team in all appropriate clinical settings

PC4a: Demonstrates skill in performing and interpreting invasive procedures

- Consistently demonstrates technical skill to successfully and safely perform and interpret invasive procedures
- Maximizes patient comfort and safety when performing invasive procedures
- Consistently recognizes appropriate patients, indications, and associated risks in the performance of invasive procedures
- Effectively obtains and documents informed consent in challenging circumstances (e.g., language or cultural barriers)
- Quantifies evidence of risk-benefit analysis during obtainment of informed consent for complex procedures or therapies

PC4b: Demonstrates skill in performing and interpreting non-invasive procedures and/or testing

- Consistently recognizes appropriate patients, indications, limitations, and associated risks in utilization of non-invasive procedures and/or testing
- Integrates procedures and/or testing results with clinical findings in the evaluation and management of patients
- Recognizes procedures and/or testing results that indicate high-risk state or adverse prognosis
- Recognizes artifacts and normal variants
- Consistently performs and interprets non-invasive procedures and/or testing in a safe and effective manner
- Effectively obtains and documents informed consent in challenging circumstances (e.g., language or cultural barriers)
- Quantifies evidence for risk-benefit analysis during obtainment of informed consent for complex procedures and/or tests

PC5: Requests and provides consultative care

- Provides consultation services for patients with basic and complex clinical problems requiring detailed risk assessment
- Appropriately integrates recommendations from other consultants in order to effectively manage patient care

Systems-based Practice

Goal: Fellows must demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care.

Competencies

SBP1: Works effectively within an interprofessional team (e.g. with peers, consultants, nursing, ancillary professionals, and other support personnel)

- Understands the roles and responsibilities of, and effectively partners with, all members of the team
- Efficiently coordinates activities of other team members to optimize care

SBP2: Recognizes system error and advocates for system improvement

- Identifies systemic causes of medical error and navigates them to provide safe patient care
- Advocates for safe patient care and optimal patient care systems
- Activates formal system resources to investigate and mitigate real or potential medical error
- Reflects upon and learns from own critical incidents that may lead to medical error

SBP3: Identifies forces that impact the cost of health care, and advocates for and practices cost-effective care

- Consistently works to address patient-specific barriers to cost-effective care
- Advocates for cost-conscious utilization of resources such as emergency department

visits and hospital readmissions
- Incorporates cost-awareness principles into standard clinical judgments and decision-making, including use of screening tests

SBP4: Transitions patients effectively within and across health delivery systems

- Appropriately utilizes available resources to coordinate care and manage conflicts to ensure safe and effective patient care within and across delivery systems
- Actively communicates with past and future caregivers to ensure continuity of care
- Anticipates needs of patient, caregivers, and future care providers and takes appropriate steps to address those needs

Practice-based Learning and Improvement

Goal: Fellows must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning.

PBLI1: Monitors practice with a goal for improvement

- Regularly self-reflects upon one's practice or performance, and consistently acts upon those reflections to improve practice
- Recognizes sub-optimal practice or performance as an opportunity for learning and self-improvement

PBLI2: Learns and improves via performance audit

- Analyzes own clinical performance data and actively works to improve performance
- Actively engages in opportunities to achieve focused education and performance improvement
- Demonstrates the ability to apply common principles and techniques of quality improvement to improve care for a panel of patients

PBLI3: Learns and improves via feedback

- Solicits feedback from all members of the interprofessional team and patients
- Welcomes unsolicited feedback
- Consistently incorporates feedback
- Able to reconcile disparate or conflicting feedback

PBLI4: Learns and improves at the point of care

- Routinely reconsiders an approach to a problem, asks for help, or seeks new information
- Routinely translates new medical information needs into well-formed clinical questions
- Guided by the characteristics of clinical questions, efficiently searches medical information resources, including decision support tools and guidelines
- Independently appraises clinical research reports based on accepted criteria

Professionalism

Goal: Fellows must demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles.

PROF1: Has professional and respectful interactions with patients, caregivers, and members of the interprofessional team (e.g. peers, consultants, nursing, ancillary professionals, and support personnel)

- Demonstrates empathy, compassion, and respect to patients and caregivers in all situations
- Anticipates, advocates for, and actively works to meet the needs of patients and caregivers
- Demonstrates a responsiveness to patient needs that supersedes self-interest
- Positively acknowledges input of members of the interprofessional team and incorporates that input into plan of care, as appropriate
- Regularly reflects on, assesses, and recommends physician and colleague self-care and wellness

PROF2: Accepts responsibility and follows through on tasks

- Prioritizes multiple competing demands in order to complete tasks and responsibilities in a timely and effective manner
- Willingly assumes professional responsibility regardless of the situation

PROF3: Responds to each patient's unique characteristics and needs

- Recognizes and accounts for the personal characteristics and needs of each patient
- Appropriately modifies care plan to account for a patient's unique characteristics and needs

PROF4: Exhibits integrity and ethical behavior in professional conduct

- Demonstrates integrity, honesty, and accountability to patients, society, and the profession
- Actively manages challenging ethical dilemmas and conflicts of interest
- Identifies and responds appropriately to lapses of professional conduct among peer group
- Regularly reflects on personal professional conduct
- Identifies and manages conflicts of interest

Interpersonal and Communication Skills

Goal: Fellows must demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals.

ICS1: Communicates effectively with patients and caregivers

- Identifies and incorporates patient preference in shared decision-making in complex patient care conversations and the plan of care
- Quickly establishes a therapeutic relationship with patients and caregiver, including persons of different socioeconomic and cultural backgrounds

ICS2: Communicates effectively in interprofessional teams (e.g. with peers, consultants, nursing, ancillary professionals, and other support personnel)

- Consistently and actively engages in collaborative communication with all members of the team
- Verbal, non-verbal, and written communication consistently acts to facilitate collaboration with team members to enhance patient care

ICS3: Appropriate utilization and completion of health records

- Patient-specific health records are organized, timely, accurate, comprehensive, and effectively communicate clinical reasoning
- Provides effective and prompt medical information and test results/interpretations to physicians and patients

IV. PRINCIPAL TEACHING METHODS

Fellows participate in the evaluation and management of cardiology patients at Beaumont-Dearborn Hospital. Each patient evaluated by the fellow is seen with the cardiology attending during daily management rounds. The management plan is to be formulated by the fellow and discussed with the cardiology attending. The rounding team consists of the attending, fellow, medical residents, interns, and any rotating medical students.

The training program begins with one year of formal, one-month long rotations as follows: in-patient cardiology service (CCU and in-patient consults) 4 months, cardiac catheterization laboratory 2 months, echocardiography 3 months, electrophysiology 1 month, nuclear cardiology 1 month, and research 1 month. The purpose of this initial period is to familiarize the trainee with all aspects of clinical cardiology and the expectation is that by the end of this period, the trainee will be facile with, although not necessarily expert in, all aspects of clinical cardiology. The additional expectation is that the trainee, with the help of the Program Director and appropriate faculty, will have identified a broad career track and an area of interest. Training

during the second and third years is flexible and intended to allow the fellows to fulfill the COCATS 4 requirements for level 1 or 2 training in the various disciplines, depending on their career aspirations (Journal of the American College of Cardiology 2015; 17:1724-1914).

Throughout the fellowship the fellows devote one-half day per week to seeing out-patients in the fellows' continuity clinic. The clinic sessions are supervised by one of the members of the core cardiology faculty.

All fellows are expected to participate in scholarly activities, and to co-author a paper for publication.

A robust schedule of conferences is designed to provide a formal didactic program that satisfies the "ACGME Program Requirements for Graduate medical Education in Cardiovascular Disease (Internal Medicine)"(www.ACGME.org). The schedule includes the following conferences: a weekly cardiothoracic conference, a weekly cardiac catheterization conference, a weekly echo conference, a bi-weekly electrocardiography conference, and a weekly didactic series that includes basic science, clinical, research, and vascular medicine topics, and a series of congenital heart disease lectures. Also, a monthly journal club is held during the evening at a local restaurant.

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 AM	Cath conference		Echo conference		
12:00 PM		Cardiothoracic conference		ECG/EP conference	
1:00 PM					Didactic conferences

V. SPECIFIC ROTATIONS AND DOCUMENTATION

The fellowship rotations are designed to allow the fellows to fulfill the COCATS 4 requirements for level 1 or 2 training in the various disciplines (Journal of the American College of Cardiology 2015; 17:1724-1914). At least 6 months will be devoted to noninvasive studies, more for fellows electing a less intensive catheterization laboratory experience. At least 4 and at most 12 months will be spent in the catheterization laboratory, with 6 months recommended for all fellows. At least 2 and as many as 6 months will be spent on the electrophysiology service. At least one month each year will be devoted to planning, initiating, and conducting research, with the anticipation that the investigation will be continued as an ongoing process throughout the year. Electrocardiography is a major focus of the electrophysiology and nuclear rotations. Stress-testing is a major focus of the nuclear rotation. One half-day weekly will be devoted to outpatient clinical care. Each fellow is allotted 15 vacations days, 10 sick days, and 3 personal days per year. All fellows are required to attend at least one national meeting or educational program each year, more if presenting at multiple meetings. The number of days for conference attendance is unlimited.

Fellows are required to log the procedures that they perform using the New Innovations software, a web-based system. These logs are reviewed quarterly by their faculty mentors and by the program director, and remain part of the fellows' permanent record.

At least the following number of procedures must be performed or interpreted and documented:

- Abstracts prepared for presentation or manuscripts submitted for publication --- 1
- Cardiac catheterizations ---------- 100
- Cardiac CT interpretations ---------- 50
- Cardioversions ----------20
- Transthoracic echos performed ---------- 75
- Transthoracic echo interpreted ----------150
- ECG interpretations ---------- 3000
- Holter monitor interpretations----------100-200
- MRI interpretations---------- 25
- Nuclear scans interpretations---------- 100
- Stress tests ---------- 200-300
- Temporary pacemakers---------- 5

Level 2 training in various subspecialty disciplines requires documentation of the following number of procedures

- Cardiac catheterizations ---------- 300
- Cardiac CT interpretations ---------- 250
- Transthoracic echos performed ---------- 150
- Transthoracic echo interpreted ---------- 300
- Pacemaker/defibrillator interrogations ---------- 100
- MRI interpretations ---------- 150
- Nuclear scan interpretations ---------- 300
- Trans-esophageal echocardiograms ---------- 50

VI. SUPERVISION

The program director and faculty members will delegate progressive authority and responsibility and conditional independence to each fellow based on their individual experiences and skills and the severity and complexity of a patient's illness or condition. It is expected that the fellows will be granted progressive autonomy on successive rotations as their knowledge and experience progress. The expected levels of supervision provided by faculty members are discussed in detail below and are consistent with the ACGME Program Requirements for Graduate Medical Education in Cardiovascular Disease (Internal Medicine)(www.ACGME.org).

1. First year fellows (F1):

a. Direct supervision: A supervising cardiologist will be physically present with the fellow during the performance of all transesophageal echocardiograms and all invasive procedures (pulmonary artery catheters, temporary pacemakers, intra-aortic balloon pumps, cardiac catheterizations and interventions, permanent pacemakers, implantable defibrillators, and invasive electrophysiology procedures).

b. Indirect supervision with direct supervision immediately available: A supervising cardiologist will be present in the hospital or out-patient clinic and immediately available to provide direct supervision for first year fellows who are participating in the following activities: out-patient visits, stress testing, in-patient consultations, and CCU patient care.

c. Indirect supervision with direct supervision available by means of telephonic and/or electronic modalities: A member of the cardiology teaching faculty will be available at all times, including nights and weekends, to provide interpretation of non-invasive diagnostic studies (electrocardiograms and echocardiograms) and to discuss management of cardiac issues that arise during off hours.

d. Oversight: The "oversight" level of supervision exists when a fellow is on call at night, providing the fellow the opportunity for patient encounters that are reviewed after care is

delivered, unless the on-call attending cardiologist is needed to perform an emergency procedure, e.g. a cardiac catheterization in a patient with an acute myocardial infarction or a pericardiocentesis in a patient with pericardial tamponade.

2. <u>Second year fellows (F2)</u>:

a. Direct supervision: A supervising cardiologist will be physically present with the fellow during the performance of all transesophageal echocardiograms and all invasive procedures that are performed in the cardiac catheterization or electrophysiology laboratories (intra-aortic balloon pumps, cardiac catheterizations and interventions, permanent pacemakers, implantable defibrillators, and invasive electrophysiology procedures).

b. Indirect supervision with direct supervision immediately available: A supervising cardiologist will be present in the hospital or out-patient clinic and immediately available to provide direct supervision for second year fellows who are participating in the following activities: out-patient visits, stress testing, in-patient consultations, and CCU patient care.

c. Indirect supervision with direct supervision available by means of telephonic and/or electronic modalities: A member of the cardiology teaching faculty will be available at all times, including nights and weekends, to provide interpretation of non-invasive diagnostic studies (electrocardiograms and echocardiograms) and to discuss management of cardiac issues that arise during off hours.

d. Oversight: The "oversight" level of supervision exists when a fellow is on call at night, providing the fellow the opportunity for patient encounters that are reviewed after care is delivered, unless the on-call attending cardiologist is needed to perform an emergency procedure, e.g. a cardiac catheterization in a patient with an acute myocardial infarction or a pericardiocentesis in a patient with pericardial tamponade.

3. <u>Third year fellows (F3)</u>:

a. Direct supervision: A supervising cardiologist will be physically present with the fellow during the performance of all transesophageal echocardiograms and all invasive procedures that are performed in the cardiac catheterization or electrophysiology laboratories (intra-aortic balloon pumps, cardiac catheterizations and interventions, permanent pacemakers, implantable defibrillators, and invasive electrophysiology procedures).

b. Indirect supervision with direct supervision immediately available: A supervising cardiologist will be present in the hospital or out-patient clinic and immediately available to provide direct supervision for third year fellows who are participating in the following activities: out-patient visits, stress testing, in-patient consultations, and CCU patient care.

c. Indirect supervision with direct supervision available by means of telephonic and/or electronic modalities: A member of the cardiology teaching faculty will be available at all times, including nights and weekends, to provide interpretation of non-invasive diagnostic studies (electrocardiograms and echocardiograms) and to discuss management of cardiac issues that arise during off hours.

d. Oversight: The "oversight" level of supervision exists when a fellow is on call at night, providing the fellow the opportunity for patient encounters that are reviewed after care is delivered, unless the on-call attending cardiologist is needed to perform an emergency procedure, e.g. a cardiac catheterization in a patient with an acute myocardial infarction or a pericardiocentesis in a patient with pericardial tamponade.

VII. EVALUATION

Fellow Performance: Fellows are oriented to the rotation expectations at the start of the block, and then receive formative verbal feedback, followed by a formal summative written evaluation at the conclusion of the rotation. The designated supervising attending cardiologist completes a fellow evaluation form using the New Innovations website. The evaluation is competency-based, fully assessing core competency performance. The evaluation is shared with the fellow, is available for on-line review by the fellow, and is reviewed by the program director as well. The evaluation is part of the fellow file and is incorporated into the semiannual performance review for directed feedback. Each year every fellow is required to participate in the annual In-Training Examination that is sponsored by the American College of Cardiology. The fellowship program's Clinical Competency Committee reviews each fellow's performance semiannually.

Assessment methods include:

Direct observation (Mini-CEX)
Multisource (360) evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Program and Faculty Performance: Upon completion of the rotation, fellows complete a faculty evaluation form using the New Innovations website. The attending faculty physicians receive anonymous periodic copies of completed evaluation forms. The Program Evaluation Committee reviews the fellowship program annually.

VIII. EDUCATIONAL MATERIALS

A variety of texts and electronic educational materials are available in the cardiology fellows' room and in the medical library. Most of the seminal texts, including *Braunwald's Heart Disease*, *The Cardiac Catheterization Handbook*, *Chou's Electrocardiography in Clinical practice, Clinical Electrocardiography, Congenital Heart Disease in Adults*, and*Textbook of Cardiovascular Medicine* edited by Eric Topol, are available on-line through the library and accessible both at home and at computer terminals throughout the hospital. Fellows may borrow the Mayo Clinic Board Review course DVDs that the fellowship purchased. Although there are many written and electronic references for patients with cardiovascular disease, a valuable resource is the American College of Cardiology website, www.Cardiosource.org. The fellows are afforded free access to the website via the fellowship program's institutional subscription. The website provides access to well-written, frequently updated clinical guidelines, which are evidence-based and comprehensively referenced. Cardiosource also provides access to the ACC's self-assessment programs: ArrhythmiaSAP, CathSAP 4, CCT-SAP 2, EchoSAP 7, Heart Failure SAP, Heart Valve SAP, Vascular Medicine SAP, and the board review module (ACCSAP 9). Fellows are strongly encouraged to utilize the ACC's self-assessment modules during their rotations e.g. Arrhythmia SAP during the electrophysiology rotation, Vascular Medicine SAP during the vascular medicine rotation, etc.

Ambulatory Clinic

Developed by: Steven Werns, M.D.
Revision Date: June 2016

I. GENERAL INFORMATION	
Name of Rotation	Ambulatory Clinic
Director	
Duration	36 months (1/2 day per week)
Location	Beech Street Office

II. FACULTY

Drs. Spears and Werns

Lines of Responsibility: Each cardiovascular disease fellow is required to have a continuity care experience providing outpatient care to a panel of patients. This care is provided in the setting of an outpatient clinic with the support and assistance of an attending cardiologist. In accordance with the growing experience and knowledge of the fellow, independence and responsibilities will be increased over the course of the three years of training. Each fellow is assigned to a faculty member as a primary preceptor who will work with that fellow over the course of the three years of training. The primary preceptor acts as the attending of record for the resident's patients.

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: The educational goal of the outpatient experience focuses on providing, overseeing, and coordinating the cardiology care of the fellow's panel of patients, including disease management, acute illness evaluation and management, and preventive care.

Objectives: Fellows are expected to:

- Assess patients with cardiovascular disease and construct a plan of care
- Incorporate test results into the plan of care and modify the plan as required
- Appropriately utilize non-invasive and invasive testing in the outpatient setting
- Understand the pharmacology of cardiovascular medications and their application in specific patient settings
- Apply preventive cardiology and disease-specific guidelines to ambulatory patient care
- Prepare appropriate and timely consultative notes using the electronic medical record
- Accept increasing responsibility according to level of training, with the faculty preceptor delegating greater communication and care roles to the fellow as appropriate.

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the major cardiovascular risk stratification tools and the principles of primary and secondary cardiovascular disease prevention
- Know the roles of genetics, family history, and the environmental and lifestyle factors in the development and clinical course of cardiovascular disease
- Know the effects of age on cardiovascular function, response to medications, and in the risks of diagnostic and therapeutic procedures
- Know the differential diagnosis of chest pain and the distinguishing features of the various etiologies
- Know the cardinal findings and differential diagnosis of palpitations, lightheadedness, and syncope, and the distinguishing features of the various etiologies
- Know the cardinal findings and differential diagnosis of dyspnea
- Know the differential diagnosis of peripheral edema and the distinguishing clinical features of the various etiologies
- Know the roles of kidney, hepatic, pulmonary, hematologic, rheumatologic, and endocrine disorders in the development, manifestations, and responses to treatment in patients with cardiovascular disease
- Know the clinical pharmacology of cardiovascular medications, and drug-drug interactions of cardiac and noncardiac medications, including in special populations and in patients with relevant comorbidities
- Know the roles of lifestyle, activity level, body mass, nutrition, alcohol and/or drug use in cardiovascular risk and disease
- Know the potential cardiovascular toxicity and side effects of major classes of drugs used for the management of patients with common medical conditions, including antimicrobial agents, immune system modulators, chemotherapeutic agents, and antiParkinsonian drugs
- Know the roles of stress, anxiety, and depression in patients with suspected cardiovascular disease
- Know the guideline recommendations for blood pressure, blood glucose, and lipid management in diverse patient populations with and without cardiovascular disease
- Know the appropriate use indications for cardiovascular screening studies, including carotid and abdominal ultrasound (or other imaging) modalities
- Know the differential diagnosis and distinguishing characteristics of heart murmurs and bruits
- Know the characteristic clinical manifestations, differential diagnosis, and appropriate testing for peripheral vascular disease
- Know the mechanisms and cardinal symptoms and findings of stroke, transient cerebral ischemia, and dementia
- Know the principles, modalities, and appropriate indications for palliative care

Patient Care

- Skill to effectively and efficiently perform an initial outpatient cardiovascular consultation, and establish a differential diagnosis
- Skill to appropriately utilize diagnostic testing – both for initial diagnosis and for follow-up care
- Skill to integrate clinical and testing results to establish diagnosis, assess cardiovascular risk, and formulate treatment and follow-up plans
- Skill to appropriately obtain and integrate consultations from other healthcare professionals in a timely manner
- Skill to recognize acute cardiovascular disorders or high-risk states that require immediate treatment and/or hospitalization, and prioritize management steps in patients

with complex or multi-component illness
- Skill to establish an effective medical regimen and monitor for side-effects, intolerance or noncompliance, and patient safety
- Skill to assess the cardiovascular risks associated with recreational and/or competitive sports for individual patients and to counsel patients about levels of physical activity appropriate to their cardiovascular health in the context of disease prevention; rehabilitation; and promotion of longevity, functional capacity, and quality of life
- Skill to effectively carry out chronic disease management in patients with chronic ischemic heart disease, hypertension, heart failure, and peripheral vascular disease
- Skill to coordinate ambulatory and longitudinal follow-up care
- Skill to effectively facilitate transition of care from hospital to ambulatory or intermediate car
- Skill to perform preoperative assessments for noncardiac procedures in patients with cardiovascular disease settings

Systems-based Practice

- Effectively lead or participate in team-based care in patients with or at risk of developing cardiovascular disease
- Effectively facilitate transition of care
- Effectively utilize electronic medical record systems, including clinical protocols and treatment/evaluation prompts
- Effectively and appropriately use remote communication tools in the care of patients
- Appropriately utilize and work with cardiac rehabilitation and intermediate care facilities
- Recognize and address social, cultural, and financial barriers to patient compliance

Practice-based Learning and Improvement

- Utilize point-of-care electronic resources to provide up-to-date clinical information and guideline-driven evaluation and treatment
- Identify gaps and carry out personalized education activities to address them
- Integrate validated performance and patient satisfaction measures into clinical practice to foster continuous quality improvement

Professionalism

- Practice patient-centered care with shared decision-making and appreciation of patients' values and preferences
- Incorporate appropriate use criteria and risk-benefit considerations in treatment decisions
- Practice in a manner that fosters patient benefit above self-interest and avoids conflict of interest
- Interact respectfully with patients, families, and all members of the healthcare team, including ancillary and support staff

Interpersonal and Communication Skills

- Communicate effectively with patients and families across a broad spectrum of ethnic, social, cultural, socioeconomic, and religious backgrounds
- Exhibit sensitivity and empathy in dealing with life-threatening and end-of-life issues
- Communicate effectively and in a timely manner with primary care and other referring or collaborating members of the healthcare team

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

Preventive Cardiovascular Medicine is a major focus of the ambulatory clinic rotation. All fellows will be expected to satisfy the COCATS 4 Training Requirements for Level 1 training in Preventive Cardiovascular Medicine, which entails knowledge of the following topics:

1. Cardiovascular biology:
2. Clinical epidemiology
3. Biostatistics

4. Clinical trials
5. Outcomes research
6. Cardiovascular pharmacology
7. Behavior and psychosocial aspects of cardiovascular disease
8. Risk assessment
9. Assessment of subclinical atherosclerosis
10. Risk factor management
11. Disease management

Fellows will be exposed to each of the topics via various educational activities, including bedside instruction by faculty cardiologists, didactic lectures, research conferences, journal club presentations, and attendance at national meetings, e.g. the annual scientific sessions of the American College of Cardiology.

Principal teaching methods:

Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the attending physicians. Assessment methods include:

Direct observation (Mini-CEX)
Global clinical performance ratings
Multisource (360) assessment
Nursing evaluations

Fellows will evaluate the outpatient rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The attending will review and confirm the historical and physical findings that have been documented by the fellow. The attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The attending will review and sign the out-patient notes that the fellow enters in the electronic medical record. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

1) Initial evaluation of all patients assigned to his/her outpatient panel
2) Follow-up care of all patients assigned to his/her outpatient panel
3) Completion of notes in the electronic medical record

IX. EDUCATIONAL MATERIALS

Some textbooks are available in the offices, but all offices have access to electronic educational materials available on-line through the hospital library. The following ACC/AHA Practice Guidelines are available at www.Cardiosource.org.

ACC/AHA Practice Guidelines (available at www.Cardiosource.org)

- Fleisher LA, et al. Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery, J Am Coll Cardiol 2014; doi:10.1016/j.jacc.2014.07.944.
- Goff DC Jr, et al.. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;63:2935–59.
- Stone NJ, et al.. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;63:2889–934.
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Cardiac Catheterization Rotation

Developed by: Steven Werns, MD
Revision Date: June 2016

I. GENERAL INFORMATION	
Name of Rotation	Cardiac Catheterization
Director	George Nahhas, MD
Duration	1 month
Location	Beaumont-Dearborn Hospital

II. FACULTY

Drs. Dabbous, Nahhas, Spears, and Werns and designated non-faculty cardiologists

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals:

A. The goals of the cardiac cath lab rotation are to:
   1. Learn the indications, contraindications, risks, and benefits of cardiac catheterization procedures
   2. Develop competent and safe technical skills in the performance of diagnostic cardiac catheterization procedures
   3. Learn how to interpret findings accurately
   4. Learn how to use the findings of the cardiac catheterization to plan medical, catheter-based, and surgical therapies

B. The interaction and integration of the history and physical exam, clinical assessment, pre-procedure imaging studies, hemodynamic and invasive imaging will be critically evaluated throughout the rotation.

C. Progressive education:
   1. The initial few weeks of the rotation will focus on early technical skills such as safe vascular access, understanding and use of the equipment, hemodynamic assessment and interpretation, operation of the table, radiographic views and panning, and simple catheter manipulation. During subsequent weeks COCATS level 1 cognitive knowledge and technical skills of invasive cardiology will be taught, with emphasis on the role of diagnostic cardiac catheterization, hemodynamic assessment, and angiographic delineation of cardiovascular anatomy and pathology in the evaluation and management of all types of heart disease.
   2. Progression of technical skills is largely a function of experience as well as individual learning curves.

Objectives: The competency-based objectives enumerated below are derived from the document entitled “ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables” and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the indications contraindications, and potential complications of cardiac catheterization for assessment of coronary, cardiac valve, myocardial, and basic adult congenital heart disease (F1)
- Know the principles of radiation safety (F1)
- Know the use and complications of contrast agents and the role of renal protection measures (F1)
- Know the indications for and clinical pharmacology of antiplatelet and anticoagulant drugs, and vasopressor and vasodilating agents, used in the cardiac catheterization laboratory (F2)
- Know cardiovascular hemodynamics and the principles and interpretation of waveforms, pressure, flow, resistance, and cardiac output measurements (F2)
- Know the characteristic hemodynamic findings with myocardial, valvular, pericardial, and pulmonary vascular diseases (F2)
- Know the methods to detect and estimate the magnitude of intracardiac shunts (F2)
- Know coronary anatomy, its variations and congenital abnormalities, and coronary blood flow physiology (F2)
- Know the angiographic features of coronary artery disease and how to assess the anatomic and physiologic severity (F2)
- Know peripheral vascular anatomy, as well as the indications for and complications of peripheral vascular angiography (F2)
- Know the indications, contraindications, and potential complications for percutaneous coronary, valvular, and structural heart interventions (F2)
- Know the indications for and complications of endomyocardial biopsy and pericardiocentesis (F1)
- Know the indications for and the mechanisms of action of mechanical circulatory support devices (F2)
- Know the indications for and complications of vascular access and closure strategies and devices (F1)

Patient Care

- Perform pre-procedure evaluation, assess appropriateness, and plan procedure strategy (F2)
- Perform venous and arterial access and closure (F2)
- Perform right heart catheterization (F1)
- Perform diagnostic left heart catheterization, ventriculography, and coronary angiography (F3)
- Analyze hemodynamic, ventriculographic, and angiographic data and integrate this data with clinical findings for patient management (F1)
- Perform pericardiocentesis (F3)
- Manage post-procedural patients, including complications and coordination of care (F2)

Systems-based Practice

- Coordinate care in a multidisciplinary approach for patient management, including transition of care (F2)
- Utilize cost-awareness and risk-benefit analysis in patient care (F2)

Practice-based Learning and Improvement

- Locate, appraise, and assimilate information from scientific studies, guidelines, and registries in order to identify knowledge and performance gaps (F2)

- Document number and outcomes of diagnostic and therapeutic procedures (F2)

Professionalism

- Practice within the scope of personal technical skills or expertise (F2)
- Promote and adhere to guidelines and appropriate use criteria (F2)

Interpersonal and Communication Skills

- Communicate with patients and families across a broad range of socioeconomic, ethnic, and cultural backgrounds, including obtaining informed consent (F2)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

General topics to be covered during this rotation:

- Informed consent and complications of catheterization and percutaneous coronary intervention (PCI); identification of high-risk individuals
- Diagnosis and management of access-site complications
- Diagnosis and management of contrast nephropathy and anaphylactoid reactions
- Coronary angiography/quantitative coronary angiography
- Catheter selection
- Coronary anomalies and vasospasm
- Aortography and LV/RV angiography
- Radiation safety involving dose to patient, staff; shielding, inverse square rule; dose calculations and tissue effects.
- Intraaortic Balloon Counterpulsation
- Right Heart Catheterization; interpretation of right heart pressure waveforms and pressures
- Acute myocardial infarction: fibrinolytics vs PCI
- Complications of acute myocardial infarction (ventricular septal defect, papillary muscle rupture, shock, ventricular rupture)
- Mitral and aortic stenosis and valvuloplasty
- CABG vs PCI
- Complete vs. incomplete revascularization
- PCI: Balloon angioplasty, coronary stents, coronary atherectomy, coronary thrombectomy
- SVG lesions
- Restenosis
- Ostial lesions and bifurcation lesions
- Total occlusions
- Coronary flow reserve
- Plaque composition and intravascular ultrasound (IVUS)
- Platelet and coagulation biochemistry and pharmacology
- Medications post-PCI
- Peripheral Vascular Obstructive Disease (PVOD)
- Peripheral angiography for carotid, renal, iliac and superficial femoral; catheter selection and placement; digital subtraction angiography.

Principal teaching methods:

Clinical teaching
Conferences
Performance feedback
Monthly and semiannual evaluations

VI. TRAINING PROGRAM CURRICULUM

A. COCATS Level 1

Level 1 Cognitive Knowledge

1. Understand coronary anatomy, its variations, and congenital abnormalities
2. Understand coronary physiology
3. Understand cardiac hemodynamics, including the measurement and interpretation of pressure, flow, resistance, and cardiac output. Understand ventricular and myocardial mechanics and the determinants of cardiovascular performance
4. Interpret hemodynamic findings in a variety of cardiac conditions, including various forms of myocardial disease, pericardial disease, valvular stenosis and regurgitation, congenital heart disease, and pulmonary vascular disease. Understand how to differentiate the hemodynamics of constrictive pericarditis from restrictive cardiomyopathy
5. Understand the relationship between hemodynamic assessment as determined by invasive measurements and echocardiography in addition to other noninvasive modalities
6. Understand the indications and contraindications for cardiac catheterization and coronary intervention
7. Understand the complications of the procedure and their management, such as hypotension, acute myocardial ischemia, congestive heart failure, renal failure, contrast reactions, retroperitoneal bleeding, cardiac tamponade, vascular problems, arrhythmias, and stroke
8. Select the optimal treatment modality, including medical therapy, percutaneous coronary and noncoronary intervention, or surgical therapy, with understanding of the indications for and risk of each revascularization strategy
9. Understand the indications for and complications of temporary transvenous pacing
10. Understand the indications for and complications of pericardiocentesis and recognize tamponade physiology
11. Understand the indications for and complications of other laboratory procedures, such as endomyocardial biopsy, intra-aortic balloon counterpulsation, and retrieval of foreign bodies
12. Understand basic principles of X-ray imaging, radiation protection, and radiation safety
13. Understand the anatomy of and methods to access cardiac chambers and coronary arteries via he femoral, brachial, and radial access sites
14. Interpret diagnostic coronary angiograms and appreciate the interface with noninvasive techniques of coronary imaging
15. Interpret ventricular, atrial, and aortic angiography and determine left ventricular ejection fraction
16. Understand the indications for and complications of contrast agents, the risk of contrast nephropathy, and the risks and benefits of various renal protective regimens
17. Understand the indications for and complications of drugs commonly used for invasive procedures, such as unfractionated heparin, low-molecular-weight

heparin, glycoprotein IIb/IIIa receptor antagonists and other antiplatelet drugs, direct thrombin inhibitors, vasopressors, vasodilators, and fibrinolytic and antiarrhythmic agents

18. Understand the indications for and the mechanisms of action of mechanical circulatory support devices
19. Understand the indications for and complications of vascular closure devices

Level 1 Technical Skills

1. Perform percutaneous vascular access from the femoral artery and vein and subclavian or internal jugular vein
2. Perform right heart catheterization using a balloon flotation catheter
3. Perform temporary right ventricular pacemaker insertion
4. Perform left heart catheterization and coronary angiography of native arteries (using standard views) and left ventriculography under supervision

B. COCATS Level 2

Level 2 Cognitive Knowledge

1. All Level 1 items
2. Understand radiologic imaging, including design and operation of X-ray cineradiographic units, digital imaging and storage, radiation physics, factors influencing image quality, radiation quality assurance, and physiology of X-ray contrast media
3. Understand the basic operation of physiologic recorders, pressure transducers, oximeters, and oxygen consumption measurement equipment
4. Understand coronary physiology using techniques such as Doppler flow and fractional flow reserve
5. Understand the indications for and methods of performing trans-septal catheterization
6. Acquire knowledge of peripheral vascular anatomy and understand the indications and complications of peripheral vascular angiography

Level 2 Technical Skills

1. All Level 1 items
2. Perform vascular access from the femoral, radial, or brachial route
3. Perform left heart catheterization and coronary angiography, as well as visualization of venous bypass and internal mammary and radial artery grafts
4. Perform angiography of the cardiac chambers (in addition to the left ventricle) and aorta
5. Perform intra-aortic balloon insertion and operate a balloon pump
6. Perform cardiac catheterization in common types of valvular, adult congenital, and cardiomyopathic heart disease
7. Perform pericardiocentesis, preferably under echocardiographic

guidance

8. Perform right ventricular endomyocardial biopsy
9. Perform vascular closure device insertion
10. Perform aortography and femoral artery angiography

VII. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians, with additional input from nurses and peers.

Assessment methods include:

Direct observation
Multisource evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Fellows will evaluate the cardiac catheterization rotation on a semi-annual basis.

VIII. RESPONSIBILITY OF ATTENDING ON ROTATION

A. The fellows on the Cath Lab rotation will perform cardiac catheterizations with designated teaching attendings. Before the procedure the attending cardiologist is expected to review the patient's history, physical, lab data, non-invasive studies, and indications for the procedure with the cardiology fellow. The procedures will be performed by the fellow at a level appropriate to experience, always under the direct supervision of the attending cardiologist. For senior level fellows the attending will allow the fellow an increasing role in the care of the patient as warranted by their experience. The attending cardiologist is expected to review one-on-one the hemodynamic and angiographic data obtained during the procedure.
B. The educational points of each procedure will be reviewed with an emphasis on evidence-based medicine regarding indications for the procedure, interpretation of the results, and clinical application of the results in patient management.
C. The attending cardiologist will review the procedure report and correct any inaccuracies.

IX. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for the four major aspects of the procedure as follows:

1. Pre-cath evaluations
   - A complete history and thorough physical examination
   - Pertinent pre-test laboratories
   - Pre-test non-invasive testing
2. Procedure performance
   - Obtain vascular access
   - Perform catheterization and angiography as appropriate for their level of training with attending physician supervision
   - Review the hemodynamic and angiographic findings with the attending cardiologist following the procedure
3. Post-cath assessment
   - Assess the access site for complications

- Understand the symptoms, and findings associated with access complications
- Understand and be able to manage the common complications following cardiac catheterization

4. Reporting and conferences
   - Complete the report in a timely fashion accurately reflecting the findings of catheterization and angiography
   - The more advanced fellow will understand the treatment options available along with their limitations and contraindications.
   - Prepare appropriate patient's data for presentation at the weekly cardiac catheterization conference.

X. CONFERENCE AND CLINIC SCHEDULE SPECIFIC TO THIS ROTATION

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM	Cath conference						
PM		Cardiothoracic conference					

XI. EDUCATIONAL MATERIALS

Textbooks

- Moscucci M. *Grossman & Baim's Cardiac Catheterization, Angiography, and Intervention Eighth Edition.* Lippincott Williams & Wilkins, 2013.
- Lim MJ, Goldstein JA, Kern MJ. *Hemodynamic Rounds: Interpretation of Cardiac Pathophysiology from Pressure Waveform Analysis Third Edition*. Wiley-Blackwell
- Kern ML. *Cardiac Catheterization Handbook, 5th Edition*. Elsevier

ACC/AHA Practice Guidelines (available at www.Cardiosource.org)

- Patel MR et al. ACCF/SCAI/AATS/AHA/ASE/ASNC/HFSA/HRS/SCCM/SCCT/SCMR/STS 2012 appropriate use criteria for diagnostic catheterization: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Society for Cardiovascular Angiography and Interventions, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol 2012; 59:1-33.
- Levine GN, et al. 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions. J Am Coll Cardiol 2011; 58:e44-122.

Internet resources

- CathSAP4 (available at www.Cardiosource.org)

Consult/CCU Rotation

Developed by: Steven Werns, MD
Revision Date: June 2016

I. GENERAL INFORMATION	
Name of Rotation	Consult/CCU
Director	Arthur Riba, MD
Duration	1 month
Location	Beaumont-Dearborn Hospital

II. FACULTY

Drs. Riba, Spears, and Werns

Lines of Responsibility: The cardiology fellow functions as the key member of the medical team whose primary objective is to care for patients with acute cardiovascular illnesses. The medical team is comprised of an attending cardiologist, a cardiology fellow, medical residents, interns (internal medicine, family practice, and transitional), and medical students. The team is led by the faculty attending, who bears final responsibility for patient management or recommendations for management. The cardiology fellow works closely with the attending and gradually assumes more autonomous decision-making responsibility.

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: During the rotation the fellow will be responsible for the care of in-patients admitted to the CCU teaching service. The fellow is also responsible for initial evaluation and triage of patients presenting to the Emergency Department with suspected acute cardiac disorders.

Objectives: At the end of this rotation, fellows are expected to be facile with:

- Evaluation, triage, management, and risk stratification of patients with chest pain
- Management of patients with stable coronary artery disease and acute coronary syndromes (unstable angina, ST and non-ST elevation acute myocardial infarction)
- Indications for and complications of non-invasive and invasive cardiac testing (including cardiac catheterization and electrophysiology), intervention and revascularization
- Primary and secondary prevention of coronary artery disease
- Management of patients with acute and chronic heart failure
- Recognition and initial management of life-threatening arrhythmias
- Management of hypertensive urgency and crisis
- Management of aortic dissection
- ECG interpretation
- Indications for use and adverse reactions of common cardiovascular drugs
- Placement (and subsequent management) of Swan Ganz catheters, temporary intravenous and transcutaneous pacemakers, and intra-aortic balloon pumps
- Provision of preoperative consultation to other services (internal medicine, surgery, etc.)
- Practice of evidence-based medicine
- Appropriate utilization of non-invasive and invasive testing in the inpatient setting
- Establishing appropriate outpatient follow-up and testing

The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

Stable Ischemic Heart Disease

- Know the epidemiology, pathophysiology, and natural history of atherosclerotic vascular disease and the characteristic features of stable and unstable coronary artery plaque (F1)
- Know the determinants of coronary blood flow and myocardial oxygen consumption (F1)
- Know the differential diagnosis of chest pain syndromes and the characteristic clinical features of typical angina, atypical angina, and non-cardiac chest pain (F1)
- Know the clinical features and natural history of angina pectoris in special populations: women, the elderly, and patients with diabetes (F1)
- Know the causes of angina pectoris not related to atherosclerotic coronary disease (including valvular heart disease, hypertrophic cardiomyopathy, cocaine, congenital coronary anomalies, vasculitis, and coronary artery spasm (F1)
- Know the medical conditions that can provoke or exacerbate angina pectoris (F1)
- Know the differential diagnosis and prognosis of myocardial ischemia in patients with non-obstructive coronary disease (F1)
- Know the characteristic ECG features of ischemic heart disease (F1)
- Know the indications, contraindications, and limitations of non-invasive testing in the context of the pre-test likelihood and predictive value for diagnosis of coronary artery disease (F1)
- Know the role of non-invasive testing in risk-assessment, including the clinical, functional capacity, ECG, and hemodynamic stress test findings indicative of advanced coronary disease or high-risk state (F1)
- Know the lifestyle and activity guidelines and risk factor treatment target in patients with ischemic heart disease (F1)
- Know the indications, contraindications, and the clinical pharmacology of medications used to improve symptoms and/or prognosis in patients with ischemic heart disease (F1)
- Know the role of left ventricular systolic function in clinical decision-making and in estimation of prognosis in patients with ischemic heart disease (F1)
- Know the indications, limitations, and risk of coronary angiography in patients with known or suspected ischemic heart disease (F1)
- Know the anatomic and physiologic catheterization findings indicating significant coronary artery obstruction and the coronary angiographic features indicative of a high-risk state (F1)
- Know the indications, risk, and benefits of percutaneous or surgical revascularization versus medical therapy in patients with ischemic heart disease (F1)
- Know the treatment options for refractory symptomatic ischemic heart disease (F1)
- Know the indications for non-invasive or invasive evaluation following revascularization procedures (F1)

ACS

- Know the epidemiology, causes, pathophysiology, and natural history of acute coronary syndromes (ACS), including the roles of plaque rupture or erosion and platelet activation and thrombosis (F1)
- Know the disorders that can simulate or mask ACS (F1)
- Know how to use risk-assessment tools in ACS (F1)

- Know the indications and clinical pharmacology of antiplatelet, anticoagulant, and other pharmacologic therapies (F1)
- Know the post-ACS risk assessment, rehabilitation, and secondary prevention measures (F1)

NSTEMI-ACS

- Know the differential diagnosis and the characteristic clinical, ECG, and biomarker features for diagnosis and risk stratification (F2)
- Know the relative risks and benefits of an initial invasive versus an ischemia-guided strategy for angiography and revascularization (F2)

STEMI

- Know the characteristic symptoms, physical findings, ECG patterns, and biomarker findings (F1)
- Know the effects and time course of ischemic injury on ventricular function and remodeling (F1)
- Know the characteristic hemodynamic complications (including hypotension, low cardiac output, heart failure, and shock) (F2)
- Know the characteristic arrhythmia and conduction complications (F2)
- Know the characteristic mechanical complications (including papillary muscle rupture and myocardial rupture) (F2)
- Know the characteristic findings and complications or right ventricular infarction (F2)
- Know indications, contraindications, and risks of reperfusion therapies, and the clinical, ECG, and angiographic signs of reperfusion (F1)
- Know the relative benefits and risks of fibrinolysis and primary PCI as an initial reperfusion strategy (F1)
- Know the indications for transfer, angiography, and revascularization in patients who did not receive primary PCI (including those who received fibrinolysis or did not receive initial reperfusion therapy) (F2)

Valvular Heart Disease

- Know the characteristic features and natural history of congenital bicuspid aortic valve disease (F1)
- Know the etiology, natural history, pathophysiology, and differential diagnosis of acquired aortic, mitral, pulmonic, and tricuspid valve disease (F1)
- Know the characteristic features and natural history of rheumatic valvular heart disease (F1)
- Know the cardinal symptoms and physical findings of aortic and of mitral stenosis and their role in management decisions (F1)
- Know the cardinal symptoms and physical findings of chronic aortic and chronic mitral regurgitation and their roles in management decisions (F2)
- Know the causes and distinguishing characteristics of acute versus chronic mitral and aortic regurgitation (F2)
- Know the natural history, clinical features, and complications of mitral valve prolapse (F1)
- Know the appropriate indications for and characteristic findings of echocardiographic testing for diagnosis and assessment of severity during initial evaluation and upon follow-up (F2)
- Know the role of stress testing in assessment of valvular heart disease (F1)
- Know the indications for MRI and CT in the assessment of valvular heart disease (F2)
- Know the indications for and characteristic findings with cardiac catheterization in patients with valvular heart disease (F2)
- Know the indications for and clinical pharmacology of drugs used for the treatment of native and prosthetic valvular heart disease, including anticoagulation and antibiotic prophylaxis (F1)

- Know the effects of arrhythmias on the clinical manifestations, risks of complications, and management of valvular heart disease (F1)
- Know the indications and expected outcomes for surgical therapy in valvular heart disease, including valve selection and repair versus replacement (F2)
- Know the indications and expected outcomes for transcatheter therapy in valvular heart disease (F2)
- Know the etiology, natural history, physical findings, differential diagnosis, complications, and treatment of native valve and prosthetic valve endocarditis (F2)
- Know the effects of pregnancy on the clinical manifestations and management of patients with valvular heart disease (native and prosthetic) (F2)

Pericardial Disease

- Know the pathophysiology, differential diagnosis, and natural history of acute and relapsing pericarditis (F1)
- Know the pathophysiology, differential diagnosis, and natural history of pericardial effusion and pericardial tamponade (F1)
- Know the pathophysiology, differential diagnosis, and natural history of constrictive pericarditis (F2)
- Know the cardinal physical findings of acute pericarditis, pericardial tamponade, and constrictive pericarditis (F1)
- Know the indications for pericardiocentesis (F1)
- Know the indications for and clinical pharmacology of drugs used for the treatment of acute and relapsing pericarditis (F1)
- Know the effects of pericardial disease on other organ systems (F2)
- Know pericardial anatomy and structural abnormalities (pericardial cyst and congenital absence of the pericardium) (F1)
- Know the indications for and characteristic findings in imaging studies of pericardial diseases (F2)
- Know the indications for surgical referral in pericardial disease and the expected outcomes (F2)

Patient Care

Stable Ischemic Heart Disease

- Obtain and utilize history, physical examination, and ECG findings in patients with chest pain syndromes to establish a clinical probability of the presence of symptomatic coronary artery disease (F1)
- Distinguish stable versus unstable coronary syndromes (F1)
- Select evidence-based and cost-effective non-invasive testing for diagnosis and/or risk assessment in patients with chest pain syndromes (F1)
- Interpret and apply results of non-invasive testing in the management of patients with ischemic heart disease (F2)
- Perform and interpret exercise ECG testing (F1)
- Establish an effective anti-ischemic medical regimen for patients with ischemic heart disease (F1)
- Identify appropriate candidates for coronary angiography and percutaneous or surgical revascularization (F1)
- Interpret diagnostic cardiac catheterization findings and integrate into patient management (F2)
- Implement lifestyle and pharmacologic interventions to control and achieve target levels of risk factors (F1)
- Perform pre-operative risk-assessment in cardiovascular patients undergoing non-cardiac surgery (F1)

ACS/STEMI

- Evaluate and diagnose patients with STEMI and initiate appropriate reperfusion therapy within guideline time limits (F1)
- Employ appropriate antiplatelet, anticoagulant, and other pharmacologic therapies (F1)
- Recognize and treat hemodynamic disturbances (including hypotension, low cardiac output, heart failure, acute pulmonary edema, and shock) and diagnose the cause (F2)
- Recognize and treat arrhythmias and conduction disturbances (F2)
- Recognize and treat mechanical complications (including papillary muscle rupture and myocardial rupture (F2)
- Recognize and treat patients with right ventricular infarction (F2)
- Assess ventricular function and utilize in treatment strategy decisions (F2)
- Interpret invasive hemodynamic data and angiographic findings and apply to treatment strategies (F2)
- Perform and interpret coronary angiography (F3)
- Insert intra-arterial and pulmonary artery catheters (F1)
- Assess overall risk, identify candidates for invasive evaluation and treatment, and establish optimal medical regimen in NSTE-ACS (F1)
- Identify patients who would benefit from mechanical circulatory support (F2)
- Achieve risk-factor target levels for secondary prevention (F1)

Valvular Heart Disease

- Identify cardinal physical findings and ECG abnormalities in patients with valvular heart disease (F2)
- Distinguish innocent from pathologic heart murmurs (F2)
- Manage patients with valvular heart and coronary artery disease (F2)
- Select appropriate testing and integrate results with clinical findings in the evaluation and management of patients with valvular heart disease (F2)
- Distinguish aortic stenosis from hypertrophic cardiomyopathy and other causes of left ventricular outflow tract obstruction (F1)
- Recognize bicuspid aortic valve disease and its associated abnormalities (F1)
- Recognize impact of ventricular dysfunction on clinical decision-making in valvular heart disease (F1)
- Recognize the cause and impact of pulmonary hypertension in management of valvular heart disease (F2)
- Determine candidacy and optimal timing of cardiac surgical or transcatheter treatment in patients with valvular heart disease (F2)

Pericardial Disease

- Clinically evaluate, diagnose, and manage patients with acute pericarditis and with chronic relapsing pericarditis (F1)
- Identify cardinal physical findings and evaluate and manage patients with pericardial effusion, including tamponade (F2)
- Identify cardinal physical findings and evaluate and manage patients with constrictive pericarditis (F2)
- Appropriately select and incorporate data from laboratory testing and non-invasive imaging in the evaluation and management of patients with pericardial disease (F2)
- Perform pericardiocentesis (F2)
- Distinguish constrictive pericarditis from restrictive cardiac disease (F2)
- Identify patients who should be referred for cardiac catheterization in the evaluation of pericardial disease (F2)
- Identify patients with constrictive pericarditis who are candidates for referral for consideration of cardiac surgery (F2)

Systems-based Practice

- Work with EMS, ED, and hospital teams to establish effective first medical contact strategies for cardiovascular emergencies (F2)
- Identify and address financial, cultural, and social barriers to diagnostic and treatment recommendations (F1)
- Utilize a multidisciplinary coordinated approach for patient management, including transfer of care and employment-related issues (F1)
- Practice in a manner that fosters the balance of appropriate utilization of finite resources with the net clinical benefit for the individual patient (F2)
- Incorporate risk-benefit analysis and cost considerations in treatment decisions (F2)
- Participate in interdisciplinary decision-making with regard to surgery and transcatheter therapy (F2)

Practice-based Learning and Improvement

- Utilize decision support tools for accessing guidelines and pharmacologic information at the point of care (F1)
- Utilize point-of-care electronic resources to provide up-to-date clinical information and guideline-driven evaluation and treatment (F1)
- Identify gaps in performance and knowledge and perform appropriate personal learning activities (F2)
- Integrate validated performance and patient satisfaction measures into clinical practice to foster continuous quality improvement (F2)

Professionalism

- Exhibit sensitivity to patient preference and end-of-life issues (F1)
- Demonstrate sensitivity and responsiveness to diverse patient populations (F1)
- Demonstrate a commitment to carry out professional responsibilities, appropriately refer patients, and respond to patient needs in a way that supersedes self-interest (F1)
- Practice patient-centered care with shared decision-making and appreciation of patients' values and preferences (F1)
- Incorporate appropriate use criteria and risk-benefit considerations in treatment decisions (F2)
- Practice in a manner that fosters patient benefit above self-interest and avoids conflict of interest (F1)
- Interact respectfully with patients families, and all members of the healthcare team, including ancillary and support staff (F1)

Interpersonal and Communication Skills

- Communicate with patients and families across a broad range of ethnic, social, cultural, socioeconomic, and religious backgrounds (F1)
- Exhibit sensitivity and empathy in dealing with life-threatening and end-of-life issues (F1)
- Communicate with all healthcare providers involved in patient care (F1)
- Communicate effectively and in a timely manner with primary care and other referring or collaborating members of the healthcare team (F2)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

General topics to be covered during this rotation:

1. Peri-operative cardiac consultation
2. Management of acute coronary syndromes, heart failure, and serious arrhythmias
3. Collaborative practice with various levels of caregivers, intensivists, cardiologists, and other subspecialists, including cardiac surgeons, PAs, and nursing staff
4. Triage of patients with potential acute cardiac illness
5. Placement, monitoring, and removal of hemodynamic monitoring catheters and IABP
6. Indications for placement of temporary pacing catheters

7. Indications for various non-invasive tests
8. Indications for acute cardiac catheterization
9. Adjustment of vasoactive and antiarrhythmic medications in critically ill patients
10. Identification and treatment of cardiac arrhythmias and knowledge of the indications for electrophysiology testing and devices in the critically ill patient

Principal teaching methods:

Clinical teaching
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the attending physicians, with additional input from nurses, students, residents, and peers. Assessment methods include:

Direct observation (Mini-CEX)
Global clinical performance ratings
Multisource (360) assessment
Nursing evaluations
Resident/student evaluations
Faculty/staff meetings

Fellows will evaluate the rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The attending will review and confirm the historical and physical findings that have been documented by the fellow/resident. The attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The attending will review and sign the notes that the fellow enters in the electronic medical record. The attending will supervise unit-based procedures. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

1. The Cardiology Fellow must act as the "Junior Attending" on the cardiology consult service and needs to make sure that all patients, both new consults and follow-ups, are seen by the residents on the team by the time Teaching Attending Rounds begin with the Teaching Cardiology Attending assigned to the Consult Service.
2. The Cardiology Fellow will accept consults for the floor and accept triage consults from the Emergency Department and if necessary, will go down to the Emergency Department to evaluate patients.
3. The Cardiology Fellow will be expected to assign patients to the cardiology team so that each resident has an equal share of patients. The Cardiology Fellow will then staff the patients with residents.
4. Stat consults to the Cardiology Consult Service are to be seen immediately by the Cardiology Fellow.
5. The Cardiology Fellow must ensure that patients are seen by the residents in a timely manner and ready for presentation on rounds. At times when the service is busy, the Cardiology Fellow may have to see patients on his/her own, and write notes in order to present patients on rounds. These patients will be delegated subsequently to the residents for follow-up.

6. The Cardiology Fellow needs to assure that there is proper sign-out to the Cardiology Fellow covering during the evenings and on weekends.
7. The Cardiology Fellow covering the weekend and nights should give proper sign-out to the regular Cardiology Fellow at the time of shift change to assure a safe continuum of care.
8. Given the restricted duty hours of the residents on the weekend, the Cardiology Fellow may have to see and present patients during rounds along with his/her responsibility to oversee the other residents.
9. The Cardiology Consult Resident and Fellow Team provides back-up for RRT calls and codes on the Fourth Floor. The Cardiology Fellow should be physically present for RRT's and codes when requested.
10. It is expected that the Cardiology Fellow attend all morning conferences, lectures and continuity clinic. When the Cardiology Fellow attends his/her continuity clinic, it is expected that he/she sign-out to the resident on the service who will take responsibility for covering the service and supervising the first-year residents.
11. The Cardiology Fellow must staff new consults with the Attending on the consult service if consulted after rounds.
12. The Cardiology Fellow must sign-out the patients and transfer his/her beeper to the Cardiology Fellow on–call on a daily basis and weekends and holidays, and assure that there is a comprehensive hand-off review.

IX. EDUCATIONAL MATERIALS

A variety of texts and electronic educational materials are available in the cardiology fellows' room, in the library, and on-line through the library, accessible both at home and at computer terminals throughout the hospital. There are many written and electronic references for patients with cardiovascular disease. A valuable resource is the American College of Cardiology website, www.Cardiosource.org. This website allows access to well-written, frequently updated clinical guidelines, which are evidence-based and comprehensively referenced.

ACC/AHA Practice Guidelines (available at www.Cardiosource.org)

- Rybicki FJ et al. 2015 ACR/ACC/AHA/AATS/ACEP/ASNC/NASCI/SAEM/SCCT/SCMR/SCPC/SNMMI/STR/STS Appropriate Utilization of Cardiovascular Imaging in Emergency Department Patients with Chest Pain. J Am Coll Cardiol 2016; 67:853-79.
- Fleisher LA, et al. 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluaton and Management of Patients Undergoing Noncardiac Surgery. J Am Coll Cardiol 2014; 64:e77-137.
- Nishimura RA, et al. 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease. J Am Coll Cardiol 2014; doi: 10.1016/j.jacc.2014.02.536.
- Fihn SD, et al. 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. J Am Coll Cardiol 2014;64:1929–49.
- Amsterdam EA, et al. 2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes, Journal of the American College of Cardiology 2014; doi: 10.1016/j.jacc.2014.09.017.
- O'Gara PT, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;61:e78–140.
- Yancy CW, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report

of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147–239.

- Goff DC Jr, et al.. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;63:2935–59.
- Stone NJ, et al.. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;63:2889–934.
- Mosca L, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women—2011 update: a guideline from the American Heart Association. J Am Coll Cardiol 2011;57:1404–23.
- Aronow WS, et al. ACCF/AHA 2011 expert consensus document on hypertension in the elderly: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. J Am Coll Cardiol 2011;57:2037–114.
- Nishimura RA, et al. 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease. J Am Coll Cardiol 2014; doi: 10.1016/j.jacc.2014.02.536.
- Fihn SD, et al. 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. J Am Coll Cardiol 2014;64:1929–49.
- January CT, et al. 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation. J Am Coll Cardiol 2014; doi: 10.1016/j.jacc.2014.03.022.
- Russo AM, et al. 2013 appropriate use criteria for implantable cardioverter-defibrillators and cardiac resynchronization therapy: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Heart Rhythm Society, American Heart Association, American Society of Echocardiography, Heart Failure Society of America, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. J Am Coll Cardiol2013;61:1318–68.
- Patel MR et al. ACCF/SCAI/AATS/AHA/ASE/ASNC/HFSA/HRS/SCCM/SCCT/SCMR/STS 2012 appropriate use criteria for diagnostic catheterization: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Society for Cardiovascular Angiography and Interventions, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol 2012; 59:1-33.
- Douglas PS, et al.. ACCF/ASE/AHA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR 2011 appropriate use criteria for echocardiography: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, American Society of Echocardiography, American Heart Association, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. J Am Coll Cardiol 2011:57:1126–66.

Echocardiography Rotation

Developed by: Syed Jafri, MD and Steven Werns, MD
Revision Date: December 2014

I. GENERAL INFORMATION	
Name of Rotation	Echocardiography
Director	Syed Jafri, M.D.
Duration	1 month
Location	Beaumont-Dearborn Hospital

II. FACULTY

Drs. Ahmad and Jafri

Lines of Responsibility: The fellow will function as part of the echocardiography laboratory and learn echocardiography skills from the sonographers and faculty. The fellow will have the primary duty of evaluating patients for procedures. The fellow will prioritize echo performance during the first year of the fellowship, spending more time with sonographers initially. The fellow will perform 3 to 5 echocardiography studies per day until he or she has performed the recommended minimum of 150 studies.

The fellow will learn skills of interpreting the ultrasound studies and how these studies are evaluated in the context of cardiac disease. The first year fellow will prioritize reading with the faculty attending during the latter part of the day so that the studies performed earlier in the day can be interpreted. Second and third year fellows will spend more time doing TEE's and stress echos. Fellows will pre-read echocardiograms to enhance their interpretative skills. All studies will be read with the faculty attending.

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: The fellow will develop competence in the performance and interpretation of all of the different modalities of echocardiography. This will be achieved in a logical stepwise approach of increasing complexity and depth of knowledge.

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the physical principles of ultrasound and the instrumentation used to obtain images (F1)
- Know the appropriate indications for: M-mode, two-dimensional, and three-dimensional transthoracic echocardiography (TTE); Doppler echocardiography and color flow imaging; transesophageal echocardiography (TEE); tissue Doppler and strain imaging;

contrast echocardiography (F2)
- Know the limitations and potential artifacts of the echo examination (F1)
- Know the standard views included in a comprehensive TTE (F1)
- Know the standard views included in a comprehensive TEE (F2)
- Know how to quantify cardiac chamber sizes, evaluate left and right ventricular systolic and diastolic function, and hemodynamics (F2)
- Know the characteristic findings of cardiomyopathies (F2)
- Know how to use echo and Doppler data to evaluate native and prosthetic valve function and disease (F2)
- Know the echo and Doppler findings of cardiac ischemia and infarction and the complications of myocardial infarction (F2)
- Know the echo findings of pericardial disease, pericardial effusion, and pericardial constriction (F2)
- Know the characteristic findings of basic adult congenital heart disease (F2)
- Know the findings of complex/post-operative adult congenital heart disease (F3)
- Know how to evaluate cardiac mass and suspected endocarditis (F2)
- Know how to evaluate diseases of the aorta (F2)
- Know how to assess pulmonary artery pressure and diseases of the right heart (F2)
- Know how to evaluate patients with systemic diseases involving the heart (F2)
- Know the indications for and the echocardiographic findings in patients with known or suspected cardioembolic events (F2)

Patient Care

- Perform and interpret a basic TTE exam (F1)
- Perform and interpret a comprehensive TTE exam (F2)
- Perform and interpret a comprehensive TEE exam (F3)
- Recognize pathophysiology, quantify severity of disease, identify associated findings, and recognize artifacts in echocardiography (F3)
- Integrate echo findings with clinical and other resting results in the evaluation and management of patients (F2)
- Interpret stress echocardiography (F3)
- Utilize echo techniques during cardiac interventions, including intraoperative TEE (F3)

Systems-based Practice

- Work effectively with the echo laboratory staff (F1)
- Incorporate appropriate use criteria, risk-benefit, safety, and cost containment considerations in the use of ultrasound techniques (F2)
- Participate in echo quality monitoring and initiatives (F2)

Practice-based Learning and Improvement

- Identify competency gaps and engage in opportunities to achieve focused education and performance improvement (F2)

Professionalism

- Promote adherence to guidelines and appropriate use criteria (F2)

Interpersonal and Communication Skills

- Communicate and educate patients and families across a broad range of cultural, ethnic, and socioeconomic backgrounds (F1)
- Communicate testing results in a timely manner to primary and referring physicians (F2)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

Practical Hands-on Training It is critical to learn how to acquire the images in order to become a skilled echocardiographer. Fellows should understand the scan planes and their relationship to one another as well as the importance of artifacts, gain settings, depth settings, etc. The fellows are expected to learn these skills primarily from the sonographers who are professionals and specifically educated and trained to perform cardiac ultrasound procedures. The sonographers will also teach the fellows the basics of operating the ultrasound equipment, and the standard study protocol. The sonographers will provide the fellows hands-on transducer time and instructions on study performance. The fellow will prioritize echo performance during the first part of the fellowship, spending more time with sonographers initially.

Reading with Faculty: The fellows will spend time with the faculty attending to learn the skills of interpreting the ultrasound studies and how these studies are evaluated and reported in the context of the patient's clinical conditions. First-year fellows will prioritize reading with the faculty attending in the afternoon so that the studies they performed in the morning can be interpreted with the faculty attending. The senior fellows will spend more time doing TEE's and stress echos. Fellows will pre-read the echocardiograms to enhance their interpretive skills.

Levels of training:

1) Level 1: 3 months. Introductory training in basic echocardiography. Minimum number of TTE performance *and* interpretation of examinations: 150. Allows the fellow to understand the functional anatomy and physiology in relation to the echocardiographic examination accurately.
2) Level 2: 6 months. Minimum number of TTE performance *and* interpretation of examinations: 300. Training emphasizes the intensity, quality, and completeness of diagnostic studies. Competence at this level denotes that the trainee is sufficiently experienced to independently interpret the echocardiographic examination accurately. This level does not require TEE or stress echocardiogram.
3) Level 3: 12 months. Minimal number of TTE performance *and* interpretation of examinations: 750. Includes training in TEE, stress echo, intraoperative echo, contrast studies, interventional and complex congenital heart disease. This training is needed for someone who aspires to be the director of a laboratory. Exposure to and proficiency in all echocardiographic procedures is expected at the end of this training.

Echo Conference: There is a weekly conference dedicated to echocardiography. The goal is to present cases and topics of interest to fellows, faculty, and staff and to provide an opportunity for more in-depth learning for the fellows in general. Attendings are available for consultation and image review and guidance preparing the topic for presentation. When case study days are scheduled, it is expected that the echo fellow will compile a number of studies, which can often revolve around a clinical disorder or literature review on a topic of general interest. The primary focus will be on presenting images, with supporting didactic and clinical information.

Textbooks and literature reading: There are ample opportunities for reading and finding topics to review while in the echo lab (see educational materials below).

Year-end Exam: Each year the fellows will be provided access to the American Society of Echocardiography's Online Practice Exam Simulation.

Principal teaching methods:

Didactic conferences
Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians. Assessment methods include:

Direct observation
Multisource evaluation
ACC In-Training Exam
Procedure logs
Conference presentation

Fellows will evaluate the echocardiography rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The faculty attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The faculty attending will arrange a time to read the echocardiograms and discuss findings with the fellow. The attending will supervise all transesophageal echocardiograms. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

- The fellows will meet with the echo rotation director on the first day of the rotation to discuss duties and expectations for the rotation.
- The fellows will perform 3 to 5 studies per day, especially during the first month.
- The fellows will read and interpret studies with the faculty attending daily.
- The fellows will utilize New Innovations to maintain a log of all echo studies in which they participate over the course of the rotation, indicating performance, interpretation, or both. The log will be reviewed with the fellows at the end of the month.
- The fellows will participate in echocardiography conference.

IX. CONFERENCE AND CLINIC SCHEDULE SPECIFIC TO THIS ROTATION

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM			Echocardiography Conference				
PM							

X. EDUCATIONAL MATERIALS

Textbooks

- Armstrong WF, Ryan T. *Feigenbaum's Echocardiography. Seventh Edition*. Lippincott Williams & Wilkins
- Otto CM. *Textbook of Clinical Echocardiography. Fifth Edition*. Elsevier
- Oh JK, Seward JB and Tajik AJ: *The Echo Manual*. Lippincott Williams & Wilkins

AHA/ACC Practice Guidelines (available at www.Cardiosource.org**)**

- Douglas PS, et al.. ACCF/ASE/AHA/ASNC/HFSA/HRS/SCAI/SCCM/SCCT/SCMR 2011 appropriate use criteria for echocardiography: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, American Society of Echocardiography, American Heart Association, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Critical Care Medicine, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic

Resonance. J Am Coll Cardiol 2011:57:1126–66.
- Reeves ST, et al. Basic perioperative transesophageal echocardiography examination: a consensus statement of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr 2013; 26:443-56.
- Hahn RT, et al. Guidelines for performing a comprehensive transesophageal echocardiographic examination: recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr 2013; 26:921-64.

Other educational resources

- EchoSAP 7 (available at www.Cardiosource.org)

Electrophysiology Rotation

Developed by: Nour Juratli, MD and Steven Werns, MD
Revision Date: December 2014

I. GENERAL INFORMATION	
Name of Rotation	Electrophysiology
Director	Nour Juratli, MD
Duration	1 month
Location	Beaumont-Dearborn Hospital

II. FACULTY

Dr. Nour Juratli and Dr. Sohail Hassan

Lines of Responsibility: The electrophysiology laboratory team is composed of technologists, nurses, cardiology fellows, and faculty attending cardiologists. The team will interact with the referring cardiologists/internists and with cardiothoracic surgeons as needed. The team is led by the faculty attending, who bears final responsibility for patient management.

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals:

- To acquire knowledge of the electrophysiologic basis for cardiac arrhythmias, the indications for invasive study, and the rationale for pharmacologic treatment and therapeutic interventions
- To understand and diagnose normal and abnormal function of implantable devices (pacemakers, implanted cardioverter/defibrillators)

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the mechanism and characteristics of normal sinus rhythm and sinus node dysfunction (F1)
- Know the pathophysiology, differential diagnosis, and clinical significance of reentrant (AVNRT; AVRT) and ectopic atrial tachycardias and accelerated atrioventricular junctional rhythm (F2)
- Know the pathophysiology, differential diagnosis, and clinical significance of atrial fibrillation and flutter (F2)
- Know the pathophysiology, differential diagnosis, and clinical significance of sustained and non-sustained ventricular tachyarrhythmias (F2)
- Know the types, mechanisms, differential diagnosis, and clinical significance of

atrioventricular dissociation and of atrioventricular heart blocks (F1)

- Know the physical examination characteristic of arrhythmias (e.g. atrioventricular dissociation)(F2)
- Know the significance of underlying structural or congenital heart disease in the likelihood and significance of cardiac arrhythmias and in clinical management decisions (F2)
- Know the indications, contraindications, and clinical pharmacology of antiarrhythmic medications, including drug-drug and drug-device interactions and proarrhythmia potential (F1)
- Know the indications and limitations of non-invasive testing in the diagnosis and management of patients with arrhythmias: ambulatory, event, implantable loop recorder, and tilt-table testing (F2)
- Know the indications for and limitations and complications of invasive electrophysiological testing, as well as arrhythmia ablation (F2)
- Know the indications for permanent pacemaker placement, CRT, and ICD placement (F2)
- Know the pathophysiology, differential diagnosis, and natural history of syncope, including neurocardiogenic causes (F1)
- Know the mechanisms, findings, and clinical significance of ventricular pre-excitation (F2)
- Know the pathology and clinical significance of genetic ion channel abnormalities and arrhythmias (F2)
- Know principles and practice of radiation safety (F1)

Electrocardiography/Ambulatory ECG

- Know the basic principles of scalar electrocardiography and the operation/use of the instruments to acquire display, and store ECGs (F1)
- Know the underlying cellular and ionic mechanisms in the genesis of the surface electrocardiograms and the effects of the autonomic nervous system (F1)
- Know how to measure and the normal values for electrical axis and ECG intervals, durations, and voltage (F1)
- Know the anatomy of the specialized conducting tissue and the spread of excitation in the ventricles (F1)
- Know reentry, automaticity, and triggered activity mechanisms for cardiac arrhythmias (F1)
- Know the types and mechanisms of aberrancy (F1)
- Know capture and fusion complexes and the ECG pattern criteria for distinction of supraventricular arrhythmias with aberrancy from ventricular arrhythmias (F2)
- Know the concepts of concealed conduction and exit block, as well as their manifestation on the ECG (F2)
- Know the indications for and limitations of continuous (Holter) and intermittent (Event) ambulatory ECG recording (F2)

Patient Care

- Evaluate and manage patients with palpitations (F1)
- Evaluate and manage patients with syncope (F2)
- Evaluate and manage patients with supraventricular tachyarrhythmias (F2)
- Evaluate and manage patient with atrial fibrillation and flutter (including rate and rhythm control and anticoagulation strategies) (F2)
- Evaluate and manage patients with wide-QRS tachycardia (F2)
- Manage patients with non-sustained and sustained ventricular arrhythmias (F2)
- Evaluate and manage patients with bradycardia and/or heart block (F2)
- Perform electrical cardioversion (F1)
- Perform tilt-table testing (F2)
- Perform temporary pacemaker placement (F2)
- Select and manage patients requiring permanent pacemaker, implantable cardioverter

defibrillator, or biventricular pacing (F2)
- Perform pacemaker and ICD interrogation, programming, and surveillance (F2)
- Perform permanent pacemaker implantation and manage complications (F2)
- Perform ICD and biventricular device implantation and manage complications (F4)
- Perform invasive electrophysiological testing and ablation therapy (F4)

Electrocardiography/Ambulatory ECG

- Identify normal ECG patterns, normal variants, and artifacts (including incorrect lead placement)(F1)
- Identify ECG signs of atrial abnormalities and of right and left ventricular hypertrophy or enlargement (F1)
- Identify types and significances of intraventricular conduction delay or block (including functional or aberrant conduction abnormalities) (F1)
- Identify the types of atrioventricular dissociation (F2)
- Identify first, second (types I, II, 2:1, and high degree), and third degree atrioventricular blocks (F1)
- Identify the ECG patterns and localization of cardiac ischemia and infarction (F1)
- Identify the ECG changes of electrolyte and metabolic abnormalities and of drug effects (F2)
- Identify non-specific QRS and ST-T wave changes (F1)
- Identify atrial, atrioventricular nodal, and ventricular arrhythmias (F2)
- Integrate ECG findings into clinical and risk assessments and the management of patients (F2)
- Select and interpret ambulatory ECG recording studies (F2)
- Identify normal and abnormal pacemaker rhythm/functions (F2)

Systems-based Practice

- Utilize a multidisciplinary coordinated approach for patient management, including transfer of care and employment-related issues (F2)
- Use technology and available registries to assess appropriateness, performance, and safety of implanted devices (F2)
- Incorporate risk-benefit analysis and cost considerations in diagnostic and treatment decisions (F2)
- Participate in hospital/practice quality monitoring of ECG testing (F2)

Practice-based Learning and Improvement

- Identify competency gaps and engage in opportunities to achieve focused education and performance improvement (F2)
- Utilize decision support tools for accessing guidelines and pharmacologic information at point of care (F2)

Professionalism

- Exhibit sensitivity to patient preference and end-of-life issues (F2)
- Practice within the scope of personal expertise or technical skills (F2)

Interpersonal and Communication Skills

- Communicate with and educate patients and families across a broad range of cultural, ethnic, and socioeconomic backgrounds (F2)
- Engage in shared decision-making with patients about their condition and the options for diagnosis and treatment (F2)
- Communicate testing results in a timely manner to primary and referring physicians (F1)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

Fellows will have direct interaction with faculty members on a daily basis in several settings: in the electrophysiology laboratory, at the bed-side during rounds, and in the outpatient setting.

Principal teaching methods:

Didactic teaching
Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians, with additional input from nurses, students, residents, and peers.

Assessment methods include:

Direct observation
Multisource evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Fellows will evaluate the electrophysiology rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The faculty attending cardiologists participating in this rotation will be responsible for the direct supervision of the fellow at all times. The faculty attending will review and confirm the historical and physical findings that have been documented by the fellow. The faculty attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The faculty attending will supervise all procedures. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

- 1st year: The fellow is fully involved with patient care and consultation. In the laboratory, the fellow assists in procedures.
- 2nd year: The fellow is fully involved with patient care and consultation. In the laboratory, the fellow assists in procedures. The fellow learns stimulation techniques and intracardiac recording and is responsible for the draft of the electrophysiology laboratory report. The goal for all second year fellows is to gain the ability to place a temporary right ventricular pacer with electrogram control. This skill is gained during a routine diagnostic electrophysiology study and/or radiofrequency ablation study.
- The fellow is responsible for completing the minimum number of procedures required – 5 temporary pacemakers, 20 cardioversions, and 100 Holter monitors.

IX. CONFERENCE AND CLINIC SCHEDULE SPECIFIC TO THIS ROTATION

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM							
PM				ECG/electrophysiology conference			

X. EDUCATIONAL MATERIALS

Textbooks

- Surawicz B, Knilans T. *Chou's Electrocardiography in Clinical Practice. Sixth Edition.*
- Fogoros RN. *Electrophysiologic Testing. Fifth Edition.* Wiley-Blackwell
- Josephson ME. *Clinical Cardiac Electrophysiology. Fourth Edition.*

AHA/ACC Practice Guidelines (available at www.Cardiosource.org**)**

- January CT, et al. 2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation. J Am Coll Cardiol 2014; doi: 10.1016/j.jacc.2014.03.022.
- Russo AM, et al. 2013 appropriate use criteria for implantable cardioverter-defibrillators and cardiac resynchronization therapy: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Heart Rhythm Society, American Heart Association, American Society of Echocardiography, Heart Failure Society of America, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. J Am Coll Cardiol 2013;61:1318–68.
- Zipes DP, et al. ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death). J Am Coll Cardiol 2006;48:e247–e346.

Other educational resources

- Off-site 2-3 day pacemaker courses offered by pacemaker manufacturers provide valuable lectures and tutorials
- ArrhythmiaSAP (available at www.Cardiosource.org)

Nuclear Cardiology Rotation

Developed by: Syed Jafri, MD and Steven Werns, MD
Revision Date: December 2014

I. GENERAL INFORMATION	
Name of Rotation	Nuclear Cardiology
Director	Syed Jafri, MD
Duration	1 month
Location	Beaumont-Dearborn Hospital and Henry Ford Hospital

II. FACULTY

Drs. Ananth (Henry Ford Hospital) and Jafri (Beaumont-Dearborn Hospital)

Lines of Responsibility: The fellow will function as part of the nuclear laboratory. The fellow will have the primary duty of evaluating patients for procedures. The nuclear cardiology rotation provides the fellow with the opportunity to perform and interpret the minimum number of 300 stress tests that are required to fulfill the COCATS 4 requirement for level 2 training.

The fellow will learn skills of interpreting nuclear studies and how these studies are evaluated in the context of cardiac disease. The first year fellow will prioritize reading with the faculty attending during the latter part of the day so that the studies performed earlier in the day can be interpreted. All studies will be read with the faculty attending so that direct instruction is more effectively performed.

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: During the rotation, the fellow will develop an understanding of normal and abnormal cardiac structure, performance and perfusion under resting and stress conditions as assessed by nuclear cardiology techniques. The fellow will understand indications for performing nuclear cardiology testing as well as established appropriateness criteria, and be able to assess indications for exercise treadmill stress versus pharmacologic vasodilator stress. The fellow will be competent in supervising treadmill and pharmacologic stress tests and demonstrate an understanding of end-points of stress testing as well as indications for administering medication to reverse the effects of pharmacologic stress.

First year: During the first year of the cardiology fellowship fellows will be taught how to ensure proper stress test selection, based on the clinical needs and evidence for contraindications to the ordered test. They will evaluate patients referred for nuclear perfusion scanning. They will become familiar with the basics of radiopharmaceutical tracer physiology; exercise and pharmacological stress testing; and heart rate augmentation with atropine. The fellows will review the nuclear scans with the assigned faculty reader of the day.

Second year: During the second year rotation fellows will refine the skills introduced during prior rotations. They are additionally expected to develop more in-depth communication with referring physicians for dissemination of critical and/or time-sensitive test results. During this year fellows will be instructed in 3-dimensional image manipulation for perfusion images and quality control of first-pass radionuclide angiograms. Fellows will be taught to use the quantitative software package to review rest and stress perfusion studies on their own processing station.

Third year: During the third year, the fellows will focus on satisfying the requirements for licensure by the nuclear regulatory commission and board certification in nuclear cardiology, based on proficiency in image interpretation, test ordering, and basics of radiation safety in the laboratory. They are expected to read a textbook of nuclear cardiology and primary literature covering details of imaging hardware, processing software, clinical applications, and appropriateness of stress testing. They will interpret scans independently, and then review their preliminary readings with the attending physician during daily reading sessions.

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

Nuclear imaging

- Know the principles of single photon emission computed tomography (SPECT) and radionuclide ventriculography (RVG) image acquisition and display, including the standard tomographic planes and views (F2)
- Know the properties and use of standard perfusion tracers (F2)
- Know the principles of radiation safety and how to minimize radiation exposure (F2)
- Know the indications for myocardial perfusion imaging and the appropriate selection of exercise versus pharmacologic stress testing (F1)
- Know how to evaluate pre-test probability and perform sequential probability analysis to assess post-test probability (F1)
- Know the mechanism of the pharmacologic stress agents, the methods of their administration, and the safety issues in using the agents (F2)
- Know the protocols for administration of the standard perfusion agents and the influence of the clinical situation on choice of imaging protocol (F2)
- Know the quality control issues, how to review raw data, and how to recognize artifacts (F2)
- Know how to assess ventricular function (F2)
- Know the protocols for the use of perfusion imaging to assess myocardial viability (F2)
- Know the indications for PET imaging and the use of PET tracers (F3)

Exercise Stress Testing

- Know the indications, risk, and contraindications for stress testing, both for diagnosis and for risk stratification, in patients with suspected or known coronary heart disease (F1)
- Know the common exercise test protocols and targets (F1)
- Know the ECG criteria for positive test (F1)
- Know the normal and abnormal HR and BP responses to graded exercise and in recovery (F1)
- Know the ECG, exercise capacity, and/or hemodynamic findings indicating a strongly positive test or adverse prognosis (F1)
- Know the criteria for stopping a test before reaching target (F1)
- Know the significance of exercise-associated arrhythmias (F1)
- Know exercise testing in special groups (women, asymptomatic subjects, post-MI, or recent acute coronary syndrome patients)(F1)
- Know the use, precautions, and contraindications of exercise testing in patients with valvular and myocardial disease (F1)
- Know the effects of baseline ECG abnormalities and medications on exercise testing (F1)
- Know clinical and baseline ECG findings that warrant the addition of imaging to the exercise ECG (F1)

- Know the indicators for the selection of pharmacologic rather than exercise testing (F1)
- Know the indications for, and the sensitivity and specificity of, adding echocardiographic or nuclear perfusion imaging to stress ECG testing (F1)

Patient Care

Nuclear imaging

- Select the appropriate imaging study (F1)
- Integrate perfusion imaging findings with clinical and other testing results in the evaluation and management of patients (F2)
- Identify results that indicate a high-risk state (F1)
- Perform and interpret gated stress-rest perfusion study (F3)
- Perform and interpret an RVG study (F3)

Exercise Stress Testing

- Skill to select clinically-appropriate exercise test type and protocol for diverse patient types and clinical settings (F1)
- Skill to safely perform appropriate heart-rate limited and maximal or near-maximal treadmill exercise tests (F2)
- Skill to identify and effectively treat complications during and following stress testing (F2)
- Skill to utilize exercise symptoms and capacity, ECG findings, and hemodynamic response in the risk assessment and management of patients (F2)

Systems-based Practice

- Effectively lead and coordinate the exercise test interprofessional team (including nurses and technicians) to ensure safe and efficient care (F2)
- Work effectively and efficiently with the Nuclear laboratory staff (F2)
- Incorporate appropriate use criteria, risk benefit, and cost considerations in the use of radionuclide imaging techniques (F1)
- Participate in lab quality monitoring and initiatives (F3)

Practice-based Learning and Improvement

- Identify gaps and opportunities to achieve focused education and performance improvement (F2)
- Review practice alignment with guidelines (F2)

Professionalism

- Know and promote adherence to guidelines and appropriate use criteria (F2)
- Routinely demonstrate sensitivity and responsiveness to diverse patient populations (F1)

Interpersonal and Communication Skills

- Communicate effectively with patients, families, and other health professionals across a broad range of socioeconomic and cultural backgrounds (F1)
- Communicate effectively and in a timely manner with referring physicians (F1)
- Create a comprehensive and user-friendly report (F3)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

A minimum of four months of the fellowship will be spent on the nuclear cardiology rotation. Fellows will assist nuclear technologists in nuclear laboratory processes twice per monthly rotation. These include QC of gamma camera, preparing radio-pharmaceutical doses, unpacking radioactive packages, and surveying for radioactive contamination. Fellows will attend twice per month nuclear cardiology didactic lectures which include the topics of radiation safety and biology, radiation physics, principles of gamma cameras, PET imaging and handling of radioactive spills.

The fellow will participate in 700 hours of training in nuclear cardiology including the following topics:

- Radiation physics and instrumentation
- Radiation protection
- Mathematics pertaining to the use and measurement of radioactivity
- Radiation biology
- Chemistry of by-product material for medical use
- Ordering, receiving unpacking and surveying radioactive material
- Use of and QC of survey meters
- Calculating, measuring and administering patient doses
- Using administrative controls to prevent a medical event
- Knowing procedures to safely contain radiation spills
- Eluting generator systems for preparation of patient doses and measuring and processing the eluate to prepare labeled radioactive drugs.

Principal teaching methods:

Didactic conferences
Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians. Assessment methods include:

Direct observation
Multisource evaluation
ACC In-Training Exam
Procedure logs
Conference presentation

Fellows will evaluate the nuclear cardiology rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct or indirect supervision of the fellow at all times.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

- Supervising, reviewing, and interpreting stress ECG, SPECT and gated SPECT studies at Beaumont-Dearborn Hospital under the supervision of the faculty reading cardiologist
- Assisting nuclear technologists in nuclear laboratory processes, including QC of gamma camera, preparing radio-pharmaceutical doses, unpacking radioactive packages, and surveying for radioactive contamination.
- Fellows will attend twice per month nuclear cardiology didactic lectures which include the topics of radiation safety and biology, radiation physics, principles of gamma cameras, PET imaging and handling of radioactive spills.

IX. CONFERENCE AND CLINIC SCHEDULE SPECIFIC TO THIS ROTATION

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM							
PM			Nuclear Cardiology Conference				

X. EDUCATIONAL MATERIALS

Textbooks

- Heller GV, Hendel RC, eds. *Nuclear Cardiology, Practical Applications. Second Edition*.

AHA/ACC Practice Guidelines (available at www.Cardiosource.org**)**

- Hendel RC, et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 appropriate use criteria for cardiac radionuclide imaging: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, the American Society of Nuclear Cardiology, the American College of Radiology, the American Heart Association, the American Society of Echocardiography, the Society of Cardiovascular Computed Tomography, the Society for Cardiovascular Magnetic Resonance, and the Society of Nuclear Medicine. J Am Coll Cardiol 2009;53:2201–29.

Vascular Medicine Rotation

Developed by: Tahir Mohamed, MD and Steven Werns, M.D.
Revision Date: November 2014

I. GENERAL INFORMATION	
Name of Rotation	Vascular Medicine
Director	Tahir Mohamed, MD
Duration	1 month
Location	Beaumont-Dearborn Hospital and Dr. Mohammed's Office

II. FACULTY

Dr. Tahir Mohamed

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals:
Fellows will receive formal instruction and clinical experience in the evaluation and management of patients with vascular diseases throughout their training, during rotations on the in-patient cardiology service and in the cardiology ambulatory clinic. This training will be supplemented by a one-month vascular medicine rotation.

During the vascular medicine rotation the cardiovascular fellow will observe, assist, and participate in vascular procedures and interventions, participate in reading sessions in which vascular studies are interpreted, see patients in the vascular clinic, and see vascular consult patients in the hospital. By the end of this rotation the fellows will be able to evaluate and manage arterial, venous, and lymphatic disease, atherosclerotic risk factors, and hypercoagulable states. They will also gain an understanding of vascular imaging (i.e., ultrasound, MRA, CTA). Upon completion of this rotation the fellow will meet COCATS 4 requirements for Level I training in Vascular Medicine.

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the anatomy of the peripheral arterial and venous systems (F1)
- Know the causes and clinical epidemiology of peripheral artery disease, including the incidence and prevalence, sex and ethnic differences, and the influence of traditional risk factors and demographics on outcomes (F1)
- Know the pathology, pathophysiology, and differential diagnosis of peripheral artery diseases, including atherosclerotic, thrombotic, vasculitic, fibromuscular, vasospastic, and atheroembolic causes (F2)

- Know the pathology, pathophysiology, and differential diagnosis of peripheral venous disease, including venous thromboembolic disease, post-thrombotic syndrome, congenital abnormalities, and varicosity and venous insufficiency (F1)
- Know the cardinal symptoms and physical findings of carotid, aorta, renal artery, and upper and lower extremity arterial diseases (F2)
- Know the indications for noninvasive vascular testing, including duplex ultrasonography of carotid arteries, peripheral arteries, bypass grafts, and renal arteries
- Know the indications for CT and MR angiography in patients with suspected vascular disease (F2)
- Know the indications, risk, clinical pharmacology, and drug interactions of drugs used to treat vascular diseases
- Know the methods and indications to assess subclinical atherosclerosis (including coronary calcification, carotid intima-media thickness, and ankle-brachial index) (F2)
- Know the indications for non-invasive screening for abdominal aortic aneurysm (F2)
- Know the role for exercise rehabilitation in patients with claudication (F2)
- Know the indications and risk for surgical and percutaneous interventional treatments of peripheral vascular diseases and the expected outcomes (F2)
- Know the indicated laboratory tests to assess for thrombophilia and vasculitis (F1)
- Know the causes and treatment of lymphedema (F1)
- Know the impact of peripheral vascular disease on overall cardiovascular morbidity and mortality (F1)

Patient Care

- Perform and interpret an ankle-brachial index measurement (F1)
- Interpret limb segmental blood pressure measurements, pulse volume recordings, and treadmill vascular exercise tests (F1)
- Interpret duplex ultrasound tests for carotid disease, abdominal aortic aneurysm, peripheral artery disease, renal artery disease, and venous disease (F3)
- Interpret and integrate clinical findings and testing results in the evaluation and management of patients with peripheral vascular disease (F2)
- Identify patients for whom referral for revascularization is indicated (F3)
- Identify asymptomatic patients who may benefit from intensive risk reduction management strategies (F1)
- Determine when assessment for subclinical atherosclerosis may be indicated and to select appropriate tests (F2)
- Evaluate and mange patients at risk for or with venous thrombosis and/or thromboembolism (F1)

Systems-based Practice

- Utilize a multidisciplinary coordinated approach for patient management, including transfer of care and employment related issues (F2)
- Practice in a manner that fosters the balance of appropriate utilization of finite resources with the net clinical benefit for the individual patient (F2)

Practice-based Learning and Improvement

- Identify competency gaps and engage in opportunities to achieve focused education and performance improvement (F2)
- Utilize decision support tools for accessing guidelines and pharmacologic information at the point of care (F2)

Professionalism

- Promote adherence to guidelines and appropriate use criteria (F2)
- Forego recommending unvalidated diagnostic testing or treatments

Interpersonal and Communication Skills

- Communicate with and educate patients and families across a broad range of cultural, ethnic, and socioeconomic backgrounds (F2)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

All fellows will be expected to satisfy the COCATS 4 Training Requirements for Level 1 training in Vascular Medicine, which entails knowledge of the following topics:

1. Peripheral arterial disease
2. Acute arterial occlusion
3. Carotid artery disease
4. Renal artery stenosis
5. Aortic aneurysm
6. Vasculitis
7. Vasospasm
8. Venous thrombosis and insufficiency
9. Lymphedema
10. Pre-operative evaluation of patients undergoing vascular surgery
11. Non-invasive vascular tests: pulse volume recordings, duplex ultrasonography, CT angiography, magnetic resonance angiography

Fellows will be exposed to each of the topics via various educational activities, including didactic lectures and bedside instruction by Dr. Mohamed during in-patient consult rounds and in the out-patient office. A portion of the time will be spent reviewing and participating in the reading of vascular studies.

Principal teaching methods:

Clinical teaching
Clinical experiences
Didactic conferences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians, with additional input from nurses, students, residents, and peers.

Assessment methods include:

Direct observation
Multisource evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Fellows will evaluate the vascular medicine rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The attending will review and confirm the historical and physical findings that have been documented by the fellow. The attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The attending will review and sign the out-patient notes that the fellow enters in the electronic medical record. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

1) Initial evaluation of all patients referred for a vascular medicine consult
2) Completion of notes in the electronic medical record

IX. EDUCATIONAL MATERIALS

ACC/AHA Practice Guidelines (available at www.Cardiosource.org**)**

- Anderson JL, et al. Management of patients with peripheral artery disease (compilation of 2005 and 2011 ACCF/AHA guideline recommendations): a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;61:1555–70.
- Brott TG, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, and the American Stroke Association, American Association of Neuroscience Nurses, American Association of Neurological Surgeons, American College of Radiology, American Society of Neuroradiology, Congress of Neurological Surgeons, Society of Atherosclerosis Imaging and Prevention, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Neuro-Interventional Surgery, Society for Vascular Medicine, and Society for Vascular Surgery. J Am Coll Cardiol 2011;57:e16 –94.
- Hiratzka LF, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the diagnosis and management of patients with thoracic aortic disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine (developed in collaboration with the American College of Emergency Physicians). J Am Coll Cardiol 2010;55:e27–129.

Internet resources

Vascular Medicine SAP (available at www.Cardiosource.org)

Heart Failure Rotation

Developed by: Steven Werns, M.D.
Revision Date: December 2014

I. GENERAL INFORMATION	
Name of Rotation	Advanced Heart Failure
Director	Celeste Williams, MD
Duration	1 month
Location	Henry Ford Hospital

II. FACULTY

Dr. Williams

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals:
Fellows will receive formal instruction and clinical experience in the evaluation and management of patients with heart failure (HF) throughout their training, during rotations on the in-patient cardiology service and in the cardiology ambulatory clinic. This training will be supplemented by a one-month rotation on the HF service at Henry Ford Hospital. The general goals of the HF rotation are:

- To learn clinical skills applicable in managing patients with complex, advanced, or refractory end-stage heart disease
- To understand the principles behind selection of candidates for heart transplantation and destination mechanical circulatory support

Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Know the pathophysiology, differential diagnosis, stages, and natural histories of HF (F1)
- Know the characteristic history and physical exam findings (and their limitations) in evaluation of HF syndromes (F1)
- Know the appropriate use of laboratory studies and imaging modalities in evaluation and management of HF patients (F2)
- Know the indications for and clinical pharmacology of drugs used for treatment of HF, including adverse effects and use in special populations (F2)
- Know the indications and clinical pharmacology of intravenous vasoactive and inotropic drugs used for circulatory support in advanced/refractory HF (F2)
- Know the types of and indications for mechanical circulatory support (F2)

- Know the effects and interactions of HF with other organ systems and in the setting of other systemic diseases (F2)
- Know the management of cardiac arrhythmias in HF patients and the indications and risks of use of ICD and cardiac resynchronization therapies (F2)
- Know the indications for referral for cardiac transplantation or assist devices (F2)

Patient Care

- Evaluate and manage patients with new-onset, chronic, and acute decompensated HF (F1)
- Appropriately select and incorporate data from diagnostic and laboratory testing in the evaluation and management of HF (F1)
- Use and perform invasive hemodynamic monitoring (F1)
- Identify candidates for palliative care and hospice, heart transplant, and ventricular assist devices (F2)
- Recognize and manage cardiac arrhythmias, including the identification of candidates for ICD, biventricular pacing, or arrhythmia ablation (F2)
- Recognize and manage co-morbidities in HF patients (F2)
- Participate in the management of patients with heart transplantation and mechanical circulatory assist devices (F2)

Systems-Based Practice

- Utilize a multidisciplinary coordinated approach for patient management, including transfer of care and employment-related issues (F2)
- Incorporate risk-benefit analysis and cost considerations in diagnostic and treatment decisions (F2)
- Identify and address financial, cultural, and social barriers to diagnostic and treatment recommendations (F2)

Practice-based Learning and Improvement

- Identify competency gaps and engage in opportunities to achieve focused education and performance improvement (F2)
- Utilize decision support tools for accessing guidelines and pharmacologic information at the point of care (F2)

Professionalism

- Exhibit sensitivity to patient preference and end-of-life issues (F2)

Interpersonal and Communication Skills

- Communicate with and educate patients and families across a broad range of cultural, ethnic, and socioeconomic backgrounds (F1)
- Engage in shared decision-making with patients about their condition and the options for diagnosis and treatment (F2)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

All fellows will be expected to satisfy the COCATS 4 Training Requirements for Level 1 training in Heart Failure.

Principal teaching methods:

Didactic conferences
Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians, with additional input from nurses, students, residents, and peers.

Assessment methods include:

Direct observation
Multisource evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Fellows will evaluate the heart failure rotation on a semi-annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The attending will review and confirm the historical and physical findings that have been documented by the fellow. The attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The attending will review and sign the out-patient notes that the fellow enters in the electronic medical record. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

1) Initial evaluation of patients
2) Completion of notes in the electronic medical record

IX. EDUCATIONAL MATERIALS

ACC/AHA Practice Guidelines (available at www.Cardiosource.org**)**

- Yancy CW, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147–239.
- Russo AM, et al. 2013 appropriate use criteria for implantable cardioverter-defibrillators and cardiac resynchronization therapy: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, Heart Rhythm Society, American Heart Association, American Society of Echocardiography, Heart Failure Society of America, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. J Am Coll Cardiol2013;61:1318–68.

Internet resources
Heart Failure SAP (available at www.Cardiosource.org)

Congenital Heart Disease Rotation

Developed by: Steven Werns, M.D.
Revision Date: November 2015

I. GENERAL INFORMATION

Name of Rotation	Congenital Heart Disease
Director	Richard Humes, MD, Chief, Cardiology
Duration	1 month
Location	Children's Hospital of Michigan

II. FACULTY

Dr. Richard Humes and Dr. Rossitza Pironkova

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: The overall goal of the fellowship program's educational curriculum is to assure that every fellow satisfies the criteria for COCATS 4 level 1 training in congenital heart disease in adults. The specific educational objectives of the curriculum are:

- To acquire an understanding of the embryology, anatomy, pathology, physiology, and genetics of congenital heart diseases
- To provide competent clinical treatment of patients with congenital heart disease, including the ordering of appropriate diagnostic testing and consultation of pediatric or adult cardiologists with more advanced training

The fellows will gain clinical experience in the diagnosis and management of congenital heart disease during a one month rotation at the Children's Hospital of Michigan in Detroit, Michigan. The educational rationale of the rotation at Children's Hospital of Michigan is to provide clinical training in the diagnosis and management of common simple congenital heart disorders, including the appropriate catheter-based and surgical repairs of those defects. This will be accomplished by in-patient consultative rounds, an ambulatory clinic experience, and lectures.

The fellows will attend an annual series of 6 lectures on congenital heart disease in adults provided by Dr. Rossitza Pironkova, a pediatric cardiologist on the staff at Beaumont-Dearborn Hospital. The following topics are discussed in Dr. Pironkova's lectures:
Hour 1 – basic embryology, anatomy, pathology, and physiology, and the genetics of common congenital heart diseases
Hour 2 – the clinical diagnosis and management of at least 6 common disorders are discussed, including bicuspid aortic valve, pulmonic stenosis, atrial septal defect, ventricular septal defect, tetralogy of Fallot, and coarctation of the aorta
Hour 3 – cyanotic congenital heart disease and Eisenmenger syndrome
Hour 4 – at least 6 catheter-based and surgical palliative and corrective techniques are discussed, including percutaneous closure of atrial septal defects, pulmonic valvuloplasty, and a variety of surgical shunts
Hour 5 – common echocardiographic features of operated and unoperated adult congenital heart disease
Hour 6 – topics include management during pregnancy, endocarditis prophylaxis, counseling on genetics and contraception, employment and exercise

Objectives: Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

- Knows the anatomy, pathophysiology, associated lesions, and natural histories of atrial septal defects and ventricular septal defects (F3)
- Knows the anatomy, pathophysiology, associated lesions, and natural histories of bicuspid aortic valve, pulmonic stenosis, coarctation of the aorta, and patent ductus arteriosis (F3)
- Knows the basic anatomy and pathophysiology of the cyanotic congenital heart diseases encountered in adolescents and adults (F3)
- Knows the risk of cardiac arrhythmias and their management in patients with adult congenital heart disease (F3)
- Knows the indications for noninvasive and invasive testing for the evaluation of adult congenital heart disease (F3)
- Knows the indications and contraindications for surgical and percutaneous interventions in adult congenital heart disease (F3)
- Knows the indications for endocarditis prophylaxis based on current guidelines (F3)

Patient Care

- Performs a comprehensive history and physical examination in the patient with simple adult congenital heart disease (F3)
- Appropriately uses electrocardiography, echocardiography, and other imaging modalities in the diagnosis and management of complex adult congenital heart disease (F3)
- Evaluates and manages the potential cardiovascular complications of pregnant women with simple adult congenital heart disease (F3)

Systems-Based Practice

- Demonstrates the ability to provide primary cardiac longitudinal care for patients with simple adult congenital heart disease in association with an adult congenital heart disease center (F3)

Practice-based Learning and Improvement

- Locates, appraises, and assimilates evidence from scientific resources, such as adult congenital heart disease clinical practice guidelines (F3)

Professionalism

- Demonstrates sensitivity and responsiveness to diverse patient populations (F3)

Interpersonal and Communication Skills

- Effectively educates patients and families across the range of socioeconomic and cultural backgrounds about adult congenital heart disease management, complications, and lifestyle issues (F3)

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

All fellows will be expected to satisfy the COCATS 4 Training Requirements for Level 1 training in congenital heart disease in adults.

Principal teaching methods:

Didactic conferences

Clinical teaching
Clinical experiences
Performance feedback
Monthly and semiannual evaluations

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians, with additional input from nurses, students, residents, and peers.

Assessment methods include:

Direct observation
Multisource evaluation
Patient and peer survey
Global clinical performance ratings
ACC In-Training Exam
Procedure logs
Conference presentation
Chart-stimulated recall

Fellows will evaluate the congenital heart disease rotation on an annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times. The attending will review and confirm the historical and physical findings that have been documented by the fellow. The attending will review and discuss the care plan and recommendations and review pertinent testing results with the fellow. The attending will review and sign the out-patient notes that the fellow enters in the electronic medical record. The ultimate responsibility for the care of the patient lies with the attending physician.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

1) Initial evaluation of patients
2) Completion of notes in the electronic medical record

IX. EDUCATIONAL MATERIALS

Textbooks

- Perloff JK and Marelli A. *Perloff's Clinical Recognition of Congenital heart Disease, 6th Edition.* Elsevier.

ACC/AHA Practice Guidelines (available at www.Cardiosource.org**)**

- Warnes CA, et al. ACC/AHA 2008 guidelines for the management of adults with congenital heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Adults With Congenital Heart Disease). J Am Coll Cardiol 2008;52:e143–263.

Cardiovascular CT/MR Rotation

Developed by: Steven Werns, M.D.
Revision Date: November 2015

I. GENERAL INFORMATION

Name of Rotation	Cardiovascular CT/MR
Director	Karthikeyan Ananthasubramaniam, MD
Duration	1 month
Location	Henry Ford Hospital

II. FACULTY

Karthikeyan Ananthasubramaniam, MD

III. GENERAL GOALS AND EDUCATIONAL OBJECTIVES FOR THIS ROTATION

General Goals: The overall goal of the fellowship program's educational curriculum is to assure that every fellow satisfies the criteria for COCATS 4 level 1 training in cardiovascular computed tomography (CCT) imaging and cardiovascular magnetic resonance (CMR) imaging. The specific educational objectives of the curriculum are:

- To understand the basic principles, indications, applications, and technical limitations of CCT and CMR imaging

Objectives: Objectives: The competency-based objectives enumerated below are derived from the document entitled "ACC 2015 Core Cardiovascular Training Statement (COCATS 4) Competency Tables" and accessed at http://www.acc.org/education-and-meetings/products-and-resources/fellowship-program-director-tools-and-resources

IV. SPECIFIC COMPETENCIES

Medical Knowledge

Cardiovascular Computed Tomography

- Know the principles of cardiovascular computed tomographic scanning and the scanning modes
- Know the risks and safety measures for cardiovascular computed tomographic scanning, including radiation reduction strategies
- Know the appropriate indications for cardiovascular computed tomography for screening or evaluating symptoms in patients with suspected cardiac disease
- Know the indications, potential adverse effects, prevention, and treatment of complications of iodinated contrast agent use in cardiovascular computed tomographic studies
- Know the indications and protocols for beta-adrenergic blocking drugs and nitroglycerin during cardiovascular computed tomographic studies
- Know the principles of cardiovascular computed tomographic scan collimation, temporal resolution, table speed, field of view, and window and level view settings
- Know the principles of post-processing methods for cardiovascular computed tomographic scanning

- Know the algorithms used for reconstruction, and recognize and isolate causes of artifacts
- Know the principles of quantitative coronary artery calcium scoring
- Know normal chest anatomy and common incidental extra cardiac findings
- Know the characteristic cardiovascular computed tomographic images of normal cardiac chambers and great vessels, normal coronary arteries and veins, and normal variants
- Know the characteristic cardiovascular computed tomographic findings of coronary atherosclerosis including plaque morphology and assessment of stenosis severity
- Know the characteristic cardiovascular computed tomographic findings of anomalous coronary arteries and other common congenital anomalies
- Know the characteristic cardiovascular computed tomographic findings in postoperative cardiac surgical patients including internal mammary artery and saphenous vein bypass grafts
- Know the characteristic cardiovascular computed tomographic findings of acquired and congenital valvular disease
- Know the characteristic cardiovascular computed tomographic findings of left atrial and pulmonary and coronary venous abnormalities
- Know the characteristic cardiovascular computed tomographic findings of pericardial disease
- Know the characteristic cardiovascular computed tomographic findings of cardiomyopathies and infiltrative myocardial diseases
- Know the differential diagnosis of cardiac masses identified by cardiovascular computed tomography
- Know the characteristic cardiovascular computed tomographic findings of common diseases of the aorta and great vessels
- Know the characteristic cardiovascular computed tomographic findings of pulmonary embolism and primary and acquired pulmonary vascular diseases
- Know when to request help with interpretation of difficult studies, such as patients with complex congenital heart disease

<u>Cardiovascular Magnetic Resonance</u>

- Know the principles of cardiovascular magnetic resonance image acquisition
- Know the principles of safety and contraindications for cardiovascular magnetic resonance imaging
- Know the uses, potential side effects, and contraindications of using gadolinium-based contrast agents in cardiovascular magnetic resonance imaging
- Know the indications for cardiovascular magnetic resonance to assess left and right heart chamber sizes and function
- Know the cardiovascular magnetic resonance indications for assessment of myocardial viability
- Know the cardiovascular magnetic resonance indications and characteristic findings of myocardial ischemia
- Know the cardiovascular magnetic resonance indications and characteristic findings of acute myocardial infarction
- Know the cardiovascular magnetic resonance indications and characteristic findings of acute coronary syndromes and other causes of myocardial injury
- Know the cardiovascular magnetic resonance indications and differential findings in cardiomyopathies of uncertain cause
- Know the cardiovascular magnetic resonance indications to assess diseases of the pericardium
- Know the cardiovascular magnetic resonance indications to evaluate valvular heart disease
- Know the cardiovascular magnetic resonance indications and characteristic findings of myocardial masses and thrombi

- Know the cardiovascular magnetic resonance indications for left atrial and pulmonary vein mapping prior to ablation of atrial fibrillation
- Know the cardiovascular magnetic resonance indications for evaluation of adult congenital heart disease including identification of coronary artery anomalies
- Know the cardiovascular magnetic resonance indications to detect and evaluate diseases of the aorta and peripheral arteries

Patient Care

Cardiovascular Computed Tomography

- Skill to appropriately utilize cardiovascular computed tomography in the evaluation and management of patients with known or suspected cardiovascular disease
- Skill to integrate cardiovascular computed tomographic findings with other clinical information in patient evaluation and management
- Skill to recognize and treat contrast-related adverse reactions
- Skill to independently perform and interpret cardiovascular computed tomography
- Skill to perform and interpret hybrid CT/SPECT and CT/PET imaging

Cardiovascular Magnetic Resonance

- Skill to appropriately order and integrate the results of cardiovascular magnetic resonance testing with other clinical findings in the evaluation and management of patients
- Skill to interpret cardiovascular magnetic resonance tissue characterization (late gadolinium enhancement) to distinguish the etiology of cardiomyopathy and acute myocardial injury
- Skill to interpret regional and global left and right ventricular wall motion and ejection fraction
- Skill to interpret vascular diseases of the aorta (e.g., intramural hematoma, dissection, coarctation, and aneurysm)
- Skill to identify and characterize myocardial masses
- Skill to identify and characterize pericardial disease
- Skill to identify and diagnose basic congenital heart disease in adults
- Skill to identify and diagnose complex adult congenital heart disease, including quantification of intracardiac shunting, and anomalous coronary arteries
- Skill to perform and interpret cardiovascular magnetic resonance stress testing
- Skill to interpret vascular diseases of the peripheral arteries

Systems-Based Practice

- Incorporate appropriate use criteria, risk/benefit, and cost considerations in the use of cardiovascular computed tomography and alternative imaging modalities
- Incorporate risk/benefit and cost considerations in the use of cardiovascular magnetic resonance testing

Practice-based Learning and Improvement

- Identify knowledge and performance gaps and engage in opportunities to achieve focused education and performance improvement
- Utilize point-of-care educational resources (e.g., guidelines, appropriate use criteria, and clinical trial results)

Professionalism

- Work effectively in an interdisciplinary CCT environment
- Reliably obtain patient informed consent, ensuring that patients understand the risks and benefits of—and alternatives to—cardiovascular computed tomographic testing
- Know and promote adherence to clinical practice guidelines

Interpersonal and Communication Skills

- Communicate testing results to physicians and patients in an effective and timely manner

V. TOPICS/TEACHING METHODS/MATERIALS USED DURING THIS ROTATION

All fellows will be expected to satisfy the COCATS 4 Training Requirements for Level 1 training in cardiovascular computed tomography and magnetic resonance.

Principal teaching methods:

Didactic conferences
Clinical teaching
Clinical experiences
Performance feedback

VI. EVALUATIONS

Evaluation of the fellow's successful completion of the above goals will be carried out primarily by the faculty attending physicians. Assessment methods include:

Direct observation
Multisource evaluation
ACC In-Training Exam
Procedure logs
Conference presentation

Fellows will evaluate the cardiovascular CT/MR rotation on an annual basis.

VII. RESPONSIBILITY OF ATTENDING ON ROTATION

The attending physicians participating in this rotation will be responsible for the direct supervision of the fellow at all times.

VIII. RESPONSIBILITY OF FELLOW ON ROTATION

The fellow will be responsible for

1) Initial evaluation of patients
2) Attending CCT and CMR reading sessions

IX. EDUCATIONAL MATERIALS

ACC/AHA Practice Guidelines (available at www.Cardiosource.org**)**

- Hundley WG, et al. ACCF/ACR/AHA/NASCI/SCMR 2010 expert consensus document on cardiovascular magnetic resonance: a report of the American College of Cardiology Foundation Task Force on Expert Consensus Documents. J Am Coll Cardiol 2010;55:2614–62.
- Mark DB, et al. ACCF/ACR/AHA/NASCI/SAIP/SCAI/SCCT 2010 expert consensus document on coronary computed tomographic angiography: a report of the American College of Cardiology Foundation Task Force on Expert Consensus Documents. J Am Coll Cardiol 2010;55:2663–99.