The Ohio State University Medical Center, Division of Cardiovascular Medicine
Cardiovascular Magnetic Resonance (CMR) and Computed Tomography (CCT) Laboratory:
Fellowship Training Guidelines and Clinical Responsibilities

General Information
Duration of rotation: (Level 1; all fellows) four week rotation
(Level 2; fellows requesting additional CMR/CT training
– (3-6 mos for CMR; 2 mos for CT)
(Level 3; advanced imaging fellowship – includes 12 mos
of training after completion of general 36 mos
fellowship)

Location to report on 1st day: Ross Heart Hospital CMR/CT Lab

It is expected that the general cardiology fellow rotating through CMR/CT will be present for all
exams barring attendance at mandatory educational conferences. Additionally, the fellow is
expected to generate a preliminary report for each study based on the fellow’s interpretation of
the qualitative and quantitative findings.

Successful completion of the one-month rotation fulfills the ACGME requirements for cardiology
fellowship training as well as the requirements for Level 1 training in CMR. Fellows with
interest in additional training to achieve Level 2 or Level 3 competency can do so with
appropriate allocation of time and effort; please refer to the ACC/AHA competency guidelines.

Recommended Texts
   Cardiovascular MR Imaging, Raymond Kim (available full-text online via OSU Library)
3. Cardiovascular Multidetector CT Angiography 2007. Subha V Raman, Patricia Grodecki,
   Stephen C Cook and Mario Garcia
4. CT and MR Angiography of the Peripheral Circulation: Practical Approach with Clinical
   Protocols 2007. Debabrata Mukherjee and Sanjay Rajagopalan

Additional Resources
A compilation of published articles on CMR/CT topics is maintained on the shared network drive.

Teaching Methods:
1. Imaging Conferences
   a. Didactic topics in CMR/CT
   b. Case-based discussions
2. Clinical teaching
3. Individual reading
4. Faculty mentorship

Overall Curriculum Goals During 36-Month Fellowship:
1. Instruction in basic principles of CMR/CT
2. Instruction in basic cardiovascular anatomy, physiology, pathophysiology
3. Understanding the role of CMR/CT in the evaluation and management of patients with various forms of known or suspected cardiovascular disease
4. Competency to perform:
   a. Prescription of patient-specific CMR/CT protocols
   b. Appropriate selection and titration of medications for cardiac rhythm optimization, vasodilatation, anxiolysis, and pharmacologic stress testing
   c. Qualitative interpretation of CMR/CT images
   d. Quantitative analysis of CMR/CT data

**General Fellows in Cardiovascular Medicine**

**Overall Focus:** Cardiovascular CT and MR fundamentals

**Number of months:** 1

**Objectives:**
1. Become familiar with operations of the CMR/CT lab.
2. Understand indications for ordering CMR/CT procedures.
3. Learn basic physics of magnetic resonance and computed tomography.
4. Achieve basic competency in supervising CMR/CT procedures including prescription of appropriate medications, titration of medications for pharmacologic stress, and patient assessment and drug selection for anxiolysis.
5. Achieve basic competency in interpretation of noncontrast calcium scoring, coronary and graft CTA, aortic imaging, and viability assessment.
6. For general fellows who do additional CMR/CT months, additional competencies to be achieved may include pharmacologic stress CMR, CMR in simple congenital heart disease, peripheral MRA, recognition of arrhythmic substrate, hemodynamic assessment, and other advanced topics.

**Mandatory Reading:**
Introductory chapters in the textbooks listed above
ACC/AHA Appropriateness Guidelines for CMR/CT
ACC/AHA Competency Guidelines for CMR/CT

**Clinical Responsibilities:**
1. Develop daily protocols with CMR/CT subspecialty fellows
2. Coordinate daily schedules with CMR/CT subspecialty fellows that allow for:
   a. Time for subspecialty fellows to perform CMR exams with no other duties.
   b. At least one fellow to be present in the control room, pre-reading CMR and CCT studies to be discussed and over-read with faculty.
3. Assist technologists and nurses with specific tasks e.g. identifying optimal pharmacotherapies for individual patients, interpreting unexpected findings to determine whether it is safe to discharge an outpatient after their scan, and calling services when orders for procedures are ambiguous or inappropriate.

**Didactic Responsibilities:**
Each fellow is expected to assist in the preparation and presentation of at least 1 CMR/CT case review session during their 36-month fellowship.

**Evaluations:**
General cardiology fellows will be assessed and evaluated by the CMR/CT lab attending staff based on the 6 core competencies. Examples are listed below:

**Curriculum Goals for Level 2 Training:**
Level 2 training in CMR/CT is for those trainees who wish to practice the clinical subspeciality of CMR/CT, including independent performance and interpretation of studies.

**Mandatory Reading:**
Same as for Level 1 but also including a more detailed review and understanding of the technical issues involved in performing quality clinical studies.

**Clinical Responsibilities:**
Same as for Level 1, but play a more supervisory role in lab operations. Level 2 trainees are required to spend more time scanning patients to become competent in the direct performance and troubleshooting in image acquisition.

**Educational/Didactic Responsibilities:**
Each Level 2 trainee is required to present a 50 minute conference on a topic of interest or clinical research project.

**Curriculum Goals for Level 3 Training (Advanced Cardiovascular Diagnostic Imaging Fellowship):**
Level 3 training in CMR/CT is for those trainees who wish to practice academic CMR/CT or become a lab director.

**Mandatory Reading:**
Same as for Level 2 but also including a more detailed review and understanding of the technical issues involved in performing quality clinical studies.

**Clinical Responsibilities:**
A Level 3 trainee is required to supervise the lab operations and protocol each diagnostic study. Once completed, they are to preliminarily interpret the study with the general fellow and help to finalize their reading with the attending staff.

**Educational Responsibilities:**
Each Level 3 trainee is required to participate in the year-long educational curriculum of the advanced fellowship in CMR/CT, including conference presentations and completion of a research project.

**Evaluation:**
Fellows will be primarily assessed and evaluated by faculty, based on the 6 core competencies and associated Milestones. Examples are listed below:

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<th>Competencies</th>
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<td>Patient Care</td>
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accurate information to define each patient's clinical problem(s)
- Develops and achieves comprehensive management plan for each patient
- Demonstrates skill in performing and interpreting non-invasive procedures and/or testing

| Medical Knowledge | ▪ Possesses clinical knowledge
|                   | ▪ Knowledge of diagnostic testing and procedures

| Systems-Based Practice | ▪ Recognizes system error and advocates for system improvement

| Practice-Based Learning and Improvement | ▪ Learns and improves via feedback

| Professionalism | ▪ Has professional and respectful interactions with patients, caregivers and members of the interprofessional team
|                 | ▪ Exhibits integrity and ethical behavior in professional conduct

| Interpersonal and Communication Skills | ▪ Appropriate utilization and completion of health records |