CMR References & Recommended Reading

for the technologists section of SCMR

To help you, please find below a useful reference point for researching and learning about cardiovascular magnetic resonance. It’s not an exhaustive list, just a starting point. Most items are listed with the most recent at the top. There are 2 parts; each divided into several sections: Part 2 is based on the standardized CMR image acquisition protocols, available at [www.scmr.org/documents/scmr_protocols_2007.pdf](http://www.scmr.org/documents/scmr_protocols_2007.pdf) This document has many embedded hyperlinks for further reading. For this reason it is better to read this document online.

Part 1: Introduction to CMR
   1. MRI physics
   2. CMR introduction and textbooks
   3. CMR official documents

Part 2: CMR standard techniques and protocols.

CMR general techniques
   1. Stress and safety equipment
   2. LV structure and function module
   4. First pass perfusion module
   5. Late gadolinium enhancement module

Disease specific protocols

Ischemic heart disease
   6. Acute MI
   7. Chronic Ischemic heart disease and Viability
   8. Dobutamine stress
   9. Adenosine stress perfusion

Angiography:
   10. Peripheral MRA
   11. Thoracic MRA
   12. Anomalous Coronary arteries
   13. Pulmonary Vein Evaluation

Others
   14. Non-ischemic cardiomyopathy
   15. ARVC
   16. Congenital heart disease
   17. Valvular heart disease
   18. Pericardial disease
   19. Masses
Part 1: Introduction to CMR

1. MRI physics

Online
There are plenty of online physics courses. If you are an SCMR member, see the members’ only online education, where there is:
- a 15 module physics course from GE
- a 238 page physics course from Siemens
- a cardiac anatomy overview by Siemens
- a ‘cardiac views’ by Philips
see also:
Revisemri.com also has great interactive and animated tutorials.
Hull physics lecture series.
http://www.cis.rit.edu/htbooks/mri/
http://www.simplyphysics.com/MAIN.HTM
http://www.mritutor.org/mritutor/
http://web2.uwindsor.ca/courses/physics/high_schools/2006/Medical_Imaging/mriphysics1.html

Books
MRI made easy (…well almost). Published by Schering, author Prof Dr Hans H Schild. This is a really great introduction. It can be bought online, or via Schering (now Bayer), who make magnevist, and sometimes give away copies at meetings.


2. CMR introduction and textbook

Small books:
Cardiovascular Magnetic Resonance Made Easy (Paperback) by Anitha Varghese and Dudley J. Pennell. This is due out October 2007.
Pocket Atlas of Cardiac MRI (Radiology Pocket Atlas) by Pamela K Woodard, Jeffrey J. Brown, and Charles B. Higgins (Paperback - 1 Sep 2004)
An Introduction to Cardiovascular Magnetic Resonance by Raad H. Mohiadin (Paperback - Aug 2002)

Big Textbooks:
Cardiovascular Magnetic Resonance Imaging: A Guide for Fellows in Training (Contemporary Cardiology) by Peter G. Danias (Hardcover - April 2008)
Cardiac Computed Tomography and Magnetic Resonance by John R. Lesser and Robert S. Schwartz (Hardcover - 15 Dec 2007)
Cardiovascular MR Imaging: Physical Principles to Practical Protocols by Vivian S. Lee (Hardcover - 1 Dec 2005)
Clinical Cardiac MRI (Medical Radiology / Diagnostic Imaging) by Jan Bogaert, S. Dymarkowski, and A.M. Taylor (Paperback - Aug 2005)
Atlas of Practical Applications of Cardiovascular Magnetic Resonance (Developments in Cardiovascular Medicine) by Guillem Pons-Llado and Francesc Carreras (Hardcover - April 2005)
Cardiovascular Magnetic Resonance by E Nagel, A.C Van Rossum, and E. Fleck (Hardcover - April 2004)
Cardiovascular MRI and MRA by Charles B. Higgins, Albert de Roos, and Albert De Roos (Hardcover - Sep 2002)

3. **CMR official documents**
Training and credentialing
Training in Advanced Cardiovascular Imaging (Cardiovascular Magnetic Resonance [CMR]):
Indications for CMR
SCMR Standardized protocols
ACR guidelines
Appropriateness Criteria for CCT and CMR
Part 2: CMR standard techniques and protocols.

See *SCMR Standardized protocols* first

CMR general techniques

a. Stress and safety equipment

See "How I Do" CMR Scanning Safely

Good references:


*Also see the list on [http://www.mrisafety.com/](http://www.mrisafety.com/). (You must register first)*

b. LV structure and function module

See "How I Do" a CMR Volume Study

*And Cardiac Views*

*And Cardiac MRI Morphology*

Good references (there are others)


c. Gadolinium dosing module.

See Gd warnings [FDA warning](http://www.fda.gov) [MHRA warning (UK)](http://www.mhra.org) [Omniscan statement](http://www.mri-safety.com) *Clin Rad article JAMA article UK/European advice (27/6/2007) here* review article *here*

d. First pass perfusion module

2 presentations to compare:

"How I Do" Myocardial Perfusion

"How we do Perfusion CMR"

e. Late gadolinium enhancement module

See a late enhancement imaging quiz here: questions, Answers

*How We Perform Delayed Enhancement Imaging* here
Disease specific protocols

Ischemic heart disease

6. Acute MI
A few good references:
Kwong RY et al. Detecting acute coronary syndrome in emergency department with CMR. Circulation. 2003;107:531-537
See a case here and here

7. Chronic Ischemic heart disease and Viability
A few good references:
Cases here and here
Full text review here

8. Dobutamine stress
See "How we do Dobutamine Stress CMR"
A few good references:
Wahl A et al. Safety and feasibility of high-dose dobutamine-atropine stress CMR for diagnosis of myocardial ischaemia: experience in 1000 consecutive cases.

9. Adenosine stress perfusion
"How I Do" Myocardial Perfusion
"How we do Perfusion CMR"
A few good references:
Angiography:

10. Peripheral MRA

11. Thoracic MRA
See "How I do CMR of the Aorta"
See a case here

12. Anomalous Coronary arteries
See a case here

13. Pulmonary Vein Evaluation

Others

14. Non-ischemic cardiomyopathy
Full text review here
A good reference: DCM:
See "How I do" CMR in DCM
A Good reference: HCM:
"How I do" CMR in HCM
See a case here and here and here
A Good reference: sarcoid
A Good reference: amyloid
A Good reference: myocarditis
See a case here

15. ARVC
A Good reference:
Also "How I Do" CMR of ARVC/D
See a case here and here

16. Congenital heart disease
See "How I do" CMR of repaired Tetralogy of Fallot
Cases here and here
Good references:
A full text review here

17. Valvular heart disease
"How I do CMR of valvular heart disease"
Full text review here
See a case here

18. Pericardial disease
see "How I Do" CMR in Pericardial Disease
see a case here
Full text review here
A good reference

19. Masses
See cases here and here and here

(James.moon@uclh.nhs.uk 28/8/2007 *.pdf and *.doc placed on www.scmr.org)