

# Development and delivery of a high-quality European Cardiovascular Magnetic Resonance Examination

**Drs Steffen E. Petersen and Sven Plein on behalf of the European Cardiovascular Magnetic Resonance Examination Board discuss this academic examination, a part of the European Cardiovascular Magnetic Resonance certification process**



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The European Cardiovascular Magnetic Resonance (CMR) Exam has been offered since 2005, but over the past 2 years has been fundamentally transformed to meet the quality requirements of a high-stakes exam. The European CMR exam now forms an integral part of the European CMR certification process, which has been offered by the ESC Working Group on CMR and subsequently the European Association for Cardiovascular Imaging—CMR Section since 2013. As European CMR certification is a new process, for an interim period ending 31 December 2014, a grandfathering scheme is available for experienced CMR practitioners.

## European Cardiovascular Magnetic Resonance Exam Board

In 2011, a European CMR Exam Board was formed with the aim of developing the existing CMR exam into a high-stakes exam. All members of the exam board were trained in good practice of question writing and agreed to strict confidentiality regulations. A CMR exam syllabus was developed by the European CMR Exam Board and made publicly available <http://www.escardio.org/communities/EACVI/education/Pages/core-syllabus-cmr.aspx>.

## QR code to link to the Cardiovascular Magnetic Resonance syllabus



All exam questions map to the CMR exam syllabus. A blueprint describes the proportion of questions in each exam that maps to topics in the CMR exam syllabus. This blueprint is publicly available and was set by the European CMR Exam board and validated in a survey among the global CMR community.

Recurring tasks of the exam board members include the drafting of questions, the peer review of questions, assessment of questions for difficulty level (which is used to determine the pass mark), putting together and reviewing of the proposed exam for matching the agreed blueprint, overseeing the exam delivery, and interpreting the psychometric data for the overall exam.

## European Cardiovascular Magnetic Resonance exam delivery

The European CMR exam currently takes place after the annual EuroCMR Congresses. The exam setting and delivery is fully computer-based and consists of 100 multiple-choice questions with a single best answer. 2.5 h is allowed to answer the questions. Multiple-choice questions may contain CMR images or CMR movies. The risk of deception is minimized through the presence of invigilators, random order delivery of the questions, and the five answer choices per question. The pass mark for each exam is determined by the modified Angoff standard-setting method, which avoids dependence of this pass mark on the exam group performance. Psychometric analysis of each question and the overall exam allow insights into the difficulty of the question and into how much each question allows the separation of the more knowledgeable from the less knowledgeable exam candidates. Cronbach's alpha is a measure of reliability of the entire exam.

## Insights from the 2013 European Cardiovascular Magnetic Resonance Exam

Sixty-five candidates sat the 2013 European CMR exam, held in Florence after the EuroCMR Congress. Across three computer rooms at the University of Florence seven invigilators supervised the exam supported by six IT staff. The mean exam duration was 144 min (range 71–150 min). 95% of candidates were 30–50 years of age, the majority ( $n = 52$ ) were non-native English speakers and 95% sat the exam for the first time. We found that being a native English

speaker did not significantly improve the chances of success. The majority of exam takers were Europeans ( $n = 60$ ), but there were also three Asians, one North American, and one candidate from Australia/New Zealand. There was variation of self-reported CMR experience among the exam candidates ranging from none ( $n = 1$ ), to <1 year ( $n = 16$ ), to 1 to 2 years ( $n = 19$ ), to 2 to 3 years ( $n = 11$ ), to >3 years ( $n = 17$ ) with one candidate not providing an answer. Interestingly, the likelihood of passing the exam was statistically not related to the length of CMR experience. This may suggest that a test of CMR knowledge cannot be compensated for entirely by experience. Although an organ of the European Society of Cardiology offers the exam, not only Cardiologists ( $n = 58$ ) take the exam. Among the candidates were four radiologists, two labelled as 'other' (likely MR physicists), and one candidate did not provide an answer. In the 2013 exam, the pass mark based on the modified Angoff score was 64% and 53 candidates (81.5%) passed the exam. The average

exam score was  $73.4 \pm 9.1\%$  (range 51.0–91.8%). There was some small variation in average scores among the different topics listed in the syllabus and blueprint. Congenital heart disease and physics were among the topics with slightly worse average scores, but there were no outliers in either direction. Written feedback from exam candidates collected immediately after the exam was generally very positive.

In conclusion, the EACVI Section CMR offers an annual high-quality, high-stakes European CMR exam that forms part of the European CMR certification process. The dedication and expertise in subject matter and exam theory of all CMR exam board members has made this possible. This high-quality exam has set an international standard for CMR and imaging exams for others to rise to.

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## The Glasgow Cardiovascular Research Centre of the British Heart Foundation

**One of the six UK Research Centres of Excellence that opened in 2006; it will soon be linked to a new clinical research facility under construction at South Glasgow Hospitals Campus, which will be the largest hospital in Western Europe**

'People make Glasgow...' is the marketing slogan of Scotland's largest city which is home to The British Heart Foundation (BHF) Glasgow Cardiovascular Research Centre (BHF GCRC).

It was the people of Glasgow who provided £7 million in addition to £5 million awarded by the BHF, to build the facility; scientists who make the Centre home to some of the world's best cardiovascular researchers; and patients whose samples and data make new medical advances possible.



However, one person in particular was responsible for getting the whole thing off the ground: Prof. Anna Dominiczak. Appointed BHF Professor of Cardiovascular Medicine in 1997, she was instrumental in securing funding for the new Centre and attracting high-calibre staff, such as Prof. Andrew

Baker and Prof. John McMurray, a world-renowned expert in heart failure, who was recently named one of the most-influential biomedical researchers in the world in a study by Stanford University.

When the BHF GCRC opened in April 2006, Prof. Dominiczak—who by then had received an OBE from The Queen—was named the Centre's first Director. Now Head of the College of Veterinary, Medical and Life Sciences and a vice-principal, she says: 'The BHF GCRC is leading the way in cardiovascular research in Scotland with our scientists providing outstanding insights into the development and treatment of heart disease'.

'Our expertise in stratified medicine is being recognised with millions of pounds of investment which will see us benefit from a new clinical research facility currently under construction at South Glasgow Hospitals Campus – which will be the biggest hospital in western Europe'.

Historically, the pioneering work begun by Drs Tony Lever, Jehoyda Brown, and Ian Robertson in the 1960s, who established the MRC Blood Pressure Unit, set the stage early on for Glasgow as an internationally renowned hub of excellence in hypertension and cardiovascular science.

Prof. Dominiczak's own research group developed internationally recognized research programmes in genetics and genomics of hypertension and stroke, with publications in *Nature Genetics*, *Nature*, and other top journals as well as multimillion research grants from the BHF, MRC, Wellcome Trust, and EU.

The Centre is now part of the Institute of Cardiovascular Medicine (ICAMS) at the University of Glasgow both of which are led by Prof. Rhian Touyz, who joined from Canada in 2011.

The BHF GCRC boasts a staff of over 160 and >200 students, with an annual research income of over £30 million. Its facilities include a 3 T MRI suite, state-of-the-art imaging, high-throughput genotyping equipment, and a fully staffed clinical research facility jointly run with NHS Greater Glasgow and Clyde. Recently, the BHF awarded it a further £3 m to become a Centre of Excellence—one of just six in the UK.