

# MRI

IN PRACTICE  
ONLINE

Dr Catherine Westbrook  
Dr John Talbot



# MRI in Practice - The Course

Welcome to MRI in Practice – The Course

The book, MRI in Practice, was first published in 1993 and quickly became the one of the world's leading MRI resources. Now in its 5th edition, it is considered an essential text for tens of thousands of MRI practitioners around the world. It is used to support learning of MRI theory by practitioners who wish to gain qualifications in MRI, including the MR Registry Review Exam in the USA and on post graduate MRI programmes in countries such as the UK and Australia.

MRI in Practice course is based on this book, it was first delivered in 1992 in Oxford in the UK. It has been continuously presented since then by the authors of MRI in Practice, Dr Catherine Westbrook and Dr John Talbot. Thousands of delegates, from over 20 countries, across 5 continents have attended the MRI in Practice course and it is now considered one of the world's leading MRI programmes. MRI professionals from across the clinical and research spectrum have attended the MRI in Practice course including radiographers, radiotherapists, radiologists, physicists,, veterinarians and engineers.

The popularity of the course is mainly due to state-of-the-art graphics that are purposed to present complex MRI theory in a user-friendly way. Catherine and John combine their extensive experience in MRI and education to uniquely enable delegates to apply MRI theory to their practice. The course also has a well-deserved reputation for its informal approach to learning that allows delegates to take advantage of networking opportunities that are fostered by this type of course.

The MRI in Practice course is now also available as an online learning experience. The following information relates to the content of both live and online courses. The timing shown applies to the on-line course.



# Lecture Programme

	Day 01 FUNDAMENTALS	Day 02 PULSE SEQUENCES	Day 03 SPATIAL ENCODING	Day 04 IMAGE QUALITY
08:30				
09:00	Basic Principles 1 hour (Westbrook)	Spin-Echo Sequences 1 hour (Talbot)	Spatial Encoding Overview 1 hour 34 minutes (Talbot)	Image Artefacts (Extrinsic) 1 hour 23 Minutes (Talbot)
10:20	Q&A	Q&A	Q&A	Q&A
10:30	Break			
10:45	Image Contrast 1 hour 8 minutes (Westbrook)	Fast Spin-Echo & Inversion Recovery 1 hour 3 minutes (Talbot)	k-Space 01 (Introduction) 1 hour 7 minutes (Westbrook)	Protocol Optimisation 1 hour 3 minutes (Westbrook)
12:15	Q&A	Q&A		Q&A
12:30	Lunch			
13:00	Instrumentation 1 hour 40 minutes (Talbot)	Gradient-Echo Sequences 2 Hours 3 minutes (Westbrook)	k-Space 02 (Data Acquisition & Image Production) 1 hour 40 minutes (Westbrook)	Image Artefacts (Intrinsic) 1 hour 06 minutes  Flow 1 hour 3 minutes (Talbot)
15:15	Q&A		Q&A	
15:30	Break			
15:45 - end	Introduction to MRI Safety 1 hour 20 minutes (Talbot)	Q&A  Revision	k-Space 03 (Non-Cartesian Filling Methods) 1 hour 20 minutes (Westbrook)	Q&A  Revision  The BIG MRI Quiz (Talbot)
	Revision		Revision	

This is the full 4-day version of the course offered online. In the USA (only) it may be attended as individual days if required.

# Alternative Lecture Programme (3-Day Course)

	Day One	Day Two	Day Three
Session 01 08:00 - 11:00	Basic Principles Image Contrast Westbrook Q&A Session	Spin Echo Pulse Sequences Fast Spin Echo & IR Talbot Q&A Session	k-Space 1 k-Space 2 Westbrook Q&A Session
	Break		
Session 02 11:30 - 13:30	MRI Instrumentation Talbot	Gradient Echo Pulse Sequences Westbrook	k-Space 3 Westbrook
	Lunch		
Session 03 14:30 - 16:15	Spatial Encoding Talbot	Image Artefacts 01 Talbot	Flow & MRA Talbot
	Break		
Session 04 16:30 - 18:00	Protocol Optimisation Westbrook Q&A Session	Image Artefacts 01 Talbot Q&A Session	The Big MRI Quiz Talbot Closing Remarks

This 3-day version of the course is offered in certain geographical locations or on request. The content is identical to the 4-day course but with a more intensive delivery.

The timing shown may vary according to organiser preferences, cultural norms and venue requirements.

The online course may also be offered as a 3-day course.

# MRI in Practice Online

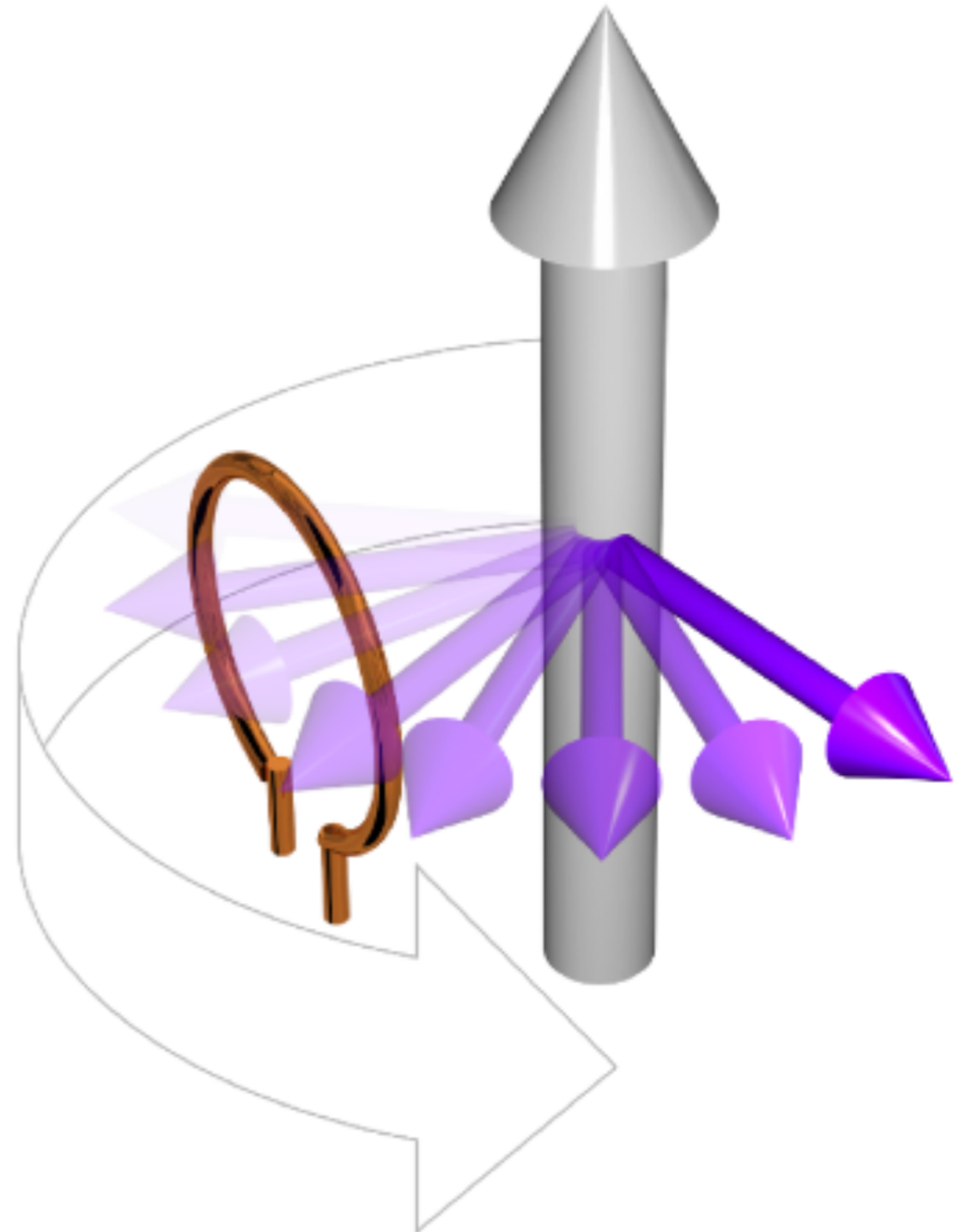
MRI is still a rapidly evolving modality and poses many challenges for the MRI practitioner. An in-depth understanding of theory and how it is applied in clinical practice are necessary to exploit the full potential of the MR system. The MRI in Practice course has always had a reputation for its use of the latest multimedia and presentation technology. We were one of the first MRI courses to use digital data projectors and HD animated graphics to present complex MRI concepts. Delegates value our unique presentation style that combines sophisticated graphics and clear analogies to enable them to easily relate MRI physics to their practice. Protocol parameter manipulation, artefact recognition, appropriate selection of pulse sequences and image interpretation are all easier after attending the MRI in Practice course!

MR professionals are advancing their knowledge of MRI using a variety of resources including online content. With this in mind, Catherine and John have developed an online version of the MRI in Practice course. The course is still presented by Catherine and John but via all-new video versions of the lectures that can be accessed on your PC, Mac or laptop.

However, MRI in Practice Online is not like other online learning resources where delegates simply view presentations over the internet. Catherine and John have over 20 year's experience of distance learning delivery of MRI and have used this expertise to add value to your learning experience. The programme is highly interactive and includes live sessions with the presenters. We use a mobile application to incorporate quizzes, revision and feedback sessions on every day of the course. We are confident that the online version of the MRI in Practice course is even more valuable than the face to face offering and, of course, far more convenient for delegates with no requirement for travel or accommodation costs.

We recognise that everyone has different levels of experience in MRI and different learning needs. For this reason, the course programme is designed to begin with first principles and then each day, progress onto to more advanced concepts. Whether you are new to MRI or a seasoned pro, we can guarantee that you will learn a great deal by attending this course.

Take a look at the lecture topics on the following pages.



# Day 01: The Fundamentals of MRI

## 01: BASIC PRINCIPLES

Dr Catherine Westbrook

(duration 00:57)

Aim: to investigate the fundamental principles of MRI:

- Nuclear structure
- MR active nuclei
- Alignment
- Precession and resonance
- Signal generation
- Relaxation processes

## 02: IMAGE CONTRAST

Dr Catherine Westbrook

(duration 01:08)

Aim: to explore and understand the processes of image contrast generation:

- Contrast definition
- MRI contrast parameters
- TR
- Fat and Water characteristics
- Relaxation
- T1 Recovery
- T1 Recovery time
- T1 Contrast and TR
- T2 Decay
- T2 Decay time
- T2 contrast and TE
- Weighting
- T1 Weighting
- T2 Weighting
- Proton density weighting
- Diffusion Weighting
- Stejskal-Tanner gradient scheme
- Diffusion-weighted images

# Day 01: The Fundamentals of MRI

## 03: INSTRUMENTATION

Dr John Talbot

(duration 01:40)

Aim: to explore the components of an MRI scanner and relate them to the functions they provide during patient scanning.

- Cryostat
- Cold head
- Cryogen vent
- Cryogen chamber
- Helium
- Superconductivity
- Solenoids
- Ramping the magnet
- Flux density
- Magnet shielding
- Shim system
- Gradient system
- RF system
- RF transmitter
- RF receiver coils

## 04: INTRODUCTION TO MRI SAFETY

Dr John Talbot

(duration 01:20)

Aim: to identify the primary risk-areas in MRI and propose strategies to reduce the risk to patients and staff.

- Safety Zones
- Primary magnetic field
- Spatial gradient
- Projectiles
- Translational and rotational forces
- Active and passive implants
- Intra-ocular foreign bodies
- Radiofrequency pulses
- Induction effects
- Antenna effect
- Patient heating
- Time-varying gradient magnetic fields
- Peripheral nerve stimulation
- Acoustic noise and hearing protection
- Quench risks

## 05: SPIN-ECHO PULSE SEQUENCES

Dr John Talbot  
(duration 01:00)

Aim: to examine the purpose and mechanism of spin-echo pulse sequences.

- Free induction decay
- The mechanism of the 180 degree rephasing pulse
- Spin-spin dephasing
- T1 vs. T2
- Types of spin-echo sequence
- Conventional spin echo
- Single echo acquisition
- Multiple echo acquisition
- Clinical applications

## 06: FAST SPIN ECHO & INVERSION RECOVERY SEQUENCES

Dr John Talbot  
(duration 01:03)

Aim: to examine the purpose and mechanism of fast (turbo) spin echo and inversion recovery pulse sequences:

- Fast (Turbo)Spin-Echo, mechanism
- Advantages and trade-offs
- Blurring
- J-coupling
- RF deployment
- Driven Equilibrium Fourier Transform
- Inversion Recovery
- "T1" Weighting at suboptimal field strength
- Short Tau Inversion Recovery
- Fluid Attenuated Inversion Recovery
- Clinical applications



# Day 02: Pulse Sequences

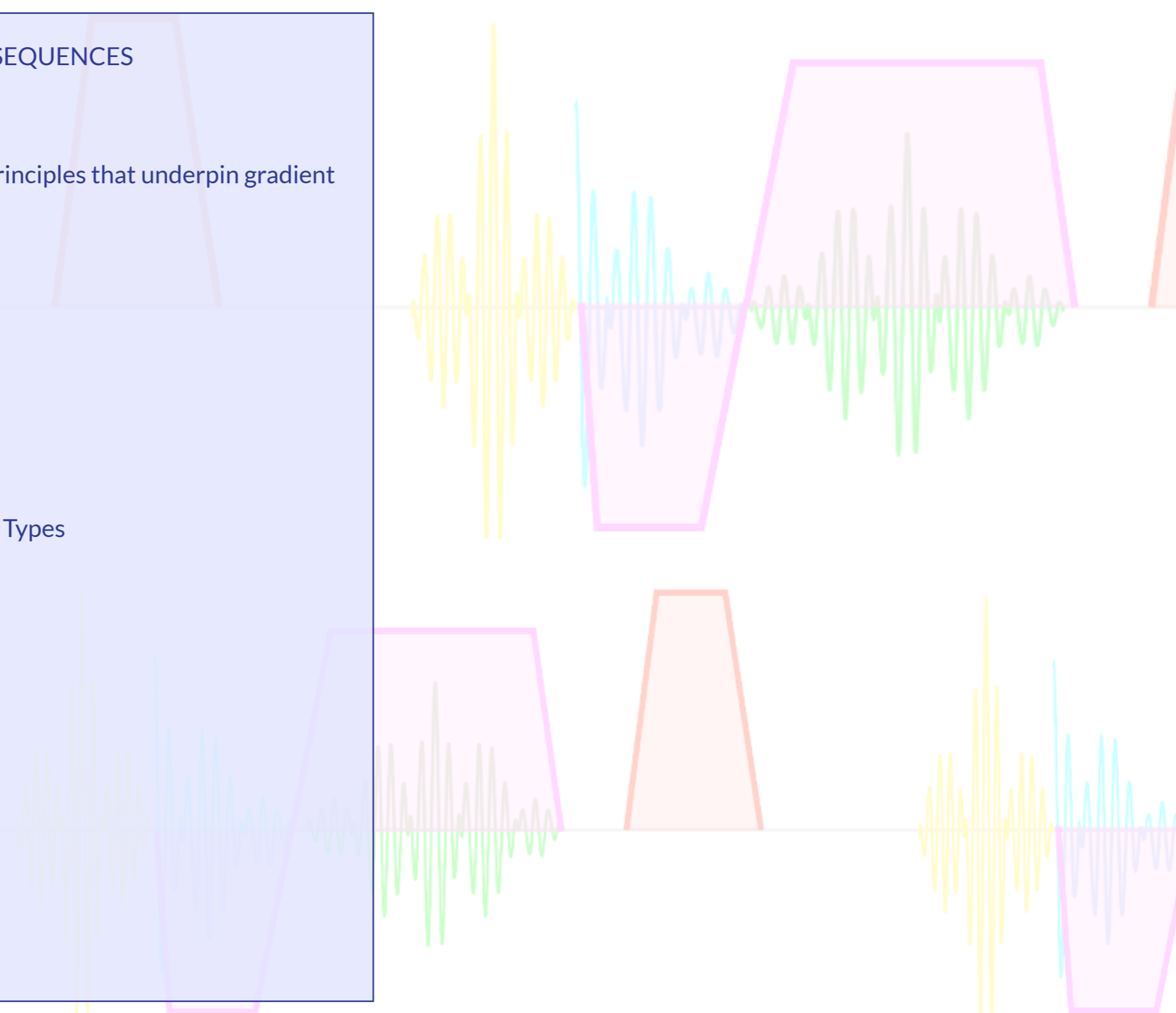
## 07: GRADIENT ECHO PULSE SEQUENCES

Dr Catherine Westbrook

(duration 02:03)

Aim: to explore, in depth, the principles that underpin gradient echo pulse sequences

- Flip Angles
- Gradient Mechanism
- Dephasing
- Rephasing
- Weighting Mechanisms
- Extrinsic Parameters
- The Steady State
- Echo generation
- Ernst Angle
- Gradient-Echo Sequence Types
- Gradient Echo Acronyms
- Rewound GE
- Spoiled GE
- Reverse GE
- Balanced GE
- Turbo GE
- Single Shot GE
- Echo-Planar Imaging
- Hybrid Sequences



# Day 03: Spatial Encoding

## 08: SPATIAL ENCODING OVERVIEW

Dr John Talbot

(duration 01:34)

Aim: to facilitate understanding relating to the use of gradient magnetic fields for the purpose of spatial encoding:

- Historic background
- Gradients in spatial encoding
- Gradient functions
- Slice selection
- Slice location
- Slice thickness
- Slice gap
- Field of view
- Phase and frequency
- Sampling waveforms
- Temporal frequencies
- Spatial frequencies
- A novel vector model (Plewes)
- Acquiring an image - phase and frequency encoding
- Relating the data to the image
- Fourier transformation

## 09: k-SPACE 01 (INTRODUCTION)

Dr Catherine Westbrook

(duration 01:07)

Aim: to provide a useful introduction to k-space including:

- Revision of gradient mechanisms in pulse sequences
- k-space functions and characteristics
- The Chest of Drawers Analogy
- Cartesian filling of k-space in a basic pulse sequence
- How k-space is used to optimise image quality

# Day 03: Spatial Encoding

## 10: k-SPACE 02 (DATA ACQUISITION AND IMAGE PRODUCTION)

Dr Catherine Westbrook  
(duration 01:40)

Aim: to explore, in depth, the principles that underpin data acquisition in MRI:

- Revision of spatial encoding
- Sampling and analogue to digital conversion (ADC)
- The Wheel Analogy
- The Runner on the Track Analogy
- User-friendly Fourier Analysis
- How data points in k-space create MR images
- The receive bandwidth - its importance in protocol optimisation
- Advantages and disadvantages of each technique in clinical use

## 11: k-SPACE 03 (NON-CARTESIAN FILLING METHODS)

Dr Catherine Westbrook  
(duration 01:20)

Aim: to investigate non-Cartesian k-space filling techniques including:

- Partial Fourier
- Fast or Turbo spin echo pulse sequences
- Respiratory Ordered Phase Encoding
- Centric k-space filling
- Single and multi-shot
- Radial k-space filling
- How k-space determines image geometry
- Parallel and compressed imaging

## 12: IMAGE ARTEFACTS (EXTRINSIC)

Dr John Talbot

(duration 01:23)

Aim: to identify, and provide remedies for MRI image artefacts that arise due to factors external to the patient.

- Aliasing
- Array Processor Error
- Cross-Excitation
- Damaged Coils
- Extraneous RF
- Field Inhomogeneity
- Magnetic Susceptibility
- Moiré Fringing
- Noise Spike
- Nyquist Ghost
- Standing Wave
- Truncation
- Zipper

## 13: PROTOCOL OPTIMISATION

Dr Catherine Westbrook

(duration 01:03)

Aim: to explore how protocol parameters are manipulated to optimise image quality:

- What is meant by a protocol.
- Balancing image quality and scan time
- Signal to noise ratio.
- Field Strength.
- Coil choice.
- Coil position.
- Time to Repeat.
- Time to Echo.
- Flip angle
- Number of signal averages.
- Receive bandwidth.
- Contrast to noise ratio.
- Spatial resolution
- Voxel volume
- Scan time.
- Phase matrix.
- Trade-offs

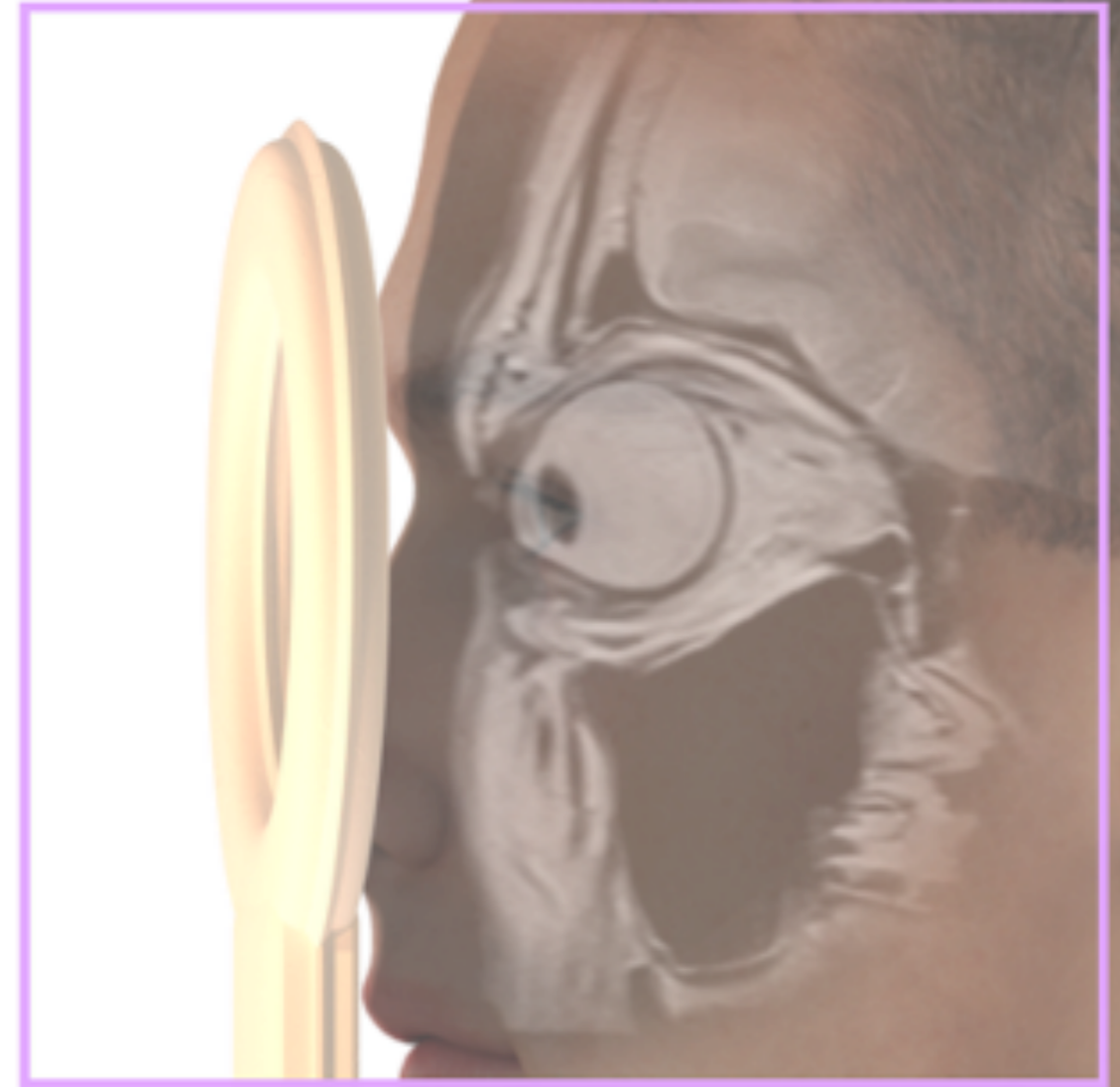
## 14: IMAGE ARTEFACTS (INTRINSIC)

Dr John Talbot

(duration 01:06)

Aim: to identify, and provide remedies for MRI image artefacts that arise due to factors relating to the anatomy and physiology of the patient.

- Chemical Shift
- Magic Angle
- Out of Phase Signal Loss
- Phase Mismatching



# MRI in Practice Online - Participant Requirements

To fully benefit from this course all of the following requirements must be met;

- Uninterrupted days for study for the duration of the daily programme (for example 8:00 am to 5:00 pm). Treat the attendance requirements as though you were participating in a face-to-face course. Children, partners and friends are, regrettably, not invited. Access must be from a domestic location (your home address), access from educational institutions, hospitals and commercial premises is prohibited. There are no exceptions to this requirement.
- You must reside in one of the geographical areas where the course is available. See our website for full details.
- You must use the latest version of any of the following browsers, Google Chrome, Microsoft Edge, Mozilla Firefox. Other browsers may or may not be compatible.
- A reasonably fast and stable broadband connection - the online lectures are streamed and contain many high resolution graphics and animations. The lectures are set to automatically display at the highest quality that your internet connection speed will allow. The quality may be adversely affected if other family members are on-line at the same time, especially if they are accessing streaming content such as Netflix.
- Headphones, or suitable audio, and a microphone on your device. There are regular meetings with the presenters and other delegates during the course and you will be encouraged to actively participate.
- A webcam on your device. For CPD, copyright protection and to monitor access, it is necessary to have your web cam switched on during all lectures and interactive sessions with the presenters. Lecture access will only be provided if you are on camera at all times.
- A second device such as a smartphone or tablet is strongly recommended. We run quizzes, revision sessions and Q and A sessions via a web app. The lectures can be accessed from a Mac, PC or laptop but having the Zoom app on a second device makes these sessions a little easier to manage. Older PCs and laptops may struggle to display both the lectures and the Zoom meeting simultaneously, in which case a tablet is an ideal way to access the Zoom meeting whilst watching the lectures on your PC. It must have a camera (see above).
- A copy of the 5th edition of MRI In Practice - as the 5th edition of the book is the course notes. No other supporting material is provided. The book is often referred to in the online lectures and it is therefore necessary to have a copy at hand throughout the course. The book can be obtained [here](#).

As part of the online course terms and conditions you agree not to film, photograph or otherwise capture the screen content during the lectures or permit access to any other individuals such as colleagues. The course fee allows access by the single applicant only. Our software uses screen-grab detection and digital watermarking that personally identifies the participant and embeds the geolocation data directly onto the video stream. Any participants who are found to have used screen-grabbing or any other form of prohibited copying of the lecture materials will be banned from course. Legal action will be taken against any individual who copies and shares content from the course either via digital networks, on-line or via any other media. Such participants will also be reported to their professional body and employer. We take intellectual property theft very seriously because our books are shared as illegal downloads and piracy costs us our livelihood.

# MRI in Practice Online - Delegate Feedback

We have just collated the delegate feedback and your presentations averaged 98 out of 100 - thank you for the great job you have done over the four days. (Bucharest Course Hosts)

*As a teacher myself, the thing that I have learned is that in MRI education we need genuine experts to teach it, because this fascinating modality deserves nothing less. For my part your job is safe for the foreseeable future! Many thanks.*

*"I am a MSK radiologist. This is not just the best MRI course I have been on - it is the best course I have ever attended. Your graphics were so clever and the presentations were fantastic." (Oslo Course)*

*The results from electronic evaluation of the course are fantastic! An average score of 5-6 on a scale to 6. Congratulations, you charmed us all!*

*In addition to competent teaching you have a real gift for developing witty and animated graphics. Your work is absolutely exceptional - the resource you have developed is better by far than anything I have come across before.*

Excellent lectures, I loved the use of analogies to explain complex processes - especially in the spatial encoding lecture.

*Incredible lecture series, and truthfully one of the most rewarding academic experiences in my adult life. The graphics are as astounding as the ease at which Dr. Talbot and Dr. Westbrook navigate the physics of MRI. Truly brilliant! Thank you. (Chicago participant 2019)*

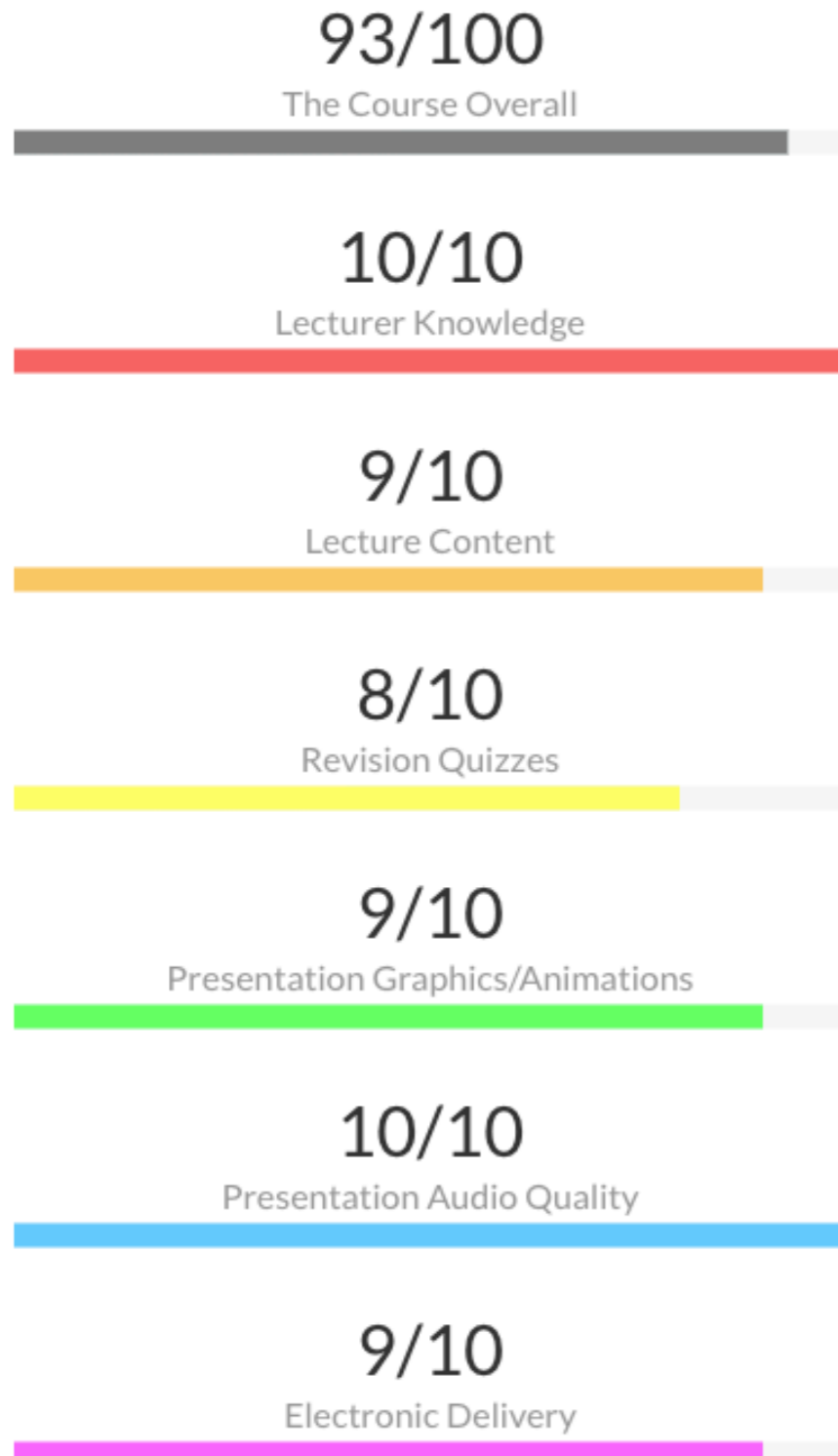
A colleague told me that the animated graphics would change my life, I was sceptical but I now feel the same way.

*I am a Radiologist this is my 3rd or 4th attendance and the course keeps getting better and better. Highly recommended. (Sydney 2017)*

*I thought the course was brilliant, all topics were covered and explained very well. I will definitely recommend this course to others.*

# MRI in Practice Online - Excellence Ratings 2021

## The Course



We collect anonymous feedback via Mentimeter for every course. These statistics are from online courses run in 2020-2021.

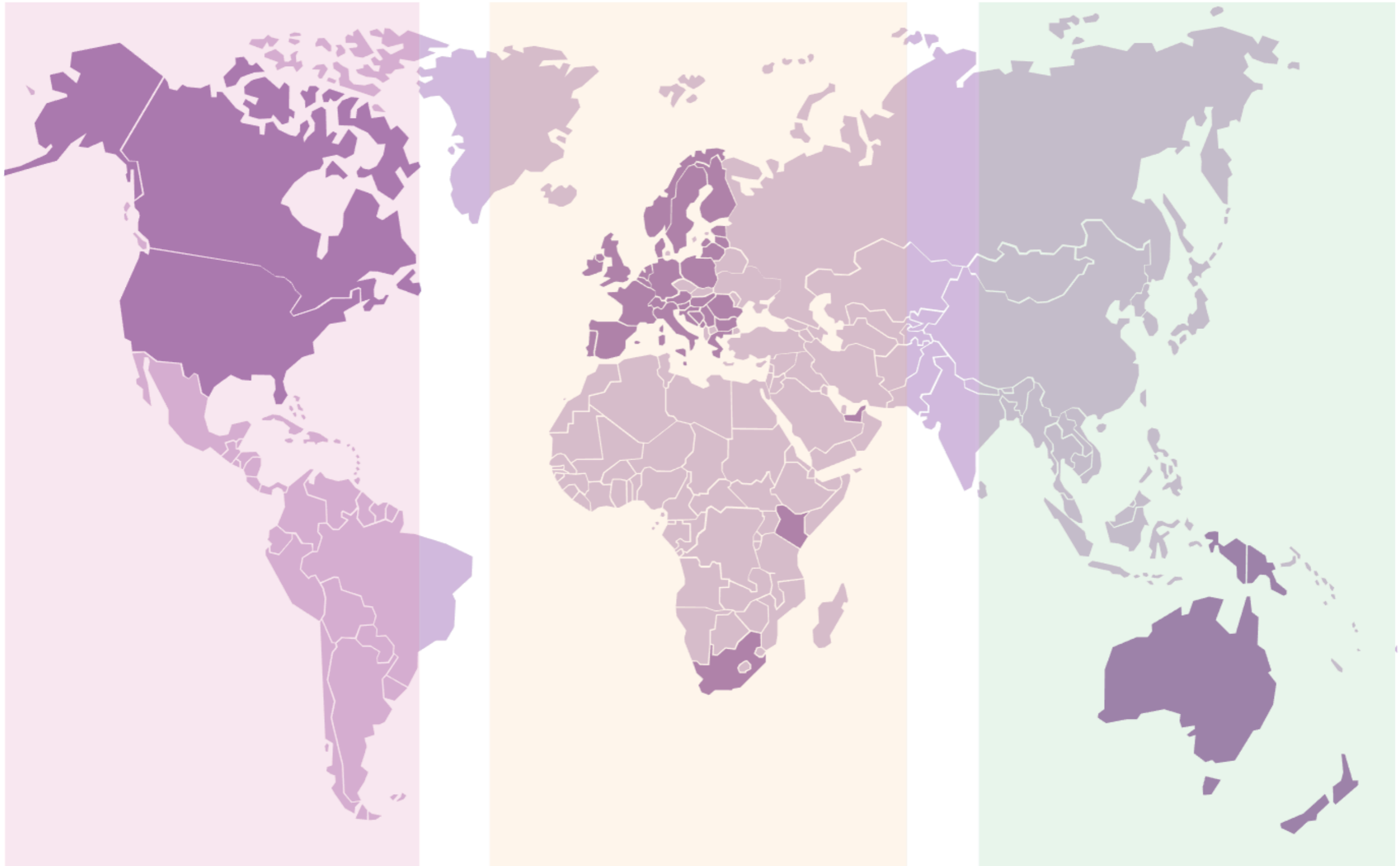
We asked all of our participants to describe the course in three words...





# MRI in Practice Online - Register Now

Click your country on the map to open a registration page in your browser...



# MRI in Practice Online - Why Choose Our Course?



If you are trying to decide between MRI in Practice and another course, you will want to make a sound, evidence-based decision. please print out this quick summary to see how we compare to other courses on the following important points:

**The Course** - MRI in Practice has been running continuously for over 30 years (formerly known as the Oxford MRI Course) and has been taught in 22 countries across 5 continents. We have presented in the UK since 1992, mainland Europe since 2005 and Australia since 2004. We engage and educate hundreds of delegates per year, and their feedback sheets consistently rate our lectures as being excellent. Unlike many other MRI courses, MRI in Practice is completely independent of any private “learning” company or institution. This is most important, because we can guarantee that our delivery is unbiased and we are free to say what we want to say.

**The Cost** - The online course is very expensive to create, run and maintain, however, we are able to offer it at a substantial discount. As a delegate, the biggest cost saving will be the fact that there is no necessity for travel or accommodation. As a result it is likely that you will save approximately £400-£500 on the overall cost of attending a live course.

**The Content** - MRI in Practice Online is based on the World’s best-selling MRI book\*. MRI in Practice is consistently at the top of its league on the Amazon.com bookstore and overwhelmingly attracts five-star reviews from the public, which for us, are the ones that count. MRI in Practice is famed as the reference text for practitioners taking the US registry exam - so you can rest assured that our course content is tried, trusted and relevant. You don’t have to take our word for it though - this course has been accredited/endorsed by The UK College of Radiographers (CPD NOW), The British Institute of Radiology, Trinity College Dublin, The Australian Society of Medical Imaging and Radiation Therapy, The Royal Australia and New Zealand College of Radiologists, The University of Sharjah (Emirates), The American Society of Radiologic Technologists and many other respected institutions.

**The Presentation** - MRI in Practice has evolved over the years, always taking advantage of the very latest technology. We were using data projection before anyone else (as long ago as 1997), and our computer graphics have also developed in line with broadcast production values. The online course is a perfect showcase for this. Delegates repeatedly tell us that our 3D graphics help to clarify difficult concepts, by bringing them to life in a way that a conventional book or PowerPoint lecture can never achieve. Our presentation feedback score (collected anonymously at the end of each course) is, at the time of writing, 98% excellence rating across all international courses.

**The Presenters** - Some courses rely on the good-will of amateur external speakers, so the quality can vary from course-to-course. MRI in Practice is consistently presented by authors Dr Catherine Westbrook and Dr John Talbot. We firmly believe that radiographers should be taught by radiographers; it seems obvious, we speak the same language, and can apply the basic principles to the real world of scanning and patient care. It goes without saying that the presenters should know their subject, Cathy and John are both clinical MRI specialists, but are also both educated in MRI to Masters level. It is (understandably) essential that course presenters should be qualified in teaching and learning. As academics, Cathy and John have formal post-graduate qualifications in teaching and learning, both have supervised students to Masters or Doctoral level and both hold Doctorates in education. We do not believe that any other course of this kind has a more highly-qualified faculty for presenting MRI education.

If you are considering attending a course run by anybody else, we recommend that you check that the entire faculty are qualified to the level described above, otherwise it is highly unlikely that they are qualified to be selling educational services, or creating and presenting educational materials. There are MRI courses currently offered in the UK and on-line by providers who literally have no qualifications in MRI or in education.

The names MRI in Practice, and MRI in Practice / The Course are copyright (1992-Date) Blackwell Science (Wiley Books) & Catherine Westbrook.

All graphics in this brochure and in the course materials are copyright (1992-Date) Blackwell Science (Wiley Books) and John Talbot. The course content is also protected by copyright, and as such, audio and video recording of the course content is strictly prohibited (including, but not limited to the use of downloads, screen-grabbing, mobile phones, voice recorders and digital cameras. Course pricing (live courses) may vary according to venue charges, location, AV charges, catering etc. and is set by the individual organisers. MRI in Practice (The Book) may be offered inclusive of the course fee in certain venues. Please check with the course organiser at the time of application. VERY IMPORTANT - In the unlikely event of a course cancellation the organiser is not responsible for reimbursing any costs incurred by delegates other than their registration fee. The course materials are updated constantly, to keep pace with changes within the field of MRI and to take advantage of the latest presentation technology and as such the course content may vary over time. The example programmes provided are indicative of a typical online course delivery. Live course timing may vary may vary slightly from country to country depending on the requirements of the local organiser, sponsors, climate and cultural norms. MRI in Practice is often commissioned by commercial companies and vendors for staff and customer training, some of our international course organisers also rely on sponsorship from private medical companies, however, MRI in Practice - The Course is completely independent of any private company, healthcare provider or equipment/consumables manufacturer.

\* Statements relating to the popularity of the book MRI in Practice are based on sales figures from Amazon.com.

MRI in Practice is an eco-conscious course, we always seek to offset our carbon footprint and would encourage you not to print this brochure, but to share it electronically with anyone you feel might be interested