MRI Glossary v. 0.9.3

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FOREWORD

This is a reference document containing MRI abbreviations, symbols & terminology. I started off making this for my own personal use but thought it might be useful to anyone trying to navigate the confusing world of MRI abbreviations.

This document is currently a list of abbreviations and will eventually have a short definition of each topic/pulse sequence listed. A more thorough list of pulse sequences and how to utilise them can be found in the *Handbook of MRI Pulse Sequences* by Bernstein et al.[1]

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CONTENTS

CHAPTER

ONE

SYMBOLS

1.1 ρ, Proton Density

Proton-density (ρ)

CHAPTER

TWO

A

2.1 ADC

Apparent Diffusion Coefficient (ADC)

2.2 ASL

Arterial Spin Labelling/Tagging (ASL/AST)

CHAPTER

THREE

B

3.1 $\mathbf{B}_0$

The magntic field strength of the superconducting MR (see 11.5) magnet ($\mathbf{B}_0$)

3.2 $\mathbf{B}_1$

The magntic field strength of the RF (see 14.2) coil ($\mathbf{B}_0$)

3.3 Bloch Equations

A set of equations which govern the beahviour of the magnetisation vector (see 11.1)

3.4 BOLD

Blood Oxygen Level Dependant (BOLD), a technique used in fMRI (see 7.6) studies.

3.5 Bruker

Bruker, a MR (see 11.5) system manufacturer

CHAPTER

FOUR

C

4.1 CNR

Contrast-to-noise Ration (CNR)

4.2 CT

Computed Tomography (CT) imaging is another imaging methodology which uses X-rays (see 19.1)

CHAPTER

FIVE

D

5.1 DCE

Dynamic Contrast Enhanced (DCE) MRI (see 11.7)

5.2 DWI

Diffusion Weighted Imaging (DWI)

CHAPTER

SIX

E

6.1 EPI

Echo Planar Imaging (EPI)

CHAPTER

SEVEN

F

7.1 FID

Free Induction Decay (FID)

7.2 FISP

Fast Imaging Steady-state Precession (FISP)

7.3 FFT

Fast Fourier Transform (FFT)

7.4 FLAIR

Fluid Attenuated Inversion Recovery (FLAIR)

7.5 FLASH

Fast Low-angle Shot (FLASH)

7.6 fMRI

Functional Magnetic Resonance Imaging (fMRI)

7.7 FOV

Field-of-View (FOV or FoV)

7.8 FSE

Fast Spin Echo (FSE)

7.9 FT

Fourier Transform (FT)

$$f(t) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} F(k) e^{ikt} dk \tag{7.9.1}$$

CHAPTER

EIGHT

G

8.1 Gating

Gating is any method for improving quality of data by preventing data acquisition during certain physiological activities e.g. during respiration.

8.1.1 Retrospective Gating

Retrospective gating is performed post data acqusition.

8.2 G_{phase}

The phase encoding gradient (G_{phase})

8.3 Gradient

MR (see 11.5) gradients are gradually increasing or decreasing radiofrequency pulses

8.4 GRASS

Gradient Recalled Acquisition of Steady-state (GRASS)

8.5 GRE

Gradient Echo (GRE or GE)

8.6 $\mathbf{G}_{readout}$

The readout gradient ($\mathrm{G}_{readout}$)

8.7 $\mathbf{G}_{slice}$

The slice selecting gradient (G_{slice})

8.8 $\mathbf{G}_{spoiler}$

The spoiler gradient ($\mathrm{G}_{spoiler}$)

CHAPTER

NINE

H

9.1 HASTE

Half-fourier Acquisition Single-shot Turbo Echo (HASTE)

CHAPTER

TEN

I

10.1 IG

IntraGate™ is a FLASH (see 7.5) based, retrospectively gated (see 8.1.1) sequence developed by Bruker (see 3.5) for pre-clinical imaging.

10.2 I.P.

Intraperitoneal (I.P.) is a route of injection into the peritoneum (the abdomen)

10.3 IR

Inversion Recovery (IR)

10.4 I.V.

Intravenous (I.V.) is a route of injection into the venous system (veins)

CHAPTER

ELEVEN

M

11.1 M

The magnetisation vector (**M**)

11.2 MDEFT

Modified Drive Equilibrium Fourier Transform (MDEFT)

11.3 MGRE

Multiple Gradient Recalled Echo (MGRE)

11.4 MPRAGE

Magnetisation Prepared Rapid Gradient Echo (MPRAGE)

11.5 MR

Magnetic Resonance (MR)

11.6 MRA

Magnetic Resonance Angiography (MRA)

11.7 MRI

Magnetic Resonance Imaging (MRI)

11.8 MRS

Magnetic Resnonace Spectroscopy (MRS)

11.9 MSME

Multi-slice Multi-echo (MSME)

CHAPTER

TWELVE

N

12.1 NMR

Nuclear Magnetic Resonance (NMR)

CHAPTER

THIRTEEN

P

13.1 PBS

Phosphate Buffered Saline (PBS)

13.2 PFC

Perflurocarbo (PFC)

13.3 PET

Positron Emission Tomogrpahy (PET), another imaging methodology

13.4 phMRI

Pharmacological Magnetic Resonance Imaging (phMRI)

13.5 PROPELLER

Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction (PROPELLER)

13.6 PV

ParaVision® is the console software on Bruker (see 3.5) MR systems.

CHAPTER

FOURTEEN

R

14.1 RARE

Rapid Acquisition with Relaxation Enhancemnet (RARE)

14.2 RF

Radiofrequency (RF)

CHAPTER

FIFTEEN

S

15.1 SAR

Specific Absorption Rate (SAR)

15.2 S.C.

Subcutanenous (S.C.) is a route of injection under the skin

15.3 SE

Spin Echo (SE)

15.4 SENSE

Sensitivity Encoding (SENSE)

15.5 SMASH

Simultaneous Acquisition of Spatial Harmonics (SMASH)

15.6 SNR

Signal-to-noise Ration (SNR)

15.7 SPAMM

Spatial Modulation of Magnetisation (SPAMM)

15.8 SPECT

Single Photon Emission Compterised Tomography (SPECT), another imaging modality.

15.9 SPGR

Spoiled GRASS (SPGR, see 8.4)

15.10 spGRE

Spoiled Gradient Echo (spGRE). See FLASH (7.5).

15.11 SSFP

Steady-state Free Precession (SSFP)

CHAPTER

SIXTEEN

T

16.1 T

Tesla (**T**) is the unit of magnetic field strength used in MRI (see 11.7). Named after Nikola Tesla.

16.2 $\mathbf{T}_1$

The longitudinal relaxation time (T_1)

16.3 $\mathbf{T}_2$

The transverse relaxation time (T_2)

16.4 $\mathbf{T}_E$

The echo time (T_E)

16.5 $\mathbf{T}_{host}$

The host sequence duration (T_{host})

16.6 $\mathbf{T}_{IR}$

The inversion recovery sequence duration (T_{IR})

16.7 $\mathbf{T}_R$

The repetition time (T_R)

16.8 TSE

Turbo Spin Echo (TSE)

CHAPTER

SEVENTEEN

U

17.1 UHF

Ultra High Field (UHF)

17.2 UHFMRI

Ultra High Field Magnetic Resonance Imaging (UHFMRI)

17.3 UTE

Ultrashort Echo Time (UTE)

CHAPTER

EIGHTEEN

V

18.1 Varian

Varian, an MR (see 11.5) scanner manufacturer.

CHAPTER

NINETEEN

X

19.1 X-ray Imaging

X-ray imaging, another imaging methodology using ionising radiation.

ABBREVIATIONS & SYMBOLS

ρ	Proton-density
ADC	**A**pparent **D**iffusion **C**oefficient
ASL/AST	**A**rterial **S**pin **L**abeling/**T**agging
B_0	$\mathbf{B}_0$ - Magnetic field strength of the MR magnet (in Tesla)
B_1	$\mathbf{B}_1$ - Magnetic field strength of the RF coil (in Tesla)
BOLD	**B**lood **O**xygen **L**evel **D**ependant
CNR	**C**ontrast-to-**N**oise **R**atio
CT	**C**omputed **T**omography
DCE	**D**ynamic **C**ontrast **E**nhanced
DWI	**D**iffusion **W**eighted **I**maging
EPI	**E**cho **P**lanar **I**maging
FFT	**F**ast **F**ourier **T**ransform
FID	**F**ree **I**nduction **D**ecay
FISP	**F**ast **I**maging **S**teady-state **P**recession
FLAIR	**Fl**uid **A**ttenuated **I**nversion **R**ecovery
FLASH	**F**ast **L**ow-**A**ngle **Sh**ot; also known as Spoiled Gradient Echo
fMRI	**F**unctional **M**agnetic **R**esonance **I**maging
FOV	**F**ield **o**f **V**iew

FSE	**F**ast **S**pin **E**cho
FT	**F**ourier **T**ransform
G_{phase}	Phase encoding gradient
$G_{readout}$	Readout gradient
G_{slice}	Slice selecting gradient
$G_{spoiler}$	Spoiler gradient
GRASS	**G**radient **R**ecalled **A**cquisition of **S**teady-**S**tate
GRE	**Gr**adient **E**cho; also abbreviated as GE
HASTE	**H**alf-fourier **A**cquisition **S**ingle-shot **T**urbo Spin-**E**cho
I.P.	**I**ntra**p**eritoneal
I.V.	**I**ntra**v**enous
IG	**I**ntra**G**ate™ – Bruker's retrospectively gated sequence for pre-clinical imaging
IR	**I**nversion **R**ecovery
M	**M** - Magnetisation vector
MDEFT	**M**odified **D**riven **E**quilibrium **F**ourier **T**ransform
MGRE	**M**ultiple **G**radient **R**ecalled **E**cho
MPRAGE	**M**agnetisation **P**repared **Ra**pid **G**radient **E**cho
MR	**M**agnetic **R**esonance
MRA	**M**agnetic **R**esonance **A**ngiography
MRI	**M**agnetic **R**esonance **I**maging
MRS	**M**agnetic **R**esonance **S**pectroscopy
MSME	**M**ulti-**s**lice **M**ulti-**e**cho
NMR	**N**uclear **M**agnetic **R**esonance
PBS	**P**hosphate **B**uffered **S**aline

PET	**P**ositron **E**mission **T**omography
PFC	**P**er**f**luro**c**arbon
phMRI	**Ph**armacological **M**agnetic **R**esonance **I**maging
PROPELLER	**P**eriodically **R**otated **O**verlapping **P**aral**l**el **L**ines with **E**nhanced **R**econstruction
PV	**P**ara**V**ision®- Bruker's MR console software
RARE	**R**apid **A**cquisition with **R**elaxation **E**nhancement
RF	**R**adio**f**requency
S.C.	**S**ub**c**utanenous
SAR	**S**pecific **A**bsorption **R**ate
SE	**S**pin **E**cho
SENSE	**Sens**itivity **E**ncoding
SMASH	**Sim**ultaneous **A**cquisition of **S**patial **H**armonics
SNR	**S**ignal-to-**N**oise **R**atio
SPAMM	**Spa**tial **M**odulation of **M**agnetisation
SPECT	**S**ingle **P**hoton **E**mission **C**omputerised **T**omography
SPGR	**Sp**oiled **GR**ASS
spGRE	**Sp**oiled **G**radient **E**cho; also known as FLASH
SSFP	**S**teady-**S**tate **F**ree **P**recession
T	**T**esla
T_1	Longitudinal relaxation time
T_2	Transverse relaxation time
T_E	Echo Time
T_R	Repetition Time
T_{host}	Host sequence duration

T_{IR}	Inversion recovery sequence duration
TSE	**T**urbo **S**pin **E**cho
UHF	**U**ltra **H**igh **F**ield
UHFMRI	**U**ltra **H**igh **F**ield **M**agnetic **R**esonance **I**maging
UTE	**U**ltrashort **TE**

BIBLIOGRAPHY

[1] M. A. Bernstein, K. F. King, and X. J. Zhou (2004). *Handbook of MRI Pulse Sequences*, vol. 32 of *Academic Press*. Academic Press.

VERSIONS

This section contains the version history and future plans for this document.

A.1 v 0.9

A.1.1 v 0.9.0

Was just a list of abbreviations and meanings, quickly edited to v 0.9.1

A.1.2 v 0.9.1

- Added chapters.
- General style developed.

A.1.3 v 0.9.2

- Ensured every section at least had the definition of the abbreviation.
- Added to Foreword.
- Added Appendix 2 - Document Details.

A.1.4 v 0.9.3

- Added natbib support.
- Added References section.
- Sorted numbering of LaTeX front/back matter.
- Though it prudent to add equations where they are useful.

A.2 Development

Future plans.

A.2.1 v 1.0

- Intend to add a few paragraphs to nearly every section.
- Increase range of topics covered.
- Add more references.
- Sort out LaTeX appendix numbering etc.

A.2.2 v 2.0

- Intend to add some fancy linking to document, may change overall layout.
- Maybe add history/important people section.

DOCUMENT DETAILS