



MR ALPHABET SOUP: UNDERSTANDING THE PRINCIPLES OF COMMON MAGNETIC RESONANCE ABBREVIATIONS

Educational Exhibit



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OUTLINE

- **Introduction to Magnetic Resonance**
 - **Current Magnetic Resonance Applications**
 - Flavors of MR: MRI, MRA, MRS, NMR etc.
 - Clinical Applications
 - Speaking the Same Language
 - **Basics for Understanding MR Physics**
 - Magnetic Principles
 - Resonance Principles
 - Physics with Hardware
- **Image Acquisition**
 - **Terms at the Terminal**
 - **Pulse Sequence Design**
 - Spin Echo
 - Gradient Echo
 - Common Clinical Pulse Sequences (FLAIR, DCE, FSE, etc.)
- **Tips for Understanding New Terms**

THE ABBREVIATED JUNGLE

Image Acquisition

PC
STIR
FSE
TOF
?
ASL
CE
PSD
BOLD
SNR
GRE
?
EPI
DWI
FSE
MRS
bSSFP
FLAIR
DTI
CNR
CSI
?

Types of MR

UTE
MRI
MRA
MR
MRE
fMRI
SE
DCE
STEAM
TE
VNR
TI
NMR

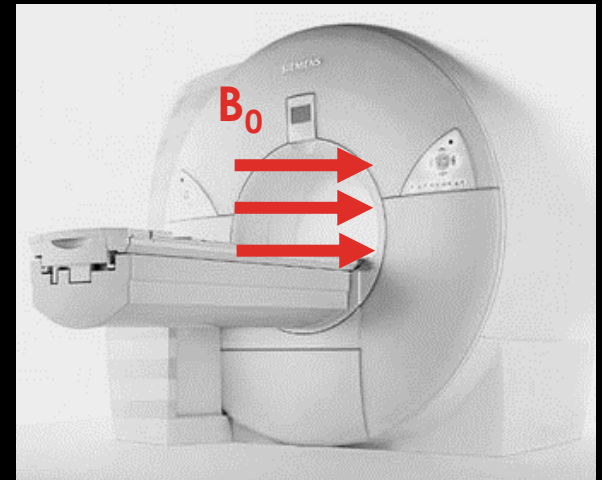
Physics and Hardware

BW
PE
B0
T2
FOV
RF
?
TR
R2
B1
T1
FE
FFT
ADC
PDW
R1
T2*
FID
NEX
?

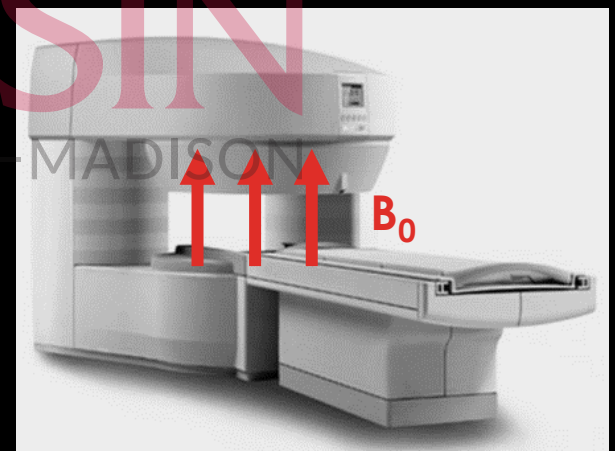
MR PHYSICS: B_0

- All MR systems rely on a **main magnetic field** to produce a signal.
- The main magnetic field is abbreviated a B_0 and referred to as **B zero or B “nought”**
- There are primarily **three** types of magnets used in the clinic:
 - **Super Conducting Magnets** (0.5T and up)
 - **Permanent Magnets** (up to 0.3T)
 - **Resistive and Electromagnets** (up to 0.6T)
- The direction of B_0 can vary depending on the types of system.

Super Conducting Magnet



Permanent Magnet

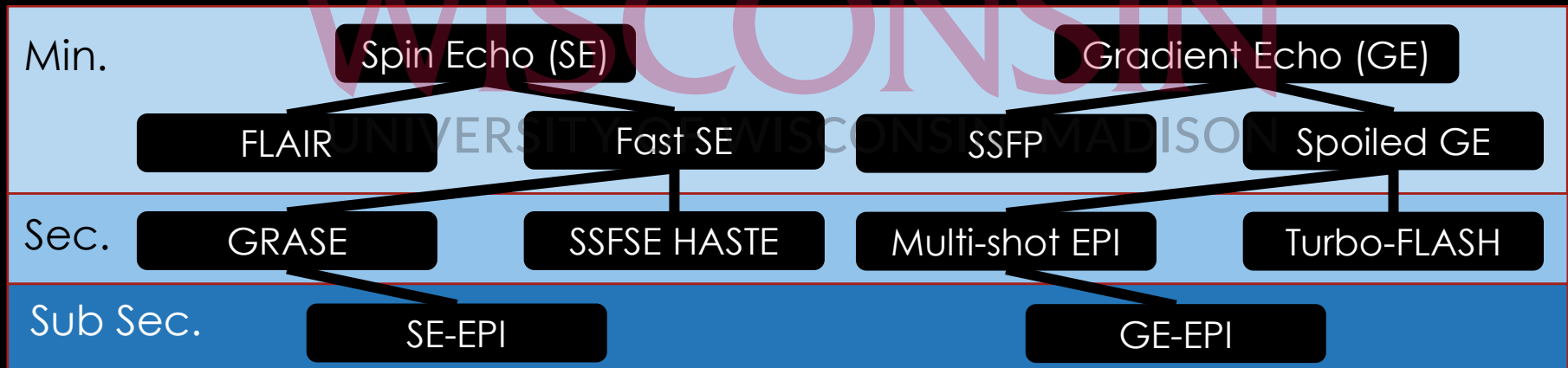


TERMS AT THE TERMINAL

- MRI has the ability to acquire a **variety** of images in relation to **contrast** and **spatial characteristics**.
- The parameters you set at the scanner can drastically change the final image characteristics
- Terms you can tweak at the terminal:
 - **TR** – Repetition Time
 - **TE** – Echo Time
 - **TI** – Inversion Time
 - **BW** - Bandwidth
 - **FOV** – Field of View
 - **NSA or NEX** – Number of Signal Averages / Number of Excitations
 - **N_{PE}** – Number of Phase Encodes
 - **N_{FE}** – Number of Frequency Encodes
- Changes you will see in the images:
 - **Noise**
 - **Contrast to Noise**
 - **Signal to Noise**
 - **Scan Time**
- By understanding principles behind the terms related to image acquisition you can better predict how images will change during protocol optimization

THE BUILDING BLOCKS OF PSD

- Essentially all pulse sequences can be group into two categories: **spin echo (SE)** and **gradient echo (GE or GRE)**
- Both pulse sequences use a **radio frequency (RF)** pulse to tip the net magnetization into the transverse plane
- SE applies a 180° refocusing pulse to give the image a **T2 weighting** while GE does not use a refocusing pulse and will have a **T2/T2* weighting**.
- From these two basic sequences a multitude of new sequences are born.



TIPS TO DECODE NEW ABBREVIATIONS

- When learning or using MRI it is common to come across unfamiliar abbreviations.
- Tips for learning a new abbreviation
 - Take a **breath** and calm down. MRI is confusing and **takes time** to become familiar with.
 - Determine if the abbreviation is related to **physics principles** or **pulse sequences**. This can be made easier by looking for familiar abbreviations contained within the new one. (ex. GRASE → GRASE → SE = Spin Echo)
 - Determine which **vendor** the term is coming from. (GE, SIEMENS, PHILIPS, ETC.) Similar **terms** and pulse sequences can **change between vendors**. (Philips = GRASE, Siemens = TGSE (turbo gradient spin echo))
 - Start from the ground up. **Strengthen your understanding of the basics** it will help simplifying new complex terms.