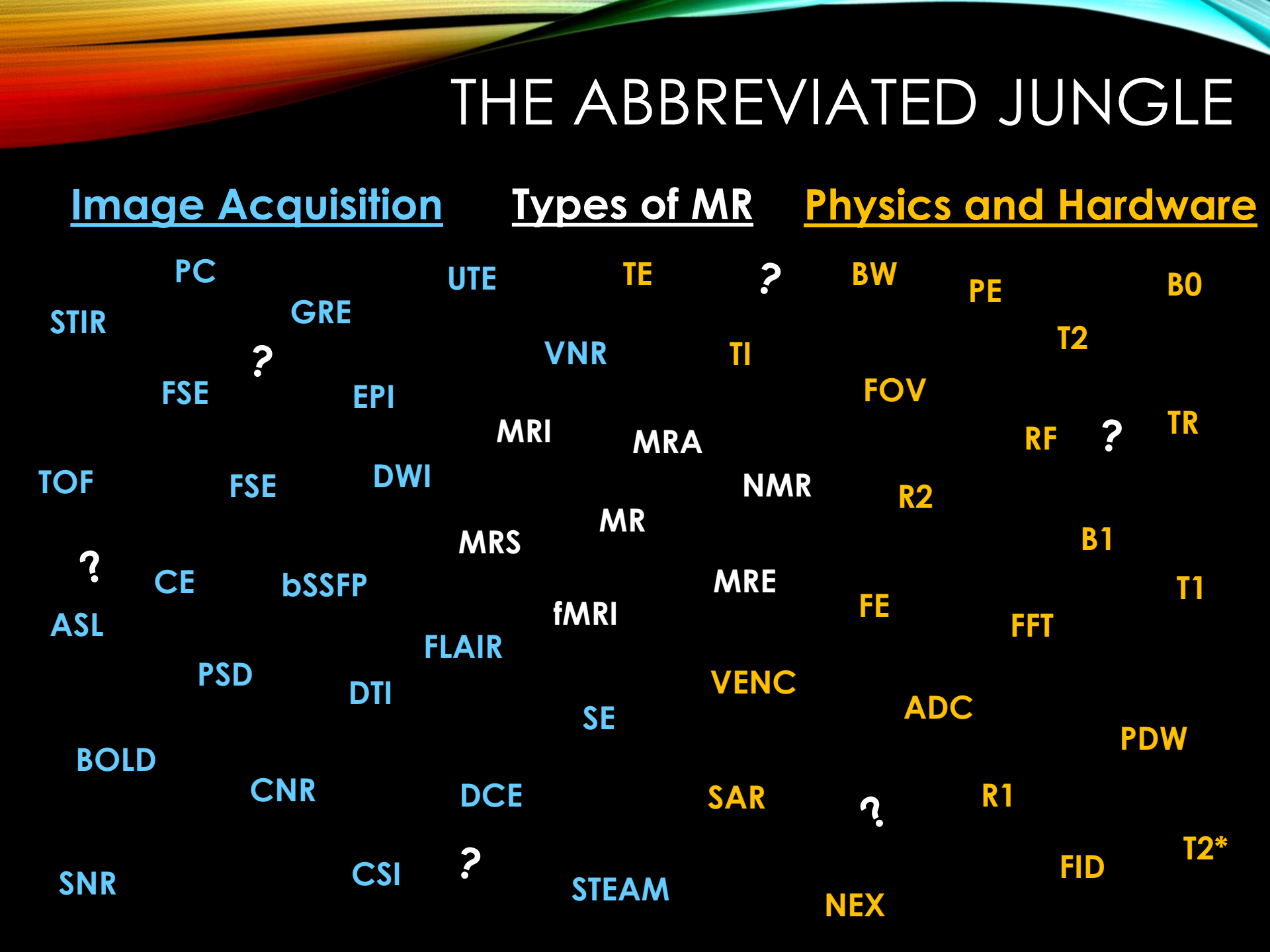
MR ALPHABET SOUP: UNDERSTANDING THE PRINCIPLES OF COMMON MAGNETIC RESONANCE ABBREVIATIONS

Educational Exhibit

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**

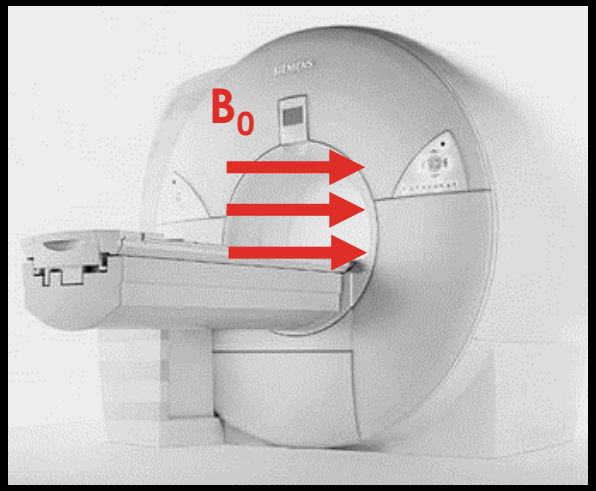
THE ABBREVIATED JUNGLE



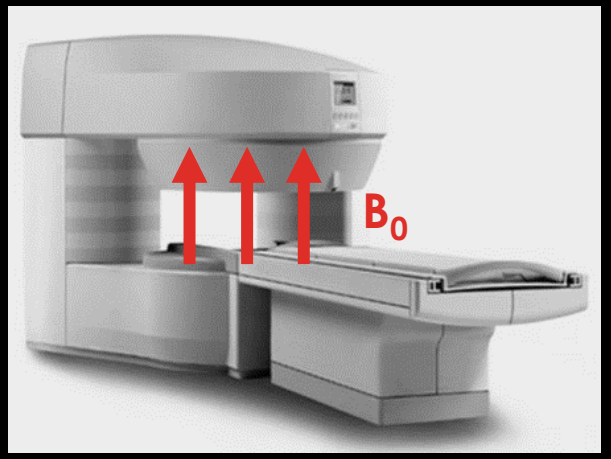
MR PHYSICS: B_0

- 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

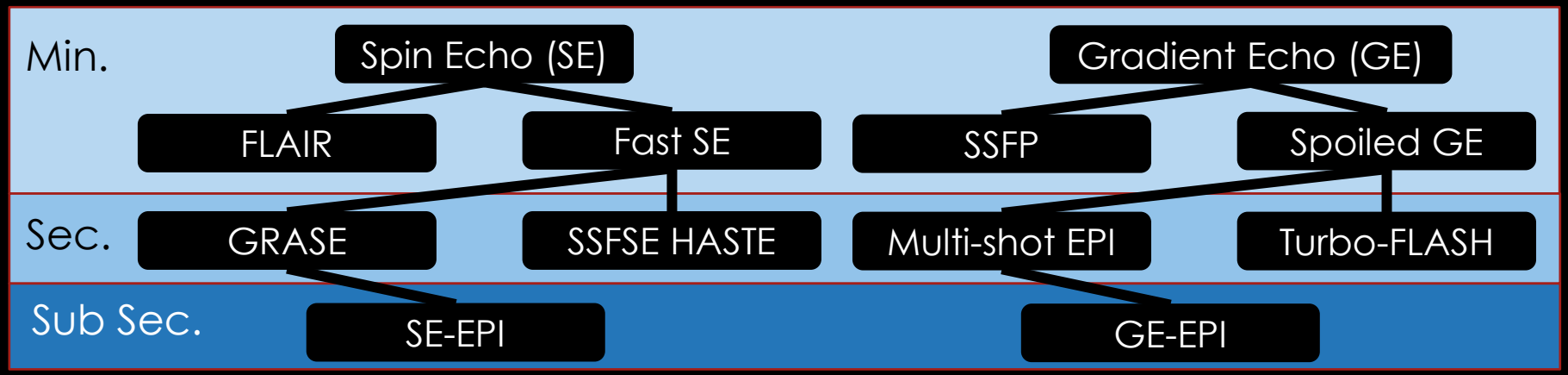


TERMS AT THE TERMINAL

- 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 → GRA**SE** → **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.