Magnetic Resonance Imaging

- MRI
- How does it work
- what can an MRI show that a CAT scan cannot

CAT scan vs. MRI’s

- A CAT scan does a good job of imaging bones, but it does not provide as good an image of soft tissue
- Also, it requires that the patient receives a big dose of x-rays, which can be harmful in themselves → it is an invasive diagnostic
- Magnetic resonance imaging (MRI) is a better method of imaging soft tissue - shows more detail and without subjecting the patient to a large dose of x-rays

Physics of MRI

- The single protons which are the nuclei of hydrogen atoms in our body are like little tops that spin randomly
- When these ‘proton tops’ are placed in a strong magnetic field they tend to line up along the magnetic field like a compass needle
- If the protons are then hit with a burst of radio waves they can momentarily flip around.
- When the radio wave burst is off the protons return to their original orientation and resound by emitting a short burst of radio waves of their own

- The MRI device detects this burst of radio waves when the protons flip.
- in places where there are more protons, the signal is stronger
- the frequency of the emitted radio waves depends on the strength of the magnetic field
- since the strength of the magnetic field is varies from one point to another, the frequency of the emitted radio waves marks the location within the body where the proton was, this provides the spatial information.

Figure 6.2: Excitation process. Following excitation, each proton within the excited volume resonates at the radio frequency. During detection of the echo, a gradient field (Gz) is applied causing a variation in the frequencies for the protons present in the echo (right). The frequency of proton spins in the soma depends on the position, according to equation (6.1). Proportions measured from the echo are mapped to the corresponding section.