

Apprentissage : Techniques d'imagerie

Master 1

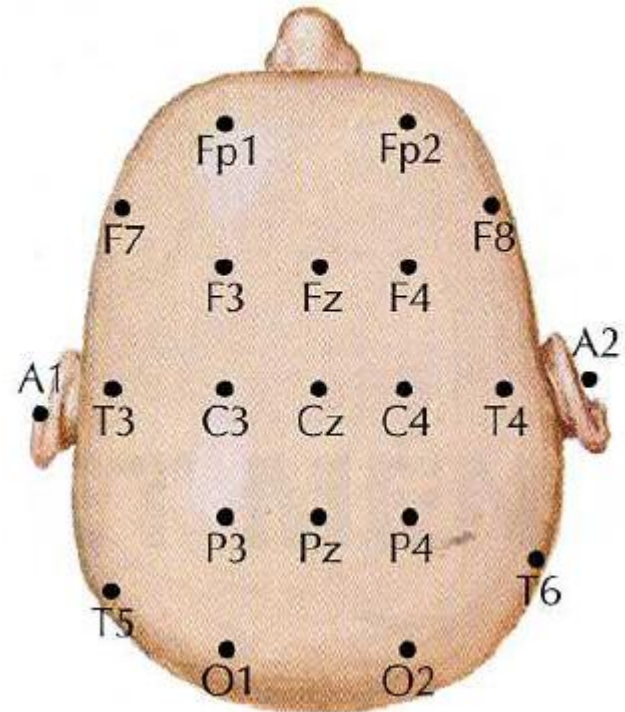
2013

Julien Lagarde

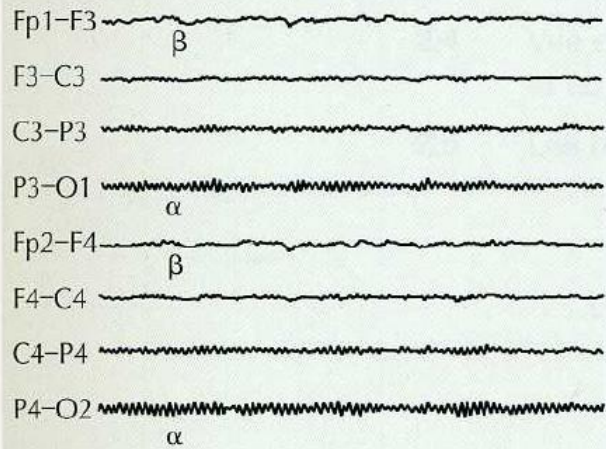
Electroencéphalographie (EEG)



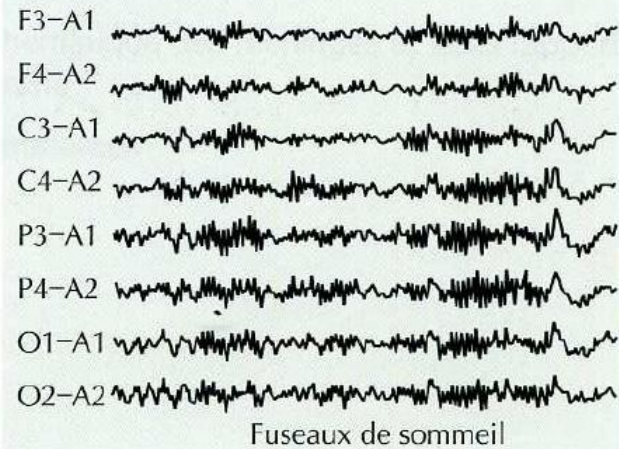
**Position des électrodes
et identification des canaux**



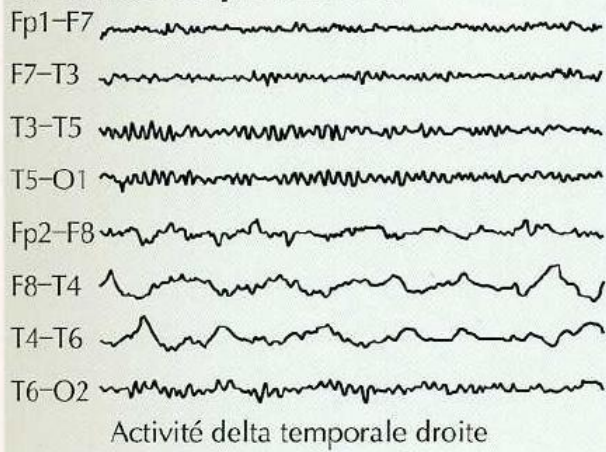
A. EEG normal, personne éveillée, yeux clos



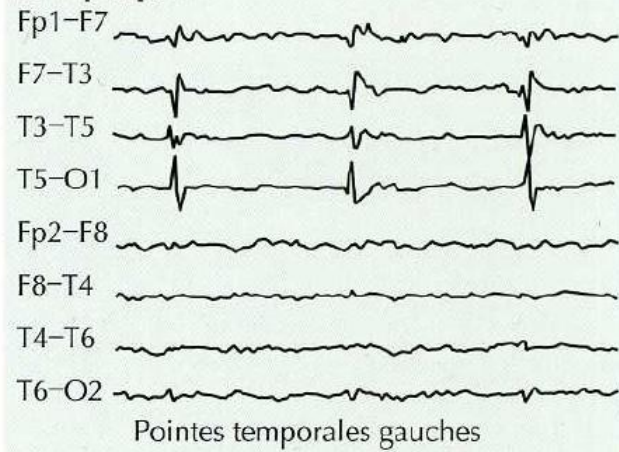
B. Sommeil normal



C. Tumeur temporale droite



D. Épilepsie



EEG & MEG

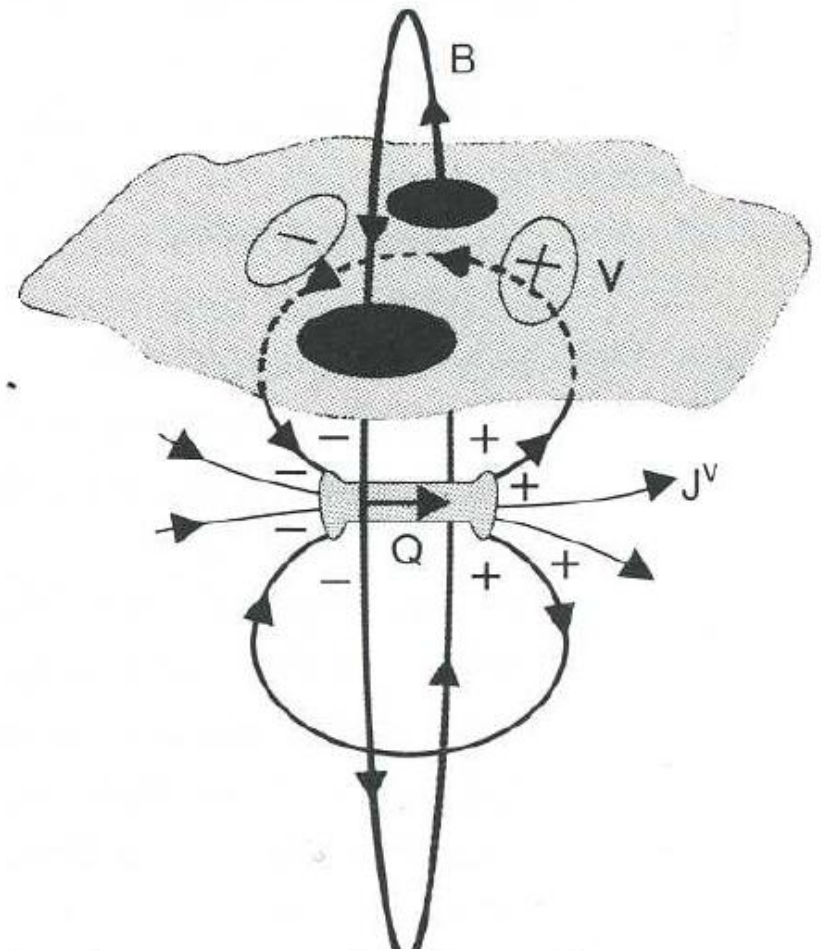
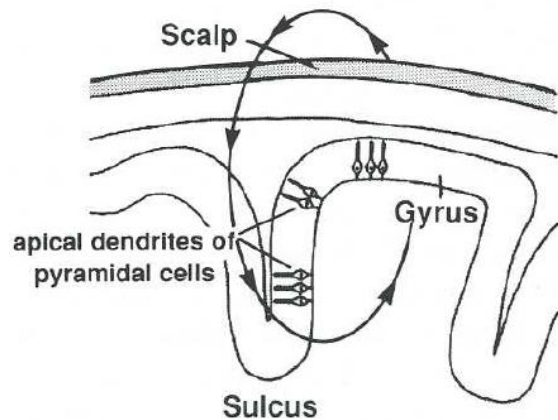
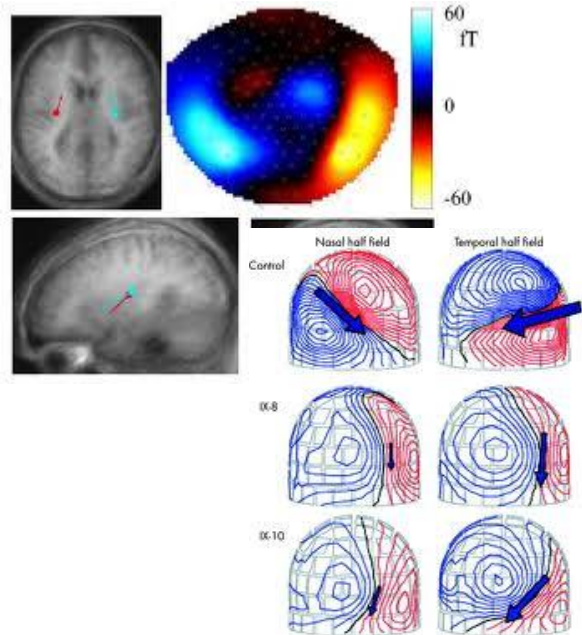
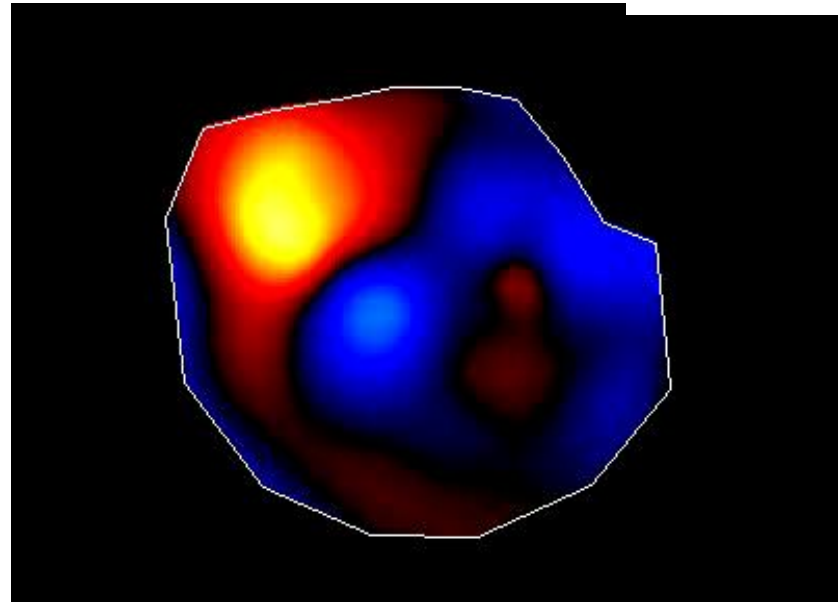
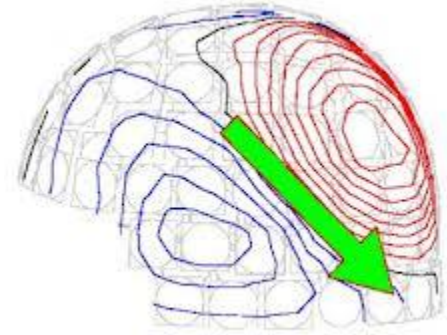
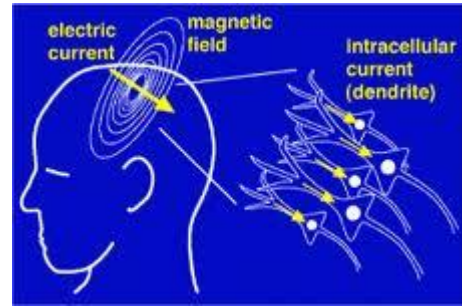
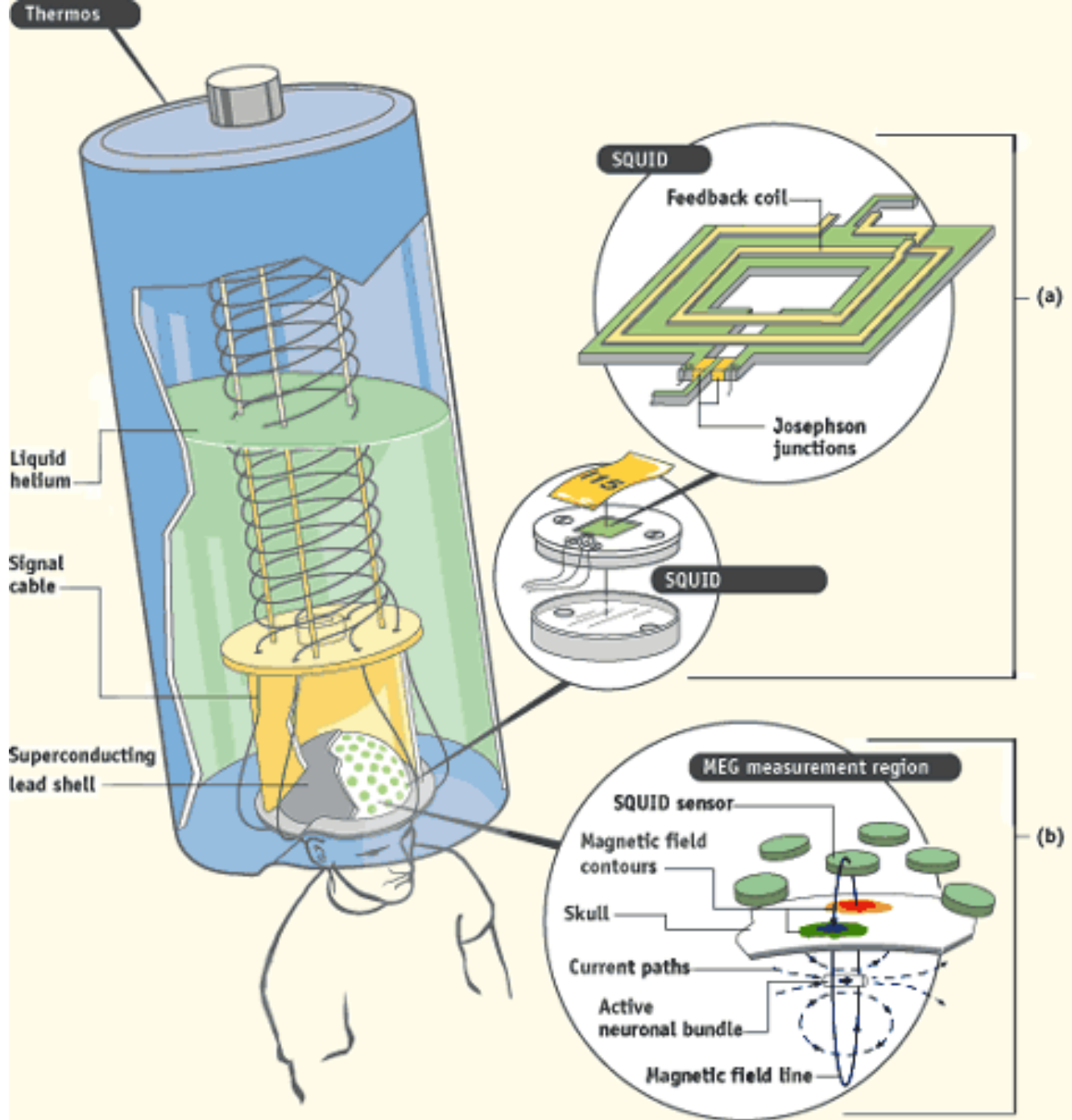


Figure 9.4 (Left) Apical dendrites of pyramidal cells in columns contained within a sulcus run perpendicular to the surface of the cortex and generate a magnetic field. (Right) A small piece of brain tissue produces a net intracellular current, Q , accompanied by a magnetic field, B , that emerges from the scalp and reenters nearby. It is the intracellular neuronal currents that are picked up by SQUIDS. Extracellular volume currents of density, J , create an electric field that diffuses to reach the scalp. The EEG electrodes detect this field as an electric potential, V .

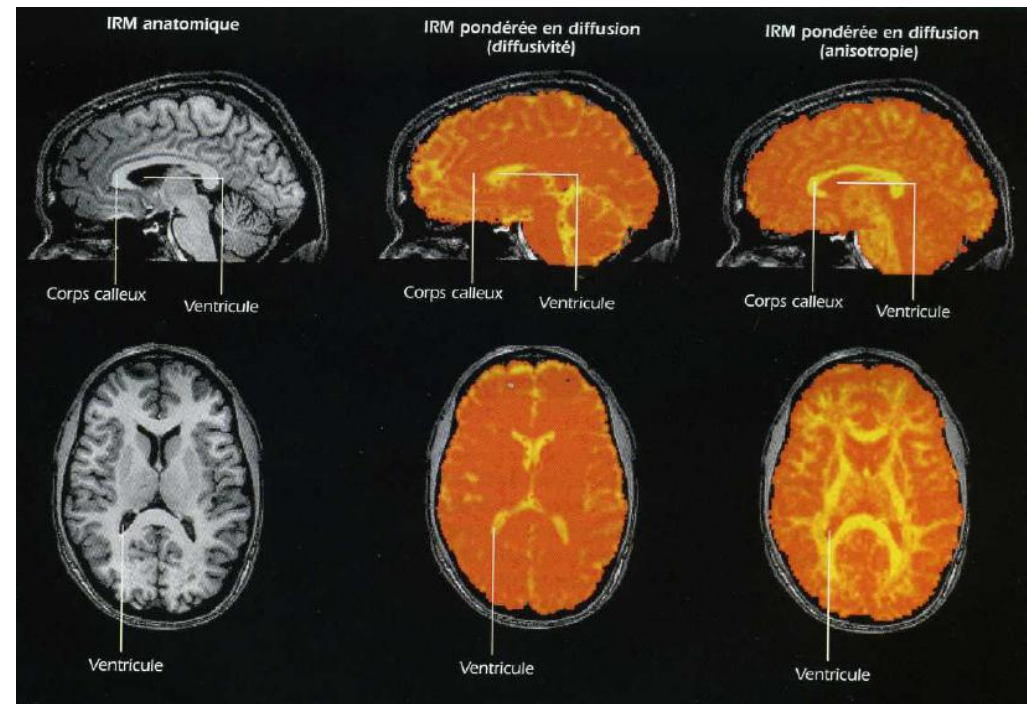




Tractographie : Imagerie par tenseur de diffusion

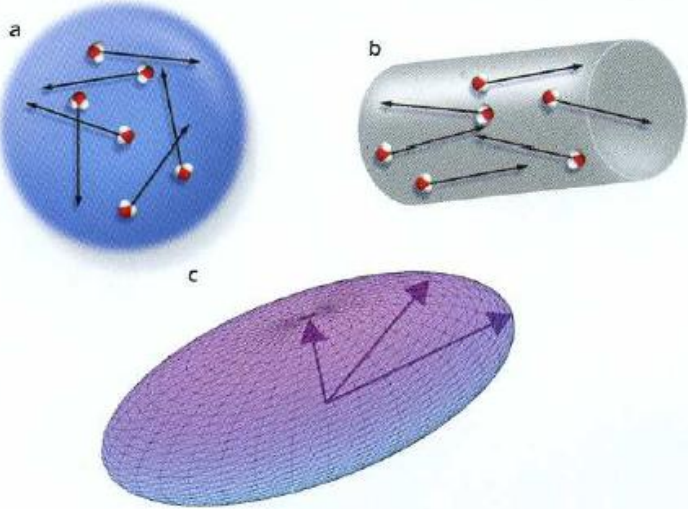


Résonance magnétique

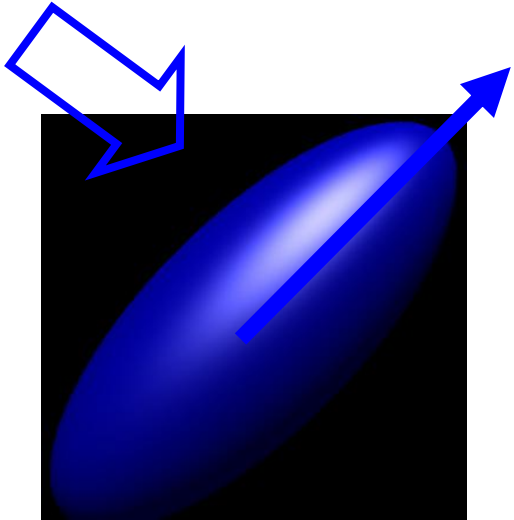
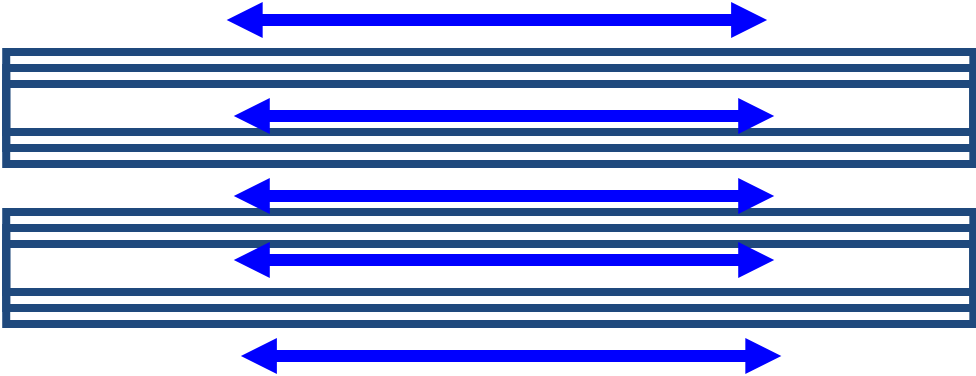
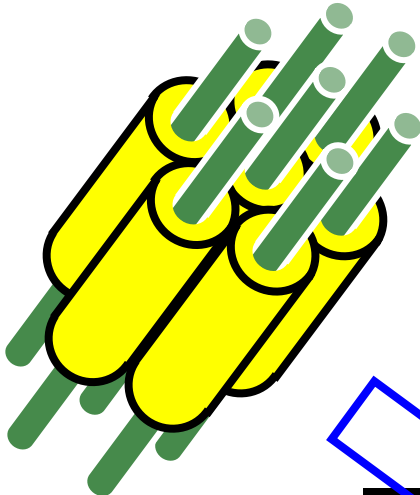


Diffusion Anisotrique

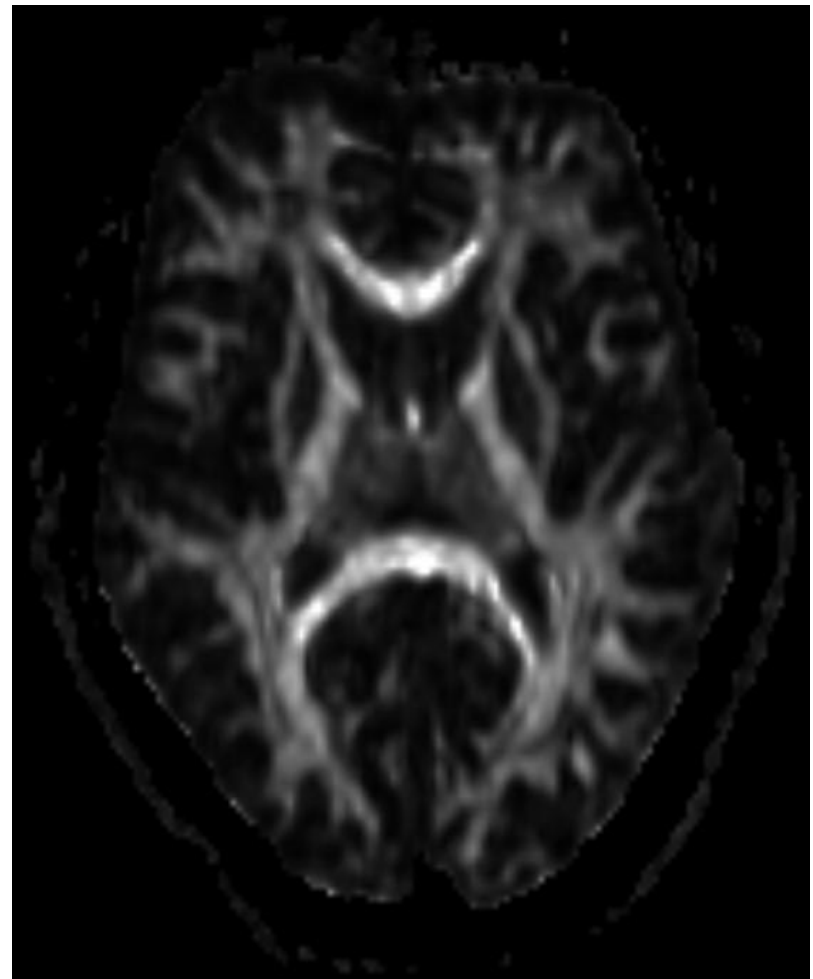
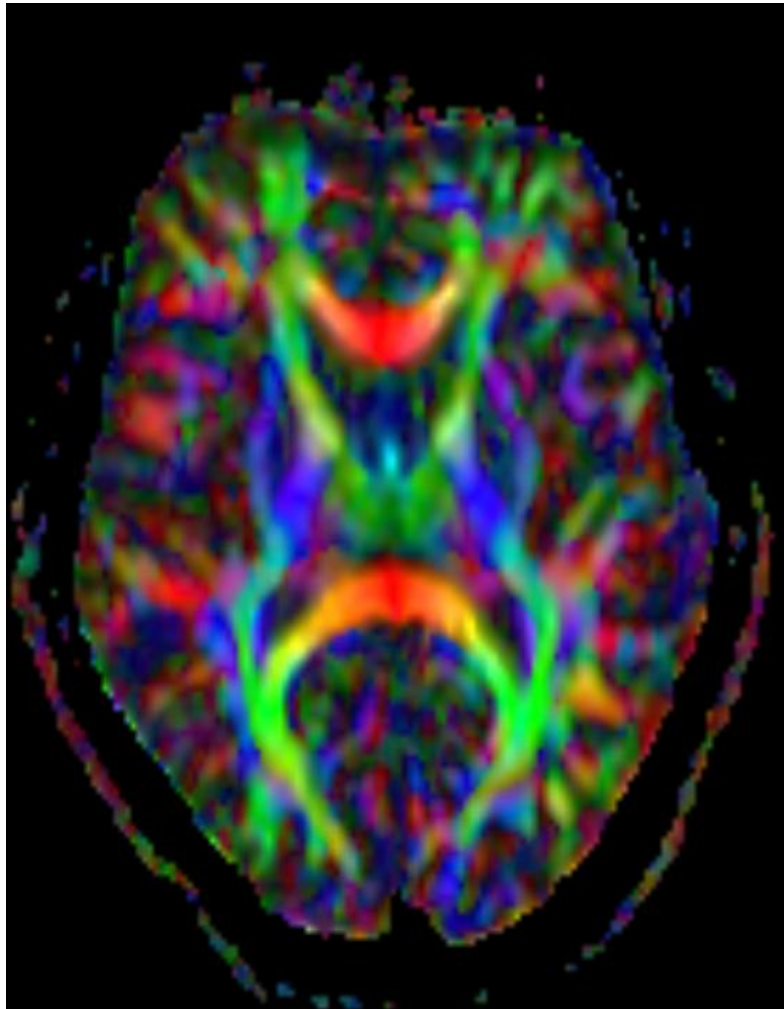
La diffusion de l'eau

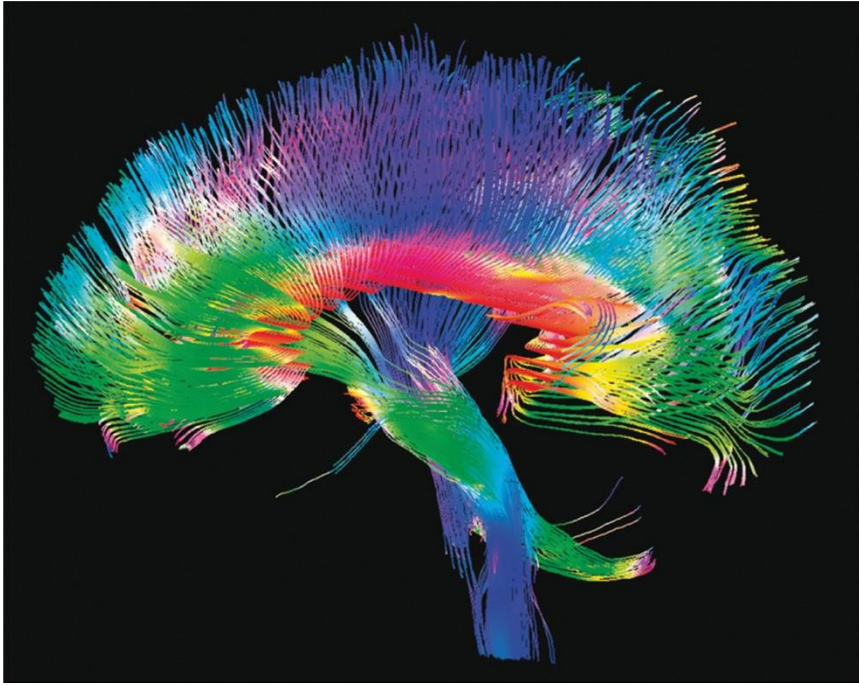


Carveau & Psycho



Color Diffusion





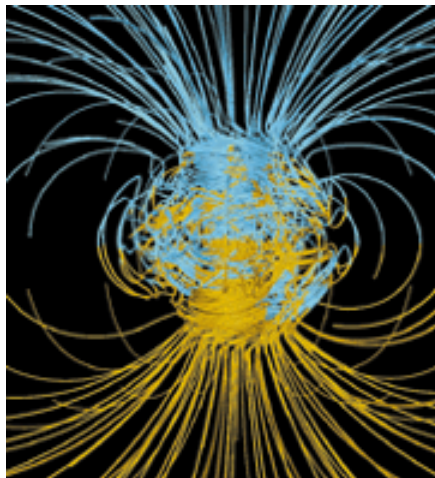
Comment marche l'IRM(f) ?

Un aimant très puissant

1 Tesla (T) = 10,000 Gauss

Earth's magnetic field = 0.5 Gauss

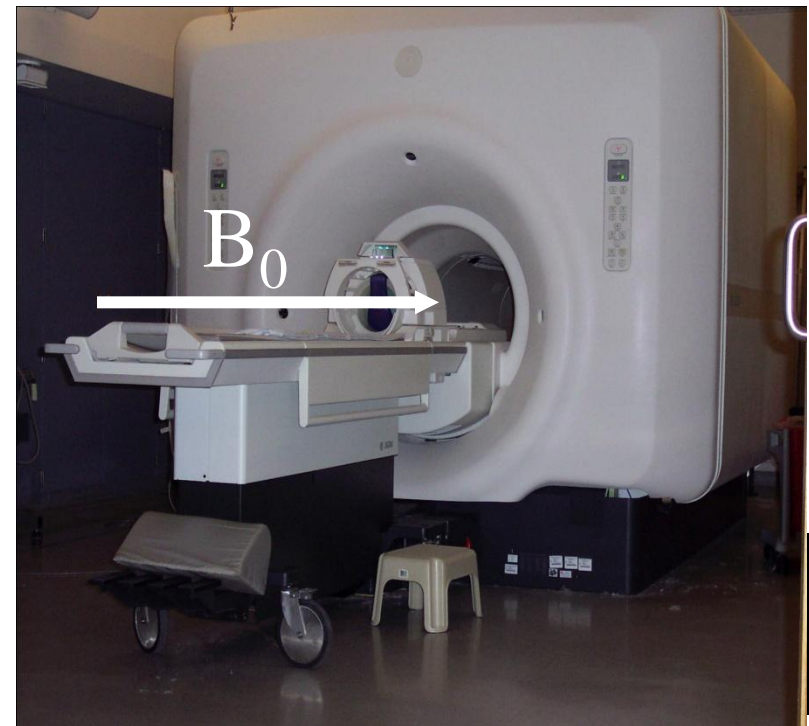
3 Tesla = $3 \times 10,000 \div 0.5 = 60,000 \times$ Earth's magnetic field



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$\times 60,000 =$

3 Tesla

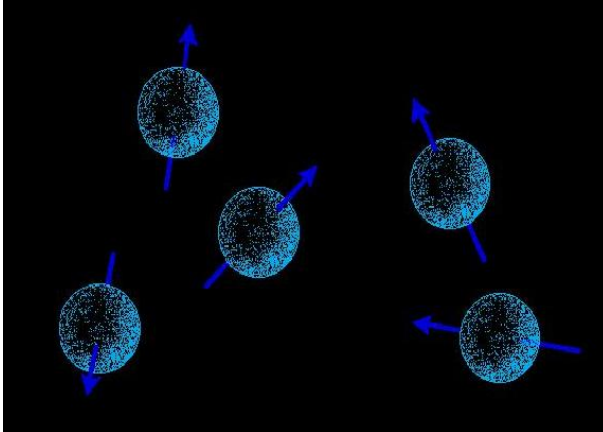


How fMRI Works

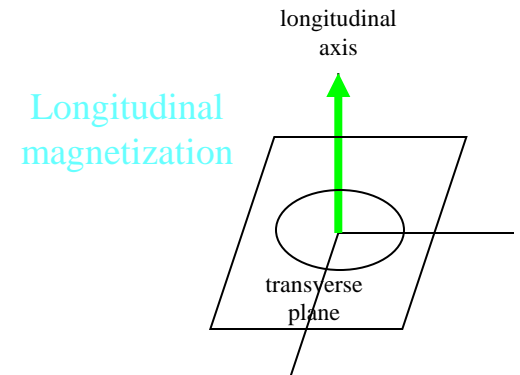
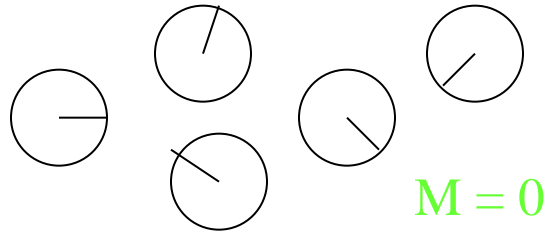
- Nuclear Magnetism
 - The proton of the hydrogen atom in water is a positive charge with spin.
 - A spinning charge creates a magnetic field, which can be orientated with that of the scanner.
 - The spins precess about the scanner field at the Larmor frequency (radio frequency).
 - Spatial encoding of the spin precession frequencies is done with field gradients.

How fMRI Works

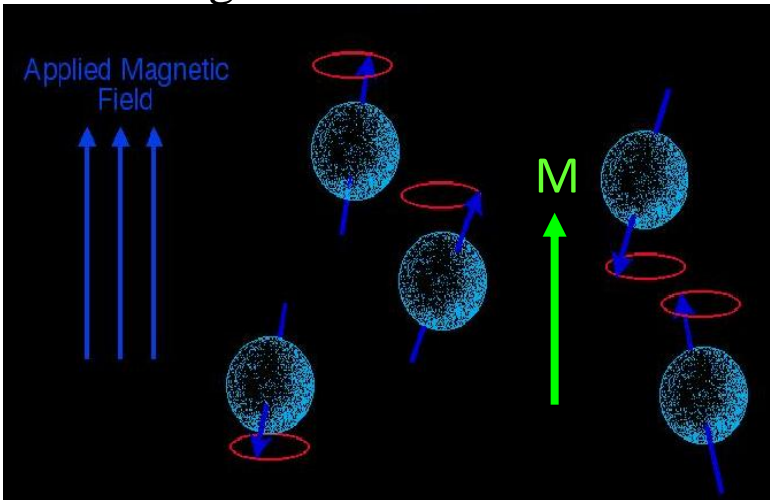
Outside magnetic field



randomly oriented

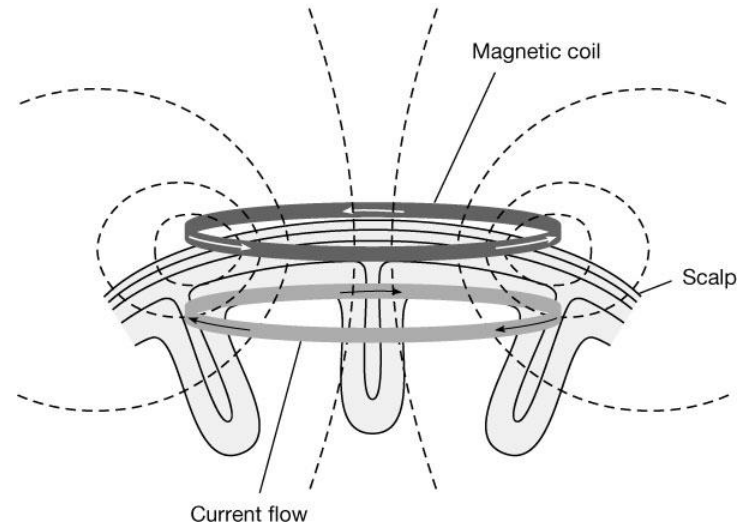
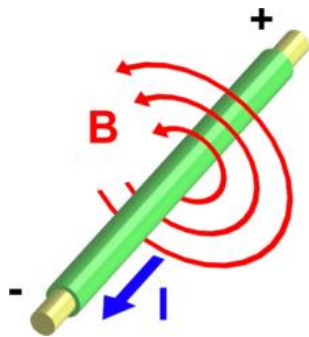
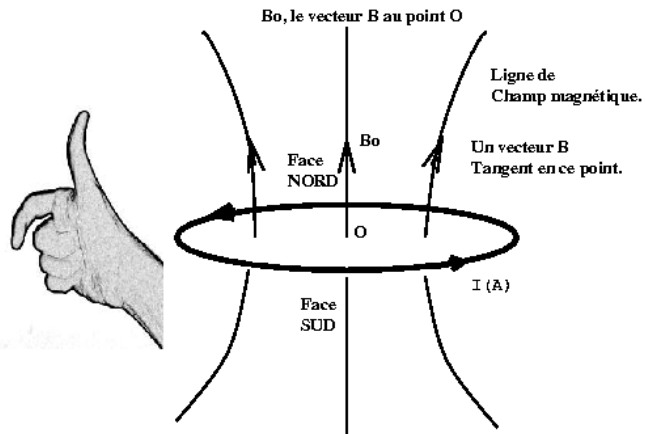
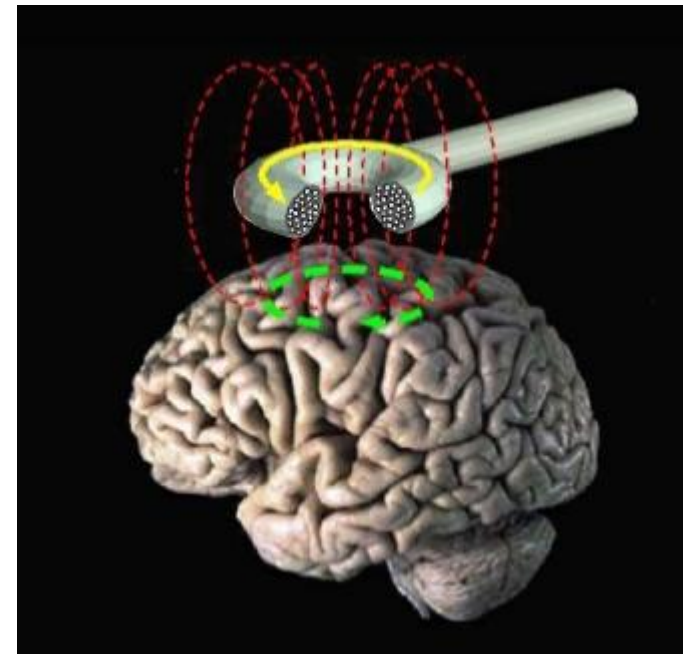


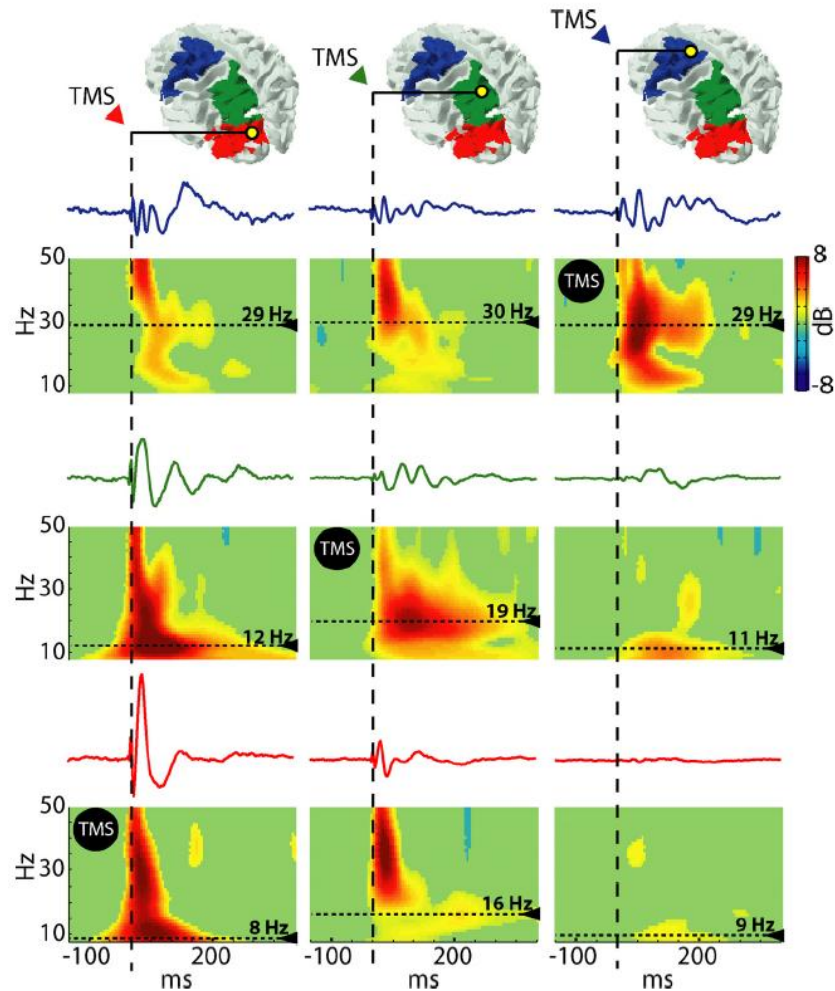
Inside magnetic field



- spins tend to align parallel or anti-parallel to B_0
- net magnetization (M) along B_0
- spins precess with random phase
- only 0.0003% of protons/T align with field

Stimulation magnétique transcrânienne (TMS)



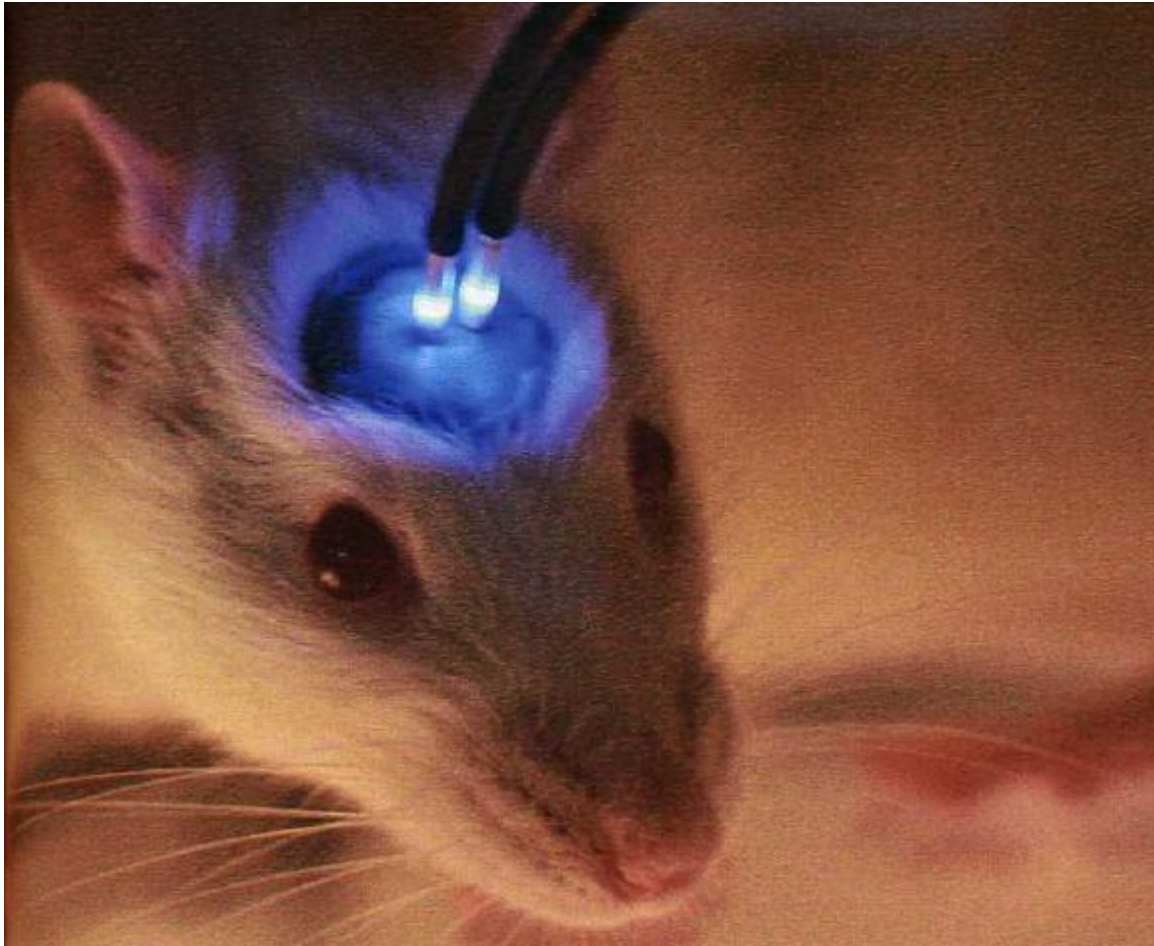


Rosanova et al 2009

Natural Frequencies of Human Corticothalamic Circuits

The Journal of Neuroscience, June 17, 2009 • 29(24):7679–7685

Optogenetics



How fMRI Works

- Radiofrequency Excitation
 - A radiofrequency (RF) pulse tips **M** to the transverse plane and gives energy to the proton spin system.
 - As the protons relax they give off energy and induce a current in the head coil.
 - Differences in spin densities and relaxation rates spatially encoded in the signal provide the image.
 - Spin dephasing (T_2^* relaxation) near oxygenated blood is slower than that near deoxygenated blood allowing for the BOLD contrast.