12 - Functional Magnetic Resonance Imaging (fMRI)

Functional Magnetic Resonance Imaging (fMRI)

© SPMM Course Magnetic Resonance Spectroscopy –MRS MR spectroscopy can detect several biologically important nuclei with an odd number of protons and neutrons. H-1 proton spectroscopy can be used to quantify Nacetyl aspartate (NAA), creatine, and cholinecontaining molecules. GABA and glutamate can be detected using MRS but not dopamine as it is available in a very low concentration Phosphorus-31 MRS can be used to determine the pH of brain regions and the concentrations of phosphorus-containing compounds (e.g., adenosine triphosphate [ATP] and guanosine triphosphate [GTP]) that are important in the metabolic activity of the brain. Additional indications include the use of MRS to measure concentrations of psychotherapeutic drugs such as lithium in the brain. Some compounds, such as fluoxetine and trifluoperazine (Stelazine), contain fluorine-19, which can also be detected in the brain and measured by MRS. Functional Magnetic Resonance Imaging (fMRI) Neuronal activity within the brain causes a local increase in oxygen consumption. Consequently the local concentration of deoxyhaemoglobin increases, relative to oxyhaemoglobin. While oxyhaemoglobin is diamagnetic (weak magnetic contrast), deoxyhemoglobin is paramagnetic, producing an MR signal that can be detected with the T2 (demyelinated) CSF Dark Dark Bright Bone Bright Bright Dark Air Dark Dark Dark Fat Dark Bright Bright Tissue Shades of grey Grey matter – grey White matter - white Shades of grey MR molecule Potential clinical uses 1H Magnetic resonance imaging (MRI), Analysis of metabolism – NAA, creatine and choline. 19F Measurement of pO2, Analysis of glucose metabolism Measurement of pH, Pharmacokinetics 7Li Pharmacokinetics 31P Analysis of bioenergetics Measurement of pH 14N Measurement of glutamate, urea, ammonia 13C Analysis of metabolite turnover rate Pharmacokinetics of labelled drugs 17O Measurement of metabolic rate

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Revision #1
Created 2026-01-04 20:05:09 UTC by Omar Ayman
Updated 2026-01-04 20:05:09 UTC by Omar Ayman