

## **From gross anatomy to physiology and microstructure - where is MR going?**

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It is difficult to overstate the impact that MR imaging had on the diagnostic process, by enabling to image gross anatomy non-invasively, without radiation risk, providing multiple contrasts and slice orientations. After about twenty years since its introduction as a clinical tool, no major breakthroughs in morphological brain imaging seem to lie at the horizon; rather, recent years have been characterised by an impetuous rise in research into MR imaging as a tool to study physiological processes, tissue microstructure, and neural activation. The purpose of this talk is to briefly introduce such advances, outlining technical principles, state of the art, clinical relevance, and perspectives for future development.

It is divided in four parts, dedicated to MR Spectroscopy, Diffusion Imaging, Functional MRI, and Perfusion Imaging, which share a similar structure. Each section begins with a presentation of physical principles, followed by their relationship with physiological and microstructural features. After a brief summary of clinical relevance, paradigmatic cases in which each technique significantly impacted the diagnostic/therapeutic process will be presented. Finally, perspectives for future application -both in research and clinical settings and technical development will be discussed.

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