**High field MRI research group**

Our research lines incorporate inventions of MR technology to be able to see the unseen for advancing medicine. Our clinical research focus areas are cancer, dementia, cardiovascular, stroke and MSK.

We are a team of about 50 researchers, engaged in medical science and eager to use advanced MR technology. In close collaboration with our clinical partners, we setup and execute novel research projects, mostly with the help of external funds. Through a large network of international academic and industrial collaborators we have embraced team science and aim to maximize advancing medical imaging.

The high field MRI group of the University Medical Center Utrecht comprises the following research groups:

**RF and Safety Group**

Design and build coil arrays for application-oriented research, study RF safety aspects of custom-built RF coils, interactions with medical implants and MRI in general. The RF and safety group has an extensive track record in RF coil array design for ultrahigh field imaging. Design concepts are typically explored by numerical simulations after which a coil array with optimized parameters is built for testing in the MRI scanner. In addition, also RF safety simulations are performed to establish safe power limits for in-vivo use of these custom-built coils and coil arrays. In addition to the RF safety of custom-built coil arrays, the RF and safety group has also explored the area of implant safety. Novel approaches for implant safety assessment have been presented and successfully applied on selected products of interested companies. More recently, the RF and safety group is focusing at MR Thermometry for RF safety assessment in general and coil array development for the upcoming 14T MRI system.

**Gradient group**

The gradient group develops novel high-performance gradient insert designs that aim to improve the signal-to-noise ratio and image distortions of MR images by reducing the time needed for spatial and molecular motion encoding. In addition, we are developing ultrasonic (silent) gradients with the aim to improve patient comfort by enabling faster and quieter scanning. For the high-performance gradients, the main application areas are diffusion, flow, and functional MRI while the ultrasonic gradients focus on applications to clinical protocols and spectroscopy. Research in the gradient group not only focusses on gradient design but also on software development for novel MR-sequences and reconstruction methods to take full advantages of the spatial and molecular motion encoding capabilities of the MR-system.

**Metabolic imaging group**

The Metabolic Imaging group aims at developing robust and highly sensitive metabolic imaging methods at ultra-high field for application in clinical studies on cancer, brain disorders, metabolic disorders, cardiovascular disease, and muscle (patho)physiology. The MRS-group develops 1H, 2H, 31P, 13C, 19F and 23Na metabolic imaging methods in the brain and body for use at ultra-high field (7 Tesla) MR systems. We focus on fast and robust methods including image reconstruction and image analysis tools.

**Platform and methods**

The Platform and Methods group aims to develop and maintain the 7T platform and to provide MR methods that enable cutting edge research. This includes both hardware and software developments where the main topics of development are MR Infrastructure and platform, Coil interfacing and safety, Software and sequence development.

**Pre-clinical Imaging Group**

The pre-clinical imaging group develops and apply magnetic resonance imaging (MRI) and spectroscopy (MRS) methods to study human diseases, with a particular focus on brain disorders, in a preclinical setting. The main research areas are Diagnosis and treatment of brain disorders, Structure and function of neural networks, Stroke recovery, neuroplasticity and brain stimulation. The laboratory is equipped with two state-of-the-art animal MR systems with field strengths of 9.4 T and 7 T. In addition, in vivo optical imaging, and transcranial magnetic stimulation (TMS) set-ups are available for multimodal studies.

**Vascular Brain Imaging Group**

The mission of the Vascular Brain Imaging group is to develop highly sensitive and precise high-field MRI methods that specifically focus on the cerebrovascular structure and function. These methods are then applied in brain imaging for both healthy individuals and those affected by various diseases. Developments encompass hardware, MRI and fMRI data acquisition methods, analysis methods, and biophysical and computational models. Applications encompass neurological and cerebrovascular diseases, neurovascular coupling, and neuroscience.