Title: Ultra-high field MRI: high-resolution neuroanatomy
Speaker: Mark A. van Buchem, MD, PhD

Syllabus abstract:

The introduction of human ultra-high field MRI systems with magnetic field strengths of 7 Tesla and up provided us with even more powerful instruments to study the brain in vivo than those we already had access to. Over the past few years, these systems have been used in a number of sites on different continents, and the information on the added value of these systems as compared to MRI systems operating at lower field strength is accumulating.

The increased signal-to-noise ratio that is inherent to these systems can be exploited in several ways. Increased spatial resolution allows us to detect in vivo substructures in the brain such as the different layers within the cortical ribbon, that were invisible before. Increased sensitivity to iron creates new, iron-driven contrasts on MR images of the brain. Since iron is an interesting component of the brain, both in health and disease, these images are potentially potent tools to study brain function and dysfunction. Increased signal from flowing blood as compared to stationary background improves time-of-flight images, allowing detection of very small arteries in the brain, such as the arteries perforating the basal ganglia. These arteries are affected in diseases with a high prevalence, such as hypertension-related arteriolosclerosis, and the possibility to detect them in vivo will help us detecting and understanding these diseases. Increased sensitivity to BOLD signal allows for functional MRI techniques with a higher spatial resolution, which can be exploited to study interaction of functional layers within the cortex. And increased spectral resolution allows for detecting specifically and more reliably cerebral metabolites.

In this presentation, I will demonstrate high-resolution applications of ultra-high field MRI in the brain, and I will discuss the potential clinical or scientific values of these applications.

Who will benefit from this information?
Researchers with a methodological background could benefit from this talk, since it will show them why increased spatial resolution as can be obtained with ultra-high field MRI could be clinically relevant. Also, clinicians with an interest in brain MRI could learn what ultra-high field MRI techniques are being developed and could lead to clinical applications.

What will learners be able to do differently because of this information?
Based on the information provided during this talk, the audience will be familiar with the latest information on the applications of high-resolution imaging techniques for the brain with ultra-high field MRI.