

# Non-Invasive In-Vivo Histology in Health and Disease Using Magnetic Resonance Imaging (MRI)

<https://www.neurodegenerationresearch.eu/survey/non-invasive-in-vivo-histology-in-health-and-disease-using-magnetic-resonance-imaging-mri/>

## Principal Investigators

### Institution

### Contact information of lead PI

### Country

European Commission

## Title of project or programme

Non-Invasive In-Vivo Histology in Health and Disease Using Magnetic Resonance Imaging (MRI)

## Source of funding information

European Commission FP7-Seventh Framework Programme

## Total sum awarded (Euro)

€ 2,000,000

## Start date of award

01/09/2014

## Total duration of award in years

5.0

## The project/programme is most relevant to:

Alzheimer's disease & other dementias

## Keywords

### Research Abstract

Understanding of the normal and diseased brain crucially depends on reliable knowledge of its microstructure. Important functions are mediated by small cortical units (columns) and even small changes in the microstructure can cause debilitating diseases. So far, this microstructure can only be determined using invasive methods such as, e.g., ex-vivo histology. This limits neuroscience, clinical research and diagnosis.

My research vision is to develop novel methods for high-resolution magnetic resonance imaging (MRI) at 3T-9.4T to reliably characterize and quantify the detailed microstructure of the human

cortex.

This MRI-based histology will be used to investigate the cortical microstructure in health and focal cortical degeneration. Structure-function relationships in visual cortex will be elucidated in-vivo, particularly, ocular dominance columns and stripes. Specific microstructural changes in focal cortical degeneration due to Alzheimer's disease and monocular blindness will be determined, including amyloid plaque imaging.

To resolve the subtle structures and disease related changes, which have not previously been delineated in-vivo by anatomical MRI, unprecedented isotropic imaging resolution of up to 250  $\mu\text{m}$  is essential. Methods for high-resolution myelin and iron mapping will be developed from novel quantitative MRI approaches that I have previously established. Super-resolution diffusion and susceptibility imaging will be developed to capture the neuropil microstructure. Anatomical imaging will be complemented by advanced high-resolution functional MRI. The multi-modal MRI data will be integrated into a unified model of MRI contrasts, cortical anatomy and tissue microstructure.

My ambitious goal of developing in vivo MRI-based histology can only be achieved by an integrative approach combining innovations in MR physics, modelling and tailored (clinical) neuroscience experiments. If successful, the project will transform research and clinical imaging.

### **Lay Summary**

**Further information available at:**

**Types:**

Investments > €500k

**Member States:**

European Commission

**Diseases:**

Alzheimer's disease & other dementias

**Years:**

2016

**Database Categories:**

N/A

**Database Tags:**

N/A