Gamma MRI

The Future of Molecular Imaging

The Need

1

Over 165 million people in Europe are affected by at least one brain disease such as Alzheimer’s, Parkinson’s, dementia, stroke etc.

Most neurological diseases are aging sensitive and with the ongoing demographic changes, their incidence is expected to increase. This will be one of the major societal challenges in Europe and worldwide.

2

Stroke alone is the second most common cause of death and the third leading cause of disability worldwide.

Nearly 85% of strokes are of the ischaemic subtype that can be treated by restoring blood flow to the ischaemic brain through thrombolysis or thrombectomy. B

But only within a relatively narrow time window of 4–7 hours after ischemic onset.

3

The evolution of ischaemic damage varies much among patients and a careful selection of the patient’s treatment path, based on imaging properties of the ischaemic brain, is essential to achieve significant improvement.

In the challenging move away from 'one size fits all’ to personalized medicine, a multidisciplinary approach is required.

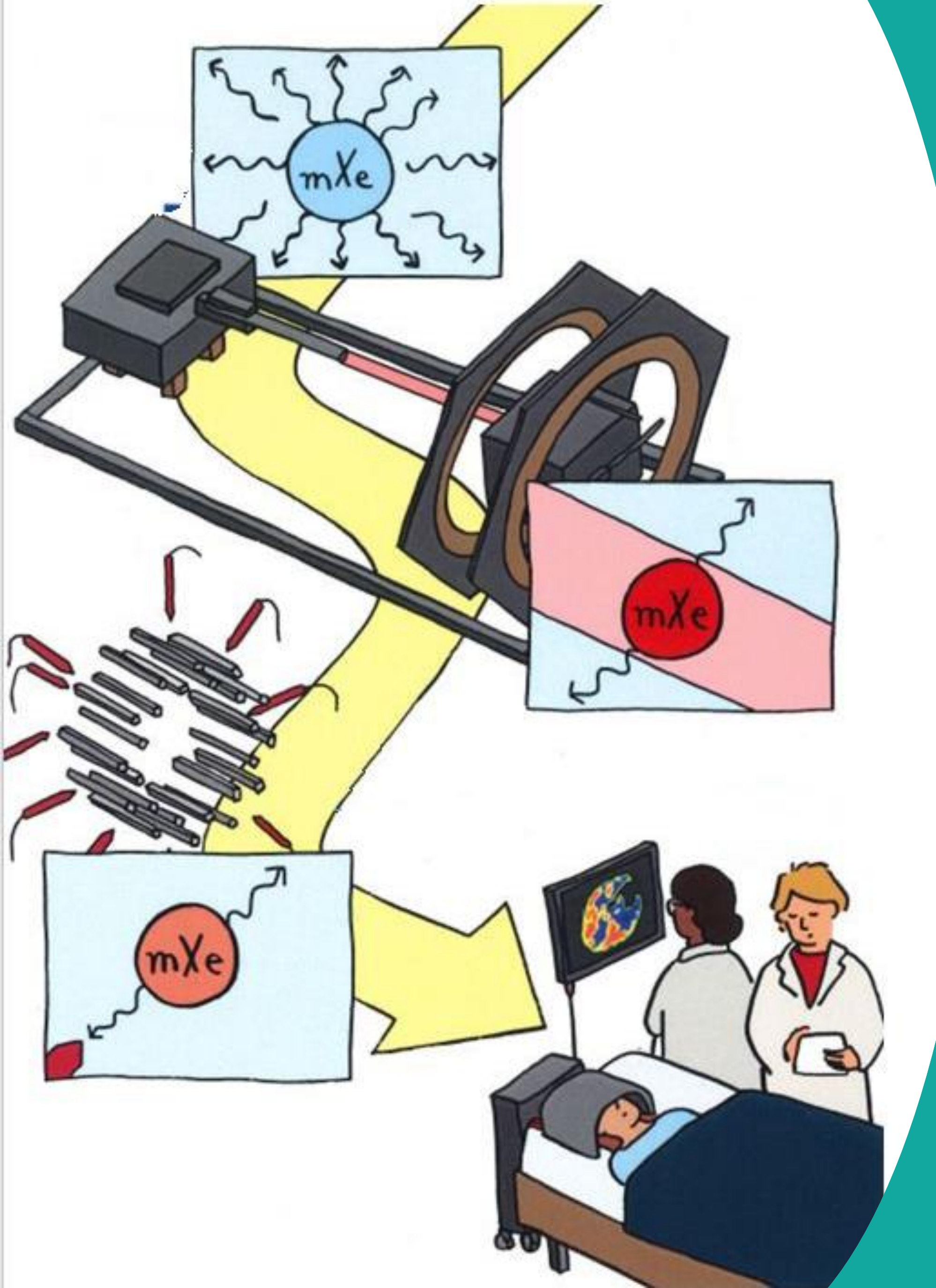
How to Improve

Molecular imaging at the cellular and molecular levels, of the processes involved in these diseases is an essential diagnostic tool to detect and correctly diagnose illnesses in an early stage of development.

What is Missing

Despite undergoing advances, current efforts in medical imaging (especially for the brain) rely on bulky, expensive and complex high-field MRI3, hybrid PET-MRI or PET-CT scanners

Gamma MRI



The GAMMA-MRI Proposition

The γMRI project will develop a working prototype for in vivo molecular imaging, based on a revolutionary technology, allowing the simultaneous exploitation of the sensitivity of gamma (γ) detection and the spatial resolution and flexibility of MRI.

In essence, γMRI will provide a ground-breaking technology for multi-tracer molecular imaging.

γMRI is not just a hybrid approach combining separate modalities but a single new modality, simultaneously achieving the high spatial resolution of MRI and the high sensitivity of PET with faster scan time

Not requiring ultra-high MRI magnetic fields and expensive EM shielded rooms, nor detection of coincidence γ rays as in PET, γMRI will be less complex and thus less expensive than present state-of-the-art devices, especially hybrid ones

This disruptive approach of a more accurate and widely available molecular imaging technology will pave new ways for patient care and medical imaging market

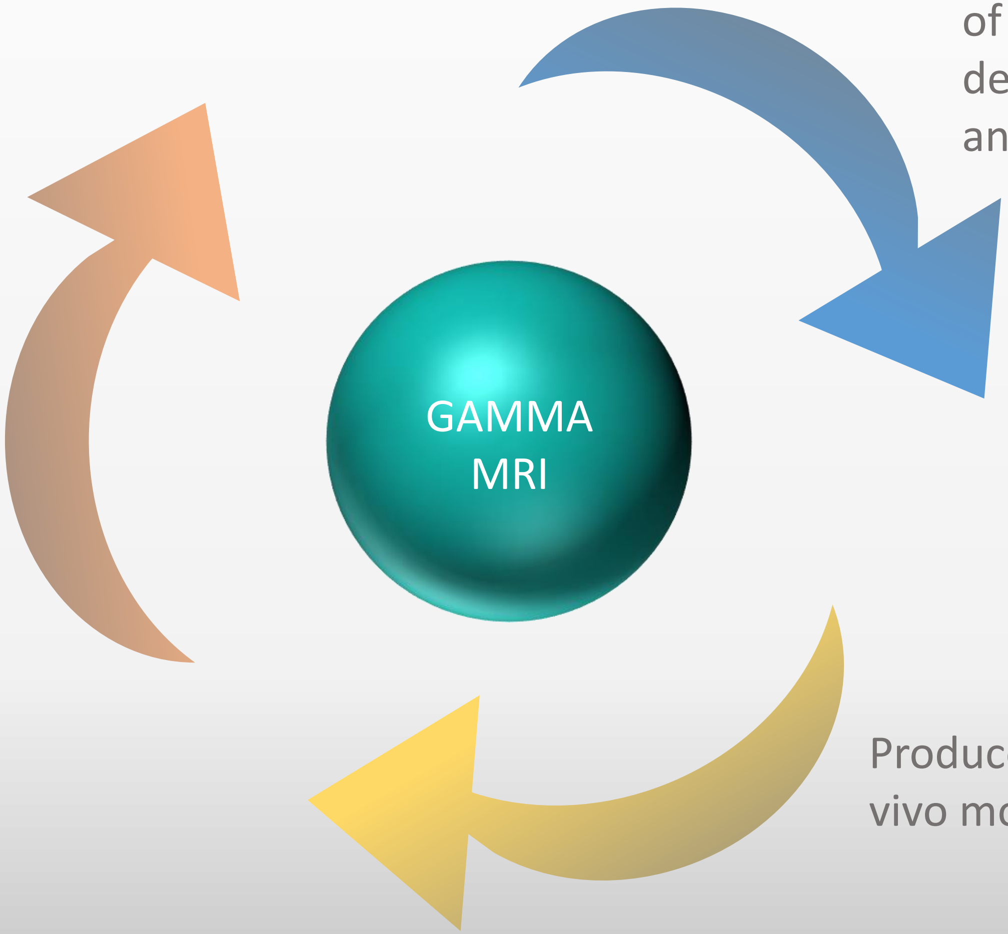
GAMMA-MRI will give access to biomarkers currently out of reach with state-of-the-art techniques. And the combined evaluation of related processes becomes possible (e.g. perfusion and metabolism).

Gamma MRI

Objectives

Allow the simultaneous exploitation of the sensitivity of gamma (γ) detection and the spatial resolution and flexibility of MRI

Develop a clinical molecular imaging device based on the physical principle of anisotropic gamma emission from hyperpolarised metastable Xenon



Produce a working prototype for in vivo molecular imaging

Gamma MRI

Scientific Highlights

1. γMRI brings the spatial resolution of MRI (<1 mm) with the sensitivity of PET

2. γMRI surpasses by 1000 times the enhanced sensitivity of hyperpolarised MRI bringing it to molecular imaging standards independently on the magnetic field. Weaker, with less requirements on homogeneity, and therefore cheaper magnetic fields can be used

3. Simultaneous high sensitivity and high resolution are possible in γMRI. Positioning is given by MRI-sequences, asymmetry of γ-ray yields tracer amount

4. Several hyperpolarised radiotracers can be used simultaneously and easily be detected separately just based on the energy of the γ ray

5. γMRI will develop new strategies to store hyperpolarised tracers for transport, from a central site of production to the imaging system

Gamma MRI

Expected Results

1 — 2 — 3 — 4

1. Production of hyperpolarised gamma-emitting xenon isomers – preserving hyperpolarisation until delivery to the targeted organ

2. Development of advanced image acquisition and reconstruction techniques using physics and artificial intelligence-based approaches

3. Design and assembling of a first prototype with a low-field versatile magnet

4. Achieve the first preclinical proof-of-concept brain imaging experiment

Gamma MRI

Current Status

The GAMMA-MRI project was started on the 1st of April 2021, and it is in the first year of development.

Currently, the overall system design has been completed, first experiments with Xenon sources have been started, components for the manufacturing of the magnet have been ordered and the framework for the development of the simulations and the imaging software is in an advanced state of development.

The GAMMA-MRI Consortium

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