



HAL
open science

Manganese-Enhanced MRI for Functional Imaging of Freely Moving Animals

Jean-Marie Bonny

► **To cite this version:**

Jean-Marie Bonny. Manganese-Enhanced MRI for Functional Imaging of Freely Moving Animals. CoCoA BeANS - Cognitive and COmputational Approaches of Behaviour and Nutrition Studies, May 2023, Paris - Cité Universitaire Internationale, France. hal-04235819

HAL Id: hal-04235819

<https://hal.inrae.fr/hal-04235819>

Submitted on 10 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Manganese-Enhanced MRI for Functional Imaging of Freely Moving Animals

Jean-Marie Bonny ^{1,2}

(1) INRAE, QuaPA, F-63122 St Genes Champanelle, France

(2) INRAE, PROBE research infrastructure, AgroResonance facility, F-63122 St Genes Champanelle, France

Advanced in vivo methods that enable the imaging of neural activity across the entire brain are crucial for understanding how information is processed during specific behaviors. One such method is manganese-enhanced magnetic resonance imaging (MEMRI), which allows the time-integration of neural activity in freely moving animals. MEMRI utilizes Mn²⁺, a paramagnetic ion that enhances MRI contrast, and serves as a surrogate marker for Ca²⁺ influx, which accumulates in neurons in an activity-dependent manner.

One major advantage of MEMRI is that it utilizes a residual and integrative contrast that can be highlighted via MRI after the animal has exhibited its specific behavior under natural conditions. This is a significant improvement over BOLD functional MRI (fMRI), which is primarily used in humans but relies on momentary hemodynamic contrast that lasts only a few tens of seconds. Thus, BOLD fMRI requires the animal to be stimulated during the MRI experiment, often under anesthesia.

Examples of high-field MEMRI will be discussed, demonstrating the potential of this approach for studying rat behaviors. Key considerations will be discussed, including the methods for administering Mn and detecting differences in brain activity among groups of animals exhibiting contrasted behaviors. By exploring these critical points, we can better understand how to utilize MEMRI to investigate neural activity in rats and gain insights into the underlying brain mechanisms governing behavior and nutrition.