
Preface

The history of nuclear magnetic resonance (NMR) is a unique success story of translating basic research from the fields of Physics and Chemistry into applied life sciences. The 1952 Nobel laureate Edward Purcell somehow anticipated the incomparable potential of NMR when stating “I am sure we have only begun to explore the domain of very weak interactions – the ‘audio spectrum’ of molecules, if I may call it that.” Several Nobel Prizes followed for related research and the latest one in 2003 acknowledges a technique that is today indispensable in everyday biomedical diagnostics: nuclear magnetic resonance imaging, also known as MRI in clinical context to avoid misleading connotations to nuclear science.

From the perspective of traditional (optical) imaging it may appear unusual that electromagnetic radiation with a wavelength in the range of one meter can be used to reveal structures on the micrometer scale. But thanks to the numerous ways to manipulate and detect an NMR signal, it is possible to obtain a variety of information with excellent spatial and temporal resolution. All this comes with the advantage of harmless, non-ionizing radiation and includes revealing of processes even down to the molecular level. Today’s MRI techniques go far beyond the illustration of pure anatomical structures. Contributions from scientists of a very diverse background helped to increase the versatility of the method tremendously and allow drawing a rather detailed picture of what is going on in living tissue. Consequently, this modality attracts great attention from many researchers not originally trained in NMR/MRI method development, but seeking to use this powerful tool to address their biomedical questions. The number of small animal imaging centers relying on MRI as a key method for preclinical research to understand diseases and to test for novel treatments is growing rapidly. This emphasizes the ever expanding community of MRI users in both academic environments and research departments of biotech companies.

In Vivo NMR Imaging is written as an experimental laboratory text to provide a descriptive approach of the various applications of magnetic resonance imaging and its underlying principles. In order to provide the reader with a descriptive compendium of modern in vivo NMR imaging, the book is structured in three parts:

1. Starting with Section I as a compact introduction of basic NMR physics and image-encoding techniques, the underlying principles of hardware setup and contrast generation are explained. Information about practical aspects of designing experimental studies that follow the special conditions for micro-imaging setups are also provided.
2. In the second part (Section II), advanced concepts of generating contrast in MR images will be introduced and corresponding protocols will be provided. These include some more recent developments in contrast generation based on special preparation of the magnetization that carries image information.
3. In the applications part (Section III-X), the authors cover an interdisciplinary range of problems to be addressed by this non-invasive technique, including study protocols for addressing morphological, physiological, functional, and biochemical aspects of various tissues in living organisms. Recent developments will be addressed with an additional focus on novel techniques for molecular imaging and new protocols for imaging metabolism and molecular markers.

Modern NMR imaging covers so many aspects that it is almost impossible to have detailed experimental experience in all its variety. To give a broad overview to the NMR novice was therefore only one aspect of designing this book. Furthermore, it is hoped that even the versed MRI scientist will find some techniques useful that he has not yet implemented in his research. The successful protocol style of this book series will surely facilitate experimental design for both types of audiences.

We are grateful that so many leading experts in their particular fields agreed to participate in this project. Their diverse experimental experience allowed gathering protocols for a broad audience and we would like to thank them for sharing this priceless knowledge.

Cornelius Faber, Leif Schröder



<http://www.springer.com/978-1-61779-218-2>

In vivo NMR Imaging

Methods and Protocols

Schröder, L.; Faber, C. (Eds.)

2011, IX, 753 p., Hardcover

ISBN: 978-1-61779-218-2

A product of Humana Press