# Extra-Cranial Applications of Diffusion-Weighted MRI

# Extra-Cranial Applications of Diffusion-Weighted MRI

Edited by

**Bachir Taouli**

Mount Sinai School of Medicine, Department of Radiology, New York, USA

CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi, Dubai, Tokyo, Mexico City

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by
Cambridge University Press, New York

www.cambridge.org
Information on this title: www.cambridge.org/9780521518697



First published 2011

Printed in the United Kingdom at the University Press, Cambridge

*A catalogue record for this publication is available from the British Library*

*Library of Congress Cataloging-in-Publication data*

Extra-cranial applications of diffusion-weighted MRI / edited by Bachir Taouli.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-0-521-51869-7 (Hardback)
1. Diffusion magnetic resonance imaging. I. Taouli, Bachir.
[DNLM: 1. Diffusion Magnetic Resonance Imaging–methods. WN 185 E96 2011]
RC78.7.N83.E98 2011
616.07′548–dc22

2010022747

ISBN 978-0-521-51869-7 Hardback

# Contents

# Contributors

**Andriy M. Babsky, PhD**
Department of Radiology, Indiana University, Indianapolis, Indiana, USA

**Navin Bansal, PhD**
Department of Radiology, Indiana University, Indianapolis, Indiana, USA

**Andrea Baur-Melnyk, MD**
Department of Clinical Radiology, University Hospitals – Grosshadern, LMU Ludwig Maximilian University of Munich, Munich, Germany

**David J. Collins, PhD**
The Royal Marsden NHS Foundation Trust, Department of Radiology, Sutton, UK

**Frederik De Keyzer, MSc**
University Hospitals Leuven, Department of Radiology, Leuven, Belgium

**Nandita M. deSouza, MD, FRCR**
MRI Unit, Cancer Imaging Centre at the Institute of Cancer Research and Royal Marsden Hospital, Sutton, UK

**Olaf Dietrich, PhD**
Josef Lissner Laboratory for Biomedical Imaging, Department of Clinical Radiology, University Hospitals – Grosshadern, LMU Ludwig Maximilian University of Munich, Munich, Germany

**Yong Guo, MD**
Radiology Department, Navy General Hospital of the PLA, Beijing, China

**Tomoaki Ichikawa, MD, PhD**
Department of Radiology, University of Yamanashi, Shimokato, Japan

**Jens Jensen, PhD**
Department of Radiology, Physiology, and Neuroscience, New York University Langone Medical Center, New York, USA

**Shenghong Ju**
Department of Radiology, Indiana University, Indianapolis, Indiana, USA

**Sooah Kim, MD**
Department of Radiology, New York University Langone Medical Center, Department of Radiology, New York, USA

**Dow-Mu Koh, MD**
The Royal Marsden NHS Foundation Trust, Department of Radiology, Sutton, UK

**Thomas C. Kwee, MD, PhD**
University Medical Center Utrecht, Department of Radiology, Utrecht, The Netherlands

**Masayuki Maeda, MD**
Department of Radiology, Mie University School of Medicine, Tsu, Japan

**Utaroh Motosugi, MD, PhD**
Department of Radiology, University of Yamanashi, Shimokato, Japan

**Ali Muhi, MD**
Department of Radiology, University of Yamanashi, Shimokato, Japan

**Anwar R. Padhani, FRCP, FRCR**
Paul Strickland Scanner Centre, Mount Vernon Hospital, Northwood, UK

**Sophie F. Riches, MPhys, MSc**
Cancer Imaging Centre at the Institute of Cancer Research and Royal Marsden Hospital, Sutton, UK

**Katsuhiro Sano, MD, PhD**
Assistant Professor, Department of Radiology, University of Yamanashi, Shimokato, Japan

**Hela Sbano, MRCP, FRCR**
Imperial College NHS Trust, Hammersmith Hospital, London, UK

**Eric E. Sigmund, PhD**
University Langone Medical Center, New York, USA

**Taro Takahara, MD, PhD**
Tokai University School of Engineering, Department of Biomedical Engineering, Japan and University Medical Center Utrecht, Department of Radiology, Utrecht, The Netherlands

**Bachir Taouli, MD**
Mount Sinai School of Medicine, Department of Radiology, New York, USA

**Harriet C. Thoeny, MD**
Department of Diagnostic, Interventional, and Pediatric Radiology, University of Bern, Bern, Switzerland

# Preface

Powered by the tremendous advances in technology over the last few years, MR imaging has the potential to go beyond morphology and provide functional information on organs and tumors. One of the most promising techniques is diffusion-weighted MRI (DWI), which has been routine in brain imaging since the early nineties, and is now applied more and more often in body imaging. I developed an interest in DWI when I was a resident; I thought it was fascinating to provide a different "dimension" to morphology. In the last few years, diffusion image quality outside the brain has improved tremendously, as major vendors and many research groups have focused their interest on this technique. While certain clinical applications of DWI – such as tumor detection and characterization – are more or less established and adopted by many academic and non-academic centers, DWI is still in its infancy, and other applications such as diffuse liver and renal disease and tumor treatment response have to be established in larger confirmatory studies. I am pleased to serve as the editor of this book, compiling the most recent information on DWI applied to the body by world-renowned experts in the field. The text is divided by organ, thus making it more easily searchable, and will serve beginners as well as more advanced diffusion users. With this book, we hope to attract more researchers into body diffusion imaging, which has enormous potential particularly in oncology.

*Bachir Taouli, MD*
Department of Radiology,
Mount Sinai Medical School,
New York, USA