# Automated analysis and visualization of preclinical whole-body microCT data

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# Publications

## Publications in international journals

- **Martin Baiker and Thomas J. A. Snoeks**, Eric L. Kaijzel, Ivo Que, Jouke Dijkstra, Boudewijn P. F. Lelieveldt, Clemens W. G. M. Löwik, "Automated segmentation and bone volume and thickness measurements in small animal whole-body MicroCT data", *Accepted for publication in Molecular Imaging and Biology.*

- Peter Kok, **Martin Baiker**, Emile A. Hendriks, Frits H. Post, Jouke Dijkstra, Clemens W. G. M. Löwik, Boudewijn P. F. Lelieveldt, Charl P. Botha, "Articulated Planar Reformation for Change Visualization in Small Animal Imaging", *IEEE Transactions on Visualization and Computer Graphics, 2010, 16(6):1396-1404.*

- **Artem Khmelinskii and Martin Baiker**, Eric Kaijzel, Josette Chen, Johan H.C. Reiber, Boudewijn P.F. Lelieveldt, "Articulated Whole-Body Atlases for Small Animal Image Analysis: Construction and Applications", *Molecular Imaging and Biology, 2011, 13(5):898-910.*

- **Martin Baiker**, Julien Milles, Jouke Dijkstra, Tobias D. Henning, Axel W. Weber, Ivo Que, Eric L. Kaijzel, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Atlas-Based Whole-Body Segmentation of Mice from Low-Contrast Micro-CT Data", *Medical Image Analysis, 2010, 14(6):723-737.*

## Contributions to peer reviewed conferences

- **Martin Baiker**, Marius Staring Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Automated Registration of Whole-Body Follow-Up MicroCT Data of Mice (poster)", *In: Fichtinger, G., Martel, A., Peters, T. (eds.): MICCAI 2011, Part II, LNCS, vol. 6892, pp. 516-523. Springer, Heidelberg.*

- Artem Khmelinskii, **Martin Baiker**, Peter Kok, Jan de Swart, Johan H. C. Reiber, Marion de Jong, Boudewijn P. F. Lelieveldt, "Atlas-based articulated skeleton segmentation of $\mu$SPECT mouse data (oral)", *Proc. IEEE Intl. Symp. on Biomedical Imaging, 2011.*

- Artem Khmelinskii, **Martin Baiker**, X. Josette Chen, Johan H. C. Reiber, Mark R. Henkelman, Boudewijn P. F. Lelieveldt, "Atlas-based organ & bone approximation

for ex-vivo Micro-MRI mouse data: a pilot study (poster)", *Proc. IEEE Intl. Symp. on Biomedical Imaging, 2010, pp. 1197-1200.*

- Martin H. Wildeman, **Martin Baiker**, Johan H. C. Reiber, Clemens W. G. M. Lŵik, Marcel J. T. Reinders, Boudewijn P. F. Lelieveldt, "2D/3D Registration Of Micro-CT Data to Multi-View Photographs Based On a 3D Distance Map (poster)", *Proc. IEEE Intl. Symp. on Biomedical Imaging, 2009, pp. 987-990.*

- **Martin Baiker**, Jouke Dijkstra, Ivo Que, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Organ approximation in $\mu$CT data with low soft tissue contrast using an articulated whole-body atlas (oral)", *Proc. IEEE Intl. Symp. on Biomedical Imaging, 2008, pp. 1267-1270.*

- **Martin Baiker**, Julien Milles, Albert M. Vossepoel, Ivo Que, Eric L. Kaijzel, Clemens W. G. M. Löwik, Johan H. C. Reiber, Jouke Dijkstra, Boudewijn P. F. Lelieveldt, "Fully automated whole-body registration in mice using an articulated skeleton atlas (poster)", *Proc. IEEE Intl. Symp. on Biomedical Imaging, 2007, pp. 728-731.*

# Other conference contributions

- **Martin Baiker**, Brendan Vastenhouw, Woutjan Branderhorst, Johan H. C. Reiber, Freek J. Beekman, Boudewijn P. F. Lelieveldt, "Atlas-Driven Scan Planning for High-Resolution Mirco-SPECT Data Acquisition based on Multi-View Photographs: a Pilot Study (oral)", *Proc. SPIE Medical Imaging, 2009, 7261, 1L, pp. 1-8.*

# Book chapters and other publications

- Eric L. Kaijzel, Thomas J. A. Snoeks, Ivo Que, **Martin Baiker**, Peter Kok, Boudewijn P. F. Lelieveldt, Clemens W. G. M. Löwik, ""In vivo" Molecular Imaging", *in Chemiluminescence and Bioluminescence: Past, Present and Future, Ed. A. Roda, Royal Society of Chemistry 2011, ISBN-13: 978-1847558121.*

- **Martin Baiker**, Jouke Dijkstra, Julien Milles, Clemens W. G. M. Löwik, Boudewijn P. F. Lelieveldt, "Atlas-based whole-body registration in mice", *in Handbook of Biomedical Imaging, Eds. N. Paragios, J. Duncan, N. Ayache, Springer N.Y. 2012, ISBN-13: 978-0387097480, in press.*

- Brendan Vastenhouw, Woutjan Branderhorst, Frans van der Have, **Martin Baiker**, Boudewijn P. F. Lelieveldt, Freek J. Beekman, "Field-of-view definition for focusing pinhole SPECT using optical cameras", *in Simulation, construction and application of focused pinhole small animal SPECT, PhD Thesis, Utrecht University, 2008, ISBN-13: 978-9039349410.*

# Abstracts

- **Martin Baiker**, Thomas J. A. Snoeks, Eric L. Kaijzel, Ivo Que, Jouke Dijkstra, Boudewijn P. F. Lelieveldt, Clemens W. G. M. Löwik, "Automated Segmentation and Bone Volume and Thickness Measurement in Small Animal Whole-Body MicroCT Data (oral)", *World Molecular Imaging Congress 2011, San Diego, USA.*

- Thomas J. A. Snoeks, **Martin Baiker**, Eric L. Kaijzel, Boudewijn P. F. Lelieveldt, Clemens W. G. M. Löwik, "Automated segmentation and bone volume and thickness measurements in small animal whole-body micro-CT scans (poster)", *European Molecular Imaging Meeting 2011, Leiden, The Netherlands.*

- **Martin Baiker**, Jouke Dijkstra, Ivo Que, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Organ approximation in $\mu$CT data with low soft tissue contrast using an articulated whole-body atlas (oral)", *Imagination 2008, Leiden University Medical Center, Leiden, The Netherlands.*

- **Martin Baiker**, Jouke Dijkstra, Ivo Que, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Organ approximation in $\mu$CT data with low soft tissue contrast using an articulated whole-body atlas (oral)", *NVPHBV Meeting 2008, Eindhoven, The Netherlands.*

- **Martin Baiker**, Jouke Dijkstra, Ivo Que, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, "Organ approximation in $\mu$CT data with low soft tissue contrast using an articulated whole-body atlas (poster)", *World Molecular Imaging Congress 2008, Nice, France.*

- **Martin Baiker**, Julien Milles, Albert Vossepoel, Ivo Que, Eric L. Kaijzel, Clemens W. G. M. Löwik, Johan H. C. Reiber, Boudewijn P. F. Lelieveldt, Jouke Dijkstra, "INTEGRIM: a Tool for Matching, Interpretation and Visualization for Fused Micro-CT and BLI imaging of Multiple Animals and Time Points (poster)", *Joint Molecular Imaging Conference 2007, Providence, USA.*

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From May 2007 to April 2011 I was working as a PhD candidate at the LKEB, the Laboratorium voor Klinische en Experimentele Beeldverwerking (Division of Image Processing), in the Section of Knowledge Guided Image Processing, under the supervision of Prof. Dr. Ir. B.P.F. Lelieveldt, Prof. Dr. C.W.G.M. Löwik and Prof. Dr. Ir. J.H.C. Reiber, at the Leiden University Medical Center (LUMC) in Leiden, the Netherlands. This thesis presents the results of the research conducted during this period.

First of all I would like to thank my colleague Vikas who made clear to me, what really counts in a thesis. Once I told him that I had already finished all the chapters and that only the 'Acknowledgements' and the cover were missing. He said, with a grin on his face, that I had done a nice job but that in fact the most important part of the thesis, which would be read by everybody, was still missing. Indeed, going for a PhD means working for 99.9% of the time to produce output that will be read by 0.1% of the people that get the thesis and vice versa: an economic disaster! (Note that I used 99.9% only for illustrative purposes. It didn't actually take me 1.46 days to write this section.) =:-)

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# Curriculum Vitae

Martin Baiker was born in Stuttgart, Germany, in 1978. He graduated *with distinction* from secondary school at the Gymnasium Albstadt-Ebingen (Germany) in 1998 and subsequently fulfilled ten months of social service at a home for seriously handicapped adults. In 1999 he started his studies at the University of Cooperative Education (Telecommunications) in Stuttgart, Germany, received a Bachelor of Science in 2002 and continued his studies in Medical Engineering at the University of Applied Sciences in Ulm, where he received his Dipl.-Ing.(FH) *with distinction* in 2005. His final thesis was conducted at the Department of Anatomy and Embryology at the Leiden University Medical Center (LUMC), Leiden, The Netherlands, on staining methods for chicken embryo vasculature. For this project, he received a scholarship from the German Academic Exchange Service (DAAD). In the same year he enrolled in Biomedical Engineering (Medical Imaging) at the Technical University Delft, The Netherlands, where he finished his studies by receiving a Master of Science degree *cum laude* in 2007. His final project was conducted at the Laboratory for Clinical and Experimental Image Processing (LKEB) at the Leiden University Medical Center, Leiden, The Netherlands, on atlas-based registration of mouse skeletons. Also for this project, he received a scholarship from the German Academic Exchange Service. From 2007 until 2011, he worked towards his PhD at the same department. The results of his research are presented in this thesis.

During his studies, he conducted several internships, including a two month stay at a research lab of the Robert Bosch Corp. in Palo Alto, USA, and a six months stay at the Escola Politècnica Superior de Gandía, Gandía, Spain. Furthermore he worked as a teacher for secondary school (math and physics), in a project involved in the construction of sewer systems and as a student assistant at the Department of Anatomy and Embryology at the LUMC.

His current research interests include preclinical image analysis and visualization, knowledge-guided image registration and segmentation, multimodality image fusion and bioluminescence tomography.