MI Lab Annual Report 2011

Summary

For MI Lab 2011 was a good year.

We now have a broad research activity with a multi-disciplinary group of 31 on-going PhD students and post doctoral fellows, and we continuously get new ideas that have potential for the MI Lab vision of inventions that may facilitate cost efficient health care and improved patient outcome. It is nice to see the competence and enthusiasm of the growing group of MI Lab hired PhD and post doc students. They obtain experience in medical R&D in the crossroad between university, industry and hospital, and will be a future pool for recruitment of high-quality personnel for Norwegian industrial R&D, health care and academia.

The Centres for Research-based Innovation represent a new scheme in which several industrial partners, university and hospital work together in an open research environment. Our experience so far is that we in MI Lab are able to build an arena for open innovation and long-term industrial research with high scientific quality and commitment from the partners. In 2011 this resulted in publication of 34 refereed articles in international journals and important inventions that are in different phases of the patenting and licensing process.

MI Lab wants to be an integrated part of the total ultrasound and MR research environment in Trondheim, and the experience so far is that the interaction is excellent between the MI Lab hired PhD and post doc students and the rest of the medical imaging community in Trondheim. We like to call this the “MI Lab family”.

The MI Lab partner Medistim ASA obtained in 2011 an official recommendation in the United Kingdom of the health benefits of the ultrasound system VeriQ: “The case for adopting the VeriQ system in the National Health System (NHS) for assessing graft flow during coronary artery bypass graft (CABG) surgery is supported by the evidence. The evidence suggests that intra operative transit time flow measurement .. may reduce perioperative morbidity and mortality. The VeriQ system is associated with an estimated cost saving of £115 per patient.”
A main success story for MI Lab has been the new pocket-sized ultrasound scanner from GE Vingmed Ultrasound, Vscan, and in 2011 the first full scientific papers with scientific evidence of the clinical benefits of Vscan were published.
These two landmarks confirm the MI Lab vision that innovations in medical imaging can facilitate cost efficient health care and improved patient outcome at the same time.

Vision

To facilitate cost efficient health care and improved patient outcome through innovation in medical imaging, and to exploit the innovations to create industrial enterprise in Norway.

Research Plan / Strategy

The strategy is to establish a creative melting pot for medical imaging research through:

- bringing together on a daily basis researchers from university, hospital and industry
- establishing a large multi-disciplinary research environment including medicine, ICT, physics, mathematics, cybernetics, electronics, physiology, molecular biology, neuroscience, psychology etc.
- in the same projects combine curiosity driven research and relevance for industry and health care

And that successful innovation for next generation technology will emanate from this integration between research on new technology and research on new clinical practice.

MI Lab has focused on the following success criteria (taken from the RCN “official” list of success criteria for Centres for Research-based Innovation):

- The centre engages in long-term industrial research of a high international calibre, and demonstrates its high quality through its production of doctorates, scientific publications, papers for presentation at recognised international conferences and other forms of scientific merit.
- Researchers from the host institution and partners participate actively in the centre's research. The centre has achieved mutual mobility of personnel between the centre and the user partners.
- The centre's user partners have increased their research activities both through participation in the centre's activities and their own R&D activities on topics of relevance to the centre.
- The centre attends to researcher training effectively, and helps to train highly skilled personnel in the centre's special fields.
- The centre's research has engendered or is expected to engender possibilities for innovation and enhanced competitiveness among user partners and expectations about social ramifications over and above the partners' direct participation in the centre's activities.

The MI Lab research plan is based on the understanding that the most important challenge for the future healthcare is how to exploit the great achievements in medical research in order to improve patient treatment and outcome while containing costs. Medical imaging is central to meeting this challenge, and new technology for improved cost efficacy should be a main focus for imaging research and industrial innovation. Innovation in medical imaging can contribute to improved cost-efficiency on several levels, and MI Lab has chosen to focus on three important areas:

- high quality medical imaging products and applications for non-expert users at the initial point of care
- less complications and more rapid patient rehabilitation with image-guided minimally invasive surgery
- more rapid and more precise choice of efficient treatment through decision-making based on advanced medical imaging.

As advised by the Scientific Advisory Board, MI Lab has chosen to have one “area of focus where it can be the synergistic agent for the creation of new program(s)”. That is basic ultrasound technology and integrating research on hardware, software and transducer arrays. In the coming years breakthroughs in ultrasound technology will cause major improvements of ultrasound image quality, and MI Lab wants to be one of the world leaders in this research area. Research on this next generation ultrasound technology will have long-term benefit for all the MI Lab ultrasound industrial partners as well as the university and hospital research groups involved in research on clinical applications of ultrasound. The MI Lab research on hardware, software and transducer arrays will be tailored to the specific challenges and goals for each industrial partner and research group. This activity is now organized in a new subproject 1.1 called “Ultrasound image improvement” which includes research on transducer arrays, ultrasound probe electronics, software beamforming, parallel imaging & compressed sensing, minimum diffractive wave imaging, model powered acquisition and new technology for flow imaging/quantification, and will also include a transducer workshop.

Inside this framework, MI Lab has the following project structure:

Research Task 1: Ultrasound technology
- Ultrasound image improvement

Research Task 1: Advanced imaging applications for non-expert user
- Cardiac Ultrasound
- Pocket-sized Ultrasound

Research Task 3: Image guided minimally invasive surgery
- Neurosurgery
- Cardiac & Vascular surgery

Research Task 4: Imaging based information to support medical decision making
- Advanced MR methods in clinical diagnosis
- Foetal Ultrasound
- MR in regenerative medicine & nanoparticles for imaging

Organisation

The MI Lab board consistes from June 8, 2011 of:
Eva Nilsen, GE Vingmed Ultrasound, leader
Erik Swensen, MediStim
Atle Kleven, Sonowand
Audun Græsli, Aurotech Ultrasound
Sturla Eik-Nes, St. Olavs Hospital
Stig Slørdahl, NTNU
Asta Håberg, NTNU

There were two MI Lab board meetings in 2011: June 8 and November 10.

On June 8 also were the 2011 MI Lab Annual Assembly for all partners and the MI Lab Corporate Partners Assembly.

Kjell Arne Ingebrigtsen had been MI Lab Board leader since the start in 2007, and he has been a key person for MI Lab success. However, Kjell Arne Ingebrigtsen is now professor emeritus, and he had expressed a wish to leave the board linked to his advice that a younger board leader was important for the processes towards continuation of the MI Lab collaboration after 2014. According to the MI Lab Consortium Agreement, the MI Lab host institution appoints the Board leader, and as new Board leader Eva Nilsen from GE Vingmed Ultrasound was appointed. Eva Nilsen was until this appointment corporate partner representative in the board, and The MI Lab Corporate Partners Assembly appointed Audun Græsli from Aurotech Ultrasound as new corporate partner representative.

The interaction between the MI Lab board, the MI Lab leader and the organisation of the host institution, NTNU, has functioned excellently in 2011. The Faculty of Medicine is host faculty for MI Lab at NTNU, and the dean, Stig Slørdahl, is member of the MI Lab board. MI Lab is co-localised with the Department of Circulation and Medical Imaging and most of the MI Lab hired PhD students, post docs and international guest professors/researchers are formally employed by this department. The head of the department, Øyvind Ellingsen, and MI Lab leader Olav Haraldseth have collaborated closely on a daily basis.

MI Lab also has an "MI Lab leader group" consisting of the MI Lab leader and the senior NTNU personnel that are most involved in the MI Lab activities as subproject leaders and main supervisors for PhD students hired by MI Lab:

- Professor Olav Haraldseth, MD, PhD
- Professor Hans Torp, PhD
- Associate professor Asta Håberg, MD, PhD
- Associate professor Asbjørn Støylen, MD, PhD
- Professor Trond Ytterdal, PhD
- Research Scientist Lasse Løvstakken, PhD
- Research Scientist Bjørn Olav Haugen, MD, PhD

Interactions with the partners

The MI Lab partners at the end of 2011 are:

- NTNU (Trondheim)
- St. Olavs Hospital HF (Trondheim)
- GE Vingmed Ultrasound AS (Horten and Trondheim)
- MediStim ASA (Oslo)
- Sonowand AS (Trondheim)
- Aurotech Ultrasound AS (Tydal and Trondheim)
- Arctic Silicon Devices AS (Trondheim)
- NordicNeuroLab AS (Bergen)
- CorTechs Labs Inc (San Diego, California, USA)

- SINTEF (Trondheim)
- Helse Midt-Norge RHF (Stjørdal)

The MI Lab partner Microsoft Development Center Norway (previously FAST) expressed in a letter dated May 25 2011 their wish to withdraw their participation in MI Lab, and the MI Lab Board decided that their withdrawal was effective from the date of the board meeting June 8, 2011.

The Centres for Research-based Innovation represent a new scheme in which several industrial partners and the university work together in an open research environment. Our experience so far is that we in MI Lab are able to build an arena for open innovation and long-term industrial research with high scientific quality and commitment from the partners. In 2011 this resulted in publication of 34 refereed articles in international journals and important inventions that are in different phases of the patenting and licensing process. In 2012 we expect the first of these inventions to be part of the industrial partners' products.

To foster integration between the partners MI Lab has arranged all-day seminars called MI lab Day twice every year. The aim of this event is to bring together all the partners and all the researchers to a day of science and mingling.
In 2011 there was only one MI Lab Day on November 10 with one international guest speaker: Kevin Brindle from University of Cambridge, UK. Other speakers were: Erik Steen from GE Vingmed Ultrasound, Svend Aakhus from Oslo University Hospital, Sverre Holm from University of Oslo and Bjørn Olav Haugen and Pål Erik Goa (both from St. Olavs Hospital and MI Lab).

How MI Lab results have been utilised by the corporate partners

GE Vingmed Ultrasound (GEVU) is the MI Lab partner with the largest own effort R&D activities, and the most important MI Lab inventions have been in the GEVU scope of business. Five of these inventions have been patented, two are already part of GEVU products (both linked to real-time automatic segmentation of the heart for improved visualisation and user-friendliness), and two are now being licensed to GEVU and will probably be part of GEVU products by the end of the year (both linked to improved visualisation and quantification of cardiac valve leakage).

More important are the many results from the MI Lab activities that has been utilised by the corporate partners in their products without any patenting process.
Some examples are:

- Improved imaging of the vessel lumen in cardiac surgery (benefit of MediStim).
- Preoperative functional MRI information made available for the surgeon in the operation theatre (benefit of Sonowand)
- Access to knowledge about analysis and visualisation methods of pre-operative functional MRI that may help the neurosurgeons in preoperative planning (benefit of Nordic NeuroLab)

- Access to knowledge about user-friendly measurements of diagnostic parameters for heart failure assessment by non-expert ultrasound users (benefit of GE Vingmed Ultrasound)

Especially the SME companies express that the two major benefits of MI Lab have been:

- small incremental improvements of their present products often emanating as spin-off from the long term research activities
- being part of long term research on new technology that may be important parts of next generation products; with the potential of early decisions for adoption and first in the market with major new improvements in technology

Examples of the latter are the on-going MI Lab research activities on:

- New transducer elements in ultrasound probes based on CMUT nanotechnology (benefit of all ultrasound partners)
- Miniaturisation of electronics in ultrasound probes to enable more transducer channels and complex soft-ware based beamforming (benefit of all ultrasound partners and Arctic Silicon Devices)
- Adoption of graphics card technology from computer games to obtain the computing power necessary for complex soft-ware based beamforming (benefit of all ultrasound partners)
- Research on new paradigms for functional MRI of complex cognitive functions in the brain (benefit of Nordic NeuroLab)

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International collaboration and EU projects

A main strategy for strengthening international collaboration is to attach foreign professors and researchers in 20% positions as international guest professors and guest researchers, and by the end of 2011 there were five such positions:

- Guest professor Arend Heerschap, Department of Radiology, Radeboud University, Nijmegen, Netherlands
- Guest professor Anders M. Dale, Multimodal Imaging Laboratory, University of California San Diego, USA
- Guest professor Jan D’hooge, Department of Cardiovascular Imaging and Dynamics, Catholic University Leuven, Belgium

- Guest professor Henrik Larsson, Unit for Functional Image Diagnostics at Glostrup University Hospital, Copenhagen, Denmark
- Guest researcher Jean-Francois Gelly, Parallel Design SA, Sofia Antipolis, France

MI Lab also has had a wish to improve the collaboration with the ultrasound research environment in Oslo (both cardiology and technology), and at the end of 2011 MI Lab had attached two guest professors:

- Svend Aakhus, consultant in cardiology, Olso University Hospital (Rikshospitalet)
- Sverre Holm, Centre for Imaging at the Department of Informatics, University of Oslo

These guest professors and guest researchers are chosen because they have a competence and research experience that is of benefit for MI Lab, and, at the same time, look upon MI Lab as an important possibility for improving their own research activities through active participation in the research environment in Trondheim.

MI Lab has an extensive international network and collaborates with researchers at foreign universities on many different levels. The MI Lab publications 2010-2011 include 65 full scientific papers in international journals with referee. In 13 of these (20%) there is co-publication with foreign professors and researchers. Currently one MI Lab financed PhD student is on research stay at the Semel Institute for Neuroscience and Human Behaviour at University of California Los Angeles.

MI Lab partners have during 2010 been involved in the following EU 7th Framework Programme with research activities closely related to MI Lab:
- "Smart PM, Smart Power Management in Home and Health" ENIAC Joint Undertaking project since 2008. GE Vingmed Ultrasound is partner in the European consortium.
- NEXES - Living Healthily at Home. FP 7 project since 2008, St. Olavs Hospital is partner.
- LUPAS, Luminiscent Polymers for the Ageing Society. New FP 7 project in 2009. NTNU is partner.
- 3MICRON, Three modality contrast imaging using multi-functionalised microballoons, new FP 7 project in 2009, SINTEF is partner.
- 3D Visualisation for Neurosurgery. Nordic NeuroLab is partner.
- NeuroImaging Genetics Biomarkers in Brain Disorders ("S-GeneBrain"). FP7-HEALTH-2010-two-stage. NTNU is partner.
- IIIOS, Integrated Interventional Imaging Operating System, Marie Curie Training Site. NTNU is one of 10 partners.

Recruitment

MI Lab thinks that recruitment of the best students is the main success factor to obtain the scientific goals. The main criteria for candidates to MI Lab PhD and post doc positions are:

- High scientific quality

- Personal abilities for scientific work in a multi-disciplinary research environment and in the crossroad between university, hospital and industry and
- High motivation for work in the relevant MI Lab research tasks and subproject

During 2011 MI Lab financed 31 PhD students/ post doc fellows (25,2 man-years since some of the medical doctors combine PhD/post doc with clinical positions in St. Olavs Hospital).

The balance between between PhD and post doc, between Norwegian and foreign recruitment and the multi-disciplinarity are according to plan:

PhD / post doc	24 / 7
Norwegian / foreign	24 / 7
Medicine / technology & other	12 / 19

The foreign recruitment was from: UK, The Netherlands, France, Greece, Turkey and China (2).
The non-medical students were from: engineering (5), electronics (3), physics (5), mathematics (3), physiology (1), molecular biology (1), and psychology (1)

However, there is a less than satisfactory balance between the sexes:

Male / female	23/ 8 (26 % female)

At NTNU (with Faculty of Medicine as host faculty) there is a PhD programme in medical technology headed by Professor Hans Torp, who is also one of the key professors in MI Lab (and part of MI Lab leader group).

Norwegian Research School in Medical Imaging (MedIm)

To further improve the quality of the PhD training MI Lab leader Olav Haraldseth initiated and is the current leader of the Norwegian Research School in Medical Imaging (MedIm: www.ntnu.no/medicalimaging). The Research Council of Norway (RCN) had an open call for post graduate researcher training programmes [forskerskoler] in 2008, and the Norwegian Research School in Medical Imaging was one of the five appointed (the only in the area of medicine and health and the only at NTNU). It is a collaboration with the universities in Oslo, Bergen and Tromsø and has a total budget of 24 million NOK over 8 years. The researcher school is for all Norwegian PhD students in the area of medical imaging (including MR, ultrasound, PET, image guided surgery, optical imaging and bionanotechnology), and the main aim is to improve the quality of medical imaging research in Norway. This will be achieved through improving national collaboration, multi-disciplinary research, quality of PhD training, and recruitment of the best students (also foreign recruitment).

MI Lab also thinks that the researcher school is an important tool for improved female recruitment to this research area.

Communication

A main concept for MI lab is that all original and important scientific results shall be published as quickly as possible though presentation at international scientific meetings and as papers in international scientific journals with review. The 2011 publication list (see appendix 3 below) contains 34 refereed articles in international journals

MI Lab also has a focus on spreading knowledge about new technology and new methods to the relevant personnel in the Norwegian health care system. The MR, ultrasound and image-guided surgery research environment in Trondheim includes also three National Centres of Competence appointed by the Norwegian Ministry of Health (Helse- og omsorgsdepartementet, HOD).
They are National Centres of Competence in:

- Ultrasound- and image guided therpay
- Functional MRI
- Foetal ultrasound

One of the main tasks of these centres is to spread new knowledge of clinical relevance to the Norwegian health care system through hands-on training, courses and seminars, and they collaborate closely with MI Lab in this context.

Scientific Advisory Board

The MI Lab Scientific Advisory Board (SAB) had its first meeting on January 18, 2010. The board consists of four foreign professors/researchers with expertise in the different areas of the MI Lab research plan.

Two of them have no scientific collaboration with MI Lab:

- Professor Peter Burns, Department of Medical Biophysics, University of Toronto, Canada
- Professor Lars-Åke Brodin, The Royal Institute of Technology (KTH), Stockholm, Sweden

The two others are attached to MI Lab as guest professor/researcher:

- Guest researcher Jean-Francois Gelly, Parallel Design SA, Sofia Antipolis, France
- Guest professor Henrik Larsson, Unit for Functional Image Diagnostics at Glostrup University Hospital, Copenhagen, Denmark

The next meeting in the MI Lab Scientific Advisory Board is planned for October 2012, and the main focus will be on advice concerning continuation of the MI lab collaboration after 2014; research ideas, organization and strategies for obtaining international financing.

Midway evaluation from RCN

Even though the Research Council of Norway (RCN) Midway evaluation of all the 14 Centres for Research-based Innovation was in 2010, we want to repeat some of the citations from Midway evaluation expert panel report:

"The current and proposed research activities of the MI Lab are excellent and cover very well the current medical needs of improvement in ultrasound imaging, MRI and image guided therapy"
"Novel opportunities are being picked up, such as nano-particle based imaging and drug delivery"
"The students constitute an interesting interdisciplinary mix of engineers, physicists, mathematicians and physicians that has the potential to lead to a very fruitful innovative environment."
"The Centre is hosted within a "showpiece" facility within St Olav's Hospital. NTNU is the host institution with excellent facilities concentrated to one floor at St Olav. The Centre is a key component of St Olav's strategy as a healthcare provider."
"The Centre aims to act as a melting pot that is both multidisciplinary and, importantly, bridges academia, the clinic and business. This approach is critical to product innovation in the medical technology area – co-location of the three in a single facility is distinctive .. this is to be applauded and should be recognised as a benchmark for others."

Large infrastructure initiatives

In 2011 The Research Council of Norway funded phase I of **NORBRAIN** with NOK 80 millions. NORBRAIN (The Norwegian Brain Initiative) is a large-scale national research infrastructure in neuroscience that aims to achieve a vertical integration from cellular biology, through systems neuroscience research in animal models to research on patients and human volunteers with advanced MR technology. MI Lab is one of three partners together with the Kavli Institute for Systems Neuroscience in Trondheim (headed by Professor Edvard Moser) and Centre of Molecular Biology and Neuroscience (CMBN) in Oslo.

Similarly, **NorMIT** (Norwegian centre for minimally invasive image guided therapy and medical technologies) is on the RCN roadmap for large-scale national research infrastructures as "investment ready". NorMIT is a collaboration between the Operating Room of the Future (ORF) at St. Olavs Hospital and The Intervention Centre at Oslo University Hospital (Rikshospitalet).

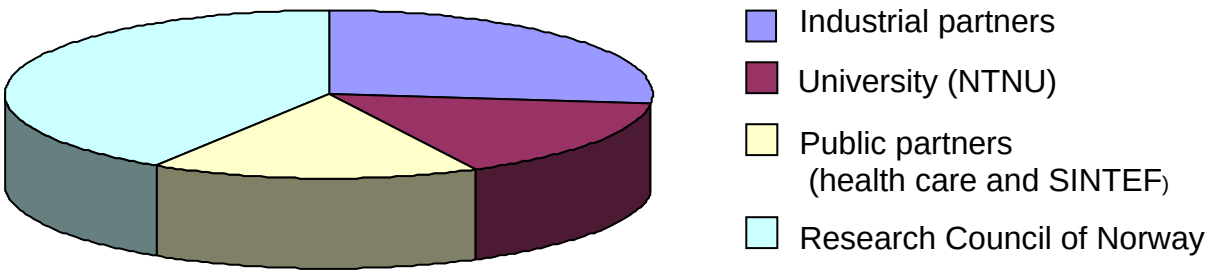
MI Lab is also partner in the "Norwegian EATRIS Centre" established in 2010 as the Norwegian node in the construction phase of the ESFRI European research infrastructure **EATRIS** (European Advanced Translational research Infrastructure in Medicine). MI Lab is also involved in Nor-BioImaging which is the Norwegian participant in the preparatory phase of the ESFRI infrastrcucture **Euro-BioImaging.** Nor-BioImaging is headed by professor Ole Sejersted from Oslo University Hospital, and MI Lab director Olav Haraldseth is official Norwegain contact person for medical imaging in Euro-BioImaging.

APPENDIX 1 - Annual accounts 2011

The total costs in 2011 of 33,8 million NOK (app. 4,4 million Euro) were split between cash contributions of 19,4 MNOK and own effort contributions from the partners (including the host NTNU) of 14,4 MNOK.

The financing split on type of source were:

Industrial partners	27 %
NTNU	16 %
Health care and SINTEF	17 %
RCN	41 %



APPENDIX 2 – MI Lab PERSONNEL 2011

The list includes all participants in research related to the MI Lab research subprojects.

Key Researchers

NAME	INSTITUTION	SEX	MAIN AREA
• Hans Torp	NTNU	M	Ultrasound technology
• Bjørn Angelsen	NTNU	M	Ultrasound technology
• Lasse Løvstakken	NTNU	M	Ultrasound technology
• Svein-Erik Måsøy	NTNU	M	Ultrasound technology
• Trond Ytterdal	NTNU	M	US probe electronics
• Asbjørn Støylen	NTNU & St. Olav	M	Cardiac ultrasound
• Asta Håberg	NTNU & St. Olav	F	Clinical MRI
• Olav Haraldseth	NTNU & St. Olav	M	Clinical MRI
• Ingrid Gribbestad	NTNU	F	Clinical MRI
• Ann-Mari Brubakk	NTNU	F	Clinical MRI
• Marte Thuen	NTNU & NNL	F	MR technology
• Dag Ole Nordhaug	NTNU & St. Olav	M	Cardiac surgery
• Geirmund Unsgård	NTNU & St. Olav	M	Neurosurgery
• Sturla Eik-Nes	NTNU & St. Olav	M	Foetal ultrasound
• Torbjørn Dahl	NTNU & St. Olav	M	Vascular surgery
• Kjell Arne Kvistad	NTNU & St. Olav	M	MR radiology
• Pål Erik Goa	St.Olavs Hospital	M	MR technology
• Anders Kristoffersen	St.Olavs Hospital	M	MR technology
• Toril A. Hernes	SINTEF & NTNU	F	Image guided surgery
• Tormod Selbekk	SINTEF	M	Neurosurgery
• Frank Lindseth	SINTEF	M	Neurosurgery
• Kjell Kristoffersen	GE Vingmed&NTNU	M	Ultrasound technology
• Eva Nilssen	GE Vingmed	F	Ultrasound technology
• Tore Bjåstad	GE Vingmed	M	Ultrasound technology
• Svein Arne Aase	GE Vingmed	M	Ultrasound technology
• Sten Roar Snare	GE Vingmed	M	Ultrasound technology
• Fredrik Orderud	GE Vingmed	M	Ultrasound technology
• Stein Inge Rabben	GE Vingmed	M	Ultrasound technology
• Erik Steen	GE Vingmed	M	Ultrasound technology
• Atle Kleven	Sonowand	M	Ultrasound technology
• Erik Swensen	MediStim	M	Ultrasound technology
• Atle Bjørnerud	Nordic NeuroLab	M	MR technology
• Yngve Kvinnsland	Nordic NeuroLab	M	MR technology
• Audun Græsli	Aurotech	M	Ultrasound technology
• Torbjørn Hergum	Aurotech	M	Ultrasound technology
• Marco Voormolen	Aurotech	M	Ultrasound technology

Visiting Researchers (= guest professors/researchers in 20% position)

NAME	AFILIATION	SEX	MAIN AREA
• Jan D'hooge	Catholic University, Leuven, Belgium	M	Ultrasound technology
• Anders M. Dale	University of California, San Diego, USA	M	MR technology
• Arend Heerschap	Radeboud University, Nijmegen, Netherlands	M	MR technology
• Henrik Larsson	Glostrup Univ. Hospital, Copenhagen, Denmark	M	Clinical MRI
• Jean-Francois Gelly	Parallel Design SA, Sofia Antipolis, France	M	MR technology
• Svend Aakhus	Oslo University Hospital, Norway	M	Cardiac ultrasound
• Sverre Holm	University of Oslo, Norway	M	Ultrasound technology

Postdoctoral researchers with financial support from the centre budget

NAME	NATIONALITY	SEX	SUBPROJECT
• Brage H. Amundsen	Norway	M	2.1
• Bjørn Olav Haugen	Norway	M	2.2
• Håvard Dalen	Norway	M	2.2
• Ingerid Reinertsen	Norway	F	3.1
• Ole Solheim	Norway	M	3.1
• Håvard B. Nordgård	Norway	M	3.2
• Helen Palmer	UK	|F	4.1

Postdoctoral researchers involved in projects in the centre with financial support from other sources

NAME	FUNDING	NATIONALITY	SEX	
• Gabriel Kiss	GE Vingmed	Rumania	M	2.1
• Charlotte B. Ingul	NFR	Sweden	F	2.1
• Niels van Strien	RCN	Netherlands	M	4.1
• Live Eikenes	HMN	Norway	F	4.1
• Hanne Lehn	NTNU	Norway	F	4.1
• Toril E. Sjøbakk	St. Olavs Hospital	Norway	F	4.1
• Else Marie Huuse	NTNU	Norway	F	4.3

PhD students with financial support from the centre budget

NAME	NATIONALITY	SEX	SUBPROJECT
• Tonje Fredriksen	Norway	F	1.1
• Bastien Denarie	France	M	1.1
• Birger Brekke	Norway	M	1.1
• Solveig S. Alnes	Norway	F	1.1
• Jørgen Avdal	Norway	M	1.1
• Zhao Kangqiao	China	M	1.1

• Hans H. Hansen	Norway	M	1.1
• Pang Weng	China	M	1.1
• Engin Dikici	Turkey	M	2.1
• Jon Petter Aasen	Norway	M	2.1
• Joakim Schistad Lund	Norway	M	2.1
• Lars Chr. Lervik Nilsen	Norway	M	2.1
• Anders Thorstensen	Norway	M	2.1
• Ole Chr. Mjølstad	Norway	M	2.2
• Garrett N. Anderson	Norway	M	2.2
• Asgeir Jakola	Norway	M	3.1
• Daniel Høyer Iversen	Norway	M	3.1
• Vigdis Holom	Norway	F	3.2
• Ingvild K. Ekroll	Norway	F	3.2
• Alexander Olsen	Norway	M	4.1
• Jarle Ladstein	Norway	M	4.1
• Tuva Roaldsdatter Hope	Norway	F	4.1
• Ioanna Sandvig	Greece	F	4.3
• Sjoerd Hak	Netherlands	M	4.3

PhD students involved in projects in the centre with financial support from other sources

NAME	FUNDING	NATIONALITY	SEX	
• Siri-Ann Nyrnes	HMN	Norway	F	1.1
• Thomas Skaug	HMN	Norway	M	1.1
• Jochen Deibele	RCN	Norway	M	1.1
• Xu Ye	RCN	China	F	1.1
• Nitin Goyal	RCN	India	M	1.1
• Sigrid Berg	RCN	Norway	F	1.1
• Kamal Raj Chapagain	RCN	Nepal	M	1.1
• Kjersti Midtbø	RCN	Norway	F	1.1
• Hourieh Atarzadeh	NTNU	Iran	F	1.1
• Kjetil Dale	NTNU	Norway	M	2.1
• Lene Annette Rustad	NTNU	Norway	F	2.1
• Sasha Gulati	St.Olavs Hospital	Norway	M	3.1
• Frode Manstad-Hulaas	St.Olavs Hospital	Norway	M	3.2
• Reidar Brekken	SINTEF & HMN	Norway	M	3.2
• Ole Vegard Solberg	SINTEF	Norway	M	3.2
• Lars Erik Bø	SINTEF	Norway	M	3.2
• Kari Ravn Eide	HiST	Norway	F	3.2
• Veronica Berezova	RCN	Czech Rep.	F	4.1
• Emilie Vallee	RCN	France	F	4.1
• Hallvard R. Evensmo	NTNU	Norway	M	4.1
• Ida Antonsen	NTNU	Norway	F	4.1
• Grete Kjelvik	HMN	Norway	F	4.1
• Tor Ivar Hansen	NTNU	Norway	M	4.1
• Guro Giskeødegård	RCN	Norway	F	4.1
• Siver Andreas Mostue	RCN	Norway	M	4.1
• Nicolas Elvemo	NTNU (forskerlinje)	Norway	M	4.1
• Carl Pintzka	NTNU (forskerlinje)	Norway	M	4.1
• Jarle Alexander Møller	NTNU (forskerlinje)	Norway	M	4.1

• Marius Widerø	NTNU	Norway	M	4.3
• Tora Morken	HMN	Norway	F	4.3
• Kristine Skårdal	RCN	Norway	F	4.3
• Jana Cebulla	NTNU	Norway	F	4.3
• Axel Nyman	NTNU (forskerlinje)	Norway	M	4.3

RCN = The Research Council of Norway
HMN = Helse Midt-Norge (the Regional Health Authority of Middle Norway)
HiST = Høgskolen i Sør-Trøndelag

APPENDIX 3 – MI Lab Publications and PhD dissertations 2011

The listed PhD dissertations and full scientific papers cover scientific results from the MI Lab subproject activities. Some of the projects and involved persons are fully financed from MI lab, some are mainly financed from other sources than MI Lab, and some are partly financed from MI Lab and partly financed from other sources.

PhD dissertations 2011

Medical doctors

1. **Ole Solheim.** Ultrasound guided surgery in patients with intracranial tumours.

Technologists & Others

2. **Halvard Høilund-Kaupang.** Models and methods for investigation of reverberations in nonlinear ultrasound imaging.
3. **Benjamin Garzon Jimenez de Cisneros.** Clinical applications of multimodal magnetic resonance imaging.
4. **Ioanna Sandvig.** The role of olfactory ensheathing cells, MRI and biomaterials in transplant-mediated CNS repair.
5. **Sten Roar Snare.** Quantitative cardiac analysis algorithms for pocket-sized ultrasound devices.
6. **Marianne Gjervik Heldahl.** Evaluation of neoadjuvant chemotherapy in locally advanced breast cancer based on MR methodology.
7. **Guro Fanneløb Giskeødegård.** Identification and charcterization of prognostic factors in breast cancer using MR metabolomics.

Publication list 2011

(only full scientific papers in international journals with referee,
and all are registered in the PubMed database at The National Institute of Health, NIH, USA)

1. Hoilund-Kaupang H et al. Transmit beamforming for optimal second-harmonic generation. IEEE Trans Ultrason Ferroelectr Freq Control. 2011 Aug;58(8):1559-69. PMID:21859575
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