



The Intervention Centre Annual report 2013

Oslo University Hospital and
Faculty of Clinical Medicine, University of Oslo



ANNUAL REPORT 2013

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Introducing New Technologies in Medicine



As medicine becomes more complex, the way we change existing practice or adopt new devices require a new comprehensive and controlled approach.

The Intervention Centre was established in 1996 as a common resource for all medical disciplines in their work to improve and change practice in diagnostics and treatment.

At the same time the Intervention centre became a resource for the med-tech industry, where they could discuss new devices and conduct early trials.

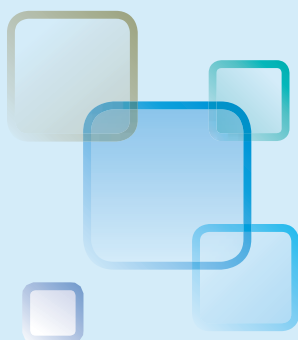
The number of new technology dependent procedures is increasing. In 2013 the Norwegian Health authorities issued new regulations on how new technologies and methods are introduced in hospital. Before adapting a new method a Health Technology Assessment should be made, to ensure that the method is well documented.

Often important issues like economic consequences of the new method and the patients' experience is not well documented. It is then important for the clinicians to provide this information themselves. In order to meet the increasing demand for controlled studies both inside the hospital and in collaboration with the med-tech industry, the Intervention Centre established a section for method development and industrial collaboration (SMI) in 2013.

The new section will help coordinate the resources and establish protocols when new methods and technologies are tried. This will help our hospital to be better prepared for the future and secure safe access to new methods and technologies for our patients.

Erik Fosse
Head of Department

Main goals and objectives

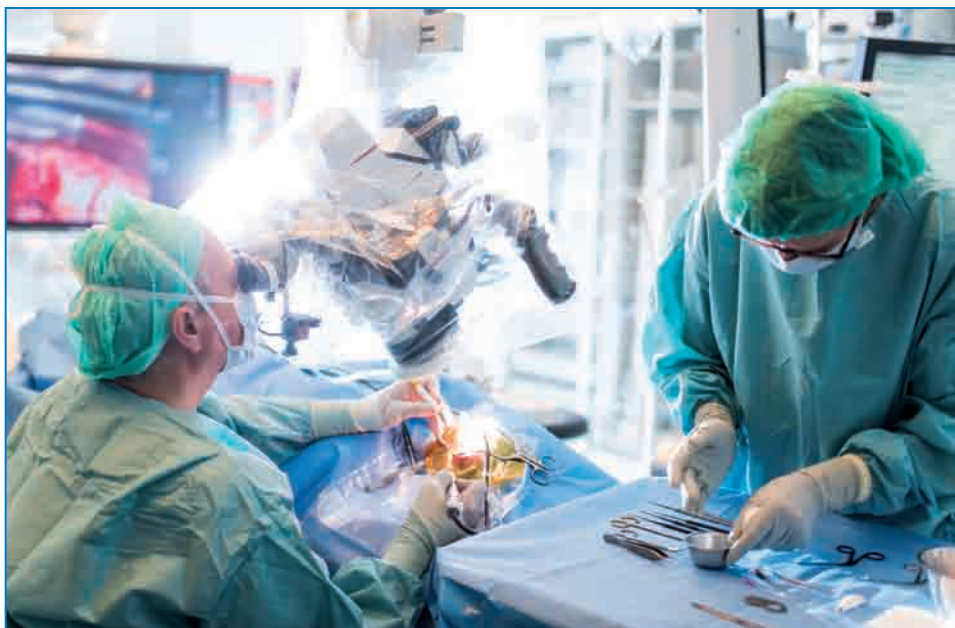


THE CENTRE HAS THE FOLLOWING TASKS:

1. Develop new procedures
2. Develop new treatment strategies
3. Compare new and existing strategies
4. Optimizing and development of advanced imaging techniques
5. Study the social, economic, and organisational consequences of new procedures on health care
6. Administration of radiation protection for all departments in the hospital

RESEARCH AREAS

- MR guided intervention and surgery
- X-ray, CT, ultrasound, video-guided interventions and surgery
- Robotics and simulators
- Sensor technology, data management and communication technology
- Physics in MR, CT, X-ray, US, PET and nuclear medicine



The hybrid OR facilities at The Intervention Centre.

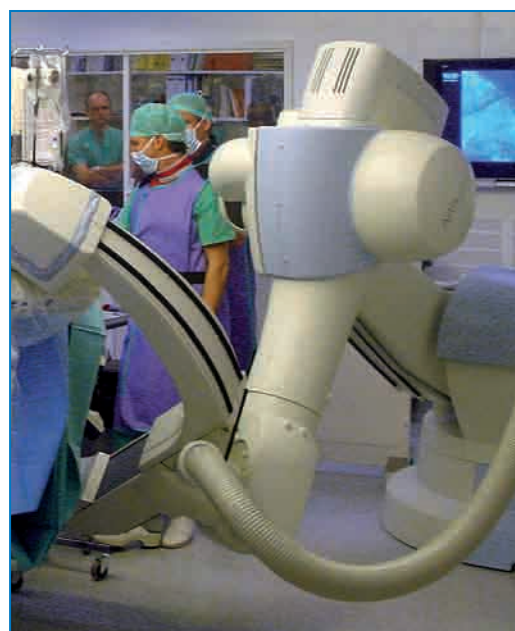
FACILITIES

The Centre is part of the general operation room area at Oslo University Hospital, Rikshospitalet. In addition to human procedures, The Intervention Centre has approval for animal trials in the operation theatres and hybrid suites. The staff is experienced in performing animal trials. In three suites advanced imaging equipment is integrated in an operation room environment.

In 2007, all advanced imaging equipment was renewed. In the combined surgical and radiological suite, the conventional angiographic equipment was substituted by a Siemens Zeego system, based on robotic technology and new advances in imaging and functionality. The Intervention Centre is a test site for their Zeego system. The MRI suite was completely rebuilt into a dual room suite where a Philips 3 Tesla MRI was installed in connection to a state-of-the-art Operation theater. The MRI was funded as a joint effort by the Norwegian Research Council, the University of Oslo and Rikshospitalet. In the videoscopy room all systems are equipped with Olympus HD equipment.

STAFF

The multi-disciplinary staff includes 45 persons (doctors, nurses, radiographers, medical physicists and technologists). Four professors and two associate professors, employed at the Faculty of Medicine and the Faculty of Mathematics and natural sciences of University of Oslo (UiO) and the Department of Electronics and Telecommunication of the Norwegian University of Technology (NTNU), are included among the staff.



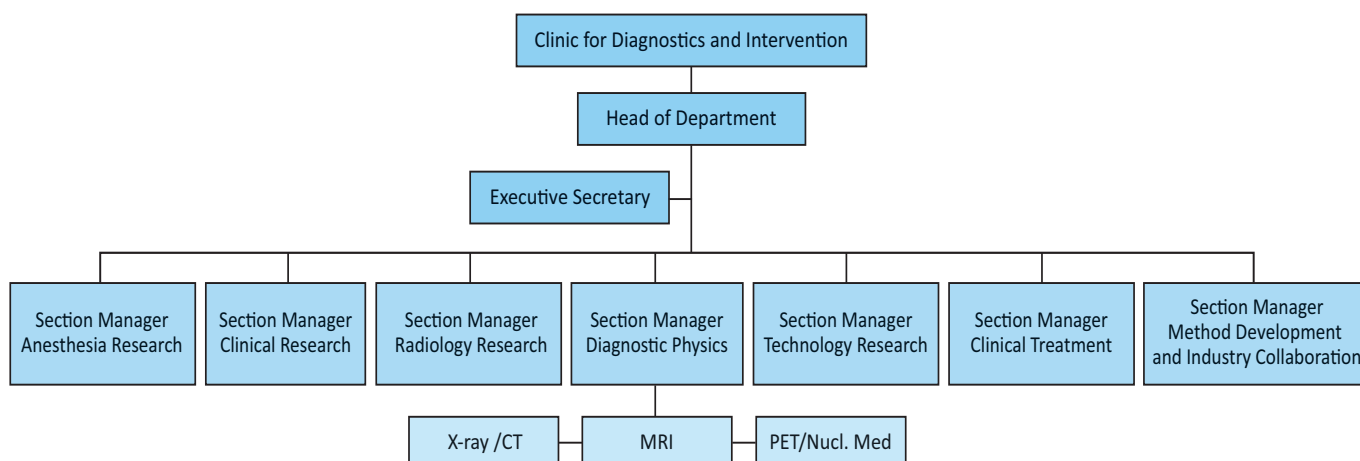
ORGANIZATION

The Intervention Centre is organized in The Clinic for diagnostics and intervention in Oslo University Hospital.

In order to facilitate effective management of multi-disciplinary projects, the personnel and equipment at the Centre are allocated to five sections. All projects in the Centre are allocated to one of these sections, and the project manager is reporting to one section manager. The operation rooms are managed by the unit nursing officer, reporting directly to the head of department. In 2005, Oslo University Hospital established a group

of medical physicists specialized in diagnostic radiology, nuclear medicine and intervention. The establishment was supported by both the Southern and the Eastern Norway regional health authorities.

From 1st January 2010, the section for diagnostic physics was allocated to the Intervention Centre, providing most of the hospitals in the South-Eastern Norway Regional Health Authority with physics services for daily running of the radiology and nuclear medicine departments and for physics research infrastructure.



Section of Diagnostic Physics

Section manager Associate professor Anne Catrine Trægde Martinsen, PhD

At the Intervention Centre, there are 22 physicists employed on regular basis, of whom 10 are working in the fields of CT, X-ray, intervention and radiation protection, 4 are working in the field of nuclear medicine and PET-CT and 8 are working in the fields of MR-physics. This is the largest department of diagnostic physics in Norway, offering a regional service in 38 departments of radiology and nuclear medicine in the South Eastern Health region of Norway.

In addition to quality assurance and radiation protection, the section is co-responsible for the daily follow-up and management of the MR core facility in Oslo University Hospital, and is heavily involved in research in topics as MR-physics, CT-physics, mammography, nuclear medicine including PET-CT, image processing and radiation protection. In addition, comparison studies of different modalities, optimization of radiation protection in pediatrics, interventional radiology and internal dosimetry are also fields of research.



REGIONAL PHYSICIST SERVICE

In 2005, Oslo University Hospital established a group of physicists specialized in diagnostic radiology, nuclear medicine and intervention, serving most of the hospitals in the south-eastern part of Norway. In 2013, the Intervention Centre offered service to all the hospitals in Oslo University Hospital and to 15 hospitals and radiological institutes at 38 locations outside Oslo University Hospital:

Akershus universitetssykehus

Sykehuset Innlandet

Sykehuset Østfold

Telemark

Lovisenberg

Diakonhjemmet

Sunnås

Martine Hansens hospital

Volvat

ALERIS

Feiringklinikken

Glittreklinikken

Helsehuset Kongsberg

Vestre Viken

Unilabs

This is a non-profit service; the salary for physicists and traveling costs related to the work done in a hospital are paid for by the receiving hospital. To the extent that it is feasible each hospital has one contact physicist working together with radiologist and technicians in the radiology department. Multidisciplinary teamwork is one important factor of success.



The services offered are:

- System acceptance tests
- Image quality and radiation dose
- Quality assurance tests performed annually
- Multidisciplinary radiation dose versus image quality optimization projects within: CT, trauma, neuroradiology, intervention, pediatrics, MR, PET and nuclear medicine
- Lectures for surgical personnel using X-ray equipment
- Lectures at the radiological and nuclear medicine departments
- Dose measurements and dose estimates
- Consultancy in purchases of new modalities used in the Radiology- and Nuclear medicine departments.

The economical benefits of a regional physicist service includes reduced personnel needs due to recirculation of lectures, reports and knowledge between the physicists in the group. Also less measuring equipment is

needed in the region due to a centralised pool of equipment. Other regional benefits are the achievement of high competence in CT, X-ray, MR, and nuclear medicine due to the exchange of experience and knowledge from different laboratories and hospitals. Technological problems are solved by experience from previous similar problems in other sites, and development of QA methods and procedures are consolidated in the group of physicists.

COURSES

The section is responsible for three master/PHD courses in physics at the University of Oslo: "FYS 4760 Physics in diagnostic X-ray", "FYS-KJM 4740/9740 MR-theory and medical diagnostics", "FYS 9750 Medical imaging" and one CT post educating course ("ViCT") for radiographers at the University college in Oslo and Akershus (HiOA).

QUALITY ASSURANCE

Methodology for acceptance tests and quality assurance on diagnostic modalities as MR, PET-CT, nuclear medicine, CT, fluoroscopy and X-ray were revised and further developed. In 2013 QA on 384 modalities, from all vendors at the Norwegian market, were performed.

Research Groups

MEDICAL PHYSICS RESEARCH | Section Manager Associate professor Anne Catrine Trægde Martinsen

CT PHYSICS AND TECHNOLOGY

Leader: Associate professor
Anne Catrine Trægde Martinsen, PhD



RESEARCH PROFILE

The group was established in 2012. Up til now, little research on CT has been performed in Norway. The frequency of CT examinations increases and CT examinations accounted for 80% of the total population radiation exposure from medicine in Norway in 2010. Therefore, development of new techniques to improve image quality and simultaneously reducing the radiation dose to patients is required. The main focus of the group is on development of new imaging methods, clinical implementation and further development of new image reconstruction algorithms and image post processing tools, such as CT perfusion, CT spectral imaging and iterative reconstruction techniques.

LONG TERM GOALS

The CT physics and technology research group focuses on the development and implementation of advanced image reconstruction and processing techniques with specific focus on improved diagnostics of patients and at the same time reduced radiation dose. Future objectives are on validation of new methodology, such as iterative image reconstruction, spectral imaging, CT organ perfusion, in terms of improved diagnostic outcome and socioeconomic value.

PROJECTS

HyPerCept – Color and Quality in higher dimensions: *Optimizing visual and diagnostic image quality in radiography*

In the study, we will investigate the transfer of knowledge from color imaging in the media industry to the radiography/radiology arena. Our motive is to develop new models, and re-use established models, for predicting the diagnostic quality of images in terms of the sensitivity and specificity of diagnostic imaging protocols.

Optimization of diagnostic image quality and radiation dose of radiological tomography techniques using advanced post processing reconstruction algorithms

The aim of the study is to introduce new applications to improve image quality and potentially lowering radiation doses to the patient.

The possibility to reduce the radiation dose for head CT using ASIR

The aim of the study is to introduce iterative reconstruction techniques in head CT to improve image quality and potentially lowering radiation doses to the patient.

New method for liver metastasis diagnostics in patients with colorectal cancer (part of the Oslo Comet study)

The aim of the study is to improve the diagnostics of liver metastasis using new features like CT liver perfusion.

Spectral imaging and iterative reconstruction in CT imaging: Image quality and radiation doses

The aim of the study is to introduce new applications in the clinic using new CT reconstruction techniques to improve image quality and lowering radiation doses to the patient.

Interphantom and interscanner variations for Hounsfield units, homogeneity and low contrast detectability in Catphan 500/600

The aim of the study is to analyze the characteristics of the most commonly used QA phantoms, Catphan 500/504/600 (The Phantom Laboratory, NY) and examine possible interphantom and interscanner variations in HU, homogeneity and low contrast detectability.

Lifetime quality of CT scanners from all vendors on the Norwegian market

The aims of the study are: Establishing a complete overview of image quality and radiation dose for CT scanners from all vendors on the Norwegian market, estimate lifetime quality performance for different types of CT scanners from all vendors and evaluate the recommended quality assurance tests and the frequency necessary to ensure safe patient examinations.

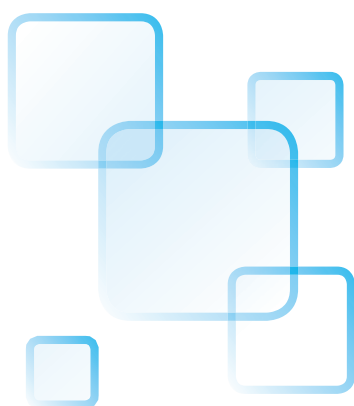
Ultralow dose chest CT

The aim of this study is to compare image quality, radiation dose and laboratory time for chest radiography (CR) with ultra low dose chest CT (ULD-CT) reconstructed with adaptive iterative dose reduction (AIDR 3D).

Monitoring radiation dose to personell and patients during TAVI procedures

GROUP MEMBERS

Kristine Gulliksrud, *PhD Medical physicist*
 Caroline Stokke, *PhD Medical physicist*
 Hilde Kjernlie Andersen, *Medical physicist*
 Ana Maria Acosta Roa, *Medical physicist*
 Siri Fløgstad Svensson, *Medical physicist*
 Mogens Aaløkken, *MD PhD*
 Hilde Olerud, *PhD Associate professor/Head of section, The Norwegian Radiation protection authority*
 Krisin Jensen, *Medical physicist, PhD-student*
 Bjørn Helge Østerås, *Medical physicist, PhD-Student*
 Dawid Mozejko, *Master-student*
 Antonio Pelegrina, *Master-student*
 Yngvild Fadnes Kvaale, *Master-student*



ADVANCED MR NEURO IMAGING

Leader: Professor Atle Bjørnerud, PhD, UiO

RESEARCH PROFILE

The main research focus of the Advanced Neuroimaging Group (ANG) is related to functional MRI applied to different neuropathological conditions. There is currently a particular focus on MR based imaging for diagnosis, prognosis- and treatment response assessment in patients with primary brain tumors (*gliomas*). A multi-centre study for evaluation of diagnostic efficacy of MR based perfusion imaging for diagnosis of gliomas is incorporated in the Norwegian Research Council (NRC) -financed project: Evaluation of functional Magnetic Resonance in the Diagnosis of Brain Tumors for Assessment of Clinical Efficacy (EMBRACE). As part of the EMBRACE project a new prospective study is ongoing, which will assess the clinical utility of advanced MR based imaging methods for evaluation of treatment response in high grade gliomas patients.

The ANG is a multi-disciplinary effort and is collaborating closely with many other groups both internally within the OUS and externally with world-class research groups in Europe and the US. The group also has a close link to industry through collaboration/co-development with software companies (*NordicNeuroLab, Bergen, Norway and CorTechs Labs, San Diego, USA*). The group has filed several patent applications related to novel image processing techniques which have been sub-licensed to our industrial partners. The ANG group members are further involved in a large number of imaging studies ongoing in the Oslo-region. In particular, the group provides MR expertise in several morphometric MR studies where high resolution MRI is used to assess neuro-structural changes related to neurodegenerative disease, Alzheimer's disease and normal aging.

SOFTWARE DEVELOPMENT – NORDICICE

The ANG has over the last years been central in the development of an extensive software package for advanced image processing in MRI, with special focus on dynamic analysis. The software package, called *nordicICE*, is now a commercial product sold in more than 20 countries. *nordicICE* is one of very few medical

image analysis software packages for advanced perfusion analysis with full FDA-approval (510K).

At Rikshospitalet, nordicICE has been fully integrated into (Sectra) PACS and is now an integral part of routine diagnostic MR procedures, including BOLD fMRI, DTI and perfusion analysis. The ANG is currently preparing the nordicICE software package for integration into the next generation Sectra PACS (IDS7) and also focusing on expanding the functionality of the package towards automated tumor segmentation and implementation of advanced statistical methods for computer aided diagnosis (CAD).

PROJECTS

EMBRACE = Evaluation of functional Magnetic Resonance in the Diagnosis of Brain Tumors for Assessment of Clinical Efficacy

SAILOR = Serial Diagnostic Assessments in Glioblastoma Therapy

LOOPS – Mapping the vessel architecture of cancer

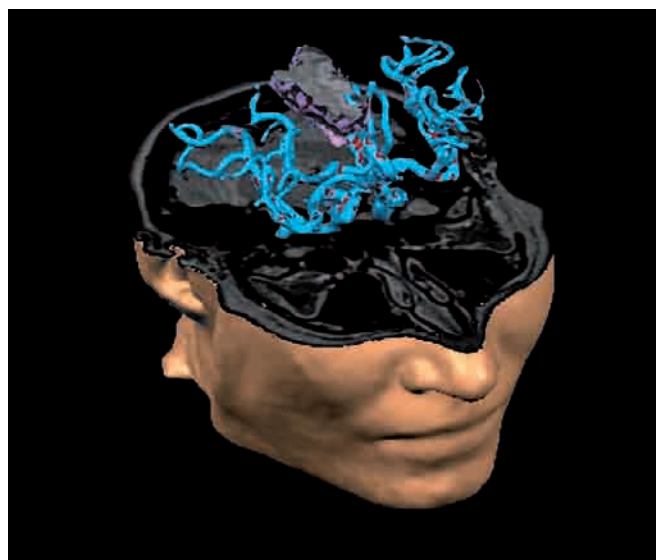
Magnetic Resonance Imaging: A Novel Method for Improved Morphologic and Functional Assessment of Breast Tumors

nordicICE integration in PACS

Quantitative MR-perfusion

Automated white matter lesion quantification

Automated brain tumor segmentation and evaluation



GROUP MEMBERS

PHD STUDENTS

Paulina Due-Tønnessen

Mentors: Atle Bjørnerud, Kyrre Eeg Emblem

Evaluation of functional magnetic resonance in the diagnosis of brain tumors for assessment of clinical efficacy

Tuva Hope

Mentors: Atle Bjørnerud, Inge Groote Rasmussen, Asta Håberg

MR based analysis of functional and hemodynamic parameters in brain tumors

Endre Grøvik

Mentors: Kjell-Inge Gjesdal, Atle Bjørnerud, Kathinka Kurz, Trygve Storaas

Magnetic Resonance Imaging: a novel method for improved morphologic and functional assessment of breast tumors

Christopher Larsson

Mentors: Atle Bjørnerud, Inge Groote

Advanced MRI for assessment of treatment response in glioma patients

Jonas Vardal

Mentors: Atle Bjørnerud, Inge Groote

Optimization and Prognostic utility of Echo-Planar Imaging-based Perfusion- and Diffusion Weighted Magnetic Resonance Imaging Sequences in Assessment of High-Grade Gliomas

Magne Kleppestø

Mentors: Atle Bjørnerud, Inge Groote

Dynamic contrast enhanced magnetic resonance imaging of high-grade gliomas; a systematic evaluation of sequence parameters

Guro Kahrs Rognsvåg

Mentors: Kyrre Eeg Emblem, Atle Bjørnerud

LOOPS – Mapping the vessel architecture of cancer

AFFILIATED PHD PROJECT

Geir Ringstad

Mentors: Per Kristian Eide, Kyrre Eeg Emblem

Imaging CSF dynamics in NPH

MSC STUDENTS

Robin Birkeland Bugge, Ingrid Digernes

SECTION FOR ANESTHESIA RESEARCH | *Section Manager Per Steinar Halvorsen, MD, PhD***CLINICAL ACTIVITY**

The section delivers anesthesia service to all operative procedures at the Intervention Centre and consists of 2 anesthesiologists and 4 nurses.

Anesthesiologists:

Per Steinar Halvorsen
and Viesturs Kerans

Nurse anesthetists:

Anton Amalathasan Josephmary,
Brita Noorland, Kari Westby
and Kjersti Wendt

**CLINICAL AND EXPERIMENTAL CARDIOVASCULAR MONITORING**

Leader: Per Steinar Halvorsen, MD, PhD

RESEARCH PROFILE

The research group aims to develop and test new technologies in cardiovascular monitoring and to evaluate hemodynamic response of new and advanced cardiovascular image guided procedures. New technologies developed or investigated for measuring cardiac function and hemodynamic status include implantable 3D accelerometers, miniaturized ultrasound sensors, novel and radar technology. The sensors are tested in both clinical and experimental models in cooperation with many departments at OUS and external institutions.

PROJECTS

Detection of regional and global myocardial ischemia in cardiac surgery with implantable sensor systems

Evaluation of left and right ventricular function by use of implantable sensors

The effect of therapeutic hypothermia on cardiac function

The role of extra corporeal membrane oxygenation after cardiac arrest

Evaluation of cardiovascular response during and after trans aortic valve implantation (TAVI)

GROUP MEMBERS

The research group consists of six senior researchers, seven PhD-students and two Post Doc.

SENIOR RESEARCHERS

Per Steinar Halvorsen, MD, PhD
The Intervention Centre
Erik Fosse, MD, PhD
The Intervention Centre
Jan Fredrik Bugge, MD, PhD
Department of Anesthesiology and Critical Care Medicine
Helge Skulstad, MD, PhD
Department of Cardiology
Thor Edvardsen, MD, PhD
Department of Cardiology
Svend Aakhus, MD, PhD
Department of Cardiology

PHD STUDENTS

Viesturs Kerans, MD
Ole-Johannes Grymyr, MD
Harald Bergan, MD
Jo Eidet, MD
Stefan Hyler, MD
Siv Hestenes, MD
Itai Schalit, MD

POST DOC

Espen Remme, MSc, PhD
Andreas Espinoza, MD, PhD

SECTION FOR ANESTHESIA RESEARCH

ECONOMIC AND ORGANIZATIONAL
CONSEQUENCES OF NEW PROCEDURES
AND TREATMENTS

Leader: Professor Erik Fosse, MD, PhD

RESEARCH PROFILE

New technology and knowledge has increased the number of treatment options. It also challenges the existing structures in hospital. Catheterbased x-ray guided treatment has allowed cardiologists and radiologists to treat disorders where before open surgery was the only option. The group studies organizational and economical consequences of new methods. This includes changes in hospital organization. Decision making and interaction between the different specialities when new methods are introduced. Cost utility analysis of new methods is also part of the programme.

GOAL

To establish knowledge of how changes in medical technology and methods challenges the health care system, and provide support to the decision makers in Norwegian Health Care.

PROJECTS

Changes in organisation of vascular surgery in the Health South East region and at Oslo University Hospital.

PhD project Kjersti Wendt. Funded by OUS.

Economic and patient and close relative experience outcome after percutaneous pulmonary valve replacement in congenital cardiac disease.

PhD project Brith Andresen.

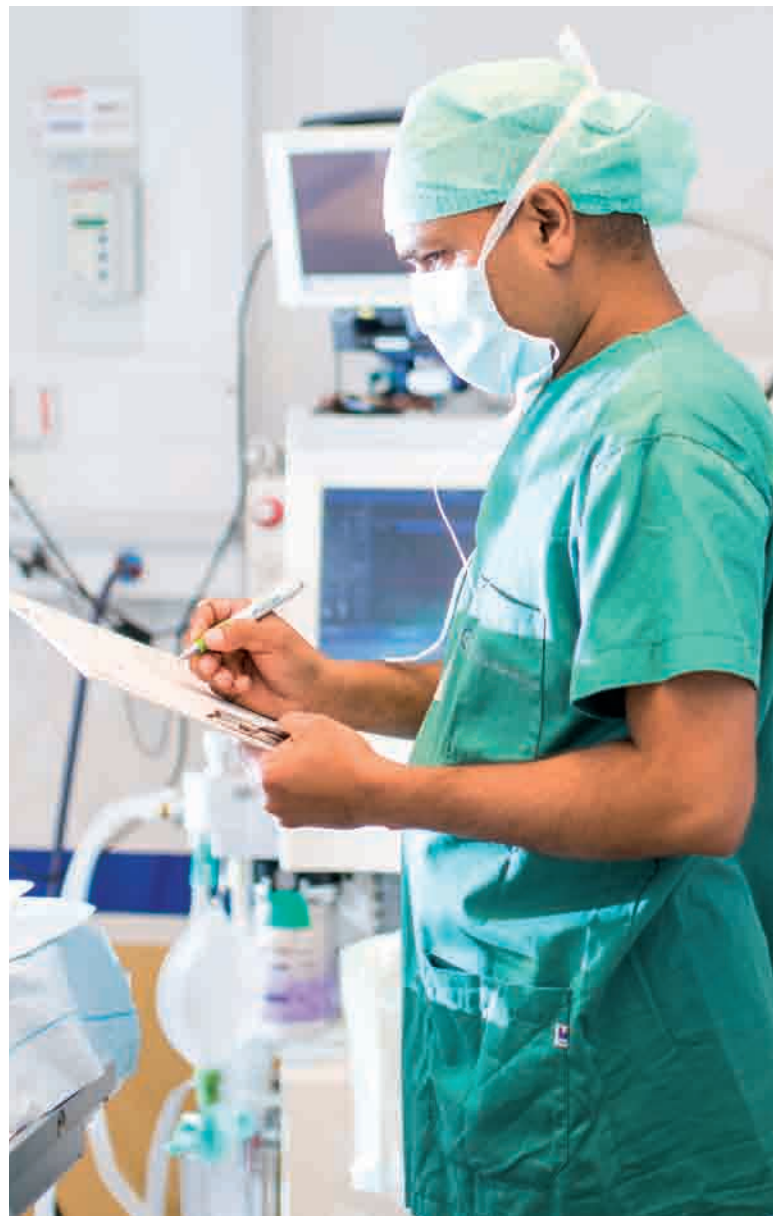
Funded by Helse Sør-Øst research funds.

Fra lokale gjennombrudd i kunnskap til integrasjon i medisinsk praksis (KINT).

PhD project Jasmina Masovic and Olga Mikhailova and one postdoc, Bjørn Erik Mørk, funded by Norwegian research council VERDIKT programme.

GROUP MEMBERS

Bjørn Erik Mørk, *PhD OUS/IFI UIO/BI*
 Kjersti Wendt, *research fellow MSc OUS / Med fak UIO*
 Brith Andresen, *research fellow MSc OUS / Med fak UIO*
 Ivar Sønbo Kristiansen, *professor PhD Inst helseled UIO*
 Jasmina Masovic, *research fellow MSc IFI UIO*
 Olga Mikhailova, *research fellow MSc BI*
 Margunn Aanestad, *professor PhD IFI UIO*
 Håkan Håkansson, *professor PhD BI*
 Per Ingvar Olsen, *ass professor PhD BI*
 Thomas Hoholm, *ass professor PhD BI*
 Vinod Mishra, *consultant PhD OUS*



COMPLEMENT RESEARCH GROUP

Leader: Professor Tom Eirik Mollnes, MD, PhD

RESEARCH PROFILE

The role of complement in human disease

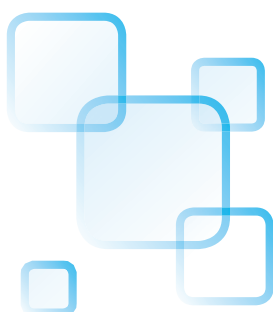
Complement is part of the innate immune system protecting the host against invading micro-organisms. Regulatory control mechanisms normally prevent the system from extensive and systemic activation, thereby protecting the host from self damage. Under various disease conditions complement is improperly activated, either locally leading to tissue damage or systemically with risk of serious homeostatic disturbances.

A primary research goal for the Complement Research Group is to elucidate the role of complement as a primary inducer of the inflammatory reaction and thereby form a basis for a future therapeutic approach in complement-mediated disease processes.

For this purpose we have developed novel assays for detection and quantification of complement activation products based on monoclonal antibodies to activation dependent epitopes on a number of complement components; the most important one being the assay for TCC (*the terminal SC5b-9 complement complex*).

These assays are used to detect complement activation experimentally and clinically and to evaluate the effect of various complement inhibitors in experimental models. In a novel in vitro human whole blood model where all potential inflammatory mediators are able to interact mutually, we are currently studying the effect of complement inhibition on a number of arms of the inflammatory network. In particular we are focusing on the cross-talk between complement and the Toll-like receptors with emphasize on CD14.

The main current projects aim to elucidate the role of complement and CD14 in sepsis, systemic inflammatory response, ischemia-reperfusion injury and transplant rejection. Porcine models for these purposes are established at the Interventional Centre and constitute a major part of the research of the complement group.



BIOSENSOR RESEARCH GROUP

Leader: Professor Tor Inge Tønnessen MD, PhD

RESEARCH PROFILE

Current monitoring methods are insensitive for detection of severe pathology in organs, and there is a major unmet medical need for real-time monitoring at the organ level for detection of pathology at a time when the organ is salvageable. The biosensor research group focus on developing technology for organ implantable sensors and carry out animal and human studies showing that it is indeed possible to detect serious organ events like insufficient blood supply (ischemia), organ rejection, bowel perforation and infection in organs.

We have developed a miniaturized PCO₂ sensor (IscAlert™) that in real time monitors blood supply in the organ. In animal studies it has detected ischemia immediately in the heart after occlusion of the coronary artery, in the liver after occlusion of the hepatic artery, in the intestine after occlusion portal vein and in a model of hemorrhagic shock PCO₂ sensors detected ischemia in all organs they monitored.

IscAlert™ is CE branded and has FDA approval. We have carried out studies with microdialysis catheters in more than 100 liver transplant patients, the largest study of its kind in the world. It was found that the most serious complication, hepatic artery thrombosis, was detected with 100% sensitivity and 100% specificity in close to real time. Rejection was detected with > 90% sensitivity and > 83% specificity 3 – 7 days earlier than current methods. Also conditions like small bowel perforation and organ infection was detected. After Whipple's operation for pancreatic cancer microdialysis catheters are placed near each bowel anastomosis. Preliminary results indicate that anastomosis leakage can be detected several days earlier than with current methods. Thus, treatment can be initiated earlier with better prognosis for the patient.

GROUP MEMBERS

SENIOR RESEARCHERS

Tor Inge Tønnessen, MD, PhD
Runkuan Yang, MD
Håkon Haugaa, MD, PhD

PHD CANDIDATES

Søren Pischke, MD
Gisli Bjørn Bergmann, MD
Lars Holhjem, MSc
Runar Strand-Amundsen, MSc
Faisal Qureshi, Medical student

SECTION FOR METHOD DEVELOPMENT AND INDUSTRIAL COOPERATION (SMI)

Section Manager Jacob Bergsland, MD, PhD



ACTIVITY

The Section was founded to focus and commit resources to the Core Facility which the Intervention Centre has become. With a grant from Health South-East HF, two employees were added to the section including a PhD Project Leader and a MSc in Health Economy.

The section will have an important role in the IVS's role as a Core Facility for development of new procedures and documentation of quality and cost of such procedures.

The section is also responsible for developing the Test-bed facility in cooperation with Oslo Med Tech and other partners, domestically and abroad.

The section will improve further the IVS capacity for research and development as well as its assistance of Norwegian and foreign companies in creation and testing new products and services.

SECTION MEMBERS:

Karl Øyri, MSc
Birgitte Booi, PhD
Milena Lewandowska, MSc
Ronny Kristiansen, MSc

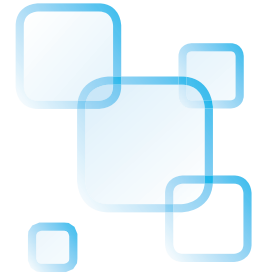
CARDIOVASCULAR SURGERY AND ADVANCED DISTRIBUTED LEARNING

Leader: Jacob Bergsland, MD, PhD

RESEARCH PROFILE

The Main Focus of the group is:

The Group has several active projects. A large OUS based study focuses on outcomes of patients going through Transcatheter aortic valve implantation. Another project is endovascular aortic interventions. A third project is repair of mitral regurgitation by Mitraclip. These three projects are performed together with the Departments of Thoracic Surgery, Cardiology and Radiology.



A development project done together with the University College of Oslo's School of Engineering is developing a new catheterbased instrument for mitral valve repair. This project has engaged 8 engineering students and several professors from Oslo University College. The group is participating in many international research constellations focused on implantable sensors and actuators.

The group has been main partner in international development projects of technological and medical character. Together with partners in Bosnia and Herzegovina an E-Health portal was developed (www.ezdravlje.org). The project was funded by the Ministry of Foreign affairs.

A project for advanced simulation training of endoscopic surgery and a corresponding E-learning portal is in progress together with SimSurgery, a company based in Oslo. This project is presently on hold.

HERD project. This is a technological project run by four partners – two in Bosnia and Herzegovina (Universities of Banja Luka and Tuzla) and two in Norway, Buskerud University College and The Intervention Centre. The project is focusing on electro-engineering.

THE GROUPS LONG TERM GOALS

The groups long term goal is to develop and test new minimally invasive methods of cardiovascular therapy, and improving health care by developing sensors and on-line medicine. Sensortechnology combined with E-Health solutions are thought to be of major importance in the near future and IVS is in the forefront in this area.

PROJECTS

Transcatheter aortic valve implantation

Project to develop quality of life, cost and risk/benefit ratios of the new procedure compared to traditional surgery.

Mitraclip

Evaluation of clinical value of the Mitraclip device.

BIPS

A project led by SimSurgery Development and validation of advanced distributed learning.

Ultrasonder

A project to develop an implantable sensor which can be charged and communicate by ultrasound with an outside control unit. To be used in chronic congestive heart failure.

E-Helse portal in Kosovo

Planned project for the development of an E-Health Portal for Kosovo, based on the experience from the Health Portal in Bosnia.

HERD

Higher Education Research and Development for BIH. Project with BUC (Buskerud University College). Cooperation project between the Norwegian partners and Universities in Banja Luka and Tuzla, BIH.

New method for endovascular repair of the Mitral valve

Project with Oslo University College, Dept of Engineering. Development of a method for chordal replacement.

Pill capsule/camera technology for diagnosis of colonic pathology

Planned project with major International technology company.

COLLABORATIONS

The group cooperates closely with multiple departments in Oslo University Hospital, other Norwegian Universities in addition to University of Oslo and international academic and corporate organizations.

GROUP MEMBERS

Jacob Bergsland, MD, PhD, Cardiothoracic Surgeons

Karl Øyri, Research Nurse

Ilangko Balasingham, Professor, PhD

Hugues Fontenelle, PhD

Peyman Mirthaheri, Professor at HiO, PhD

Samir Delibegovic, Professor at UKC, Tuzla, MD, PhD

Zoran Gajic, M.Sc, CEO Exit Centre, Responsible

E-Health Initiative, BIH

Emir Mujanovic, MD, PhD, Chief of Surgery,

BH Heart Centre, BIH



SECTION FOR CLINICAL RESEARCH | *Section Manager professor Bjørn Edwin, MD, PhD*



CLINICAL ACTIVITY

The Section for Clinical Research is responsible for the ongoing clinical projects at The Intervention Centre. Together with the full time employees (one surgeon, four OR nurses, one OR assistant and four PhD students) we provide guidance and help in minimal invasive surgery and in design of studies for departments using the Centre.

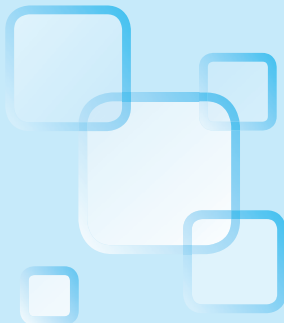


IMAGE-GUIDED SURGERY AND MINIMAL INTERVENTION

Leader: Bjørn Edwin, professor, MD, PhD

RESEARCH PROFILE

Development and assessment of minimal invasive therapy in all surgical fields.

Development and assessment of local ablation in liver malignances, Cryotherapy, Radio frequency ablation and High Intensity focused ultrasound (HIFU).

Development of and assessment of Implants from Bio-medical material, (percutaneous implants for stomas).

Development and assessment of a 3D map for liver and pancreas used to navigate before and during the navigation.

Development and assessment of a new database platform including possibilities to make data from this platform anonymous and use them in public search engine, e.g. PubGen.

Development and assessment of training programs for laparoscopic and single port surgery (LESS).

LONG TERM GOALS

Completion of mentioned research program. Initiate, stimulate and assess more advanced minimal invasive procedures, e.g. Whipple's procedure and advanced liver resections. Assessment of 3D vision to see if 3D will simplify laparoscopic surgery. Assess use of robots in surgery.

PROJECTS

OsloCoMet-study:

Oslo randomized laparoscopic vs. open liver resection for colorectal metastases – study.

Study 1: Surgical stress and Immunosuppression

To compare stress and immunosuppression following laparoscopic and open liver resection.

Study 2: Immediate and short term outcomes

To compare intraoperative and early postoperative outcomes, and immediate oncologic outcomes.

Study 3: Postoperative pain and quality of life

- To compare health related quality of life before the procedure, on 2nd postoperative day and in 4, 8, 12 months after the procedure.
- To compare pain on the 2. postoperative day and after 1 month.

Study 4: Repeat resections

To define and compare surgical outcomes and major oncologic indexes between sub-groups of repeat resections.

Studies 5-6: Long term oncologic outcomes

- To define and compare major oncologic indexes in the 3 and 5 year follow-up period (Study 5).
- To define and compare major oncologic indexes in 10 year follow-up period (study 6).

Study 7: CoMet Mol

The aim is to perform molecular characterization of biological samples harvested perioperatively (Biobank) and during follow-up and results correlated with clinical end points.

Study 8: CoMet anti-tumor immunology

The aim is to evaluate immunological parameters related to anti-tumour immunity and inflammatory factors.

Study 9: CoMet Imaging

The aim is to compare CT perfusion to conventional CT and MRI, with respect to the detection of liver metastases from colorectal carcinoma.

Project TAVI**Project MitraClip****Project MecMed** (COREMINE/Metajournal)**Project 3D map and navigation** (liver and pancreas)**GROUP MEMBERS**

Trond Buanes, *Prof.*
 Kjersti Flatmark, *MD, PhD*
 Åsmund Avdem Fretland, *MD*
 Marit H. Andersen *MN, PhD*
 Bjørn Atle Bjørnbeth, *Leader, MD, PhD*
 Bård Røsok, *MD, PhD*
 Anne Waage, *MD, PhD*
 Olaug Villanger, *MD, PhD*
 Knut Jørgen Labori, *MD, PhD*
 Dejan Ignjatovic, *MD, PhD*
 Milan Spasojevic, *MD*
 Airazat Kazaryan, *MD, PhD*
 Leonid Barkhatov, *MD*
 Karl Øyri, *Research fellow*
 Stig Ronny Kristiansen, *(IT)*
 Erik Næss-Ulseth (*PubGene*)
 Kjell Arne Rein, *MD, PhD*

Gry Dahle, *MD*
 Cecilie Våpenstad, *MSc*
 Astrid Jones Lie (*PubGene*)
 Sven Petter Haugvik, *MD*
 Ivar P. Gladhaug, *Prof.*

PHD CANDIDATES

Irina Pavlik Marangos
 Airazat Kazaryan
 Åsmund Avdem Fretland
 Tom Nordby
 Kim Ånonsen
 Milan Spasojevic
 Sven Petter Haugvik
 Leonid Barkhatov
 Mark Shmarvonyan
 Martin Johansson
 Rahul P. Kumar
 Hilde Kjernlie Andersen
 Jens Marius Næssgård

COLLABORATION

SimSurgery, Oslo

National Competence Centre for Ultrasound and Image guided Therapy, NTNU, Trondheim

Department of Tumor Biology,
 Radiumhospitalet, OUS

PubGene AS, Oslo

A strong cooperation between the different research groups in The Intervention Centre

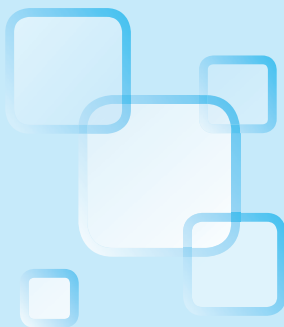
Prof Robert Troisi
 Dept. of General and Hepato-Biliary Surgery and Liver Transplantation Service
 Ghent University Hospital Medical School
 Belgium

Ass. Prof Mohammad Abu Hilal
 Faculty of Medicine, Southampton University
 Research and development lead for Surgery
 Southampton University hospital
 Great Britain

Dr Luca Aldrighetti, Chief of Liver Unit
 Department of Surgery, Scientific Institute
 San Raffaele, University Vita-Salute San Raffaele
 Milan, Italy

SECTION FOR RADIOLOGY RESEARCH | *Section Manager professor Per Kristian Hol, MD, PhD***CLINICAL ACTIVITY**

At The Intervention Centre one radiologist and three radiographers are employed full-time. The section is responsible for radiological service to all users of the centre, and the daily operating of the angiographic equipment in the hybrid suite and of the 3T MR.

**IMAGING RESEARCH AND IMAGE GUIDED INTERVENTION**

Leader: Per Kristian Hol, MD, PhD

RESEARCH PROFILE

A number of research projects using the 3T MR scanner or the combined angiographic suite are performed in corporation with different academic partners, including Departments of Neuropsychiatry and Psychosomatic Medicine, Oncology, Ear Nose and Throat, Neurosurgery, Neurology, Anesthesiology and Radiology.

The research topics cover brain, spine, liver, prostate, brachial plexus and inner ear.

A total of 11 PhD programs used the angiographic suite or the MR scanner for their research in 2013:

Cand. Med. Trygve Kjelstrup:

Axillary plexus block, nervestimulator, ultrasound and MRI

Mentors: Øivind Klaastad, Department of Anaesthesiology, and Per Kristian Hol, The Intervention Centre, Oslo University Hospital

Cand. Med. Torbjørn Elvsåshagen:

Neuroplasticity in patients with bipolar disorders

Mentors: Ulrik Frederik Malt and Stein Andersson, Department of Neuropsychiatry and Psychosomatic Medicine, Oslo University Hospital. Espen Dietrichs, Department of Neurology, Oslo University Hospital. Ole Andreassen, Institute of Psychiatry, University of Oslo

M.Sc. Ralf Greisiger:

Cochlear Implants and DynaCT imaging

Mentors: Greg E. Jablonski and Terje Osnes, Dept. of Ear Nose and Throat, Oslo University Hospital. Ole Jacob Elle and Per Kristian Hol, The Intervention Centre, Oslo University Hospital and Jon K. Shallop, Mayo Clinic Medical School

Cand. Med. Jarle Sundeth:

Factors affecting the results of surgical treatment of cervical disc prolapse

Mentors: Frode Kolstad, Department of Neurosurgery and Øystein Nygård, Trondheim University Hospital

Cand. Med. Karolina Ryeng Skagen:

The vulnerable carotid artery plaque

Mentor: David Russell, Department of Neurology, Oslo University Hospital

Cand. Med. Geir Ringstad:

Assessment of Intracranial Pulsatility and Cardiac-beat Intracranial Volume Change using MRI

Mentors: Per Kristian Eide, Department of Neurosurgery, Kyrre E. Eble, The Intervention Centre, and Noam Alterin, University of Miami, Florida, USA

Astrid Almaas, Elin Blakstad, Sissel Moltou and Kenneth Strømmen:

Nutrition, growth and development of premature children

Mentor: Christian A. Drevon, Department of Nutrition, Institute of Basic Medical Sciences, University of Oslo

Cand. Psych. Gudmundur Skarphedinsson:

In vivo MR spectroscopy as a neuroimaging diagnostic study in children and adolescents with obsessive-compulsive disorders

Mentor: Tord Ivarsson, Regionsenter for barn og unges psykiske helse (PBUP Øst og Sør)



MR GUIDED HIGH INTENSITY FOCUSED ULTRASOUND TREATMENT

Leader: Per Kristian Hol, MD, PhD

RESEARCH PROFILE

High Intensity Focused Ultrasound (HIFU)-therapy is completely non-invasive as the ultrasound energy is delivered outside the body, but focused in defined areas in an organ.

MR provides three-dimensional treatment planning and real-time temperature feedback. Integrating HIFU in MR-scanners melds the technology for visualization and treatment, optimize the procedure and increase the therapeutic potential of HIFU treatment.

The 3 T MR at the Intervention Centre has integrated HIFU equipment as part of a research agreement with Philips Medical Systems. Focus has been on both basic and clinical research projects. Organs to be studied have been uterus (uterine fibroids), liver and prostate.

GROUP MEMBERS

SENIOR RESEARCHERS

Per Kristian Hol, MD, PhD
Bjørn Edwin, Professor, MD, PhD
Erik Dorenberg, MD, PhD
Frederic Courivaud, PhD
Tryggve Storås, PhD

PHD CANDIDATE

Ulrik Carlig, MD

COLLABORATIONS

Philips Medical System

Dept of Radiology, OUS

(Eric Dorenberg, MD, PhD, and Erik Rud, MD)

Dept of Gynecology, OUS

(Kirsten Hald, MD, PhD, and Eva Ring, MD)

Dept of Urology, OUS Aker

(Viktor Berge, MD, PhD, and Eduard Baco, MD)

Norwegian School of Veterinary Science

(Professor Lars Moe)

Dept of Pathology, OUS Radiumhospitalet

(Professor Aud Svindland)



SECTION FOR RADIOLOGY RESEARCH

NEURO COGNITIVE IMAGING

Leader: Associate professor Tor Endestad



RESEARCH PROFILE

The fMRI group at the research group for cognitive and clinical neuroscience at the department of Psychology, UiO work with basic research related to cognitive functions.

The group is engaged in the study of memory and cognitive control. In one of the programs studies of early visual memory are combined with attention to better understand the building block of the human memory system. In addition memory errors (false memories) and the relationship between executive functions and impulse control are studied. Both patients with focal brain injuries and psychological disturbances are included in the research. In another line of projects studies of brain damaged patient address frontal lobe damage, hormone influence on cognitive functions. In 2013 projects on bio-feedback, post traumatic stress disorder (PTSD), and depression has been included.

Several projects with cooperation between the Centre and Oslo University Hospital (FRONT, Cerebellum) were continued in 2013.

In addition to basic research, the group participate in the development of functional MRI as part of pre-surgical planning and improvement of neuropsychological diagnostics.

PROJECTS

PHD:

Visual working memory

PhD student: Dag Alnes

Principal res: Tor Endestad, Bruno Laeng

FRONT Frontal Lobe Injury and cognition

PhD Student: Marianne Løvås, Ingrid Funderud

Principal Res: Tor Endestad, Anne Kristin Solbakk, Magnus Lindgren.

Marianne Løvås finalised in 2012

Ingrid Funderud finalised in 2013

Cerebellar damage and cognitive control

PhD Student: Torgeir Moberget

Principal Res: Tor Endestad, Stein Anderson

Positive and negative placebo

PhD Student: Dan Mikael Ellingsen

Principal Res: Tor Endestad, Siri Leknes

Finalised in 2013

Genetics of depression

PhD: Rune Jonassen

Principal Res: Tor Endestad, Nils Inge Landrø

POST DOC:

Parametric BOLD activation in multiple object tracking: Prediction of individual differences in attentional performance

Post Doc: Thomas Espeseth. PhD: Dag Alnes

Embodied cognition in the study of language

Post Doc: Marit Lobben

PTSD after traffic accidents

Post Doc: Inez Blix

ADHD and Decision making

Post Doc: Guido Biele and Inge Rasmussen

Phd: Anastasia Movinkel, Mads Pedersen

Med Stud: Mats Fredriksen

MASTER:

Unconscious processing of emotions

Master student Laura Bakke

Principal Res: Tor Endestad, Bruno Laeng

Finalized in 2013

Language and cerebellum damage

Master student Eva Hilland

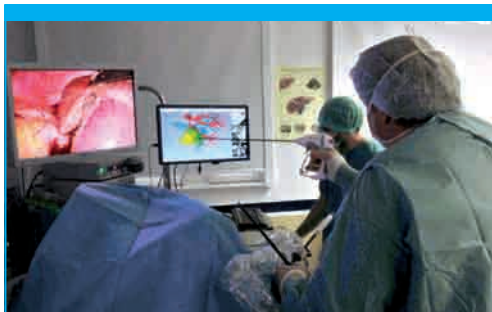
Principal Res. Tor Endestad, Torgeir Moberget

Finalized in 2013

fMRI as neurofeedback

Master Student: Andre S. Nilsen

SECTION FOR TECHNOLOGY RESEARCH | *Section Manager Ole Jakob Elle, associate professor, PhD*



FOCUS

The Section for Technology Research at The Intervention Centre aims to develop cutting edge technological solutions which support minimally invasive procedures and intra-operative monitoring.

In addition to the research group members, the section has 4.3 permanent employees with various technological backgrounds supporting research at the operating suites, all with PhD degree and 20% academic positions as professors or associate professors.

The R&D covers a span of different technologies like biosensor technology and communication technology including wireless communication, image processing and visualisation, navigation technology and robotics.

What is a common aim is that the technology is mainly focusing on solutions for intra-operative use. The solutions should give more information to the surgeon, such as sensor information and image information, during intervention and presenting this information by real-time visualization.

MEDICAL ROBOTICS, VISUALISATION AND NAVIGATION

Leader: Associate professor Ole Jakob Elle, PhD

RESEARCH PROFILE

Most minimally invasive procedures restrict the access and direct vision to the regions which require surgery. Such procedures require intraoperative image modalities such as ultrasound or endoscopic images to be able to monitor the surgery real-time. In many cases this information is not sufficient to perform the procedure accurately and safely. Merging information acquired pre-operatively, mainly from for instance MRI, CT or PET, with intra-operative data can increase the basis for decisions and thereby improve the safety and accuracy of the procedure.

The Medical Robotics, visualization and navigation group develops cutting edge technological solutions which support minimally invasive procedures. The research focus is on image processing methods that are key elements in any software system which supports minimally invasive procedures. In particular, we are focused on developing real-time image-segmentation and – registration methods where segmentation methods finds important anatomical structures such as tumors and vessel structures in images, while registration methods enables fusion of images.

Visualization and navigation is required to present the medical images to the surgeon intra-operatively. We are developing visualization systems which use advanced techniques such as augmented reality and volume rendering for this purpose.

Robotic surgery which so far primarily has been tele-manipulators like Da Vinci, will in the future in addition to use real-time sensors like force/torque, inertia (accelerometer/gyro) and 3D video be more and more cross-linked with medical image information and move toward automation of surgical procedures. The research group is doing research in all these fields of technology facilitating minimally invasive surgery.

LONG TERM GOALS

The research group aims to be nationally and internationally leading research environment in technological solutions for image guided minimally invasive treatment. The group will strive to have competent personnel within the following technological areas:

- Real-time Image-processing
(*image- and video analysis, segmentation...*)
- Real-time volume visualisation

SECTION FOR TECHNOLOGY RESEARCH

- Navigation technology
- Robotic technology
- Real-time sensing
- Technology support to Minimally Invasive Treatment in the hybrid OR's in general

The research group want to further extend the national and international research networking by applying research grants as coordinator through NFR and EU-calls as well as participating in consortiums within EU initiatives.

The group will strive towards increasing the number of publications in peer reviewed journals and conferences of high standing.

PROJECTS

The section is partly financed through the hospital (permanent staff), but to a larger extent through projects funded by NFR and EU. We are currently participating in 3 EU-projects as well as several NFR-projects and projects financed by Innovasjon Norge.

NorMIT

NFR funded the two-node (St.Olavs Hospital (FOR) and The Intervention Centre, OUS) national infrastructure for minimally invasive therapy. Part of this funding is the establishment of a national Navigation Platform for image guided threatment led from the research group at IVS.

HyperCept

The research group has a collaboration on video processing in Video assisted surgery with Norwegian Colour and Visual Computing Laboratory, Faculty of Computer, Science and Media Technology Gjøvik University College. Two PhD fellows are connected financed through the HyperCept-project (NFR), one with main supervision from the research group and the other co-supervised from the same.

IIIOS

(Integrated Intra-operative Imaging Operating System): The scope of the IIiOS consortium is to provide technology and training for the integration of ultrasound and bio-photonics based imaging guidance with magnetic resonance imaging (MRI), Computed Tomography (CT)

and Positron Emission Tomography (PET) to define the specs of an Integrated Interventional Imaging Operating System (IIIOS) aimed at minimal invasive treatment of common life-threatening disorders, e.g., cancer, cardiovascular disease and structural heart defects.

SCath (*Smart Catheterization*):

SCATH aims to provide the interventionalist with visual and haptic tools for robust and accurate catheter guidance, which will be developed through novel approaches, by fusing preoperative patient-specific anatomical and mechanical models and intra-operative data streams from in situ sensors.

I-SUR (*Intelligent Surgical Robotics*):

This project addresses a very complex problem that can be expressed in a very simple form: is it possible to automate surgery? To explore the feasibility of a solution to this problem, in this project we develop general methods for cognitive surgical robots capable of combining sensing, dexterity and cognitive capabilities to carry out autonomously simple surgical actions, such as puncturing, cutting and suturing.

COLLABORATIONS

- University of Dundee
- University of St. Andrews
- Norwegian University of Science and Technology
- University of Homburg, SAAR
- Delft University of Technology
- MR Comp GmbH
- University of Lubeck
- Fakultni Nemocnice u sv. Anny v Brne
- GE Medical Systems
- Katholieke Universiteit Leuven, Leuven, Belgium
- Zürcher Hochschule für Angewandte Wissenschaften, Winterthur, Switzerland
- Imperial College London, London, United Kingdom



- Institute of Biomechanics,
Center of Biomedical Engineering,
Graz, Austria
- Endosense SA, Geneva, Switzerland
- Scuola Superiore Sant'Anna, Pisa, Italy
- University of Verona
- Oslo University Hospital
- Tallin University
- San Raffaele Hospital
- Yeditepe University
- ETH Zurich
- King's College London
- University of Oxford
- GE Vingmed
- Cascination
- Sintef Medical Technology
- Sheffield Hallam University
- Universidad de Zaragoza
- Universidad politecnica de Madrid

GROUP MEMBERS

Ole Jakob Elle, *Section Manager
Technology Research Associate. Prof., PhD*

Frederic Courivaud, *Senior Researcher, PhD*

Espen Remme, *Senior Researcher, PhD*

Laura Slaughter, *Senior Researcher/Ass. Prof., PhD*

Hugues Fontenelle, *Senior Researcher, PhD*

Phuong Nguyen, *Postdoc, PhD*

Rafael Palomar, *Researcher/Software
developer, MSc*

Rahul Kumar, *PhD fellow, MSc*

Abubakr El Dirdiri, *PhD fellow, MSc*

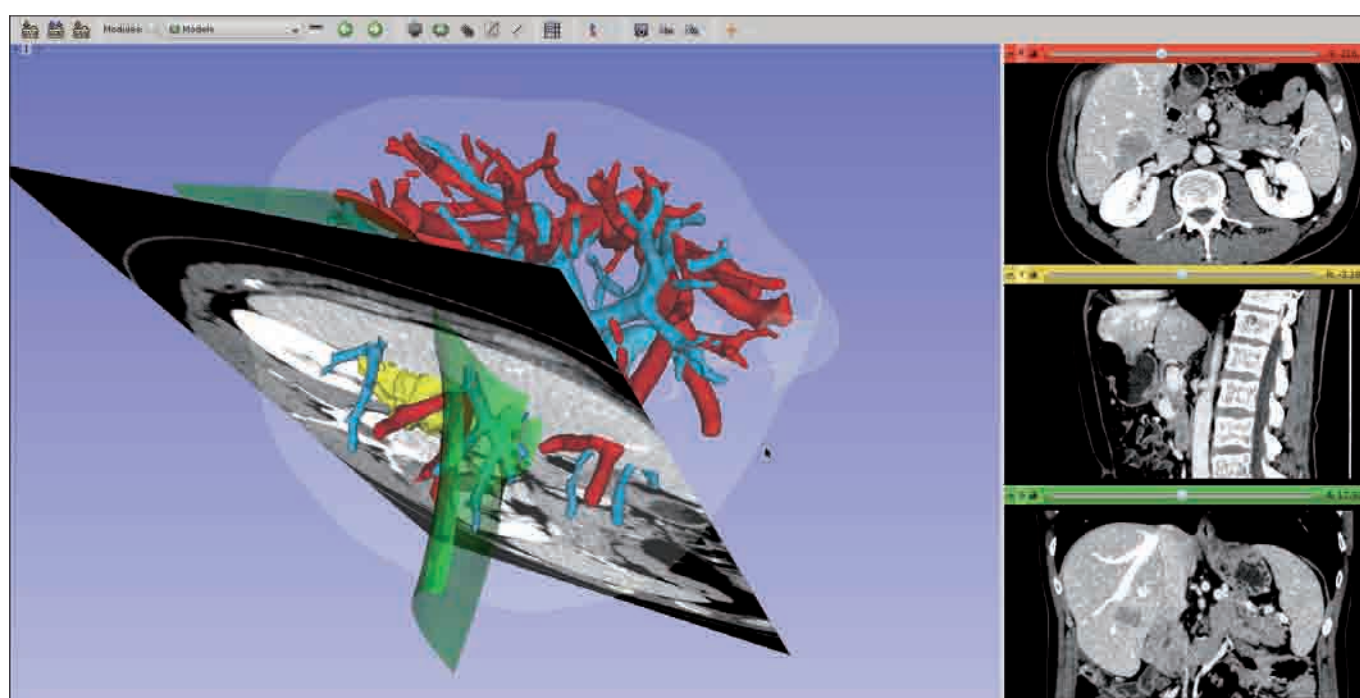
Dilla Handini, *PhD fellow, MSc*

Kim Mathiassen, *PhD fellow, MSc
(also at ROBIN-group at IFI / UIO)*

Ralf Greisiger, *PhD fellow, MSc
(also at ROBIN-group at IFI/UIO)*

Egil Utheim, *Researcher, MSc*

Sergio Salvatore Caccamo, *Early stage researcher*



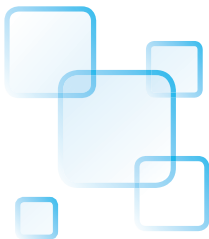
SECTION FOR TECHNOLOGY RESEARCH

WIRELESS SENSOR NETWORKS

Leader: Ilanko Balasingham, professor, PhD

RESEARCH PROFILE

The research group performs fundamental research and development on wireless sensors and systems with applications in diagnostics, minimal invasive therapy, and ambient point of care monitoring. One of the technological focused areas is on ultra low power and reliable wireless sensor networks, where the research is on novel transceiver design (coding, modulation, antenna, etc.), low power data compression, and processing algorithms for anomaly detection, data fusion, etc. Special interest topics are in implantable cardiac sensors, capsule endoscopes, nano scale communications, and nanomachine-to-neuron interfaces for stimulation for applications in neuro-degenerative diseases.

**Focused research topics are:**

- Ultra low power wireless transceiver design
- Algorithms for localization and tracking intra body sensors
- Signal processing for implant communications
- Sensor networks
- Algorithms for colonoscopy and capsule endoscope videos for anomaly detection
- Nanomachine-to-neuron communications and networks (graphene, molecular, THz band, etc.)

We have a close collaboration with the Department of Electronics and Telecommunications at the Norwegian University of Science and Technology (NTNU), Trondheim, and several national and international research institutions and companies participate in different projects.

NEWS

The project MELODY (Medical Sensing, Localization, and Communications using Ultra Wideband Technology) which has been running since 2008 received phase II funding for three more years since 2013.

The funding is for 2 PhD students and 3 Post docs.

We have had a wonderful scientific production last year with 4 PhD fellows and 2 master students graduated:

Fatemeh Kazemeyni

Collaborative Wireless Sensor Networks: Modeling and Analysis.

PhD thesis, Intervention Center
University of Oslo, Sept. 2013

Babak Moussakhani

On Localization and Tracking for Wireless Capsule Endoscopy.

PhD thesis, NTNU, June, 2013

Trung Hieu Nguyen

Power Efficient Communication for Medical Wireless Sensor Networks.

PhD thesis, NTNU, April 2013

Hessam Moussavinik

On Narrowband Interference Mitigation Methods for Robust Wireless Sensor Networks

PhD thesis, NTNU, March 2013

Rune Svensrud

Remotely estimating Vital Signs from Ambient-light Photoplethysmography.

M.Sc. thesis, NTNU, 2013

Nikolai Grov Roald

Estimation of Vital Signs from Ambient-Light Non-Contact Photoplethysmography.

M.Sc. thesis, NTNU, 2013

Moreover, we published 15 peer-reviewed papers: 2 in Level II journals, 5 in Level I journals and 8 in Level I conferences.

Our postdoc Raul Chavez-Santiago was awarded the prestigious JSPS Fellowship for Short-Term Scientific Research in Japan and visited Prof. Jianqing Wang's lab at the Nagoya Institute of Technology for 40 days. Furthermore, we have received a DAAD Norway-Germany Mobility Grant for 2 years starting from 2014, where each group will spend approximately 2 months in each others lab. Rohit Chandra from India has been granted the ERCIM postdoctoral fellowship and will join the group from May 2014.

LONG TERM GOALS

The long term goal is to become the Norwegian Center of Excellence with international recognition.

PROJECTS

The project portfolio consists of the following projects:

- Medical Sensing, Localization, and Communications using Ultra Wideband Technology (MELODY), large scale ICT project funded by the Research Council of Norway for 2008-2012 successfully completed the mid term evaluation and has been approved for three more years funding from 2013.
- Adaptive Security for Smart Internet of Things in eHealth (ASSET), approved for funding by the Research Council of Norway for four years.
- NORBAS, approved for funding by the Ministry of Foreign Affairs of Norway for three years.
- Innovation grant for CameraPill, approved for funding by the Health Region South East, 2013.

OUTREACH ACTIVITIES

- Keynote speaker on future and emerging topics, Nano-to-neuron interfaces and communications. The 2013 ICST/ACM International Conference on Body Area Networks, (BODYNETS) Boston, USA, Oct. 2013.
- Invited speaker on hot topics, Nanoscale communication networks for medical applications. The 2013 IEEE International Conference on Ultra Wideband, (ICUWB) Sydney, Australia, Sept. 2013.
- Invited speaker, Electromagnetic wave and neuron communications. The 1st International Summer School on Nanocommunications, Tampere University of Technology, Finland, May 2013.
- Invited speaker, Self diagnosis and intervention E-health 2013, Norway.
- Guest editor for Special Issue on Medical ICT, IEICE Transactions on Communications, Japan, 2013.
- Participation in the Management Committee of the COST Actions IC0902 and IC0905 on cognitive radio/software-defined radio, and IC1004 on cooperative radio communications.

GROUP MEMBERS

SENIOR RESEARCHERS

Jacob Bergsland, *MD, PhD*
Pål Anders Floor, *PhD*
Rie Komuro, *PhD*
Raul Chavez-Santiago, *PhD*

JUNIOR RESEARCHERS (PhD students)

Minh-Long Pham, *MSc*
Lars Erik Solberg, *MSc*
Kashif Habib Sheikh, *MSc*
Mladen Veletic, *MSc*
Karl Øyri, *MSc*

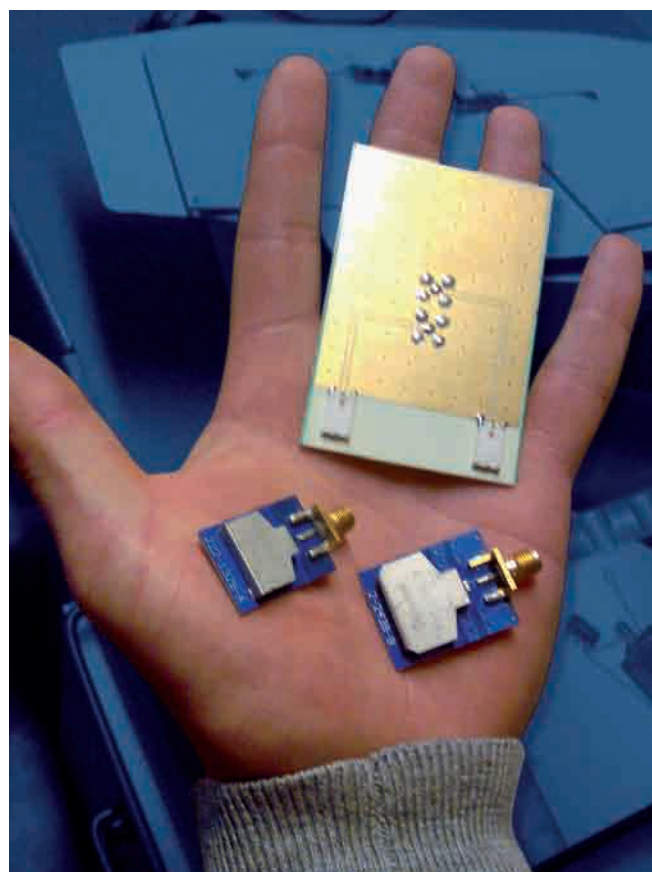
INTERNATIONAL VISITORS

Associate Professor Ali Khaleghi, The K. N. Toosi University of Technology, Tehran, Iran, 3 months.

Stefan Fraedrich, MSc, Technical University of Dresden, Dresden, Germany, 11 months.

Jens Abraham, Technical University of Dresden, Dresden, Germany, 10 months.

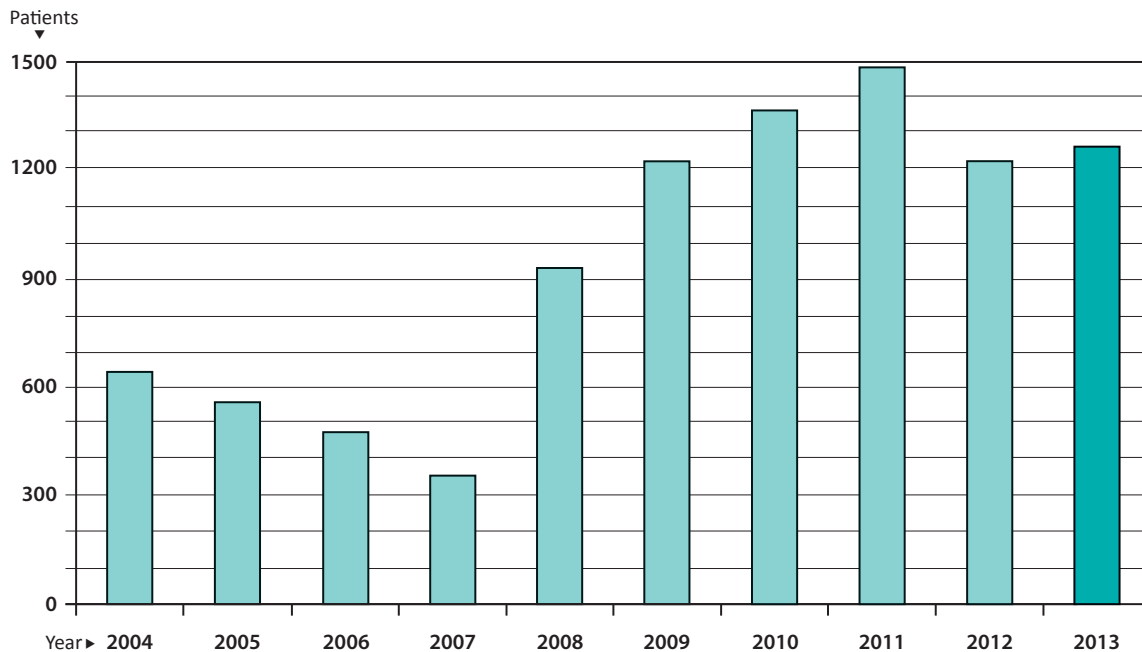
Daninius Jankunas, Vytautas Magnus University, Lithuania, 3 months.



Scientific statistics

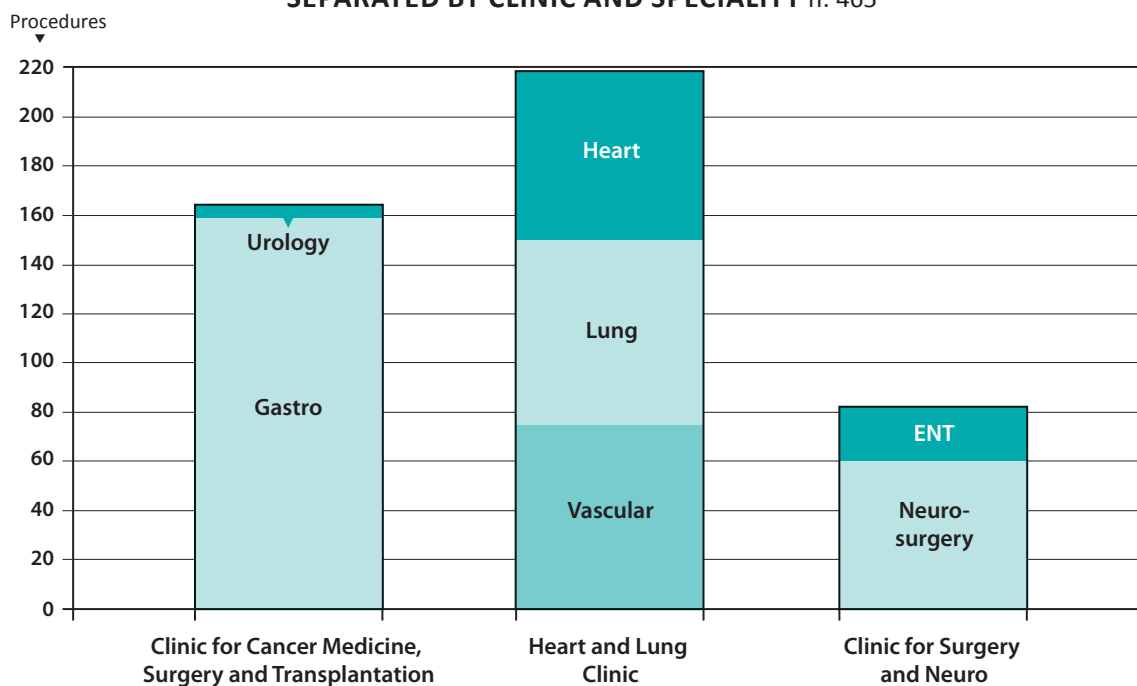
The Intervention Centre 2013

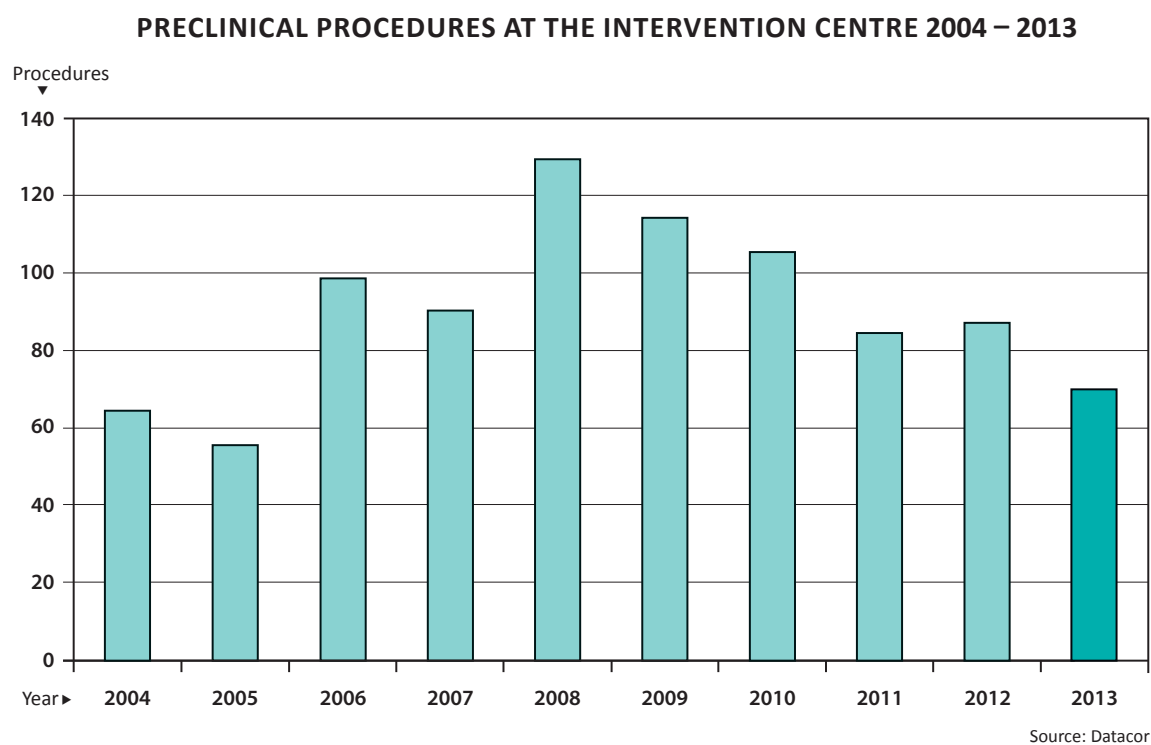
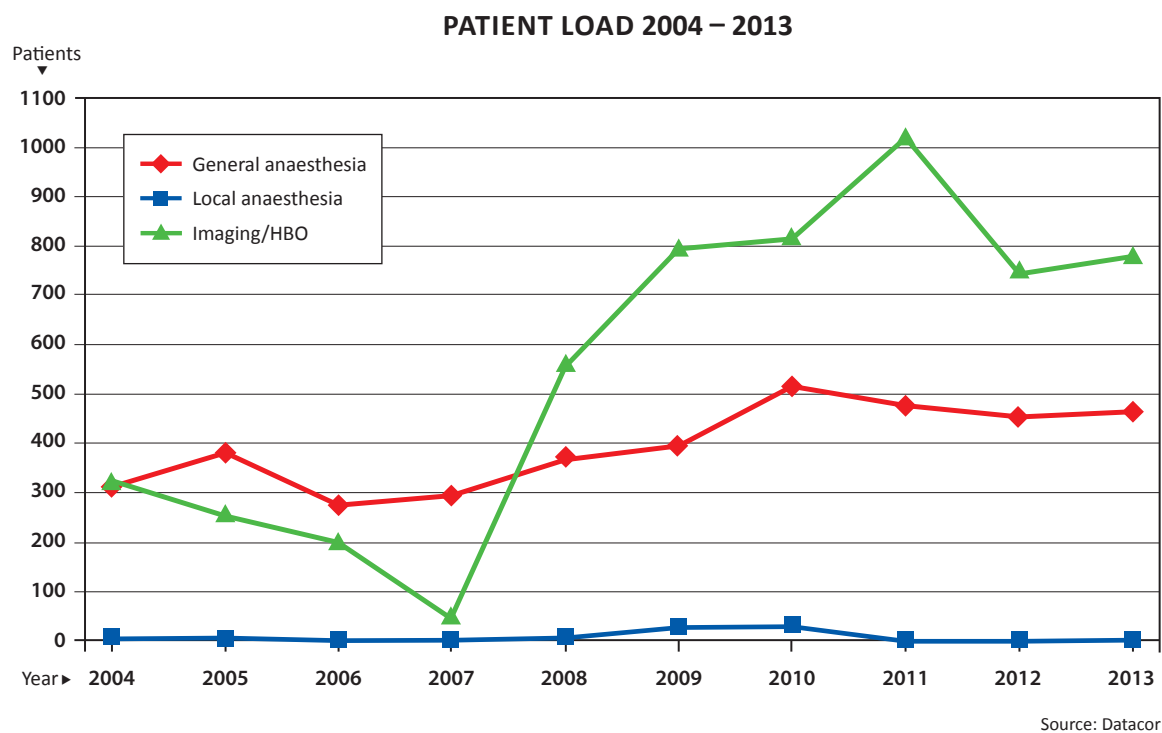
PATIENTS AT THE INTERVENTION CENTRE 2004 – 2013

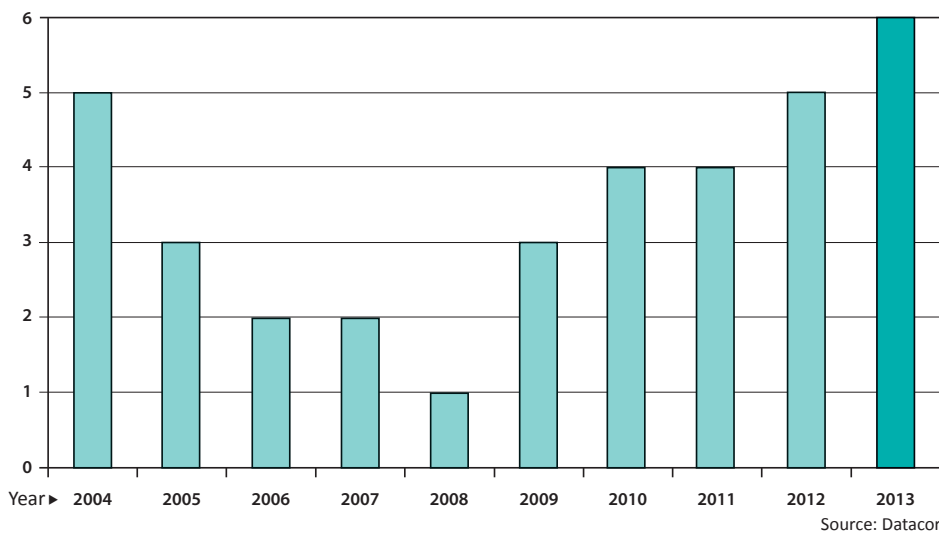
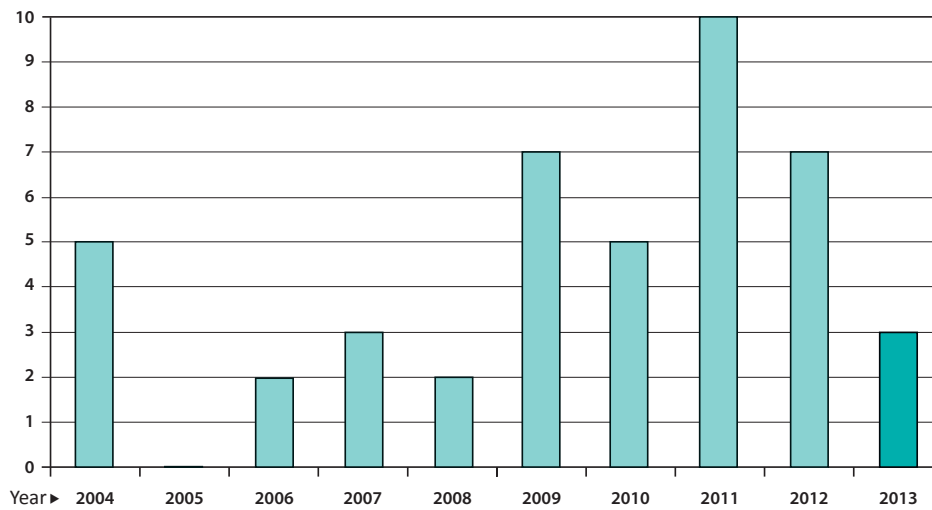


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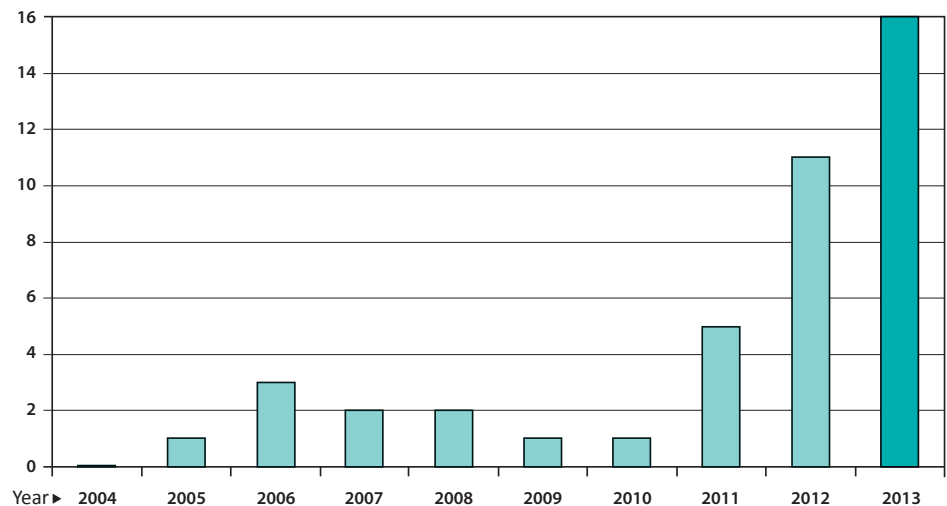
**SURGICAL PROCEDURES AT THE INTERVENTION CENTRE IN 2013
SEPARATED BY CLINIC AND SPECIALITY n: 465**



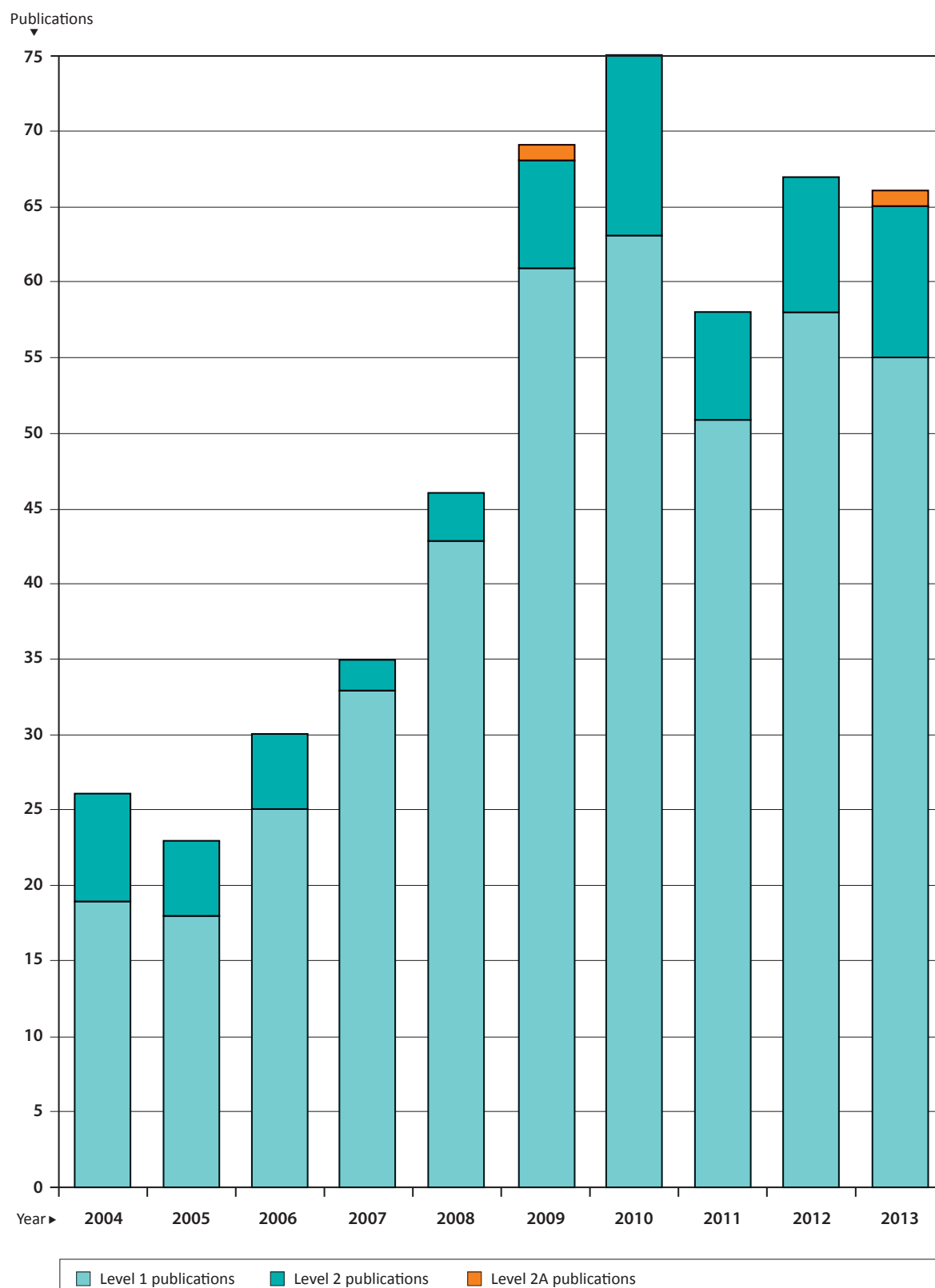


DISSERTATIONS AT THE INTERVENTION CENTRE 2004 – 2013 n: 35**PATENTS FROM THE INTERVENTION CENTRE 2004 – 2013 n: 44****DESCRIPTION OF INVENTION (DOFI's) SUBMITTED TO INVEN2 n: 42**

Inven2 is the Technology Transfer Organisation of Oslo University Hospital and University of Oslo.



PEER REVIEWED SCIENTIFIC PUBLICATIONS 2004 – 2013 n: 495







Budget and expenditures

Internal hospital funds funds administered by the Intervention Centre in 2013

	ALLOCATED	INCOME	RESULT
Total	35.293	6.000	-1.797

External funds administered by the Intervention Centre in 2013

SOURCE	AWARDED GRANTS 2013	RESEARCH EXPENDITURES
Research Council of Norway NFR	5.344.276	2.396.021
Regional Health Authority HSØ	11.380.774	5.773.240
European Commission EU	2.813.939	4.005.795
University of Oslo UIO	520.000	520.000
Norwegian Cancer Society	1.272.000	1.107.502
Others	409 038	1.171.482
Sum:	21.740.027	14.794.040



Publications

Scientific publications¹ from The Intervention Centre 2013 – 2009

¹ Scientific channels are journals, series and publishers that fulfill specific criteria given by the Norwegian register for scientific journals, series and publishers (NSD: www.dbh.nsd.uib.no/kanaler). There are two levels: **Ordinary publication channels** (level 1) and **highly prestigious publication channels** (level 2).



2013

Level 2A

1. Emblem KE, Mouridsen K, Bjornerud A, Farrar CT, Jennings D, Borra RJH, et al.
Vessel architectural imaging identifies cancer patient responders to anti-angiogenic therapy.
Nat Med.2013;19(9):1178-83.

Level 2

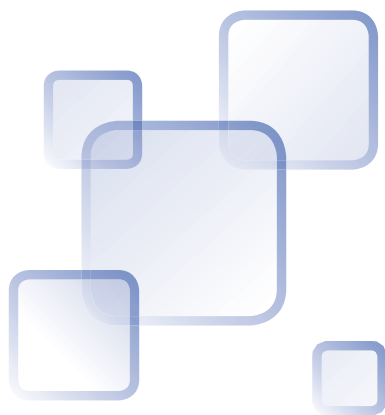
1. Barratt-Due A, Thorgersen EB, Egge K, Pischke S, Sokolov A, Hellerud BC, et al.
Combined inhibition of complement C5 and CD14 markedly attenuates inflammation, thrombogenicity, and hemodynamic changes in porcine sepsis.
J Immunol.2013;191(2):819-27.
2. Batchelor TT, Gerstner ER, Emblem KE, Duda DG, Kalpathy-Cramer J, Snuderl M, et al.
Improved tumor oxygenation and survival in glioblastoma patients who show increased blood perfusion after cediranib and chemoradiation.
Proc Natl Acad Sci USA. 2013; 110(47): 19059-64.

3. Chavez-Santiago R, Sayrafian-Pour K, Khaleghi A, Takizawa K, Wang J, Balasingham I, et al.
Propagation Models for IEEE 802.15.6 Standardization of Implant Communication in Body Area Networks.
IEEE Commun Mag.2013;51(8):80-7.
4. Coello C, Willoch F, Selnes P, Gjerstad L, Fladby T, Skretting A.
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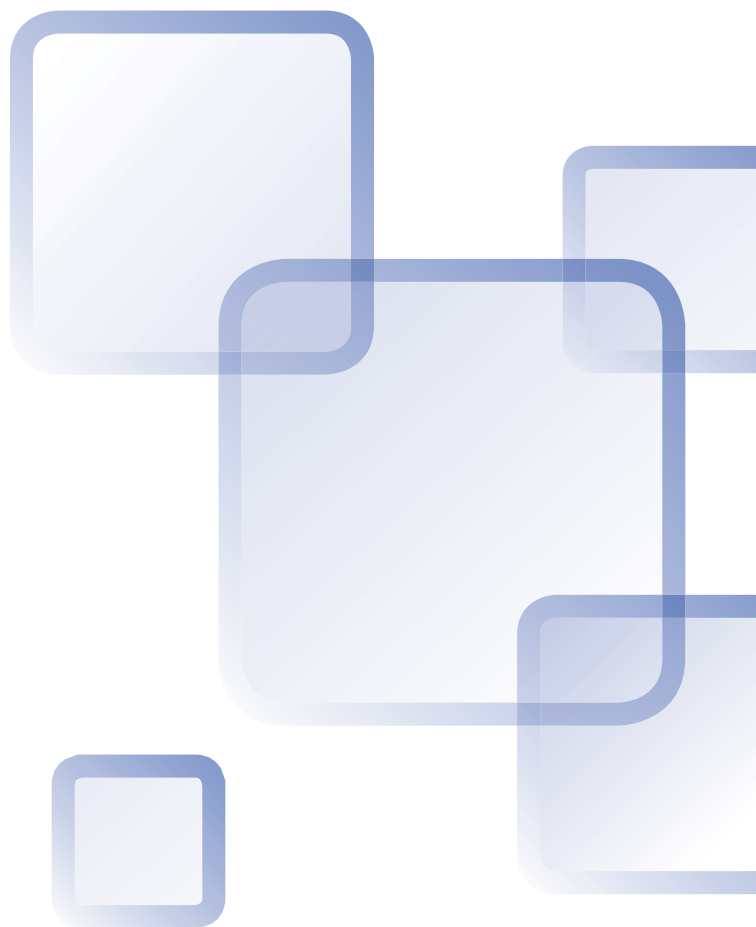
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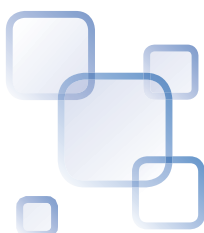
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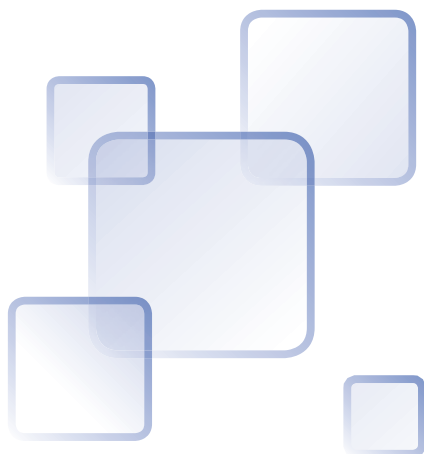
2011

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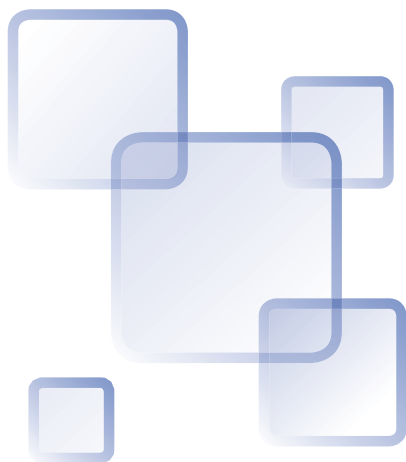
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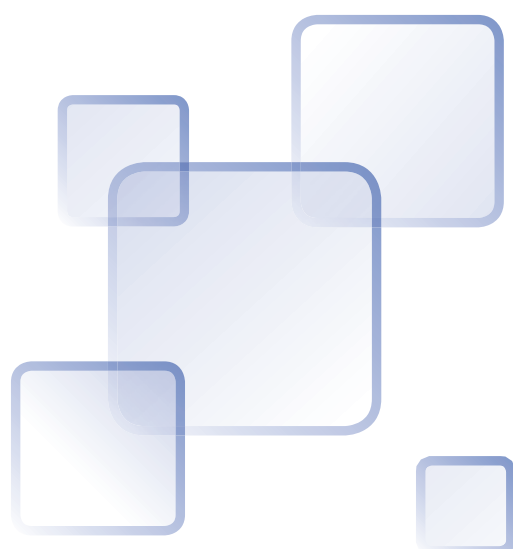
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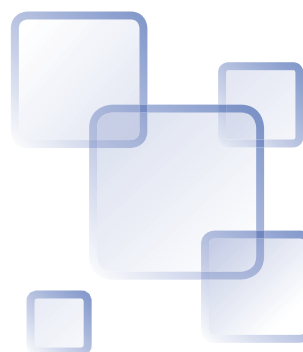


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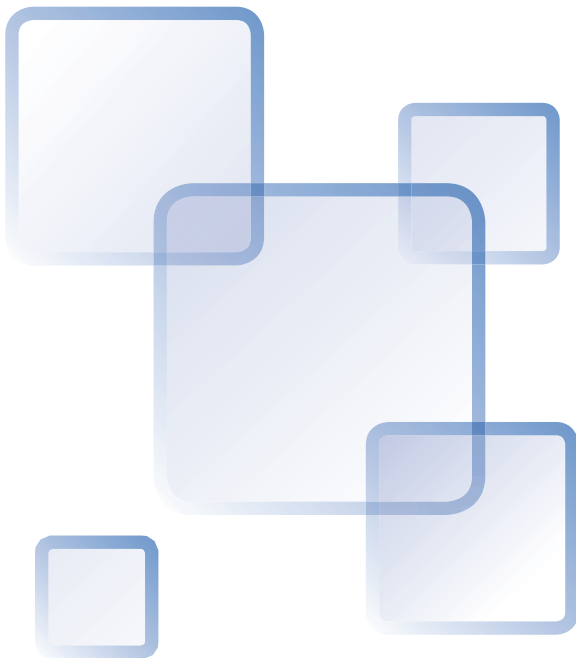
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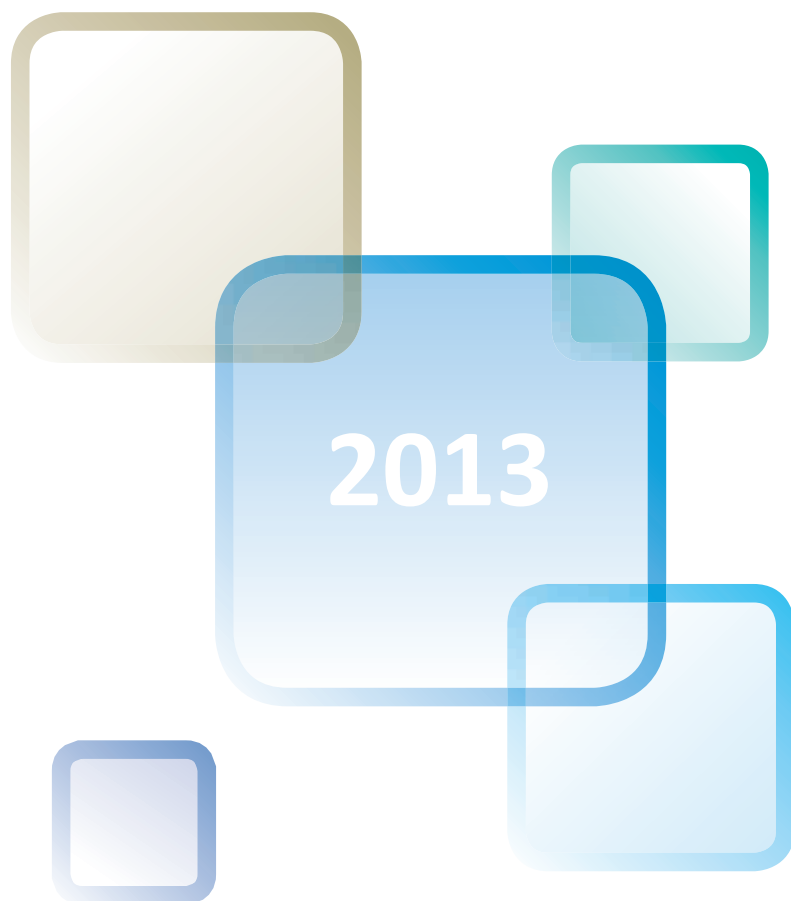
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Oslo University Hospital is Norway's largest hospital, and accounts for a large part of medical research and the education of health personnel in Norway.

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