Rikshospitalet University Hospital
The Interventional Centre

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The Interventional Centre-The European centre

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The Interventional Centre – The European centre

In 2005 The European Marie Curie network project ARISER managed by the Interventional Centre took off. The project comprised centres from all over Europe that worked together in solving some of the challenges in image guided therapy.

In 2005 the Centre also joined another EU application for a Specific Targeted Research project termed CREDO. The project focus on modelling and analysis of evolutionary structures for distributed services.

In the clinical field the centre continued to develop new treatment strategies in collaboration with clinical departments both at Rikshospitalet and other hospitals. However lack investments in new equipment represented a challenge.

A particular challenge was the further development of MR guided surgery. In 1996 The Interventional centre joined the pioneer group testing out the GE Signa SP open magnet for surgical interventions. The research in this magnet has led to four PhDs and 100 scientific papers from the Interventional centre, but clinically the open magnet had a limited use the reason being the compromises that had to be made both in image quality and in surgical freedom. Today high field magnets are used intermittently during surgery by sliding either the patient or the magnet for intermittent imaging.

In 2005 three PhDs emerged from the centre, all within the target areas: biosensor research, development of interventional techniques for congenital heart disease and laparoscopic surgery, all in collaboration with other departments and/or hospitals.

Erik Fosse, Professor
Head of department
Main Goals and Objectives

The Interventional Centre is a research and development department for image guided and minimally invasive therapy at Rikshospitalet University Hospital in Oslo.

The Centre has the following tasks:

1. Develop new procedures
2. Develop new treatment strategies
3. Compare new and existing strategies
4. Study the social, economic, and organisational consequences of new procedures on health care

Strategy

The Interventional Centre is a research and development resource for all the clinical and laboratory departments at Rikshospitalet.

The Centre shall actively offer similar services to the health care community in Norway outside the hospital.

The Interventional Centre shall work as a link between technology institutions (commercial and academic) and the clinical medical environment in the hospitals.

The Interventional Centre shall promote and work actively to protect new knowledge and facilitate commercial exploitation.

The research is focused in four strategic areas:

1. MR guided intervention and surgery
2. X-ray, CT, ultrasound, video-guided interventions and surgery
3. Robotics and simulators
4. Biosensors, data management and communication
**Organisation**

The Interventional Centre is an independent hospital department. The Head of department reports directly to the hospital director. A National Advisory board with representatives from all universities in Norway and the main departments at Rikshospitalet, monitors and gives advice on research and activity.

In 2005 the Centre had a cross-disciplinary staff of 24 employees. 3 of these positions were financed partly through industrial partners. In 2005 there were 3 university-employed professors (Erik Fosse, Tor Inge Tønnessen and Halfdan Ihlen) and 1 associate professor (Eigil Samset). Seven doctors, nurses, radiographers and engineers employed by other departments worked regularly at the Centre while a large number of medical staff from most departments in the hospital worked at a less regular basis at the Centre.

In 2005 professor Frode Lærum was appointed academic head representing the University of Oslo.

**Matrix organisation**

In order to facilitate effective execution of cross-disciplinary projects, the personnel and equipment at the Centre are allocated to five resource sections in a matrix organisation (figure 1). Each section is headed by a section manager.
Facilities

The Centre has a unique architectural structure. In the three suites advanced imaging equipment is integrated in an operation room environment (Figure 2). In one suite radiological equipment (AngioStar, Siemens) is installed in a state of the art OR, facilitating the integration of advanced surgery and radiological guided intervention. In a second suite an open MR system (Sigma SP, GE Medical Systems) is integrated in an OR facilitating MR guided surgery and intervention. A third suite is hosting projects in videoscopic guided and robot-assisted surgery.

Scientific activity 2005

PhD Programs

A total of 27 PhD programs were ongoing, the majority in collaboration with other institutions. There were three PhD dissertations in 2005, all with partners outside the Interventional Centre:

Dr. Scient. Peyman Mirtaheri
A novel biomedial sensor for early detection of organ ischemia
Faculty of Mathematics and Natural Sciences
The Interventional Centre

Dr. Philos. Per G. Bjørnstad
Catheter-based treatment for persistently patent arterial ducts and for atrial septal defects in the oval fossa
Dept. of Paediatrics
The Interventional Centre

Ph.D. Bjørn von Gohren Edwin
Advanced Laparoscopy – from the Research and Development Department to Day Care Surgery
Dept. of Surgery, Ullevål University Hospital
Dept. of Surgery, Rikshospitalet – Radiumhospitalet
The Interventional Centre

Publications

18 international papers with one or more authors from the Interventional Centre were published in 2005 (figure 3).

Figure 3: Peer reviewed papers 1998 – 2005

Intellectual Property Rights

One patent priority document was filed during 2005.
Research groups

Five major research groups worked at the Centre in collaboration with several other departments in the hospital and industrial partners outside:

a) Improving cardiovascular surgery and intervention
b) Cardiac function and imaging
c) Biosensors
d) MR guided therapy
e) MIT visualisation and robotics lab

In addition there were several minor projects.

a) Improving cardiac surgery
A series of studies was performed on off-pump coronary surgery including new techniques for grafting. A study comparing surgery with or without use of intracoronary shunts was terminated. In 2005 a program for minimally access mitral valve replacement and repair was started with the help of Dr. Aubrey Galloway for New York University Medical Center. These studies were performed in cooperation with Dept. of Thoracic and Cardiovasc. Surgery, Dept. of Cardiology, Dept. of Radiology, Dept. of Neurology and Dept. of Anaesthesia at Rikshospitalet. So far, 15 papers in international journals have been published, whereof 4 in 2005.

b) Cardiac function and imaging
The Centre has established cardiac functioning and imaging as a separate research group headed by Prof. Halfdan Ihlen. The synergies given by a close cooperation with the coronary surgery group created also a unique opportunity to perform cardiac function research during beating heart surgery, e.g. by means of ultrasound procedures. A total of 6 Ph.D programmes were linked to the cardiac function and imaging activity. The group received a grant of NOK 1 mill through interdisciplinary research funding from the Hospital in 2005.
c) Biosensors

The Biosensor research group has three main branches of interest, namely the biologic basis for ischemia and the choice of parameters for detection thereof, the second is the development of a specific pCO2 sensor and the third is developing methods for early detection of rejection in transplant patients. The biologic basis has been studied through animal experiments and we have several ongoing clinical studies.

Concerning the development of the sensor IscAlertTM, we have collaboration with Alertis Medical AS. This is an OFU collaboration, meaning that we receive funds from Innovasjon Norge that benefit both the company and the Interventional Centre. Peyman Mirtaheri has for several years worked in developing this sensor. He defended his thesis “A novel biomedical sensor for early detection of organ ischemia” in 2005. The development of the sensor has now come into a clinical phase where we currently work on the clinical proof of principle of the sensor.

Also in 2005 the biosensor group is administrating a Core facility from Rikshospitalet of 1 million NOK. This is mainly for clinical programs using biosensors and we have carried out a major study where we put microdialysis catheters in all patients undergoing liver transplantation, two catheters in the liver and one catheter subcutaneously. Every hour metabolic parameters of ischemia is measured and every four hours we collect analysate for measuring cytokines and complement factors for detection of rejection.

The Interventional Centre is also heading a joint project called “MicroHeart” for detection of motion changes of the heart surface. The goal is to develop a system for early detection of ischemia through continuous per- and post-operative monitoring using a 3-axis accelerometer for patients undergoing coronary revascularisation (Patent number: NO 20016385). The “MicroHeart” project is in close collaboration with Vestfold University College in Tønsberg. The Interventional Centre is responsible for the clinical research activity, and an animal study is ongoing to verify the sensitivity and specificity of the detection method. The main responsibility for Vestfold University is miniaturizing a three-axis accelerometer for incorporation into a temporary pace-maker electrode. The project is partly financed by the Research Council of Norway (NRC) with several PhD scholarships at Vestfold University College.

d) Hyperbaric oxygen treatment

We have treated some few patients on special indications this year. Research on focused research topics will be implemented in 2006.

e) Interventional bronchoscopic therapy

Interventional bronchoscopic therapy is going on as a clinical activity with a broad spectrum of diagnoses, malignant and benign. The research concentrates on stenting for post lung transplant stenosis, the treatment of idopathic, subglottic stenosis (a subgroup of Wegener’s granulomatosis), and the survival of lung cancer patients treated for total lung occlusion.

Transbroncial lazer therapy

f) MR guided therapy

Together with a number of clinical departments the Interventional Centre has for a number of years performed research and development of MR-guided treatment in an open magnet. This included thermal ablation of liver tumours in collaboration with the Department of Surgery, MR-guided neurosurgery with the Department of Neurosurgery, diagnostic research of female incontinence in collaboration with the Department of Gynaecology, techniques for plexus anaesthesia in collaboration with the Department of Anaesthesia, various diagnostic imaging research projects related to spine and joints and imaging of claustrophobic patients. The last two years three PhD theses have been successfully defended, and in 2005 one was ongoing.
g) MIT visualisation and robotics lab

The Minimally Invasive Therapy visualisation and robotics lab is headed by Dr. Ole Jakob Elle. The lab has a close collaboration with several Departments at The Norwegian University of Science and Technology (NTNU) and at the University of Oslo where Dr. Eigil Samset holds an adjunct Associate Professor position at the Department of Informatics. One PhD project was successfully defended in 2005 entitled “A novel biomedical sensor for detection of organ ischemia” by Peyman Mirtaheri in collaboration with Department of Clinical Engineering -RH, Department of Physics -University of Oslo. The group focuses on developing tools to improve Minimally Invasive Therapy as well as enabling technologies in the field of image-processing, visualisation robotics/haptics and bio-sensor technology. The group hosts a large number of master students from both the University of Oslo and NTNU, and have a wide national and international network both academically and industrially. In 2005 two PhD-students were appointed by The Interventional Centre. One PhD was funded by the EU through a project called ARIS*ER for performing research on visualization, collision detection and crosslinking this with robotics. The other was funded by The Norwegian Research Council (NRC) for research into the area of Surgical Robotics and Haptics, supervised by both The Interventional Centre and NTNU. One engineer working with augmented reality visualisation was appointed for one year by The Interventional Centre in June 2005 funded by the health region (Helse Sør) in collaboration with the University of Oslo (UIO).

ARIS*ER - ”Augmented Reality in Surgery, Research Training Network for Minimally Invasive Therapy technologies” - is a European Union funded project, co-ordinated by the Interventional Centre, which was granted in 2004. The project is a Marie Curie Research Training Network with eight partners in seven European countries. The project scheduled to last for 4 years and started in December 2004. The total budget is 2.7 Mill. Euros and will finance 8 PhD- students and 5 post.doc fellows. 657 applications were reviewed by the European Commission services under this call, and only 37 were selected for funding. The application received top rankings from both the scientific and the ethical review panels.

The ultimate goal of the joint project, is to create an Augmented Reality system for interactive image guided therapy providing the clinical user with a new generation of decision support tools. This system will integrate intra-operative and pre-operative image-information and enable the user to see beyond the organ surface to inner structures and pathology. An intuitive human computer interface consisting of 3D display systems, haptics and robotics will hide the underpinning complexity of the decision support tools. More information can be obtained by visiting www.ariser.info or contacting the project co-ordinator – Eigil Samset, PhD – at eigilsa@ifi.uio.no.

Other research programs

Together with Dept. of Surgery, the Interventional Centre developed complex endoscopic procedures. The Interventional Centre was also participated in a PhD programme on quality of life after laparoscopic organ harvesting.

The Interventional Centre also co-operated with the Institute for Informatics and The Institute for Health Management and Health Economics at the University of Oslo, as well with the Norwegian School of Management (BI) in a research project focusing on the relationship between innovation, learning, technology and organisational change-processes. One PhD project was running as part of this program in 2005.

Patient diagnosis and treatment

551 patients were treated or diagnosed at the Interventional Centre during 2005. The hospital income from these patients was approximately 16 mill NOK. Table 2 on page 9 shows the DRG income from these procedures for the hospital, and Annex 7 gives a summary of the different procedures performed at the Centre 2005.
**Animal studies**

Four animal studies comprising 58 test animals (rabbits and pigs) were performed at the Centre in 2005.

**Test animals at the Interventional Centre 1996-2005**
**Video conferences**
The video conferencing unit at the Interventional Centre was established in 1996 and is run in collaboration with the IT-department.

**Public Relations**
The Centre was portrayed in different media (journals, newspapers or TV) 13 times in year 2005.

**Presentation of the Interventional Centre in the media 1196-2005**
Included newspapers, television, radio.

Total 157
Visitors at the Interventional Centre
141 guests visited the Interventional Centre in 2005. During the last 9 years 2376 visitors at the Centre were registered.

Visitors at the Interventional Centre
1997-2005

Total 2376 visitors in 9 years

Website
73 548 requests for pages were recorded at the Interventional Centre web site during 2005

Requests for homepages ivs.no

Research Collaboration
The Interventional Centre network included both external collaboration and collaboration with other departments at the hospital and at the University of Oslo. A strong link to industry was necessary to be in the forefront of technology. In addition, a strong link to national and international centres working on minimal invasive therapy was maintained.

An overview of important collaborations in 2005 is visualised in the map in annex 1. A detailed description of the collaborations is given in annex 2.
Financial Position

The research performed at the Centre was mainly financed though the budgets of Rikshospitalet University Hospital. Of the total expenditure of NOK 33,326,000 in 2005, NOK 19,376,000 was directly allocated over the budget of Rikshospitalet, while NOK 12,750,000 (38%) represented income from other sources. The Centre contributed to the hospital DRG generated income through the operating procedures performed at the Centre. In 2005 the DRG generated income of patients treated or diagnosed at the Interventional Centre was approximately NOK 16 mill, more that 75% of the hospital cost for the Centre. The DRG income for patient treatment at the Centre was allocated to the department responsible for the treatment. An overview over collaborating departments and DRG is given in Table 2.

<table>
<thead>
<tr>
<th>Department</th>
<th>No. of patients</th>
<th>DRG patients</th>
<th>NOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of Thoracic Surgery</td>
<td>95</td>
<td>293,4</td>
<td>5338413</td>
</tr>
<tr>
<td>Surgical Department- Gastroenterology</td>
<td>96</td>
<td>301,9</td>
<td>5493071</td>
</tr>
<tr>
<td>Surgical Department Urology</td>
<td>8</td>
<td>25,6</td>
<td>465792</td>
</tr>
<tr>
<td>Pain clinic</td>
<td>4</td>
<td>3,2</td>
<td>58224</td>
</tr>
<tr>
<td>Surgical Department- Pediatrics</td>
<td>2</td>
<td>4,8</td>
<td>87336</td>
</tr>
<tr>
<td>Gynecology</td>
<td>8</td>
<td>4,7</td>
<td>85517</td>
</tr>
<tr>
<td>Department of Lung Medicine</td>
<td>70</td>
<td>183,5</td>
<td>3338783</td>
</tr>
<tr>
<td>Department of Endocrinology</td>
<td>5</td>
<td>0,8</td>
<td>14556</td>
</tr>
<tr>
<td>Department of Cardiology</td>
<td>4</td>
<td>18,2</td>
<td>331149</td>
</tr>
<tr>
<td>Department of Pediatrics</td>
<td>1</td>
<td>1,2</td>
<td>21834</td>
</tr>
<tr>
<td>Department of Immunology</td>
<td>1</td>
<td>0,7</td>
<td>12737</td>
</tr>
<tr>
<td>Neurosurgical Department</td>
<td>14</td>
<td>32,7</td>
<td>594977</td>
</tr>
<tr>
<td>Department of Reumatology</td>
<td>3</td>
<td>2,9</td>
<td>52766</td>
</tr>
<tr>
<td>Department of Orthopedics</td>
<td>1</td>
<td>3,1</td>
<td>56405</td>
</tr>
<tr>
<td>Department of Oto-Rhino-Laryngology</td>
<td>1</td>
<td>6,8</td>
<td>123726</td>
</tr>
<tr>
<td>Centre for palliative treatment</td>
<td>2</td>
<td>2</td>
<td>36390</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>315</strong></td>
<td><strong>885,5</strong></td>
<td><strong>16111673</strong></td>
</tr>
</tbody>
</table>

Table 2 The number of patients, DRG and DRG-generated income in projects at the Interventional Centre 2005. The sum is based on a DRG compensation of NOK 18195 pr. point.

Appendix 7 gives a detailed overview over procedures performed at the Interventional Centre in 2005.
Budget and Expenditures 2005

<table>
<thead>
<tr>
<th>Rikshospitalet - Radiumhospitalet University Hospital</th>
<th>Budget</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payroll expenses</td>
<td>11.861</td>
<td>10.842</td>
</tr>
<tr>
<td>Other operating expenses</td>
<td>8.728</td>
<td>9501</td>
</tr>
<tr>
<td>Sum internal finance</td>
<td>20.589</td>
<td>20.343</td>
</tr>
</tbody>
</table>

Externally financed expenditures
Payroll expenses[1] | 3.750
Other operating expenses[2] | 9.000
Sum externally financed expenditures | 12.750

Total internally and externally financed expenditures | 33.093

Non-budgeted financial support:
Two of the research groups established at the Centre received grants from Rikshospitalet as part of the Core Facility and Interdisciplinary Research funding programs of the hospital (included in "external financing, other operating expenses" shown in the table above).
The Interventional Centre has also received a grant from the Norwegian Ministry of Foreign Affairs related to co-operation between Bosnian hospitals and Rikshospitalet University Hospital.
These grants have partly been used as payroll expenses and party as other operating expenses but is registered under Other Operating Expenses in the table above.

| Grant from the Ministry of Foreign Affairs | 1.000     |
| Biosensor Research Group (prof. Tor Inge Tønnessen) | 1.000     |
| Total | 2.000     |

Hospital income based on patient treatment at the Centre, 2005:

<table>
<thead>
<tr>
<th>Points:</th>
<th>NOK 1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRG-points (patients)</td>
<td>885.5</td>
</tr>
<tr>
<td>Out patient examinations</td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>16.432</td>
</tr>
</tbody>
</table>

[1] Personal grants, students, NRC project support and civil service personnel
**Assets**

Equipment (price > NOK 50,000,- and lifespan of 3 years).
The value of the equipment of the Centre was estimated to be approximately NOK 51,000,000,- (VAT excluded).

**Stocks**
The Interventional Centre held, through Medinnova, minority shares in three companies established as a result of the research activity at the centre:

<table>
<thead>
<tr>
<th>Number</th>
<th>Nominal Value (NOK)</th>
<th>Share</th>
<th>Book Value (NOK) Medinnova</th>
</tr>
</thead>
<tbody>
<tr>
<td>SimSurgery AS</td>
<td>113,113</td>
<td>1,-</td>
<td>12,43%</td>
</tr>
<tr>
<td>Alertis Medical AS</td>
<td>8,568</td>
<td>10,-</td>
<td>22,09%</td>
</tr>
<tr>
<td>OstomyCure</td>
<td>140,800</td>
<td>9,02%</td>
<td>624,080</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 1 - Patent applications Interventional Centre 1998-2005

### Active Patents and Applications

<table>
<thead>
<tr>
<th>Patent nr.</th>
<th>Title</th>
<th>Inventors</th>
</tr>
</thead>
<tbody>
<tr>
<td>EP 1063923</td>
<td>Method and device for suturless anastomosis</td>
<td>Sumit Roy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Erik Fosse</td>
</tr>
<tr>
<td>WO 0169130</td>
<td>Light system for use especially by operating theatre</td>
<td>Erik Fosse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frode Lærum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ole Jakob Elle</td>
</tr>
<tr>
<td>WO 0004386</td>
<td>Device for PCO2 detection</td>
<td>Tor Inge Tønnessen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peyton Mirtaheri</td>
</tr>
<tr>
<td>WO 9211823</td>
<td>Filtering device for preventing embolism and/or distension of blood vessel walls</td>
<td>Frode Lærum</td>
</tr>
<tr>
<td>NO 20016385</td>
<td>System for monitoring changes in movements of an organ, preferably a heart muscle</td>
<td>Erik Fosse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Martin Gulbrandsen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ole Jakob Elle</td>
</tr>
<tr>
<td>NO 20023605</td>
<td>Method and device for connecting two tubular organs</td>
<td>Erik Fosse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ole Jakob Elle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sumit Roy</td>
</tr>
<tr>
<td>Filed by Ostomyecure</td>
<td>Device for Ostomy</td>
<td>Erik Fosse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bjørn Edwin</td>
</tr>
</tbody>
</table>

### Withdrawn Patents and Applications

<table>
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<tr>
<th>Patent nr.</th>
<th>Title</th>
<th>Inventors</th>
</tr>
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<tbody>
<tr>
<td>WO 0128453</td>
<td>Low-profile, non-stented prosthesis for transluminal implantation</td>
<td>Sumit Roy</td>
</tr>
<tr>
<td>WO 0149197</td>
<td>Device for use by brain operations</td>
<td>Eigil Samset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Henry Hirschberg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Åge Kristiansen</td>
</tr>
<tr>
<td>WO 0048533</td>
<td>Multi-purpose valve</td>
<td>Sumit Roy</td>
</tr>
<tr>
<td>NO 20024630</td>
<td>System for display on a screen a radiological image of a patient linked in real time to the position of the patient</td>
<td>Eigil Samset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Henry Hirschberg</td>
</tr>
<tr>
<td>WO 0209594</td>
<td>Device, Apparatus and Prosthesis for suturless Anastomosis</td>
<td>Erik Fosse</td>
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<td></td>
<td></td>
<td>Ole Jakob Elle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sumit Roy</td>
</tr>
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</table>
Appendix 2. Research groups at the Interventional Centre 2005

<table>
<thead>
<tr>
<th>Improving coronary Surgery</th>
<th>Cardiac Function and Imaging Group</th>
<th>Biosensor Research Group</th>
<th>MR Guided Therapy and Interventions</th>
<th>MIT Visualisation and Robotics Lab</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Dr. Med Erik Fosse Prof. dr. med Jan L Svennevig Dr med Runar Lundblad Dr med Kjell Arne Rein Dept Thoracic and Cardiovasc surg David Russell Prof. dr. med Dept Neurology Sigurd Nitter-Hauge Prof. Dr. Med Dept. Cardiology Hans Jørgen Smith Prof. Dr. med Dept Radiology</td>
<td>Halfdan Ihlen Prof. Dr. Med Ilangko Balasingham, Dr. Ing.</td>
<td>Tor Inge Tønnessen Prof. Dr. Med</td>
<td>Per Kristian Hol, Cand. Med. Sumit Roy Dr. Med. Eigil Samset, Dr. Philos Geir Hafsaht Cand Med. Hans Henrik Lien Prof. Dr. Med DNR Jarl Æ. Jakobsen Prof Dr. med. Hans Jørgen Smith Prof. Dr med. Atle Bjørnerud PhD Jon-Terje Ramm-Pettersen Cand. Med. Erik Rokkones Dr. Med, Bjorn Edwin, Cand. Med.</td>
<td>Ole Jakob Elle, Dr. Ing. Eigil Samset, Dr. Philos Ilangko Balasingham, Dr. Ing. Peyman Mirtaheri Dr. Scient Atle Bjørnerud PhD</td>
<td>Erik Fosse Johan Olaissen</td>
</tr>
<tr>
<td>PhD students</td>
<td>Improving coronary Surgery</td>
<td>Cardiac Function and Imaging Group</td>
<td>Biosensor Research Group</td>
<td>MR Guided Therapy and Interventions</td>
<td>MIT Visualisation and Robotics Lab</td>
</tr>
<tr>
<td>--------------</td>
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<td>--------------------------</td>
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<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>Per Snorre Lingaas</td>
<td>Trond Vartdal</td>
<td>Berit Dahl</td>
<td>Tom Mala</td>
<td>Petter Risholm</td>
</tr>
<tr>
<td></td>
<td>Jacob Bergsland</td>
<td>Thomas Helle Valle</td>
<td>Lars Wælgaard</td>
<td>Lars Frich</td>
<td>Siv. Ing.: Martin Reimers</td>
</tr>
<tr>
<td></td>
<td>Per Kristian Hol</td>
<td>Helge Skjulstad</td>
<td>Per Steinar Halvorsen</td>
<td></td>
<td>Siv. Ing.: Ole Jakob Elle</td>
</tr>
<tr>
<td></td>
<td>Mona Skjelland</td>
<td>Per G. Bjørnstad</td>
<td>Andreas Espinoza</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MSc</strong></td>
<td></td>
<td><strong>Cand. Scient.</strong></td>
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### Appendix 3 Collaborations

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The Interventional Centre's joint venture partners

The Simula Centre
Contact person: Morten Dæhlen
The Interventional Centre and the Simula Centre work together as partners in Oslo Graphics Lab. A framework for a large research project in image processing and modelling was formed, STORFORSK.

Department of Informatics (IFI), Faculty of mathematics and national sciences, University of Oslo
Contact person: Knut Mørken
The Interventional Centre cooperated closely with IFI. The project consists mainly of supervision of master degree students, (in 2005: 6 students). The head of the technology section at the Interventional Centre is employed as assistant professor at IFI.

Centre for Microtechnology, The University College of Vestfold
Contact person: Hans Jørgen Alker
Cooperation on the project “Micro-heart”. Based on a patent idea by the Interventional Centre an implantable microsensor is being developed. The sensor will monitor changes in heart movement caused by ischemia. The project is financed by the Norwegian research council and include several research fellows at the University College of Vestfold.

Institute for Energy Technology (IFE), Halden
Contact person: Kjell Haugset
IFE and the Interventional Centre has common interests in order to understand the interaction between human, technology and organisation – with special focus on security. Some technology-platforms are common (i.e. augmented reality and simulators) and there is a common interest for research on learning of skills. The two institutions formed a joint program, for learning surgical skills by simulator use. An application for financing the project “Learning basic laparoscopic skills using virtual reality simulators” was sent to the Research council in the AKLIMED program.

Interventional Centre hosts the NCT regional contact for Helse Sør.

IT department, Sorlandet hospital
Contact person: Harald Brunvand
The Interventional Centre manages a project financed by the Norwegian research council program HØYKOM. The aim is to connect connect PACS system information with a message system for clinical teleradiology implementation. Sorlandet hospital attends in this project as a test-partner.

Norwegian Computing Center
Contact person: Lars Holden
Same project as above.

Telenor
Contact person: Torbjørn Sund
The Interventional Centre was a partner in the BIP project “Wireless health and care-WSHC” managed by Telenor. The Interventional Centre performed research on the use of wireless sensors in the operation room and wireless transmission of patient monitoring data within the hospital. The WSHC project started in 2003, and was finalized in 2005. (http://www.wshc.no)

Centre of Mathematics for Applications – University of Oslo
Contact person: Prof. Knut Mørken
The Interventional Centre and the Centre of Mathematics for Applications in cooperation tutored a PhD degree which was defended by Martin Reymers. The PhD was part of research cooperation about fundamental mathematical methods for use in image-guided treatment. Together with the Simula Centre, the Interventional Centre and CMA are applying for the STORFORSK project “Mathematical methods supporting minimally invasive therapy in medicine”.

NTNU
Contact person: Bård Kjos
The cooperation was established during the 1990ies and consists of mutual PhD and master projects. Until now 20 students have done their master degrees at the Interventional Centre. One PhD program was completed in 2004.

Institute for computer technique and informatic science
Contacts: Bård Kjos and prof. Richard Blake
(Image processing and datagraphics. Tutoring of students, common applications to the NRC)

Institute for Cybernetics

Appendix 4. Detailed description of collaborations
Contacts: Prof. Olav Egeland and prof. Bjørn Angelsen  
(Robotic technique and ultrasonic. Common applications to the NRC)

Institute for electronics and telecommunication  
Contacts: Prof. Tor Ramstad and Andrew Perkis  
(Media, compression of images, tutoring of students, electronic journal)

Institute for production- and quality technique  
Contact: Prof. Terje Kristoffer Lien  
(Robotic technique. Tutoring of PhD students)

Institute for energy- and processing technique  
Contact: Prof. em. Magne Lamvik  
(Thermodynamics, cryo ablation of the liver)

CompuTouch AS  
Contact person: Hans Kristian Holmen  
A research project for advanced tools within robotic surgery focusing on haptic and tactile feedback is suggested. This project (Multimodal user-interfaces for minimally invasive surgery – MUMIS) is now funded by NRC through a PhD scholarship starting in 2005 and tutored by the Interventional Centre and NTNU – Institute for technical cybernetics. CompuTouch contributes with tactile sensors and know-how within haptic feedback.

Medi-Stim AS  
Contact person: Arne Grip  
OFU contract for development of Doppler flow probes for coronary surgery.

Dept. for occupational diseases,  
Haukeland University Hospital  
Contact person: Leif Aanderud  
New applications for hyperbaric oxygen treatment. A PhD project at Rikshospitalet University hospital focusing on measurement of ischemia in tissue after hyperbaric oxygen treatment on patients undergoing reimplantation of extremities using micro surgery.

The Norwegian School of Management (BI)  
Contact person: Prof. Johan Olaisen  
A research program on organisational challenges related to developments, modifications and transfer of new medical procedures and/or technologies was started. Organising for learning and innovation in Norwegian hospitals – How new technologies challenge existing organisational structures and cultures. Mentors: Prof. Erik Fosse, Interventional Centre, Prof. Johan Olaisen BI, Professor Terje Hagen, University of Oslo.

The Institute for Health Management and Health Economy, UiO  
Contact person: Prof. Terje Hagen  
The same project as above.

Ostfold Hospital Trust  
Contact person: Jon Otto Sundhagen  
This collaboration aimed at establishing and quality assesses laparoscopic colon cancer surgery in Østfold and Vestfold. The Interventional Centre took part in development of the procedure and followed up the clinical protocols.

SimSurgery AS  
Contact person: Jan Sigurd Røtnes  
SimSurgery AS is pioneering the development of advanced real-time 3D simulations for surgical procedures. SimSurgery AS started due to clinical needs specified by the Interventional Centre. After a feasibility study SimSurgery was established (Sept. 1999) with researchers from the Interventional Centre and SINTEF. There is an ongoing collaboration in development and quality assessment of the simulators.

OstomyCure as  
Contact person: Bente Buverud  
In a joint effort by OstomyCure as, the Swedish company Hot Swap and the Interventional Centre new methods for ostomy were developed and tested in animal studies.

Dept. Surgery, Ullevål University Hospital  
Contact person: Prof. Trond Buanes  
This collaboration on laparoscopic techniques focused on developing outpatient procedures in minimal invasive surgery at Ullevål University Hospital. One joint PhD program was terminated in 2005 with the thesis from Bjørn Edwin.

Institute of Physics, Faculty of mathematics and natural sciences. University of Oslo  
Contact person: Prof. Sverre Grimnes  
Development of a pCO2 sensor. One PhD program

Alertis Medical AS  
Contact person: Anne Kjersti Fahlvik  
Development of a pCO2 sensor. Five PhD programs.

The school of Pharmacy, Faculty of mathematics and natural sciences. University of Oslo  
Contact person: Prof. Jan Karlsen  
Development of a radioactive gel for treatment of bowel tumours.
Dept of radiology, The Norwegian Cancer Hospital
Contact person: Prof. Arne Skretting
Development of a radioactive gel for treatment of bowel tumours.

International collaboration
Partners in the Marie Curie project ARIS*ER – coordinated by the Interventional Centre

- Systems in Motion, Norway
- Graz University of Technology, Austria
- The Katholieke Universiteit Leuven, Belgium
- Technical University of Delft, The Netherlands
- Siemens Molecular Imaging, United Kingdom
- Ljubljana Medical Center, Slovenia
- IFC-CNR, Italy

Department of Radiology, Brigham and Women’s Hospital, Boston
Contact person: Prof. Ferenc Jolesz
BWH has been a leading hospital in introducing MR guided treatment as a research field and has made new methods for treatment of patients. The cooperation consists of exchange of research personnel. An application named “Development of novel applications for high-field MRI-guided therapies” was granted by the Norwegian research council (NRC) in 2004 for three years financing of the project.

Dept. of physics/Dept. of neuroradiology, University of Wisconsin, Madison WI, USA
Contact person: Prof. Victor Haughton
Development program for estimation of rotation in the vertebral column.

Center for medical imaging research, Linköping University Hospital, Sweden
Contact person: Prof. Örjan Smedby
Professor Smedby was previously employed as a guest professor at the Interventional Centre (funded by NorFa) and was tutoring PhD students. The cooperation continues through mutual visits and exchange of experience.

Intuitive Surgical (former Computer Motion)
The collaboration was directed towards testing and development of robotic systems for surgery. The Interventional Centre has two PhD programs linked to this collaboration focusing on instrument tracking, and head tracking.

Medtronic Vingmed AS
Contact person: Sigurd Kahn
The company has been an important partner in a randomised study on beating heart coronary bypass operations.

Siemens AS
Contact person: Ole Per Målsøy
The collaboration focused on development of combined tables for surgery and angiography. Siemens and the Interventional Centre shared the cost of one position at the Centre.

University Hospital of Tuzla, Dept. Cardiac Surgery (Bosnia)
Contact persons: Prof. Emir Kabil, Dr. Jacob Bergsland
1) Since 1998 The Interventional Centre (IVS) has been active in building medical expertise in Bosnia. The Cardiovascular Clinic in Tuzla which was started with assistance from USA soon developed a close relationship with the Centre and Department of Thoracic Surgery at Rikshospitalet. When Rikshospitalet moved from the old premises, a valuable catheterization laboratory was donated by Norwegian Authorities after request from IVS. The cooperative program has continued in 2004 and 2005. The program has supported by grants from the Royal Norwegian Foreign Department. In 2005 the activity focused on further education of medical personnel and the development of academic expertise. A total of 4 nurses from the Cardiovascular clinic in Tuzla visited Rikshospitalet and under the leadership of Karl Øyri, Head nurse at IVS were trained in advanced cardiac intensive care.
2) An initiative for improving the administrative practices of the clinic an intensive health administrative workshop was arranged in Oslo followed by a symposium in Mostar for the leadership of the clinic. The initiative was led and executed by Professor Ole Berg.
3) Research initiatives have included preparation for two important research projects to be conducted as collaborative programs between Rikshospitalet and Tuzla: A) A cross-sectional study to look at the incidence of cardiovascular risk factors in a rural and urban population in Bosnia, and a randomized study evaluating the effect of plateletactive drugs in coronary artery bypass patients.
4) ICT initiatives have been made to improve the access to clinical and research data for the hospitals in Bosnia. This project is involving the strategy of ICT in health in Bosnia as well as more concrete software development projects.
5) It is the intention of the program to involve all the University Clinics in Bosnia and at the present time an application to the Foreign Department is under preparation.
Cooperative Program with Bosnia and Herzegovina

The Interventional Centre has continued its cooperation with the cardiovascular clinic in Tuzla and has also developed connections with other parts of the health care system in Bosnia and Herzegovina. Due to a generous grant from The Royal Norwegian Foreign Department, the academic programs between Rikshospitalet and Bosnia have greatly expanded. A few of the more important aspects of the program are summarized below:

A) Support for interventional vascular procedures. This program was initially supported by The Research Council who approved a grant for Dr. Haris Huseinagic who trained with Dr. Geir Hafshahl from RH. The program was continued in Bosnia where a successful vascular interventional program is currently established. The academic component of this program is under development.

B) Nursing development. The highening of status and academic position of nursing is an important priority in Bosnia and a nursing exchange program was therefore developed between the two institutions. So far 4 nurses have undergone short term visits to RH guided by the head nurse at the Interventional Centre, Karl Øyri, who also visited the Cardiovascular Clinic in Tuzla and in Banja Luka.

C) Physician education. Modern intensive care has been a serious deficiency in Bosnian medicine. The exchange of doctors between Tuzla and RH was organized by the Interventional Centre. 2 anesthesiologists underwent postgraduate training in advanced life support and intensive care.

D) Pilot research programs. Several pilot programs are being conducted with RH supervision including a randomized study of the effect of Clopidogrel on perioperative graft patency in CABG surgery. Other projects, still in the early phase are utilizing the massive information collected in databases developed together with RH in previous years.

E) Management program. The lack of adequate management skills in health care has been addressed in an initial small workshop organized in Oslo with the leadership from Tuzla. Further plans for a larger, in depth and more practically oriented symposium is currently being planned.

F) ICT programs. Through the Interventional Centre contacts were made within telemedicine and ICT. This cooperation has been developing into a much more broad-based plan for the use of digital solutions in health care for the whole of Bosnia. At present expertise from RHs ICT department is working closely on plans to develop a major grant proposal within health ICT. ICT exchanges have been initiated.

In conclusion 2005 was a very active year for IVS cooperation with Bosnia. A number of important programs have been initiated and will continue in 2006. Through generous support from UD, Norwegian Embassy in Sarajevo and the Research Council of Norway, the academic cooperation with Bosnia has become an important and highly visible program in that country.

Collaboration with Setchenov

Moscow Medical Academy, Moscow, Russia

The co-operation involved exchange of medical students in addition to an extensive collaboration in the development of laparoscopic surgery with guest instructors from Norway and several seminars in Moscow.

GE Amersham

Contact person: Gunnar Hansen
Development of temperature sensitive contrast media for MRI.

GE Vingmed-Sound

Contact person: Gunnar Hansen
Development of ultrasound equipment for cardiology
Appendix 5
PhD programs at The Interventional Centre

Graduates


2002  Dr. Scient. Aanestad, Margunn Cultivating networks: Implementing surgical telemedicine. Faculty of Mathematics and natural sciences University of Oslo (ISSN 1501-7710) 2002. Mentors: Prof. Ole Hanset, Institute for informatics, Faculty of Mathematics and natural sciences, UiO and dr. med/Siv Ing Jan Sigurd Røtnes, The Interventional Centre, Rikshospitalet, Faculty of Medicine, UIO

2003  Dr. Philos. Samset, Eigil: MR guided intervention - Technological solutions. Faculty of Medicine, University of Oslo (ISBN 82-8072-069-3) 2003 Mentor Prof. Erik Fosse, The Interventional Centre, Rikshospitalet, Faculty of Medicine, UIO

2004  Dr. Med. Mala T. Cryoablation of liver tumours - Monitoring, techniques and tumour effects. Faculty of Medicine, University of Oslo. (ISBN 82-8072-100-2) 2004. Mentors: Dr. med. Ivar Gladhaug and prof. Odd Søreide Dept. Surgery Bjørn Edwin, The Interventional Centre, Rikshospitalet, Faculty of Medicine, UIO

Dr. Med. Klaastad Ø. Evaluations of brachial plexus block methods by magnetic resonance imaging and development of a novel method. Faculty of Medicine, University of Oslo. (ISBN 82-8072-113-4) 2004. Mentors: Prof. Erik Fosse, The Interventional Centre, prof Harald Breivik, Dept. Anaesthesia, Rikshospitalet, Faculty of Medicine, UIO, Prof. Ørjan Smedby, Dept. Radiology, Linköping University Hospital, Sweden.

Dr. Ing. Elle O J. Sensor Control in Robotic surgery. NTNU (ISBN 82-471-6257-1) 2004. Mentors: Prof. Terje K. Lien, Faculty of engineering science and technology, NUST, Trondheim, prof. Erik Fosse, The Interventional Centre, Faculty of Medicine, UIO.

Dr. Med. Kvarstein G. Tissue PCO2 for early detection of organ ischemia. Faculty of Medicine, University of Oslo (ISBN 82-8072-136-3) 2004. Mentor: Tor Inge Tønnessen, Dept. Anaesthesia, Rikshospitalet, Faculty of Medicine, UIO

Dr. Scient. Reimers M. Mathematical methods for 3D visualizaiion of organ geometry in image guided surgery and simulation. University of Oslo (ISSN 1501-7710) 2004. Mentors: Prof. Knut Mørken, Centre of Mathematics for Applications Faculty of Mathematics and natural sciences, Dr med/siv. ing. Jan Sigurd Røtnes, The Interventional Centre, Faculty of Medicine, UIO

2005  Dr. Philos Bjørnstad P. Catheter-based treatment for persistently patent arterial ducts and for atrial septal defects in the oval fossa. Faculty of Medicine, University of Oslo ISBN 82-8072-149-5. 2005

Dr. Scient Mirtaheri P. A novel biomedical sensor for early detection of organ ischemia. Faculty of Mathematics and natural sciences. University of Oslo ISSN 1501-7710-407. 2005

PhD Edwin B. Advanced laparoscopy – from the research and development department to day care surgery. Faculty of Medicine, University of Oslo ISBN: 82-8072-655-9. 2005

Ongoing

MR group
Group co-ordinator: Cand. Med. Per Kristian Hol


Improving coronary surgery group
Group co-ordinator: Professor Erik Fosse
Professor Jan Ludvig Svennevig Dept of Thoracic and cardiovascular surgery


3. Cand. med. Lund, Christian: Neurologic conse-
quences of coronary surgery with or without cardiopulmonary bypass. Mentor: David Russell, Dept of Neurology.


9. Cand. Scient Lars Fleischer: Accelerator sensor data for monitoring cardiac ischemia and function. Mentors: Erik Fosse, The Interventional Centre, Prof. Lars Hoff, Vestfold University College, Faculty of science and Engineering, Horten

Biosensor group
Group co-ordinator: Professor Tor Inge Tønnessen


12. Cand. Med. Halvorsen, Steinar: Basic and clinical studies on cardiac ischemia by biosensors. Mentor: Tor Inge Tønnessen, the Interventional Centre/Dept of Anaesthesiology, RH

Cardiac function and imaging
Group coordinator: Professor Halfdan Ihlen


Miscellaneous


18. Cand. Polit. Mørk, Bjørn Erik: Organising for learning and innovation in Norwegian hospitals – How new technologies challenge existing organisational structures and cultures. Mentors: Prof Erik Fosse, the Interventional Centre, Prof Johan Olaisen Norwegian School of Management Oslo, Prof Terje Hagen, Institute for health management and health economy, University of Oslo.
Appendix 6 -
Publications from the Interventional Centre 1998-2005

(Conference abstracts not included)

Peer reviewed Publications in International Journals

1997
1. Reiertsen, O.; Larsen, S.; Trondsen, E.; Edwin, B.; Faerden, A.E.; Rosseland, A.
randomized controlled trial with sequential design of laparoscopic versus conventional appendicectomy --
British Journal of Surgery. 1997; 84 : 842-847
Preoperative local infiltration with ropivacaine for postoperative pain relief after inguinal hernia repair --

1998
Minimally invasive direct coronary artery bypass grafting without cardiopulmonary bypass in combination with
intraoperative percutaneous transluminal coronary angioplasty for palliative coronary revascularization in a
4. Arafa, O.E.; Pedersen, T.H.; Svennevig, J.L.; Fosse, E.; Geiran, O.R.
Intraaortic balloon pump in open heart operations: 10-year follow-up with risk analysis -- Annals of thoracic
surgery. 1998; 65 : 741-747
5. Lærum, F.; Borchgrevink, H.M.; Fosse, E.; Faye-Lund, P.
The new Interventional Centre - a multidisciplinary R&D clinic for interventional radiology and minimal access
surgery. -- Computer methods and programs in biomedicine. 1998; 57 : 29-34
The new interventional center. Experiences after 12 months of operation -- Acad Radiol. 1998; 5(Suppl 2) :
446-449
7. Trondsen, E.; Edwin, B.; Reiertsen, O.; Faerden, A.E.; Fagertun, H.; Rosseland, A.
Prediction of common bile duct stones prior to cholecystectomy: a prospective validation of a discriminant anal-
ysis function. -- Archives of Surgery. 1998; 133 : 162-166]

1999
8. Fosse, E.; Lærum, F.; Røtnes, J.S.
The Interventional Centre-31 months experience with a department merging surgical and image-guided inter-
vention -- Minimally Invasive Therapy and Allied Technologies. 1999; 8 (5) : 361-369
Laparoscopic and open operations in patients with perforated peptic ulcer -- European Journal of Surgery. 1999;
165 : 209-214
10. Samset, E.; Hirschberg, H.
Oskarsson, W.; Krohg-Sørensen, K.; Brekke, M.; Myhre, H.O.
Endovascular treatment of abdominal aortic aneurysms in Norway. the first 100 patients. -- Eur J Vasc Endovasc
Surg. 1999; 18 (6) : 506-509
12. Klaastad, Ø.; Lilleås, F.G.; Røtnes, J.S.; Breivik, H.; Fosse, E.
Magnetic resonance imaging demonstrates lack of precision in needle placement by the infracavicular brachial
plexus block described by Raj et al. -- Anesthesia and analgesia. 1999; 88 : 593-598
13. Hirschberg, H.; Samset, E.
Intraoperative image directed dye marking of tumor margins -- Minimally Invasive Neurosurgery. 1999-09; 42
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32. Magnar Martinsen
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33. Jonas Helgemo
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34. Philip Bruvoll
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Tracking of surfaces-matched with CT/MR. UIO: IFI 2005
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Navigated 3D X-ray. UIO: IFI
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Datacor report
OPERATIONS, INTERVENTIONS AND EXAMINATIONS
THE INTERVENTIONAL CENTRE, RR-HF

GENERAL
Total number of patients: 551
Number of women: 283
Number of men: 268
Total number of animal studies: 55
Total number of vitro studies: 28

LOAD
Intervention in total anaesthesia: 326
Intervention in local anaesthesia: 0
Imaging, total: 225

PATIENTS IN THE COMBINED SURGERY/ANGIOGRAPHY SUITE
172
Intervention in total anaesthesia: 150
Intervention in local anaesthesia: 0
Imaging: 22
Animal studies: 20
In vitro studies: 1

PATIENTS IN THE COMBINED SURGERY/MR-SUITE
173
Intervention in total anaesthesia: 4
Intervention in local anaesthesia: 0
Imaging: 169
Animal studies: 9
In vitro studies: 29

PATIENTS IN THE COMBINED VIDEOSCOPY/ULTRASOUND SUITE
181
Intervention in total anaesthesia: 173
Intervention in local anaesthesia: 0
Imaging: 8
Animal studies: 15
In vitro studies: 0
### Appendix 8 - Members of the Advisory Board 2005

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Affiliation</th>
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<tbody>
<tr>
<td>Professor</td>
<td>Frode Lærum, Chairman</td>
<td>Section for Experimental Radiology, Rikshospitalet</td>
</tr>
<tr>
<td>Professor</td>
<td>Otto A. Smiseth</td>
<td>Section of Cardiology, Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Jan L. Svennevig</td>
<td>Thoracic Surg. Dept., Rikshospitalet</td>
</tr>
<tr>
<td>Director</td>
<td>Kathrine Cappelen</td>
<td>???, Rikshospitalet</td>
</tr>
<tr>
<td>Professor</td>
<td>Jan P. Blomhoff</td>
<td>Medical Dept., Rikshospitalet</td>
</tr>
<tr>
<td>Professor</td>
<td>Anstein Bergan</td>
<td>Surgical Dept., Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Tryggve Lundar</td>
<td>Neurosurgical Dept., Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Sverre O. Lie</td>
<td>Department of Paediatrics, Rikshospitalet</td>
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<tr>
<td>Head of department</td>
<td>Thomas Åbyholm</td>
<td>Department of Obstetrics and Gynaecology, Rikshospitalet</td>
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<tr>
<td>Dr.</td>
<td>Sjur Sponheim</td>
<td>Dept. for Anaesthesiology, Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Harald Breivik</td>
<td>Dept. for Anaesthesiology, Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Hans J. Smith</td>
<td>Department of Radiology, Rikshospitalet</td>
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<tr>
<td>Head of department</td>
<td>Jarl A. Jakobsen</td>
<td>Department of Radiology, Rikshospitalet</td>
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<tr>
<td>Head of department</td>
<td>Øystein Jensen</td>
<td>Medical Techn. Department, Rikshospitalet</td>
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<td>Professor</td>
<td>Sverre Grimnes</td>
<td>Medical Techn. Department, Rikshospitalet</td>
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<td>Professor</td>
<td>Frode Vartdal</td>
<td>Institute of Immunology, UiO</td>
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<td>Professor</td>
<td>Per Teisberg</td>
<td>Medical Outpatient Department, Rikshospitalet</td>
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<tr>
<td>Professor</td>
<td>Ansgar O. Aasen</td>
<td>Inst. For Surgical Research, University of Oslo</td>
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<tr>
<td>Medical Director</td>
<td>Arnt Jakobsen</td>
<td>Managing Director’s Office, Rikshospitalet</td>
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<td>Professor</td>
<td>Erik Schrumpf</td>
<td>Manager, Department Group for Clinical Medicine, University of Oslo</td>
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<td>Professor</td>
<td>Per Brandtzæg</td>
<td>Vice Manager, Faculty Division Rikshospitalet, University of Oslo</td>
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<td>Professor</td>
<td>Torfinn Taxt</td>
<td>University of Bergen</td>
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<td>Ass. Professor</td>
<td>Jarle Rørvik</td>
<td>University of Bergen</td>
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<tr>
<td>Professor</td>
<td>Hans Olav Myhre</td>
<td>St. Olavs Hospital, Trondheim</td>
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<td>Professor</td>
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<td>Tromsø University Hospital</td>
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<td>Professor</td>
<td>Kirsti Ytrehus</td>
<td>Tromsø University Hospital</td>
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<tr>
<td>Director</td>
<td>Berit Mørland</td>
<td>The Norwegian Health Services Research Centre</td>
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<tr>
<td>Senior scientist</td>
<td>Inger Norderhaug</td>
<td>The Norwegian Health Services Research Centre</td>
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<td>Professor</td>
<td>Trond A. Buanes</td>
<td>Ullevål University Hospital</td>
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<tr>
<td>Professor</td>
<td>Karl-Erik Giercksky</td>
<td>The Norwegian Cancer Hospital</td>
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<tr>
<td>Consultant surgeon</td>
<td>Ulf Kongsgaard</td>
<td>The Norwegian Cancer Hospital</td>
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<tr>
<td>Professor</td>
<td>Arne Bakka</td>
<td>University Hospital of Akershus</td>
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<tr>
<td>Dr.</td>
<td>Steinar Pedersen</td>
<td>University Hospital of Tromsø</td>
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