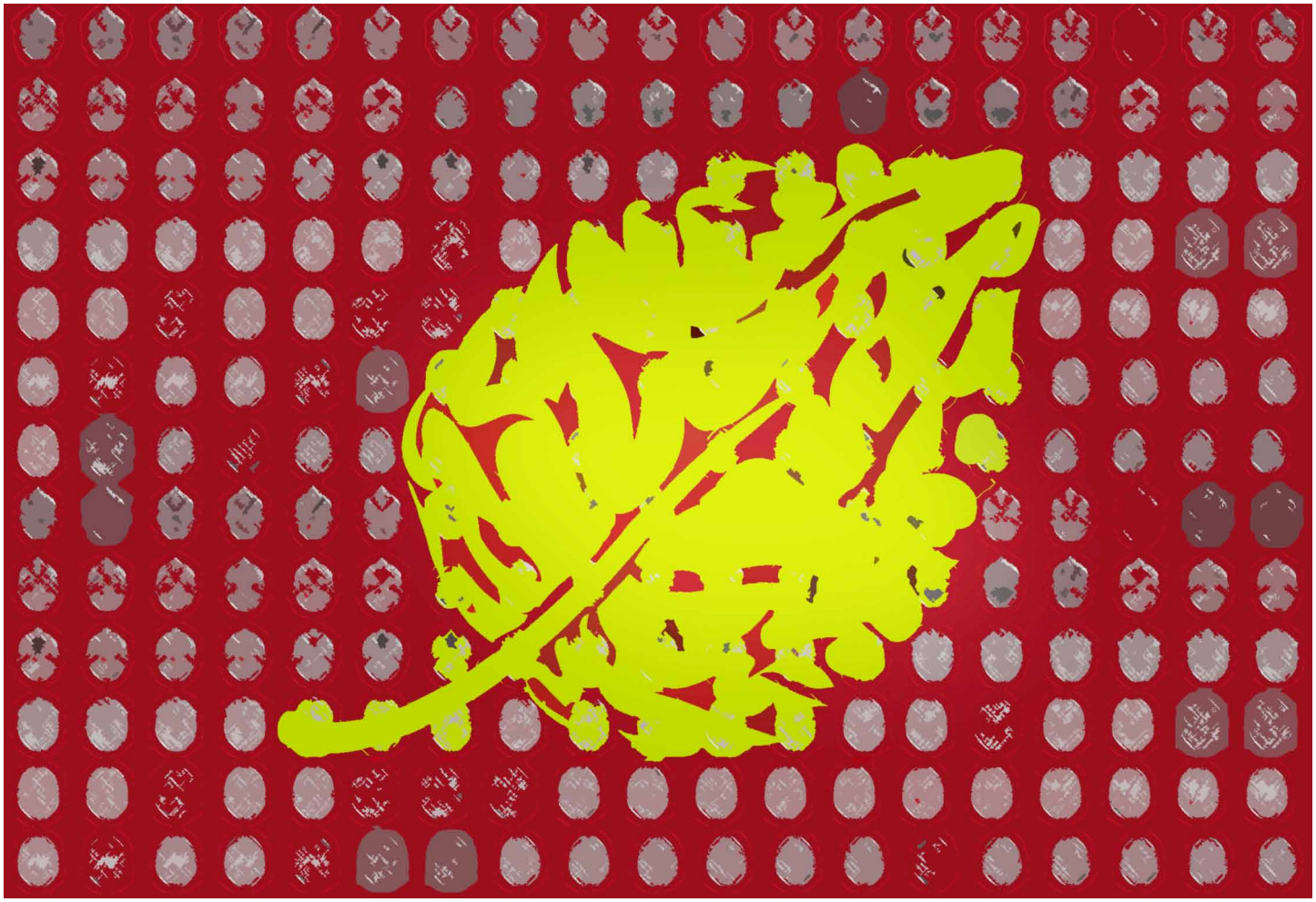
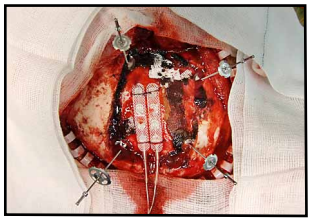


Annual Report 2011

Umeå center for Functional Brain Imaging - UFBI

Content



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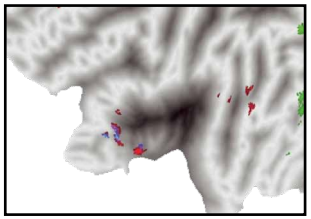

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Welcome

Lars Nyberg's Editorial

It is time to look back at a busy, interesting, and fun 2011 at Umeå Center for Functional Brain Imaging (UFBI). More than 400 fMRI examinations were performed during 2011, we have had many visitors and students in the lab, many interesting papers have been published - including papers in Science, J Neuroscience, and NeuroImage - and results have been presented at many meetings and in various media. We will try to exemplify some of the activities in this report.

One interesting project has been to work in close collaboration with neurosurgeons and use fMRI as a tool to produce information on preserved and damaged neural tissue, with the hope that this information can aid surgery. This clinical use of fMRI is developing very well. We are glad that our images can be of immediate practical use, and we receive valuable feedback on our ability to functionally challenge specific regions. In this report you can read more about the clinical use of fMRI.

The time-series data generated in fMRI studies is often transformed into colorful pictures and even movies. At UFBI we strive towards developing illustrations of findings that trigger the viewers curiosity to learn more about a specific research area. You will find some examples in the report of this "artwork".

UFBI is continuing to grow. As a result of new collaborations, we move into novel areas of research. Some exciting projects are described in this report – read about brain functions in relation to touch, smell, virtual reality navigation, and your ability to decide!

The UFBI activities revolve around the MRI scanners at NUS. However, several other techniques are necessary to comprehensively study the human brain. In this report you can read about a fantastic imaging method that now is available to researchers at Umeå University; namely positron emission tomography (PET). A visitor to UFBI from USA initiated a PET project on motivation and the dopamine system. Many other projects will soon follow.

UFBI has been up and running as a center for more than 10 years, but in 2011 we were happy to appoint a new board. The board members are introduced in this report. We look forward to continued discussions and advice.

UFBI co-director Johan Eriksson and myself like to thank all who have contributed to past year's UFBI achievements. Maintaining this kind of advanced infrastructure taxes many skills and competences that all contribute to form a pleasant and professional environment for data collection, statistical analyses, interpretation, and discussions. We look forward to hard work and exciting discoveries in 2012!

January 2012
Lars Nyberg, UFBI Director (2001 - Present)

Clinical use of fMRI

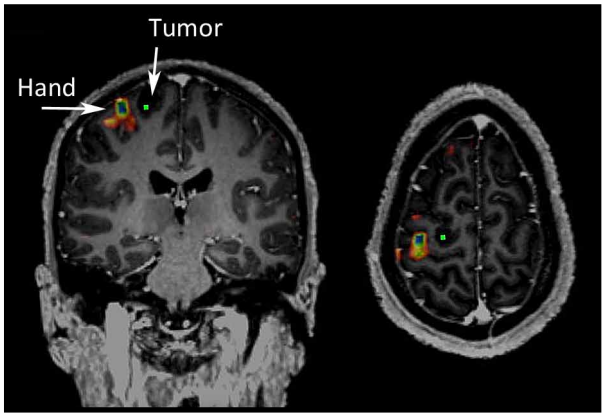
One of the areas for research and clinical development in brain tumor surgery is the application of fMRI in preoperative investigations and integration of the obtained fMRI data in a navigation system.

This navigation system works like a GPS in the brain, it allows the surgeon to visually define the position of the instruments in relation to anatomical images of the patient. In recent years new and more sophisticated surgical techniques for tumor resection have been developed. Treatment modalities such as electrical stimulation of motor cortex for various pain syndromes are also under investigation. This technical development puts higher demands on the surgeon's possibility to navigate safely in the brain and the visualisation of areas that is responsible for different neurologic functions are of significant importance.

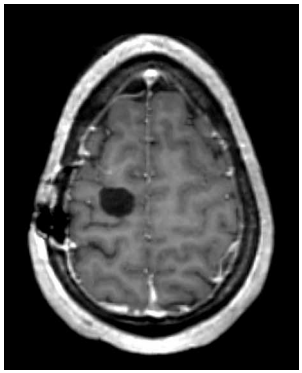
Malignant brain tumors, gliomas, are difficult to treat since they are almost always growing infiltrative in the brain tissue. From clinical studies we know that if a larger part of the tumor surgically can be resected, the prognosis of the patient is far better. Since the tumor is diffusively growing, a clearly defined border to normal tissue is seldom obvious.

The problem for the neurosurgeon is to define the border of the tumor and its location in relation to various functional areas in the brain. In order to surgically resect as much tumor tissue as possible, without interfering with the normal function of the brain, a preoperative investigation showing the anatomical location of important neurological functions is of great value.

Tommy Bergenheim

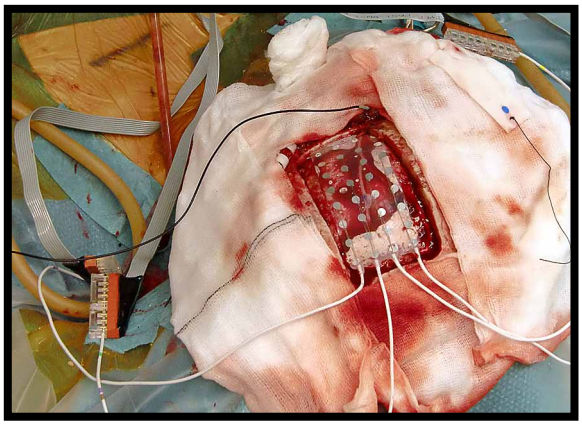

Tumor
Hand

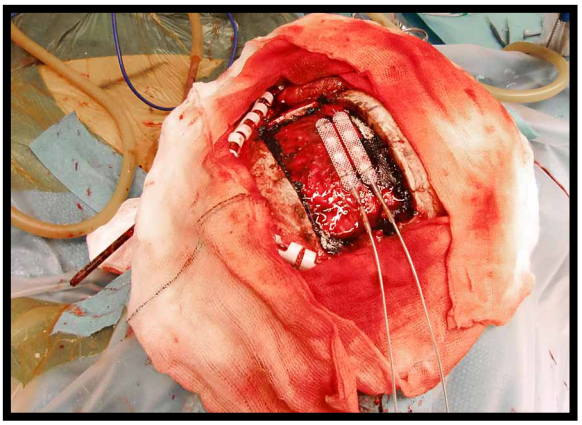

Medtronic
BARRIER
TREON plus



Several UFBI projects have clinical relevance, e.g., research on Parkinson's disease, hydrocephalus, peripheral nerve damage, etc. There is also continuous collaboration with neurosurgery in relation to preoperative mapping of brain function. Here, the goal is to provide relevant information regarding case-specific functional brain organization. For example, mapping how different parts of the face are represented in primary motor cortex for optimal placement of implanted electrodes to reduce chronic pain, or mapping critical brain functions such as language or motor control to improve the outcome from brain tumor surgery. Usually, the experimental protocols are tailored to the specific problems for each patient, but a promising path under development is the use of so called "resting state" protocols. Here, the patient is not performing a cognitive task during scanning, but is instead asked to rest (but to stay awake). Previous research have shown that activity in brain areas that work together during normal cognitive processes tend to co-vary during rest and the protocol can thus provide information on the integrity of such brain networks. Major advantages of the resting state protocol is that it is versatile and can be applied to a large array of clinical situations, and the fact that the patient does not need to engage the sometimes elaborate cognitive tasks used to probe specific brain functions.

Johan Eriksson





Previous page, top: Tumor navigation with the aid of fMRI-data. The green dot is the tip of the surgical probe. *Middle:* Realtime-navigation during surgery. *Bottom:* structural image after surgery. *This page, left:* motorcortex-stimulation with electrode-grid. Patient is facing the top right corner of the image. *Right:* permanent motorcortex electrodes attached.

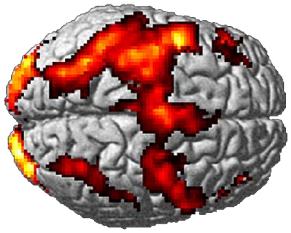
All photos: Tommy Bergenheim

Visualizing fMRI

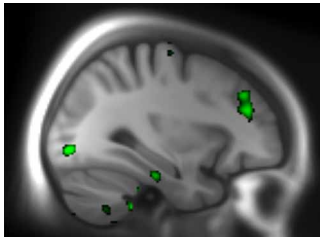
Functional brain imaging makes it possible to peer into the human mind, providing us with unique information on the relation between cognitive functions and brain structure. However, the vast amounts of data coming out of a regular fMRI experiment would be difficult to grasp if it could not be properly visualized.

A central purpose for visualization is thus to provide an overview of the results. In this respect, mapping the statistical evaluation on to brain anatomy is preferably made in a way that gives a birds-eye view, for example on "glass brains", whole-brain renderings, or flat maps. In relation to more specific hypotheses of structure-function relations, precise anatomical localization may have higher priority. Here, mapping to detailed anatomical structure, for example on T1-wheighted MR slices, can be advantageous. For experimental designs with chronological structure, movies of how brain activity changes over time can provide additional information (Kalpouzos et al. 2010). Visualization of fMRI data is thus an essential step in brain imaging research. A plethora of visualization methods exist that fulfill different purposes; which one to use depends on research context.

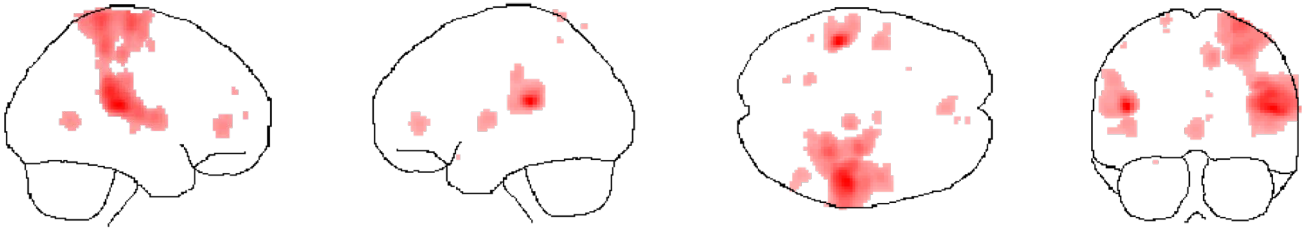
Johan Eriksson



Rendered brain with activity.

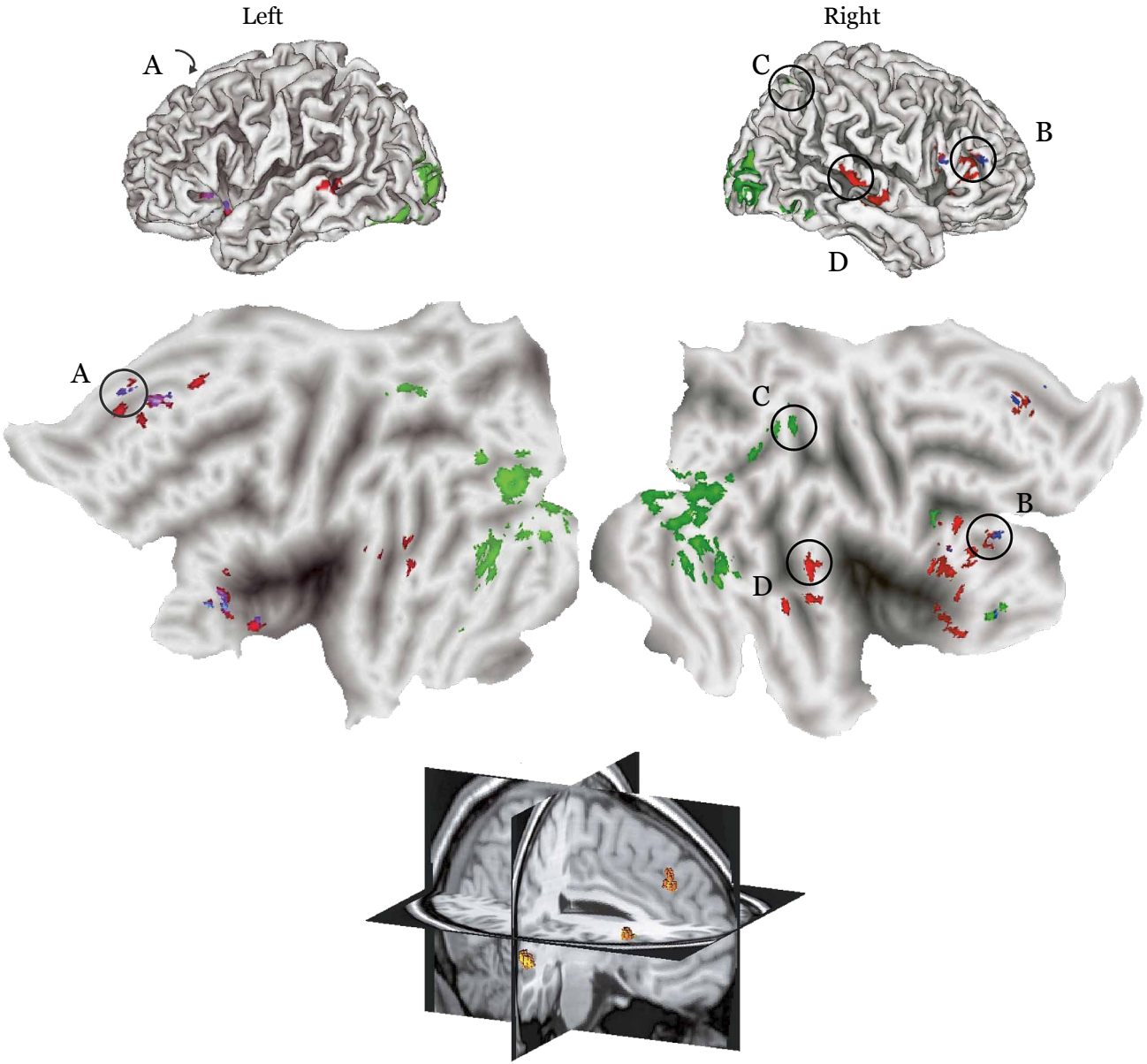


Structural template with activity.



Glass brain with activity seen in sagital (right then left), transverse and coronal (dorsal) view.

Illustrations: Micael Andersson



Illustrations: Johan Eriksson

Top: A brain in its folded state. *Middle:* Flatbrain images of the same brain in an unfolded state. *Bottom*: Activity projected on slices in all three axes.

Research

UFBi is involved in a wide range of inhouse, national, and international projects. Here is a presentation of some of the projects that were done within and in collaboration with UFBI during 2011.

Chemical intolerance

Chemical intolerance (CI) is a term that refers to the surprisingly common phenomenon of persons getting ill from everyday odours. Estimations suggest that around 10% of the population is negatively affected by such chemicals. A few percent react to such a degree that even the slightest whiff of perfume triggers a multitude of debilitating symptoms. Although symptoms are similar to those found in asthma and allergies, the sufferers do not show any signs of immunologic deviations. CI neither conforms to toxicological dose-response relationships as the sufferers react to very low concentrations of chemicals assumed to be harmless. As the mechanism behind the affliction is unknown, CI is still defined as a medically unexplained symptom. With the hypothesis that sensitization is a key characteristic of CI, we have utilized the fMRI technique to investigate whether such signs can be discerned in the brain. By exposing intolerant and non-intolerant individuals to odorants while in the scanner, we hope to find patterns of blood flow that parallels those found in other afflictions characterized by sensory amplification, such as fibromyalgia.

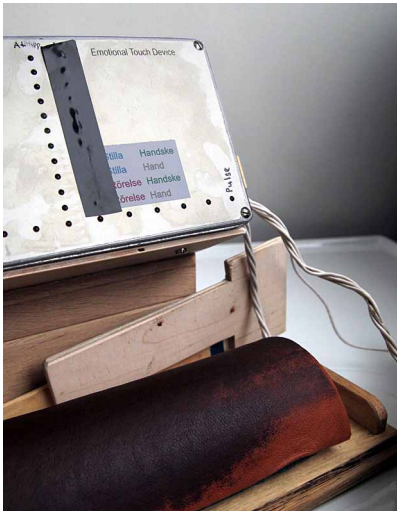
Linus Andersson

The olfactometer used during the fMRI-experiments to expose the participants to different kinds of odours.

Learning and Memory
This project is part of Umeå School of Education (USE). The main goal is to offer a neuroscience perspective on central questions related to learning. One theme is concerned with the "testing effect" and fMRI is used to examine how patterns of brain activity change as a function of repeated testing. Preliminary findings implicate the medial frontal cortex in the testing effect. This issue is currently explored further in collaboration with colleagues at the Department of Psychology. Another theme relates to another project within USE and examines learning advantages and neural correlates of various forms of mathematics learning. Preliminary findings imply that activity in parietal cortex might play a pivotal role for mathematical proficiency.

Judgment and Decision Making
Central phenomena commonly observed in human judgment and decision making may have their proper explanation in the limitations of human controlled cognitive processing. In a current project this hypothesis is investigated by combining cognitive modeling of judgment and decision making with fMRI. One example of a central phenomenon under investigation is the tendency to use different types of cognitive processes in different judgment situations. In a series of experiments we are investigating whether these types of processes give rise to separable brain activation patterns and to what extent such patterns can be used to diagnose what processes are used in contexts where behavioral data are not diagnostic enough.

Linnea Karlsson



The emotional touch device created for UFBI by Göran Westling.

Tactile stimulation

Touch massage is characterized by gentle touch of the skin involving light pressure effleurage and long, calm stroking movements. In clinical settings touch massage is sometime used as a complementary treatment to decrease pain, anxiety and stress among patients. In this project we used fMRI to evaluate brain regions involved with pleasant human touch to better understand physiological and emotional responses during touch massage.

Lenita Lindgren

Photo: Lars Nyberg

Preparation before entering the PET/ CT-scanner.

Motivation

Using activation Positron Emission Topography (PET), we examined if dopamine (DA) release in brain regions such as the striatum or prefrontal cortex (PFC) mediated motivation/cognition interactions. We infused participants with raclopride to occupy DA D2 receptors during “unmotivated” and “motivated” (money) task-switching. We predict motivation will lead to DA release and raclopride displacement in striatum and PFC, providing a molecular basis for translating motivation into cognitive force.

Adam Savine

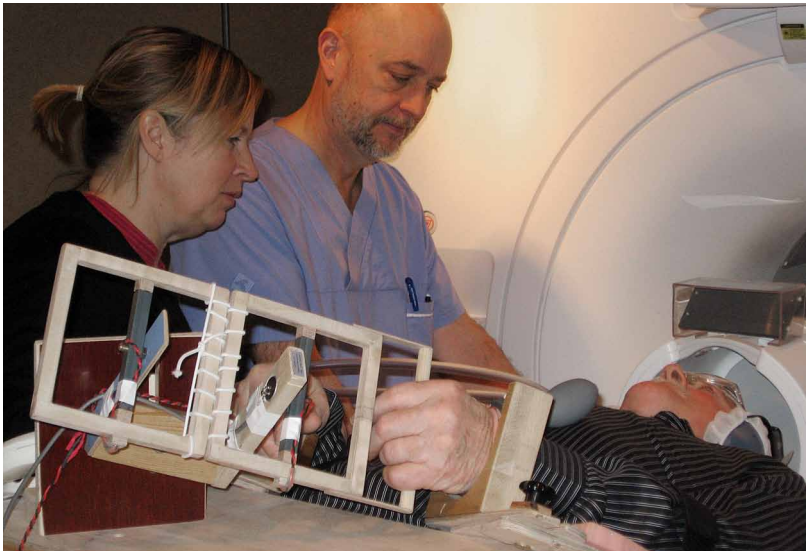


Photo: Göran Westling

Stroke rehabilitation
The neurologist Helena Fordell is studying stroke rehabilitation using Virtual Reality (here supported by x-ray nurse Hans-Olov Karlsson). The affected hand of the patient controls a visual cursor by pronation-supination movement of the wrist (recorded with a potentiometer). Successful tasks are enhanced by flexion-extension movements of the wrist by two motor-coils in the static magnetic field (the two plywood frames; construction by Göran Westling at laboratory of human hexterous manipulation). Viewed subject is not a patient.

Göran Westling

Zooming in

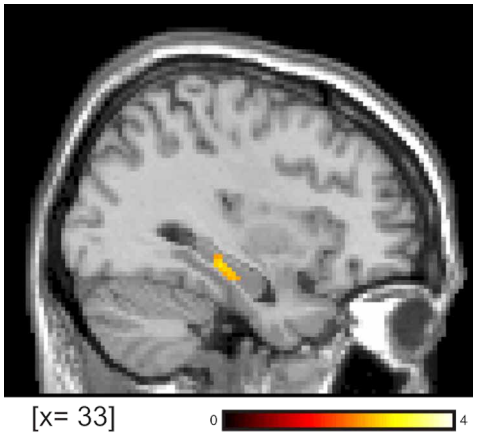
... on some of the articles produced and published by members of UFBI in 2011. Below, we turn it over to Karolina Kauppi and Carl-Johan Olsson who will describe the work that was done and that resulted in published articles.

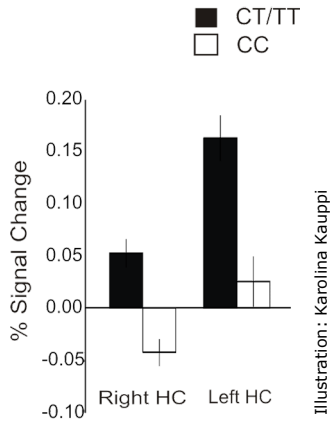
Kauppi, K., Nilsson, L.G., Adolfsson, R., Eriksson, E. & Nyberg, L. (2011). KIBRA polymorphism is related to enhanced memory and elevated hippocampal processing. *Journal of Neuroscience, 31*(40), 14219-14222.

In this imaging genetics study we investigated a genetic variation of the KIBRA gene in relation to memory performance and brain activation. Individuals carrying a certain KIBRA T allele have repeatedly shown superior episodic memory performance than noncarriers of the T allele. One study reported increased hippocampal activation in T noncarriers during memory retrieval (Papassotiropoulos et al., 2006, Science), which was interpreted as compensatory activation to reach the same performance as T carriers. Here, using larger behavioral (N=2230) and fMRI (N=83) samples, we replicated the KIBRA effect on memory performance but found increased hippocampal activation in T carriers instead of noncarriers. These findings link the enhanced memory performance in KIBRA T carriers to elevated hippocampal functioning, rather than to neural compensation in noncarriers.

Ongoing UFBI projects within the imaging genetics field include relating fMRI data from 376 participants to genome-wide genetic data (GWAS).

Karolina Kauppi





Olsson, C.-J., & Nyberg, L. (2011). Brain simulation of action may be grounded in physical experience. *Neurocase, 17*(6), 501-505.

An intriguing feature of the human brain is that when actions are imagined, corresponding brain regions are recruited as when the actions are actually performed. However, it has been hypothesized that the similarity between real and simulated actions depends on the nature of the motor representations.

In this study we tested this hypothesis by examining subject SD, who has never used her legs but is an elite wheelchair athlete. Our results show that only tasks that were in SD's motor repertoire recruied motor brain regions. For other tasks the prefrontal cortex was recruited instead, which was confirmed with a control group. Thus, brain simulation of actions may be grounded in specific physical experiences. Our results affect the use of motor imagery in several fields such as rehabilitation and sports, but also advance the theory of motor imagery. Future studies are now aiming at understanding the preservation of the motor representation of complex motor tasks following injuries.

Carl-Johan Olsson

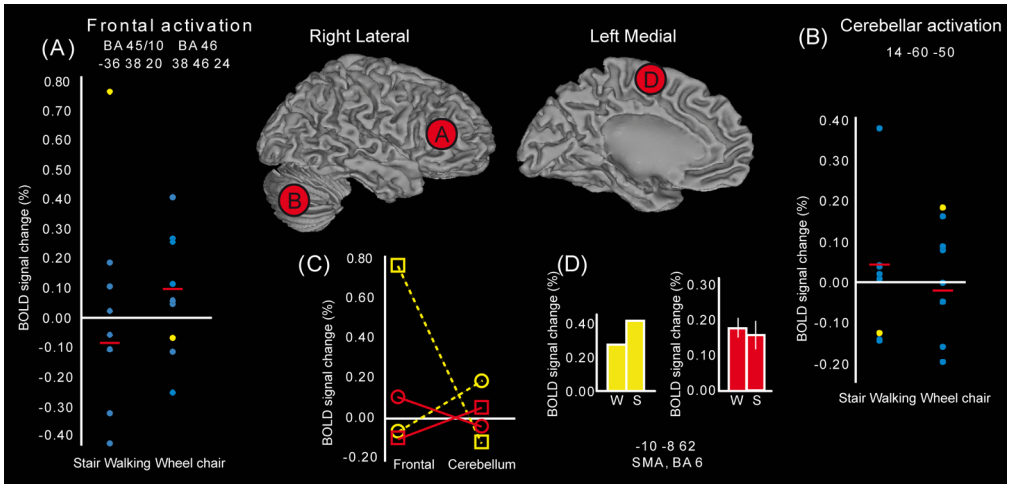


Illustration: Carl-Johan Olsson

A new modality for brain imaging: PET

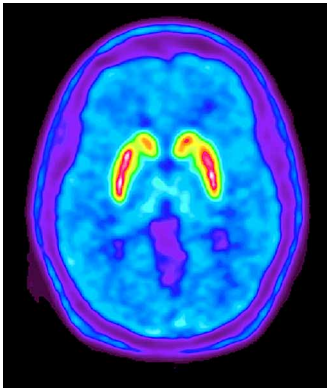
In 2010 the centre for PET/CT-cyclotron and tracer chemistry started at Norrlands University Hospital. It is equipped with a high-end PET integrated with a 64-slice CT scanner from General Electric. The PET studies can be done as static studies or as dynamic activation studies. Equipment for stimuli presentation is installed in the scanner.

During 2011 the production of fluorine and carbon labelled tracers according to GMP (good medical practice) has been set up and beside FDG (Fluorodeoxyglucose) also Fluorine, Acetate, FLT, Raclopride and 15O-water are available. The high molar sensitivity of the PET system is the main advantage of this molecular imaging system.

The chosen tracer decides which molecular function is to be studied. If using FDG the sugar metabolism is examined and since the glucose metabolism is strongly correlated to neuronal activity FDG measurements act as a surrogate marker for brain activity. If Raclopride is used the dopamine receptor (D2) activity is measured. The PET/CT is used both for clinical and research scanning.

Katrine Åhlström Riklund

The GE Discovery 690 at Norrlands University Hospital.



PET image showing Striatum.

Illustration: Adam Savine

UFBI-Board

In 2011 we were happy to appoint a new board for UFBI. The board members who were appointed were: Martin Ingvar, Katrine Åhlström Riklund, Roland Johansson, Anna Stigsdotter Neely and Tommy Olsson. We now give the word to the chairman of UFBI, Martin Ingvar:

The northern light in brain research

The investment in Umeå on research concerning the function of the brain is an example of what can be achieved with methodical planning combined with academic thinking. Both are needed. The course is set, all administrative details are kept to a minimum, and shared values are about originality, quality and new knowledge. Young colleagues are encouraged and surrounding health care and academia share pride in the successes. The analysis also provides initiatives that are focused to where a scientific difference can be made.

The rich Betula material is a continuous source of success. Along with a heavy theoretical analysis of the aging brain and many methods in addition to imaging, UFBI is an internationally prominent and important player within this area of research. The challenge now is to nurture a number of successful scientists who share the view that success is doubled when it is shared with others. The ardor that is being demonstrated, as well as the hard work within the research center is a source of inspiration not only locally but also clearly in the entire scientific field.

Martin Ingvar

Photo: Stefan Zimmerman

Seminars and meetings

A multidisciplinary research environment, a multi-faceted research agenda, and a growing research group makes structured interaction platforms indispensable. To this end we have weekly lab meetings where project plans, experimental designs, analysis strategies, and results are discussed in an informal setting to take benefit from the whole brain trust of UFBI. During 2011 we celebrated our 100th UFBI lab meeting.

To increase the interaction among, and to inform people around UFBI of lab activities, we also arrange annual meetings. These meetings have been given to provide feedback and to present and discuss completed, ongoing, and future UFBI projects. At this year's meeting 10 talks were given on different subjects and almost 40 collaborators attended. There was also a clinical fMRI meeting held at Norrlands Univeristy Hospital in November where colleagues from Linköping, Lund, Uppsala and Göteborg came to share their experiences in the field. UFBI is also frequently privileged with requests to give presentations of lab activities aimed at the general public, as well as participating in the press.

Visitors

During 2011 we at UFBI had many visits from both national and international collaborators. Each year we also recieve several requests from students that wants to be involved in different projects. This year we had students from several different countries visiting us during a longer period of time. Our guests this year was: *Elsa Bonnard,* master student, University Pierre & Marie Curie University, France. *Lisa Kruggel*, bachelor student, Saarland University, Germany. *Larisa Mayorova*, PhD student, Russian Academy of Sciences (IHNA RAS), Russia. *Tony Nelson*, PhD student, Federal University of Pará State, Brazil. *Adam Savine*, PhD student, Washington University in St. Louis, USA.

Lenita Lindgren at UFBI-lab day June 22 at Umeå Folkets Hus.

Linnea Karlsson talking at the Science lunch series at Café Station in downtown Umeå October 20.

We now give the word to Larisa Mayorova and Adam Savine who want to share their experience at UFBI with us.

At the end of my first year as a PhD student I was lucky to visit UFBI during two months in the fall of 2011. I was strongly impressed by the organization of the lab, the warm atmosphere and the competent people surrounding me. My main aim was to learn how to deal with fMRI data correctly, but I got a lot more. From Micael Andersson and Alireza Salami I gained clear understanding of principles of fMRI data processing and I also got many practical guidelines from them concerning experiment holding. From Johan Eriksson, who kindly gave me a lot of useful advice and theoretical knowledge, I got interesting ideas from discussions and most importantly, the approach to solving the problems, which I'm sure I will face in the future.

Larisa Mayorova

I am a Ph.D student who visited from Washington University - St. Louis in the USA. Working with collaborators within the UFBI and Norrlands University Hospital, I helped implement the raclopride / motivation PET imaging project - the first activation PET scan conducted in Umeå. My interactions within the UFBI were wonderfully stimulating, as I both acquired new scientific knowledge and skills as well as meaningful personal connections. Combined with the general Swedish style of life, I enjoyed my time in Umeå!

Adam Savine

CJ Olsson at the Radiology week in Umeå, Aug 13.


Lars Nyberg also gave a presentation at the Radiology week.

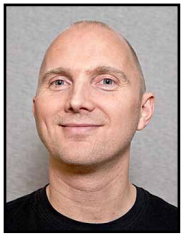
Some of the UFBI members. *From the top in a clockwise order:* Lars Nyberg (director), Per Nordmark, Alireza Salami, Micael Andersson, Mikael Stiernstedt, Malahat Mousavi, Magdalena Domellöf-Eriksson, Fredrik Bergström, Johan Eriksson, Anders Lundquist, Maria Josefsson, Sara Pudas, Karolina Kauppi, Carl-Johan Olsson.

UFBI members*

Name: Micael Andersson
Position: Research engineer
Research and work: Micael is a diploma engineer and has been working with fMRI since 2004. He makes the in-house program DataZ, which is a Matlab-based add-on for the analysis software SPM and is used for batching the analysis and visualizing results. Micael is also performing the fMRI-analysis for several of the research projects.

Name: Fredrik Bergström
Discipline: Cognitive Neuroscience/ Philosophy
Research and work: Fredrik is a graduate student and uses fMRI to study and contrast the neural correlates of conscious- and unconscious cognition. He is particularly interested in the role of attention and working memory for consciousness, as well as the implications for theories of consciousness.

Name: Magdalena Domellöf-Eriksson
Discipline: Clinical neuroscience
Research and work: Magdalena is a PhD student investigating cognitive functions in patients with Parkinson's disease (PD). She will be using fMRI to explore differences in brain activation during working memory between PD and controls.



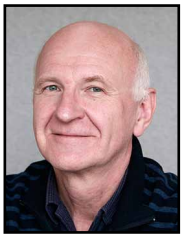
Name: Urban Ekman
Discipline: Cognitive Neuroscience
Research and work: Urban is a PhD student who focuses on questions that relates working-memory processing to functional brain responses in a population-based cohort diagnosed Parkinson's disease with or without mild cognitive impairment (MCI). Additionally, potentials of brain plasticity will be examined in participants with MCI.

Name: Kerstin Englund
Position: X-ray technician/nurse
Assignments: Kerstin has been working with MR since 2000. When the new MR-scanner was installed in November 2009, she got the opportunity to start working part time with fMRI. Her other workplace is the Interventional Neuroradiology lab at Norrlands University Hospital.

Name: Johan Eriksson
Discipline: Cognitive Neuroscience
Research and work: Johan is an Assistant Professor and uses fMRI to study the neural correlates of consciousness, several forms of memory, brain plasticity and learning, and to perform preoperative mapping of brain functions.

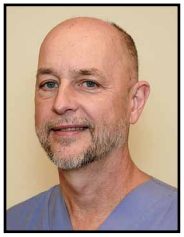
Name: Peter Hägglund
Position: Master of Science in Engineering
Assignments: Peter is involved in the service and technical support of the MRI scanners at Umeå University and Norrlands University Hospital.

Name: Susanna Jakobsson Mo
Discipline: Radiology and Nuclear medicine
Research and work: Susanna is a consultant specialist in Radiology and Nuclear medicine. She is a PhD student working with imaging of dopamine function with SPECT in parkinsonian disorders within the NYPUM-project.



Name: Roland Johansson
Discipline: Sensorimotor control in humans
Research and work: Roland is a professor of physiology working with analysis of neural mechanisms supporting planning and control of dexterous object manipulation with emphasis on sensory, mnemonic and predictive mechanisms. Roland is a member of the Swedish Royal Academy of Sciences.

Name: Maria Josefsson
Discipline: Statistics
Research and work: Maria is a PhD student in statistics, studying models for longitudinal memory performance using data from the Betula project. The main focus is models for repeated measures data with informative attrition and causal inference.



Name: Hans-Olov Karlsson
Position: X-ray technician/nurse
Assignments: Hans-Olov worked with MR between 1993-98, and since 2003 onwards. He started working part time with fMRI in the autumn of 2009 when the new MR scanner was installed at Umeå University Hospital. When he is not at MR, he works at the Interventional Neuroradiology lab.

Name: Linnea Karlsson
Discipline: Psychology/Cognitive Science
Research and work: Linnea is a postdoc using brain imaging together with cognitive modeling to test theories of judgment and decision making. She is also investigating practical learning processes from a cognitive neuroscience perspective.

Name: Karolina Kauppi
Discipline: Imaging genetics
Research and work: Karolina is a PhD student studying the genetics underlying human episodic memory function by using large-scale behavioral and brain imaging data from the Betula project. For example, allelic variations of the KIBRA gene are investigated in association with brain activation during memory retrieval.

Name: Ann-Kathrine Larsson
Position: X-ray technician/nurse
Assignments: Ann-Kathrine has been working with MR since 1990, and started working with fMRI in 1999. She is currently a research nurse, running logistics for the different studies including method development, creating protocols and making sure that the contacts between the different parts involved in the project are working.

Name: Anne Larsson
Discipline: Radiation physics and nuclear medicine
Research and work: Anne is a Medical physicist with a PhD in radiation physics. The research has been directed to improve the quantitative accuracy of single photon emission computed tomography (SPECT), and will now be extended to dynamic positron emission tomography (PET).

Name: Helen Ledin
Position: X-ray technician/nurse
Assignments: Helen has been working with MR for about 10 years. She started working part time at the new research MR-scanner in January 2010. When she is not at MR, she is working at the Interventional Neuroradiology lab at Norrlands University Hospital.

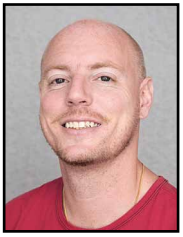
Name: Lenita Lindgren
Discipline: Nursing
Research and work: Lenita is a PhD student investigating human touch from an affective neuroscience perspective, using fMRI.

Name: Anders Lundquist
Discipline: Statistics
Research and work: Anders is a postdoc shared between UFBI and the Statistics department. Besides some general consulting, he is working with data from the Betula study combining information from memory tests, fMRI images and genetics data. The datasets are very large which gives rise to some statistical challenges.

Name: Malahat Mousavi
Discipline: Molecular biologist and Biochemist
Research and work: Malahat is a PhD in molecular neuropharmacology. In March 2011 she joined the UFBI as a group leader and works with metabolomics for finding distinct metabolites in serum and saliva which will be used as biomarkers for preclinical diagnosis of dementia.

Name: Per Nordmark
Discipline: Physiology
Research and work: Per is a PhD student as well as doing his internship at Norrlands University Hospital. In his research he uses MRI to study functional and structural changes of the central nervous system in persons who have suffered from traumatic peripheral nerve injury.

Name: Lars Nyberg
Discipline: Cognitive neuroscience
Research and work: Lars is a professor of Neuroscience and the Director of UFBI. PI for work on cognitive training and imaging within the longitudinal Betula project. Lars is a member of the Swedish Royal Academy of Sciences. In 2007 he received the Göran Gustafsson award in medicine, and in 2009 he became a Wallenberg scholar.



Name: Carl-Johan Olsson
Discipline: Exercise neuroscience
Research and work: CJ is now working within the Ageing and Living Conditions Programme (ALC). In this work he is examining how brain function and structure is affected during the lifespan. Especially investigating if lifestyle factors, such as physical activity, may help to preserve the brain and its functions.

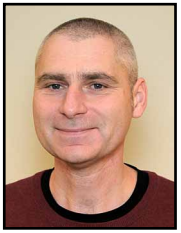
Name: Greger Orädd
Position: MR physicist
Assignments: Greger is among other things doing quality assessment and tests of the MR scanner, control/backup of the huge amount of data generated, as well as testing/ modifying programs and hardware associated with data collection.

Name: Andrew Pruszynski
Discipline: Neurophysiology
Research and Work: Andrew completed his PhD in 2011 at Queen's University in Canada where he studied the fast feedback mechanisms which underlie successful motor behavior. His current research in Umea, funded by the Human Frontier Science Program, investigates information processing in human tactile afferent neurons.

Name: Jonas Persson
Discipline: Cognitive Neuroscience
Research and work: Jonas is an Associate Professor at the Aging Research Center at KI and Stockholm University. He uses MRI to study the structural and functional correlates of episodic memory and executive functions in young and older adults. He is also involved in brain imaging within the longitudinal Betula project.

Name: Sara Pudas
Discipline: Psychology
Research and work: Sara is a PhD student at Stockholm University and her thesis concerns the neural characteristics of heterogeneity in normal cognitive aging, ranging from cognitive decline to successful aging. The thesis is based on 15-20 year longitudinal memory data from the Betula project.

Name: Alireza Salami
Discipline: Computational neuroscience
Research and work: Alireza is a PhD student doing research that concentrates on implementing different multivariate techniques (e.g. PLS, ICA) to different imaging modalities to extract features that are inaccessible using univariate methods.



Name: Matthias Schenkel
Position: Master of Science in Engineering
Assignments: Matthias is involved in the service and technical support of the MRI scanners at Umeå University and Norrlands University Hospital.

Name: Daniel Sjölie
Discipline: Human-Computer Interaction
Research and work: Daniel is a PhD student investigating how an increased understanding of the brain and brain measurements can be used in conjunction with reality-based interaction (such as virtual reality) to improve interaction with computer applications for optimized training, rehabilitation, etc.

Name: Sabina Sonning
Position: Research assistant
Research and work: Sabina is a student in Master of Science in Engineering in Interaction and Design, and works part time as assistant and programmer on Linnea Karlssons' project, using brain imaging together with cognitive modeling to test theories of judgement and decision making.

Name: Mikael Stiernstedt
Position: Research engineer
Assignments: Mikael is lab coordinator for UFBI and is involved with data collection in different studies when needed, as well as handling general matters concerning the Betula-study. He is also in charge of the production of the annual reports, the UFBI webpage and other general matters in the lab.

Name: Peter Vestergren
Discipline: Educational neuroscience
Research and work: Peter is a post doc who is using brain imaging to investigate fundamental learning processes from a neuroscientific perspective. Implications of the findings are considered for current educational settings.

Name: Carola Wiklund-Hörnqvist
Discipline: Psychology
Research and work: Carola is a PhD student who is investigating how different learning methods are related to successful learning. The main focus is to identify the cognitive processes, particularly memory processes, related to pedagogical methods including elements of testing. The effects will be examined using brain imaging and behavioral data.

Photo: Josefin Åhlström Riklund

Name: Katrine Åhlström Riklund
Discipline: Radiology and nuclear medicine
Research and work: Katrine is a professor/ consultant doctor who works with movement disorders (parkinsonian diseases), imaging of dopamine function, dementia, imaging of brain function, and PET/CT - oncologic applications.

* = The list of UFBI members is not exhaustive. Several past members, currently working outside Umeå, are still involved in UFBI-activities (e.g., Johanna Lind, Petter Marklund). In addition, many group leaders and their teams at UmU (e.g., Bert Jonsson, Johan Lithner, Xavier de Luna, Anna Neely, Steven Nordin) and at NUS (e.g., Tommy Bergenheim, Lars Forsgren, Niklas Lenfeldt, Jan Malm, Tommy Olsson) are involved in various fMRI projects.

Publications 2011

The list below is focused on journal articles, book chapters, and doctoral theses that were based on structural and functional MRI data collected within UFBI. Additionally, a few studies present PET data and we expect more such publications in the future.

Bäckman, L., Nyberg, L., Soveri, A., Johansson, J., Andersson, M., Dahlin, E., Neely, A., Virta, J., Laine, M. & Rinne, J.O. (2011). Effects of working-memory training on striatal dopamine release. *Science, 333*(6043), 718.

Eriksson, J., Kalpouzos, G., & Nyberg, L. (2011). Rewiring the brain with repeated retrieval: A parametric fMRI study of the testing effect. *Neuroscience Letters, 505*(1), 36-40.

Kalpouzos, G., Persson, J. & Nyberg, L. (in press). Local brain atrophy accounts for functional activity differences in normal aging. *Neurobiology of Aging.* [Published online April 23, 2011]

Kauppi, K., Nilsson, L.G., Adolfsson, R., Eriksson, E. & Nyberg, L. (2011). KIBRA polymorphism is related to enhanced memory and elevated hippocampal processing. *Journal of Neuroscience, 31*(40), 14219-14222.

Kompus, K. (2011). Default mode network gates the retrieval of task-irrelevant incidental memories. *Neuroscience Letters, 487*(3), 318-21.

Kompus, K., Eichele, T., Hugdahl, K., & Nyberg, L. (2011). Multimodal Imaging of incidental retrieval: The low route to memory. *Journal of Cognitive Neuroscience, 23*(4), 947-960.

Kompus, K., Kalpouzos, G., Westerhausen, R. (2011). The size of the anterior corpus callosum correlates with the strength of hemispheric encoding-retrieval asymmetry in the ventrolateral prefrontal cortex. *Brain Research, 1419*(October 24), 61-67.

Lenfeldt, N., Larsson, A., Nyberg, L., Birgander, R., Eklund, A., & Malm, J. (2011). Diffusion Tensor Imaging Reveals Supplementary Lesions to Frontal White Matter in Idiopathic Normal Pressure Hydrocephalus. *Neurosurgery, 68*(6), 1586-1593.

Lindgren, L., Westling, G., Brulin, C., Lehtipalo, S., Andersson, M. & Nyberg, L. (in press). Pleasant human touch is represented in pregenual anterior cingulate cortex. *NeuroImage.* [Published online November 10, 2011]

Naghavi, H. R., Eriksson, J., Larsson, A., & Nyberg, L. (2011). Cortical regions underlying successful encoding of semantically congruent and incongruent associations between common auditory and visual objects. *Neuroscience letters, 505*(2), 191-195.

Nyberg, L. (2011). Funktionell MRI kan avbilda hjärnan in action. *Neurologi i Sverige, 3*, 23-26.

Nyberg, L. & Eriksson, J. (2011). Fuktionell hjärnavbildning. In C. Nilsson, L-O. Wahlund & A. Wallin (Eds), Kognitiv medicin, pp. 120-125. Nordstedts.

Olsson, C.-J., & Nyberg, L. (2011). Brain simulation of action may be grounded in physical experience. *Neurocase, 17*(6), 501-505.

Persson, J., Kalpouzos, G., Nilsson, L.G., Ryberg, M., & Nyberg, L. (2011) Preserved hippocampus activation in normal aging as revealed by fMRI. *Hippocampus, 21*(7), 753-766.

Persson, J. , Pudas, S., Lind, J., Kauppi, K., Nilsson, LG., Nyberg, L. (in press). Longitudinal structure – function correlates in elderly reveal MTL dysfunction with cognitive decline. *Cerebral Cortex.* [Published online November 7, 2011]

Salami, A., Eriksson, J., Nilsson, L.G., & Nyberg, L. (in press). Age-related white matter microstructural differences partly mediate age-related decline in processing speed but not cognition. *Biochimica et Biophysica Acta - Molecular Basis of Disease.* [Published online September 10, 2011]

Sandström, A., Peterson, J., Sandström, E., Lundberg, M., Rhodin-Nyström, I-L., Nyberg, L., & Olsson, T. (2011). Stress-related cognitive deficits in relation to personality type and hypothalamic-pituitary-adrenal (HPA) axis dysfunction in women. *Scandinavian Journal of Psychology, 52*(1), 71-82.

A selection of UFBI presentations

Kauppi, K. (2011, September). KIBRA polymorphism related to improved memory through enhanced hippocampal processing. Poster presented at Boosting the Brain symposium, Stockholm, Sweden.

Nyberg, L. (2011, September). Maintaining good memory performance in older age - manifestations in the aging brain. Invited presentation at the 11th International Conference on Cognitive Neuroscience (ICON XI). Palma, Mallorca, Spain.

Nyberg, L. (2011, September). Relating 20-years change in episodic memory to life-style, genetic, and neural factors. Talk presented at Boosting the Brain, Stockholm, Sweden.

Josefsson, M. (2011, August). Attrition-considered statistical characterization of 15-year longitudinal cognitive change. Poster presented at Joint Statistical Meetings 2011, Miami Beach, USA.

Kauppi, K. (2011, June). KIBRA polymorphism related to improved memory through enhanced hippocampal processing. Poster presented at the Imaging and Cognition Genetics 2011 conference, Bergen, Norway.

Nyberg, L. (2011, June). fMRI phenotypes and cross sample comparisons. Talk presented at the Imaging and Cognition Genetics 2011 conference, Bergen, Norway.

Salami, A. (2011, June). Age-related differences in the functional neuroanatomy of episodic memory: Combining structural and functional data. Poster presented at Human brain mapping conference, Quebec City, Canada.

Salami, A. (2011, June). Age-related differences in the functional neuroanatomy of episodic memory: Combining structural and functional data. Talk presented at the Imaging and Cognition Genetics 2011 conference, Bergen, Norway.

Eriksson, J. (2011, May). On the complexity of consciousness: An fMRI study on the intersection between auditory conscious perception, working memory content, and task difficulty. Talk presented at the 13th Towards a Science of Consciousness, Stockholm, Sweden.

Salami, A. (2011, May). Age-related differences in the functional neuroanatomy of episodic memory: Combining structural and functional data. Poster presented at JCLL Conference Personalized Aging: potential and limits of a new concept, Bremen, Germany.

Josefsson, M. (2011, March). Attrition-considered statistical characterization of 15-year longitudinal cognitive change. Poster presented at the Winter conference in Statistics 2011, Hemavan, Sweden.

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UFBI

Umeå center for

Functional Brain Imaging

Contact Information

www.umeabrainimaging.com/

Visiting Address

Research Scanner
Norrlands University Hospital, basement of building 3A.

Umeå center for Functional Brain Imaging
Biology Building, Linneaus Väg 15, sixth floor
Umeå University

Director
Lars Nyberg
E-mail: lars.nyberg@physiol.umu.se, lars.nyberg@diagrad.umu.se
Phone: +46 (0)90-786 64 29 / +46 (0)90-785 33 64 / +46 (0)70-60 92 775

Research Nurse
Ann-Kathrine Larsson
E-mail: Anncatrine.g.larsson@vll.se
Phone: +46 (0)90-785 80 63

Assistant Professor
Johan Eriksson
E-mail: johan.eriksson@physiol.umu.se
Phone: +46 (0)90-786 51 86 #20

Project Manager
Mikael Stiernstedt
E-mail: mikael.stiernstedt@physiol.umu.se
Phone: +46 (0)90-786 78 69