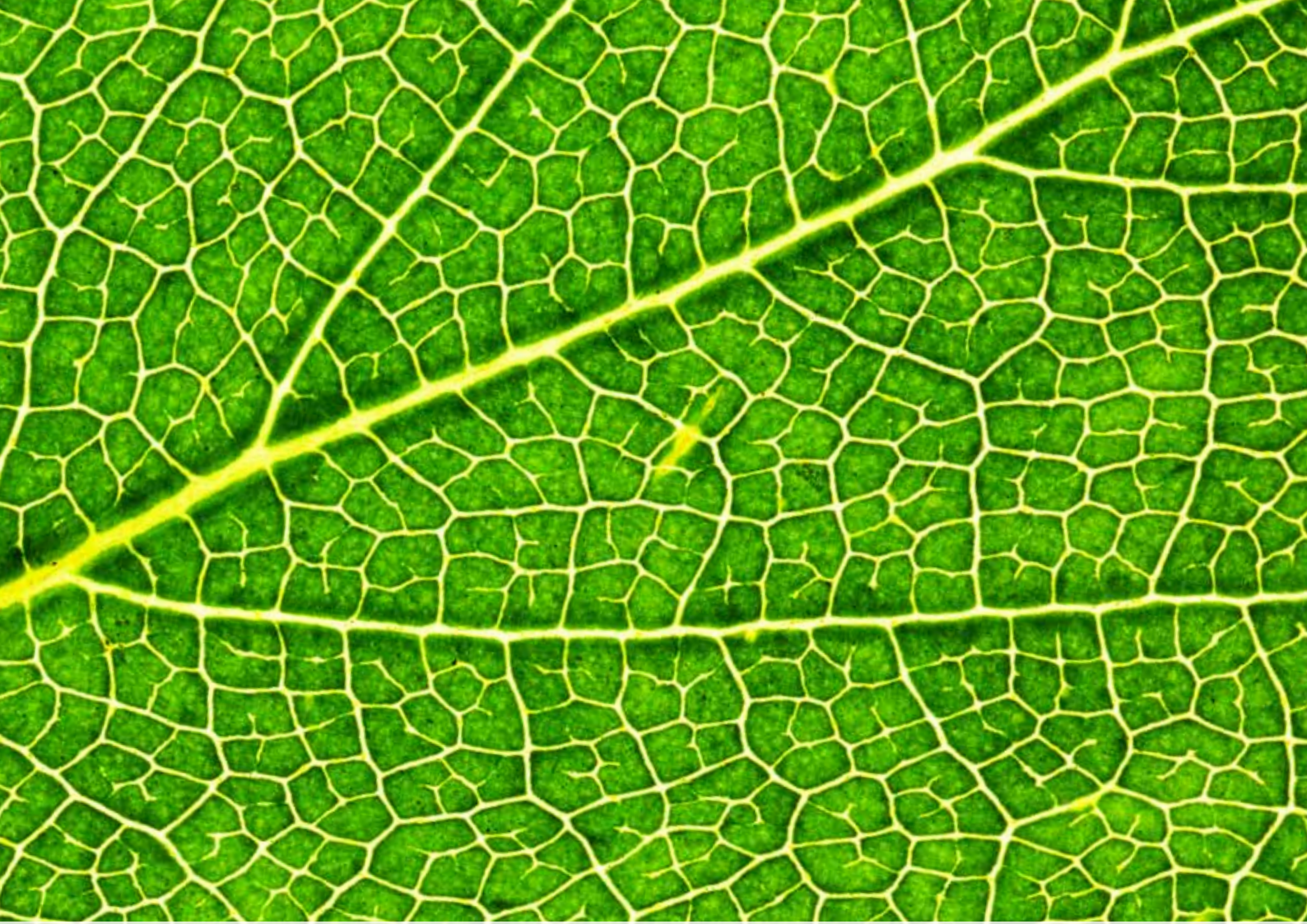

Annual Report 2012

Umeå center for Functional Brain Imaging - UFBI

UMEÅ UNIVERSITET

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Welcome

Lars Nyberg's Editorial

The past year, 2012, offered many stimulating UFBI-related activities. Some of these are presented in this report. It is satisfying to note that UFBI members are highly active participants at scientific meetings in Sweden and abroad. These presentations help to introduce the work we do at UFBI to a broad audience, and I am confident that all members have been "good ambassadors". You can read more in the section on "meetings and seminars" on pages 16-17 and view the list of presentations at the end of the report. A very special tour by UFBI-member CJ Olsson, to Australia, is also a very fine example of international exchange.

Productivity is of course vital at a research center, and we present some figures and facts in the report. I am glad to see that we continue to do many fMRI examinations, for clinical as well as research purposes, and that we produce papers that get published in top journals in the field. A collaborative project with colleagues at Lund University resulted in a publication on how the brain changes when you learn a new language in adulthood. The first author, Johan Mårtensson, describes the study in this report – and some of the vast media attention it generated!

Johan is one of four PhD students who defended a thesis during 2012 that, in whole or in part, was based on empirical work conducted at UFBI. We congratulate the new doctors. Work by PhD students is a cornerstone of our activities – and it is therefore pleasing to see that many students at different levels contact us in order to do shorter or longer projects at UFBI.

The core research topics of today's UFBI are presented in the report, and some projects are described in a little more detail. One of these, named COBRA, is a new addition to the bag of UFBI-projects, and it has a very novel multimodal ingredient by combining PET dopamine imaging with structural and functional MRI. COBRA is a joint project among scientists at Umeå University, *Karolinska institute*, and *Max Planck Institute* in Berlin. We expect this project to run over 10 years, and that it will generate a lot of new knowledge on how the brain ages (see "Outlook ageing" in Nature, vol. 492, Dec 12).

These are some of the many highlights from 2012. A lowlight was the flooding of the hospital basement that forced us to close down the MRI-lab during December-January and do major re-construction. Luckily, when I write these words in early February of 2013, we are again back in business and look forward to a new exciting year.

February 2013
Lars Nyberg, UFBI Director (2001 - Present)

In short

Numbers, figures and other interesting facts about UFBI from 2012.

The **23** members of UFBI together produced:

4 doctoral dissertations

16 published articles

22 conference presentations

The research scanner at Norrlands University hospital performed a total of:

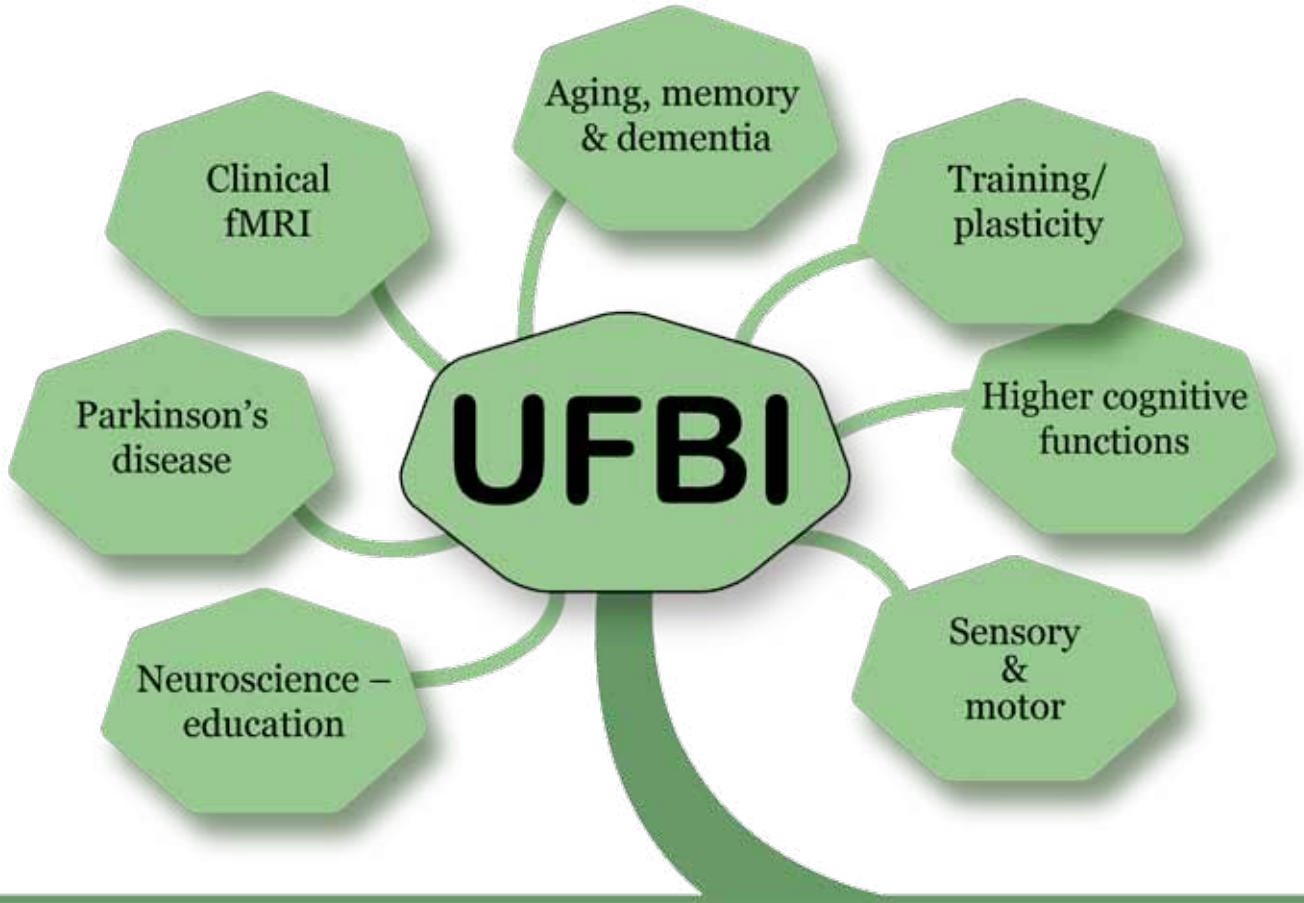
346 hours of fMRI scaning

12 bloodflow-measures

Research

UFBI is involved in a wide range of inhouse, national, and international projects. We willl start off with an overview of some of the main projects going on in the lab during 2012. We will also focus on some specific projects.

Topics of UFBI



Neuroscience – Education
Areas: **Testing effect, mathematics**
Mårtensson et al (2012) NeuroImage
Eriksson et al (2011) Neurosci Lett

Parkinson's disease
Projects: **NYPUM**
Marklund et al (2009) Brain
Ekman et al (2012) Lancet Neurol

Clinical fMRI
Nordh et al (2011) Int S Intraop Neurom

Aging, Memory & Dementia
Projects: **Betula, COBRA**
Nyberg et al (2010) PNAS
Persson et al (2006; 2012) Cereb Cortex
Nyberg et al (2012) TiCS

Training/plasticity
Areas: **Cognitive, physical**
Dahlin et al (2008) Science
Bäckman et al (2011) Science
Olsson et al (2008) Front Hum Neurosci

Higher cognitive functions
Areas: **Memory, consciousness, decisions**
Eriksson et al (2008) J Cog Neurosci
Persson et al (2010) Hippocampus
Pudas (2009) Acta Psychologica Sinica

Sensory & Motor
Areas: **Hand/finger, olfaction, tactile**
Johansson et al (2006) PLoS Biology
Lindgren et al (2012) NeuroImage
Nordmark et al (2012) J Cog Neurosci

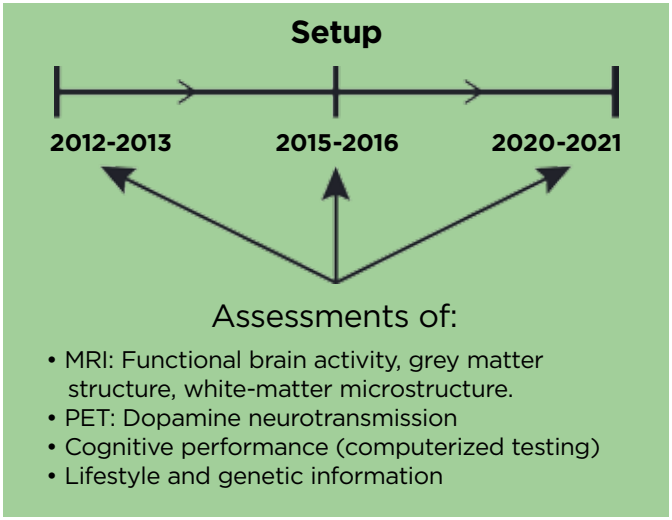
Cognition, brain, and aging

During the fall of 2012 the longitudinal study *Cognition, brain, and aging* (or *COBRA*) was launched here in Umeå. This project will follow a large representative cohort of elderly, healthy individuals over one decade.

Cognitive impairments in aging compromise the well-being of individuals and make independent living difficult. Such impairments come with major individual and societal costs. Few studies have comprehensively integrated age-related brain changes as measured by different in vivo imaging modalities and linked such changes to cognitive decline, and hardly any previous multi-modal imaging studies used a longitudinal design. This is a noteworthy omission as inferences of change from cross-sectional comparisons may significantly deviate from inferences based on actually measured longitudinal change.

The study will follow a large cohort of 63-67 year-old healthy individuals randomly selected from the population registry in Umeå over a 10 year period. Cognitive performance, functional and structural brain integrity, and relevant lifestyle-related factors will be assessed at three measurement points.

We expect that some of the participants will demonstrate impaired cognitive ability, which can be related to the different brain recordings. In addition, lifestyle habits will be identified, such as physical activity, diet and sleep, which can further illustrate why deterioration is seen in some but not other individuals. Such knowledge can inform theory and practice about the aging brain's constraints and opportunities.



Left: Preparing for PET scan. **Right:** The MRI scanner at Norrlands University Hospital.

Cerebral blood flow in stroke and aging

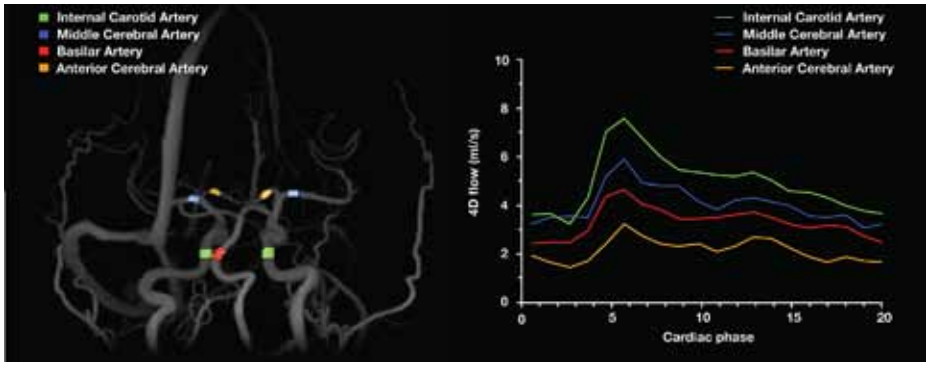
Stroke is one of the leading causes of death and chronic disability in the world. Moreover, vascular risk factors are frequently associated with cerebral aging and dementia. In a collaboration between the *Departments of Clinical Neuroscience and Biomedical Engineering* at Umeå University Hospital, and UFBI, we are investigating how cerebral blood flow changes with aging and how this may affect brain structure and function, as well as vulnerability to stroke. Furthermore, we aim to improve the stroke diagnosis by adding valuable information concerning the capacity of the secondary, emergency blood vessels that the brain possesses in order to withstand deviations in blood flow of the large cerebral arteries. Ultimately, this information will be used to predict disease development.

Exploring deviations in arterial flow and perfusion and corresponding effects on the brain represents a fundamental step in knowledge with far-reaching implications on future development of new treatment strategies. Although the cerebral arterial system is highly complex, the most important factor that has limited the exploration of this field is that cerebral arterial blood flows are partly inaccessible with conventional non-invasive methods. Recent technical advances in MRI have made non-invasive, high-resolution assessments of cerebral blood flow possible, unlocking the possibility for a more complete assessment and analysis of cerebral blood flow dynamics.

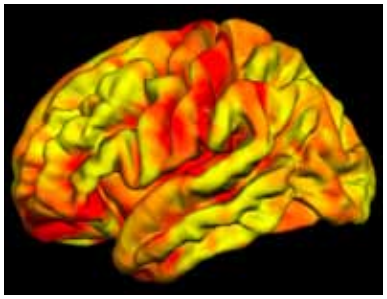
We focus on two parts of cerebral blood flow: perfusion and arterial flow, i.e. the micro- and macro-circulation. Using 3D arterial spin labeling, we're able to track water molecules, exchanged between the arterial blood and brain tissue. This information can be used to provide detailed images of the cerebral perfusion rate. The macro-circulation is assessed using state-of-the-art, time-resolved velocity measurements, with whole brain coverage (4D flow measurements). The 4D flow measurements have been developed at the University of Wisconsin and within a productive collaboration we are applying this technique to extract vital and previously unknown properties of the cerebral circulation.

A comprehensive technical development is paralleling our clinical studies. Here, we strive to improve the technical aspects of the blood flow measurements. A central part of this work is around validating the methods that form the basis of the clinical investigations. Furthermore, efforts are continuously made to better integrate information of cerebral blood flow with data from other MRI modalities (e.g. structural and functional scans).

Anders Wåhlin



4D flow data provides the flow waveform of major cerebral arteries.



A brain with a color map displaying age-related decrease in perfusion. Yellow indicates regions with a rapid decline in perfusion.

Illustrations: Anders Wåhlin

Non-consciously encoded memory

Conscious experiences define our lives, yet it is well known that most of our neural processing occurs without conscious awareness. Even so, it has long been assumed that non-consciously perceived information quickly fades within a second, after which behavioral effects no longer can be detected. In a series of ongoing projects we are investigating the nature and limitations of such non-consciously encoded memories.

We have used relatively long non-conscious presentation durations to see if the memory representations would last longer than previously thought. Our findings indicate that non-consciously presented information is durable for at least several seconds. To better understand what kind of non-conscious memory this is we proceeded by replicating the experiment in the fMRI scanner. Interestingly, we found metabolic activity during the maintenance of non-consciously encoded information that is commonly observed in working memory.

It is known that working memory has certain properties, such as a limited capacity, and interacts with long-term memory. To further investigate the possibility of non-conscious working memory, we are preparing an fMRI experiment to compare the memory capacity between consciously and non-consciously encoded memory. In the future we will also investigate how the presence or absence of conscious awareness affects the interaction between working memory and long-term memory in the hippocampus. We furthermore intend to explore to what extent the hippocampus is involved with the conscious experience of time related to long-term memories of events in space and time (i.e., episodic memory).

Fredrik Bergström

Setup for non-conscious presentation during behavioural testing.

Judgment and decision making

Human judgments are often the result of applying a judgment strategy to reach a final verdict. Research has demonstrated that humans can adopt a variety of such judgment strategies and current research is focused on what factors can be used to predict which strategy will be used when. In a series of experiments we are investigating whether different strategies give rise to separable brain activation patterns and whether these patterns can inform theories of judgment and decision making. First findings indicate that two qualitatively different strategies, namely similarity-based strategies and rule-based strategies, rely on overlapping but also separable neural correlates.

Moreover, these correlates appear to be related to the specific cognitive demands that are imposed by the two strategies. Further research will demonstrate the generalizability of these findings.

Linnea Karlsson

UFBI in the world

G´day Mate

In October 2012 I got the opportunity to trade my morning coffee for morning tea, and escape winter for summer. For three months I have now been visiting and working together with Professor David Ames at the *National Ageing Research Institute* (NARI) at University of Melbourne, Australia.

At NARI several longitudinal research projects are currently running and the focus is on dementia, brain functions and successful cognitive aging. During my visit I have had the chance to work on data from some of these projects. One is the AIBL (Australian Imaging Biomarkers and Lifestyle) study of aging. The goal with this project is to understand the transition from normal aging to Alzheimer's disease. In order to do so 1112 individuals aged over 60 (200 with AD and 100 with MCI) are tested every 18 months using PET and MRI scanning, cognitive performance and blood sampling. Another project is the MAS (Syndey Memory and Ageing Study, in collaboration with University of New South Wales, Sydney). Within this project I am looking at gene-gene interaction in combination with change of memory performance and hippocampus volume longitudinally. Also in this study there is a large sample of participants (over 500 in the imaging sample). These two cohorts will gain us important knowledge about aging, brain functions and the transition to dementia.

In Melbourne, being a neuroscientist is exciting; almost at a weekly basis I have been able to attend lectures or seminars at the *Melbourne Brain Centre* often with international speakers, giving me the opportunity to connect with fellow researchers from all over the world.

Besides work, Melbourne is indeed a fantastic city. It is very relaxed with friendly people. There is always something going on from rock concerts to big sporting events, the city has simply always something to offer. And don't you worry, despite the tradition of morning tea; I have enjoyed an occasional Latte at the Italian Precinct, good food, and visits to vineyards.

Cheers
Carl-Johan Olsson

Photo: Private

New doctorates in 2012

In 2012 there were four dissertations published by members and collaborators of UFBI. Here, Anders Wåhlin, Lenita Lindgren, and Alireza Salami share their personal experience from the thesis work, as well as what their plans are for the immediate future. The fourth doctorate, Johan Mårtensson, describes one of the articles that was a part of his dissertation on page 15

I was grateful for the opportunity to start as a PhD student in 2008. Studying cerebral blood flow with MR felt very exiting, almost surreal. Now, after my dissertation, I'm even more enthusiastic about the field as I start to realize the potential associated with these measurements. Fortunately, I'm given the chance to further explore the cerebral arterial system with support from the *Swedish Brain Foundation* that awarded me post-doc funding in a project regarding stroke.

Anders Wåhlin

I was told that there were two main conditions that could occur after the thesis was finished, post dissertation stress disorder (PDSD) and a confusing state of not knowing what to do. Therefore, I prepared myself by having a three-week vacation, celebrating Christmas and New Year with family and friends. This strategy must have been successful, as no signs or symptoms of the disorder have yet appeared. In the near future I will tutor students at the department of Nursing and continue research on touch/reward in relation to brain activation here at the UFBI. The confusing state of not knowing what to do after dissertation has thus been postponed.

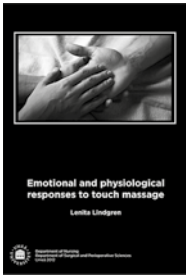
Lenita Lindgren

Having completed a Master's thesis in medical imaging at Kalmar University, I became a member of the UFBI as a doctoral student from 2008 untill 2012. My PhD thesis concentrated on implementation of various techniques to analyze different imaging modalities which had been acquired with the MRI scanner at the centre. The UFBI lab-meetings every week were always a source of inspiration. The atmosphere in the group was also simulating which supported enthusiastic work with competent people.

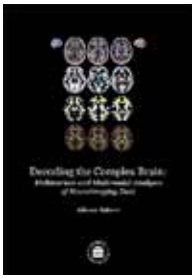
I mainly enjoyed the part of the work during which I discussed my results with the UFBI-team, particularly with Lars Nyberg and Johan Eriksson. I especially never forget my first manuscript that was reviewed by the same reviewer in three different journals. All in all, I am glad that I have spent the best four years of my academic career at UFBI and hope that this opportunity will be possible for students seeking for an enthusiastic working environment.

Currently, I am a joint postdoctoral fellow at the UFBI and at the *Aging research center* (ARC). The research skills acquired during my PHD studies will facilitate development of novel projects.

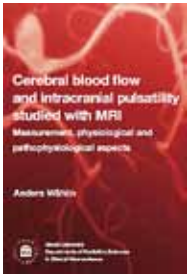
Alireza Salami



Lindgren, L. (2012). Emotional and physiological responses to touch massage.



Salami, A. (2012). Decoding the complex brain: Multivariate and multimodal analyses of neuroimaging data.



Wåhlin, A. (2012). Cerebral blood flow and intracranial pulsatility studied with MRI - Technical, physiological and pathophysiological aspects.

Photo: Line Lindgren

Lenita Lindgren defending her thesis. Opponent was docent, consultant physician Lars Berggren from Örebro, Sweden.

Aliresa Salami defending his thesis. Opponent was Professor Cheryl L. Grady from Rotman Research Institute, Toronto, Canada.

Zooming in

... on some of the articles published by members of UFBI in 2012. We turn to Gregoria Kalpouzos and Johan Mårtensson who will describe the work that was done and that resulted in published articles.

Kalpouzos, G., Persson, J. & Nyberg, L. (2012). Local brain atrophy accounts for functional activity differences in normal aging. *Neurobiology of Aging, 33*(3), 623.e1-13.

Until recently, neuroimaging studies on structure and studies on function were typically dissociated. Thanks to methodological advances, it is presently possible to combine different neuroimaging modalities, allowing to unveil structure-function relationships.

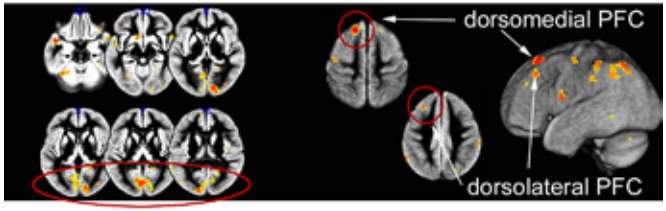
Here, we tested whether the differences in local brain activity between younger and older adults during an episodic memory task could be accounted for by local age-related atrophy. At the functional level, a typical age-related pattern was found, with under-recruitment of occipital regions and over-activation of prefrontal regions.

Whereas pronounced occipital atrophy significantly accounted for under-recruitment of the same regions, modest to moderate atrophy in the prefrontal areas that showed over-activation suggested compensation, such that regions with minor atrophy may be recruited in order to compensate for deterioration occurring here and elsewhere in the brain.

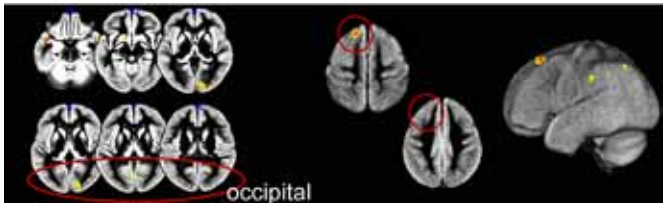
Coupling T1-weighted images and fMRI provided crucial information in understanding the interplay between structure and function in healthy aging. Past, ongoing and future works also deal with other neuroimaging modalities that are integrated together (e.g. Dopamine-PET, DTI) to increase our knowledge about the healthy and pathological aging brain.

Gregoria Kalpouzos

Encoding: Younger > Older Retreival: Older > Younger



Accounting for grey matter volume



Illustrations: Gregoria Kalpouzos

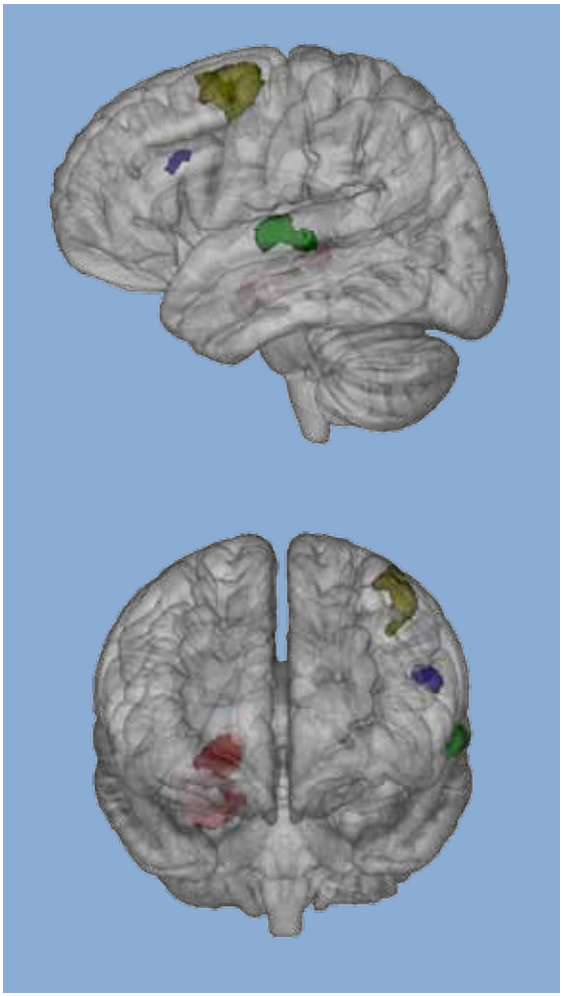
Mårtensson, J., Eriksson, J., Bodammer, N.C., Lindgren, M., Johansson, M., Nyberg, L. & Lövdén, M. (2012). Growth of Language-Related Brain Areas after Foreign Language Learning. *Neuroimage, 63*(1), 240-244.

Can intense language training change brain structure in adulthood? Using structural MRI we investigated the effects of intense language training on 14 interpreters at the *Swedish Armed Forces Language School*. This select group go from no prior knowledge in a foreign language to near fluency over the course of 13 months.

Results showed that three cortical areas as well as the right hippocampus increased in size over the course of three months of language studies. The affected areas are well known from models of language, with the superior temporal gyrus suggested as shared tissue between streams that handle perception and production of speech. The hippocampus is believed to be involved in rapid word learning whilst the inferior frontal gyrus and middle frontal gyrus are part of the articulatory network.

Furthermore, many of the increases were linked to separable behavioral effects in the form of measures of educational performance or the effort needed to remain at the academy. The results saw widespread news coverage with notable appearances in Swedish state television (*Rapport*, *SVT*) and radio (*P1*); as well as articles in *Der Spiegel* and other international news agencies ranging from Brazil to India.

Johan Mårtensson



Illustrations: Johan Mårtensson

Interpreters showed larger increases in the left middle frontal gyrus (yellow), the left superior temporal gyrus (green), the left inferior frontal gyrus (blue) and the right hippocampus (red) compared to the controls.

Meetings and seminars

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.

Besides these weekly inhouse meetings, members of UFBI usually attend several meetings and conferences held in and outside Sweden, and 2012 was no exception In this section we present some "memories" from 2012 presentations by UFBI members. As you will see from the photos, giving talks does not simply engage "the brain and the mouth" but also the hands and the arms! A complete list of conferences attended by UFBI members can be found on page 24.

Photo: Lars Nyberg

Image 1: Lars Nyberg giving a talk at *Imaging the brain* - minisymposium at Umeå University hospital, Mars 23. **2:** Lars and Johan went to visit the *Institute of Higher Nervous Activity* in Moskow, April 2012. **3, 4:** Lars was interviewed at *Psykologisk Salong* at Umeå Folkets Hus October 4, and gave a presentation at the *Student Congress of Cognitive Science* October 5.

Images 5 & 9: Linnea Karlsson gives a talk at the *Swedish Neuropsychological society* annual meeting on Novemver 12-13. **7 & 8**: Johan Eriksson and Urban Ekman lectured at the same meeting. **6:** Bert Jonsson presented at the annual *UFBI lab-day*, June 5. **10:** Lars fills the house at *Lärande lunch*, October 9.

Accidents do happen

During the night of October 31, there was a leak from a water conduit in the cellar of Norrlands University Hospital. The water flooded parts of the culvert from building 11 over to adjacent buildings. This resulted in that an extensive renovation was forced to be done in the premises housing the MRI scanner. All testing was put to a halt in the beginning of December 2012 and the facillity was up and running in the beginning of February 2013.

Photos by Peter Hägglund

Photo: Mikael Stiernstedt

Photo: Mikael Stiernstedt

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
Research and Work: Fredrik is a PhD student and uses fMRI to study the neural correlates of consciousness. He is particularly interested in the role of attention and memory for consciousness, and is currently investigating the possibility of working memory without conscious awareness and its potential limitations.

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.

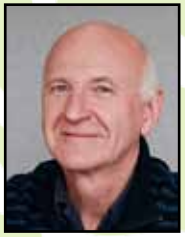
Name: Urban Ekman
Discipline: Cognitive Neuroscience
Research and work: Urban is a PhD student who focuses on questions that relates working-memory processing to functional brain responses in a population-based cohort diagnosed Parkinson's disease with or without mild cognitive impairment (MCI). Additionally, 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 Jakobson 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 in educational neuroscience investigating test-enhanced learning and mathematical learning with brain imaging. She is also the principal investigator in a project studying the neural correlates to judgment and decision-making.

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: 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 whose main interest is to understand emotional and physiological responses observed during rewarding stimuli such as human touch. In her research, she used fMRI to identify brain regions activated by pleasant human touch.

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: Neuroscience
Research and work: CJ is Associate Professor (Docent) of Neuroscience and is working at the Ageing and Living Conditions Programme (ALC). CJ is examining how life style factors such as diet and physical exercise may help to preserve brain structure and function across the lifespan.

Name: Greger Orädd
Discipline: Physics
Assignments: Greger completed his PhD in physical chemistry in 1994 at Umeå University where he studied model membrane systems with magnetic resonance. Since 2009 he has been working as an MR physicist, involved in quality assessment, control/backup of data, as well as testing/modifying programs and hardware.

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 completed his PhD in computational neuroscience in 2012 at Umeå University where he implemented various multivariate and multimodal techniques for analysis of different imaging modalities. He is now a joint postdoctoral researcher at (UFBI) and at Aging Research Center (ARC).

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: 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, and handling general matters concerning the Betula-project. He is 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: 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: Carola Wiklund-Hörnqvist
Discipline: Psychology
Research and work: Carola is a PhD student 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.

Name: Anders Wåhlin
Discipline: MR-Physicist
Research and Work: Anders completed his PhD in 2012 at Department of Radiation Sciences, Umeå university, where he specialized in MR based measurements of cerebral blood flow and cerebrospinal fluid dynamics. His post-doc research, funded by the Swedish Brain Foundation, investigates cerebral blood flow in stroke and aging.

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

The list below is focused on journal articles, book chapters, doctoral theses and conference proceedings that were based on structural and functional MRI data collected within UFBI.

Bäckman, L. & Nyberg, L. (in press). Dopamine and training-related working-memory improvement. *Neuroscience and Biobehavioral Reviews.*

Ekman, U., Eriksson, J., Forsgren, L., Jakobson Mo, S., Riklund, K. & Nyberg L. (2012) Functional brain activity and presynaptic dopamine uptake in patients with Parkinson's disease and mild cognitive impairment: a cross-sectional study. *Lancet Neurology, 11*(8), 679-687.

Josefsson, M., de Luna, X., Pudas, S., Nilsson, L-G. & Nyberg, L. (2012). Genetic and lifestyle predictors of 15-year longitudinal change in episodic memory. *Journal of American Geriatrics Society, 60*(12), 2308-2312.

Kalpouzos, G., Persson, J. & Nyberg, L. (2012). Local brain atrophy accounts for functional activity differences in normal aging. *Neurobiology of Aging, 33*(3), 623.e1-13.

Kalpouzos G, Nyberg L. (2012). Multimodal neuroimaging in normal aging: Structure-function interactions. In M., Naveh-Benjamin & N., Ohta (Eds), *Memory and Aging: Current Issues and Future Directions*, pp. 273-304, Psychology Press.

Kauppi, K., Nilsson, L-G., Adolfsson, R., Lundquist, A., Eriksson, E. & Nyberg, L. (*in press*). Decreased medial temporal lobe activation in BDNF 66Met allele carriers during memory encoding. *Neuropsychologia.* [*Published online Dec 2 2012*]

Lindgren, L., Westling, G., Brulin, C., Lehtipalo, S., Andersson, M. & Nyberg, L. (2012). Pleasant human touch is represented in pregenual anterior cingulate cortex. *Neuroimage, 59*(4), 3427-3432.

Marklund, P. & Persson, J. (2012). Context-dependent switching between proactive and reactive working memory control mechanisms in the right inferior frontal gyrus. *Neuroimage, 63*(3), 1552-1560.

Mårtensson, J., Eriksson, J., Bodammer, N.C., Lindgren, M., Johansson, M., Nyberg, L. & Lövdén, M. (2012). Growth of Language-Related Brain Areas after Foreign Language Learning. *Neuroimage, 63*(1), 240-244.

Nordmark, P., Pruszynski, A. & Johansson, R. (2012). BOLD responses to tactile stimuli in visual and auditory cortex depend on the frequency content of stimulation. *Journal of Cognitive Neuroscience, 24*(10), 2120-2134.

Nyberg, L., Lövdén, M., Riklund, K., Lindenberger, U. & Bäckman, L. (2012). Memory, aging, and brain maintenance. *Trends in Cognitive Science, 16*(5), 292-305.

Olsson, C-J. (2012). Complex motor representations may not be preserved after complete spinal cord injury. *Experimental Neurology, 236*(1), 46-49.

Olsson, C.-J. (*in press*). Physical experience shapes neural correlates of internal imagery. *Journal of Mental Imagery, 36* (1 & 2), 76-79.

Olsson, C.-J., Hedlund, M., Sojka, P., Lundström, R. & Lindström, B. (2012). Increased prefrontal activity and reduced motor cortex activity during imagined eccentric compared to concentric muscle actions. *Frontiers in Human Neuroscience, Sep 2012*(6), 255.

Olsson, C.-J., & Nyberg, L. (2012). Learning by doing vs. learning by thinking. In M. N. Seel (Ed.), *The Encyclopedia of the Sciences of Learning*, pp. 619. Springer.

Persson, J., Pudas, S., Lind, J., Kauppi, K., Nilsson, L.-G. & Nyberg, L. (2012). Longitudinal structure – function correlates in elderly reveal MTL dysfunction with cognitive decline. *Cerebral Cortex, 22*(10), 2297-2304.

Salami, A., Eriksson, J., & Nyberg, L. (2012). Opposing effects of aging on large-scale brain systems for memory encoding and cognitive control. *Journal of Neuroscience, 32*(31), 10749-10757.

Salami, A., Eriksson, J., Nilsson, L.G., & Nyberg, L. (2012). 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, 1822*(3), 408-415.

Soveri, A., Tallus, J., Laine, M., Nyberg, L., Bäckman, L., Hugdahl, K., Tuomainen, J., Westerhausen, R. & Hämäläinen, H. (2012). Modulation of auditory attention by training. *Experimental Psychology 2012*, 1-9.

Dissertations

Lindgren, L. (2012). Emotional and physiological responses to touch massage. Doctoral dissertation, Umeå University.

Salami, A. (2012). Decoding the complex brain: Multivariate and multimodal analyses of neuroimaging data. Doctoral dissertation, Umeå University.

Wåhlin, A. (2012). Cerebral blood flow and intracranial pulsatility studied with MRI - Technical, physiological and pathophysiological aspects. Doctoral dissertation, Umeå University. *[contains data from UFBI]*

Mårtensson, J. (2012). Regimented language training. Changes to brain and behaviour following intensive non-native language learning. Doctoral dissertation, Lund University. *[contains data from UFBI]*

Conference proceedings

Nyberg, L. & Bäckman, L. (2013, December). Recent advances in functional and molecular brain imaging: Implications for current views on memory and aging and memory training. Talk presented at The Royal Science Academy. Stockholm, Sweden.

Nyberg, L. (2012, November). Learning and memory functions of the brain. Talk presented at The Brain 2012. Stockholm, Sweden.

Karlsson, L. (2012, November 13). Why is it good for memory to test it? Talk given at Swedish Neuropsychological society annual meeting 2012. Umeå , Sweden.

Ekman, U. (2012, November 12). Level of cognitive function and its neuronal correlates in Parkinson's disease patients. Talk given at Swedish Neuropsychological society annual meeting 2012. Umeå , Sweden.

Eriksson, J. (2012, November 12). Memory and awareness – can you remember things that you never had an experience of seeing? Talk given at Swedish Neuropsychological society annual meeting 2012. Umeå , Sweden.

Nyberg, L. (2012, November 12). A memory set in stone, or...? Consolidation, re-consolidation, sleep and practice. Talk given at Swedish Neuropsychological society annual meeting 2012. Umeå , Sweden.

Nyberg, L. (2012, October 5). A brain to remember. Talk presented at Student congress cognitive science. Umeå, Sweden.

Ekman, U. (September, 2012). Functional brain activity in patients with Parkinson's disease with and without mild cognitive impairment. Talk presented at Swedish Brain Power workshop. Ekerö, Sweden.

Nyberg, L. (2012, September). Cognitive training and transfer: Functional brain systems and neurotransmission. Talk presented at Geriatric Forum 2012. Stockholm, Sweden.

Orädd, G. (September, 2012). MR safety in practice: Now and in the future. Poster presented at International Society for Magnetic Resonance in Medicine (ISMRM) Workshop. Lund, Sweden.

Nyberg, L. (2012, June). Association of MCI in Parkinsons's disease to altered fronto-striatal functional brain activity. Talk presented at The Changing Brain, 11th International Neuropsychological Society Mid-Year Meeting. Oslo, Norway.

Nyberg, L. (2012, June). Old brain, new demands on information processing: A dilemma? Talk presented at Nordic congress of gerontology: Dilemmas in Aging Societies. Copenhagen, Denmark.

Nyberg, L. (2012, May). Aging and cognitive abilities. Talk presented at Arbets- och miljömedicinskt vårmöte. Umeå, Sweden.

Nyberg, L. (2012, May). Cognitive control of episodic memory: the high and low routes to memory. Talk presented at Learning & perception. Dubrovnik, Hungary.

Vestergren, P. & Nyberg, L. (2012, May). Does testing enhance memory by influencing subsequent restudy? Poster presented at the EARLI-SIG 22: Neuroscience and Education 2012. London, England.

Jonsson, B., Karlsson, L., Lithner, J., Liljekvist, Y., Norqvist M. & Nyberg, L. (2012, May). Mathematical Teaching Method affects Performance and Brain Activity. Poster presented at the EARLI SIG 22: Neuroscience and Education, London, England.

Wiklund-Hörnqvist, C., Karlsson, L., Eriksson, J., Jonsson, B. & Nyberg, L. (2012, May). The neural mechanisms underlying test-enhanced learning: an event-related fMRI study. Talk presented at the EARLI SIG 22: Neuroscience and Education, London, England.

Pudas, S. (2012, April). Preserved prefrontal and medial temporal activation characterizes cognitive maintenance over two decades. Poster presented at Cognitive Neuroscience Society Annual Meeting 2012. Chicago, USA.

Eriksson, J. (2012, March). fMRI: Research and clinical applications. Talk presented at fMRI and DTI: From research to clinical practice. Bergen, Norway.

Nyberg, L. (2012, March). Imaging genetics of episodic memory: Recent evidence from the Betula study. Talk presented at 10th Tsukuba International Conference on memory. Tsukuba, Japan.

Nyberg, L. (2012, March). Mapping memory networks in the human brain with fMRI. Talk presented at Imaging the brain, minisymposium. Umeå, Sweden.

Nyberg, L. (2012, January). Cognitive training and transfer: Functional brain systems and neurotransmission. Talk presented at 4th national geriatric researcher forum, Stockholm, Sweden.

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