Laboratoire de Recherche en Neuroimagerie

2014 Annual Report

UNIL | Université de Lausanne

CHUV

LREN Annual Report 2014

01 Foreword

After four exciting years setting up the LREN imaging neuroscience laboratory at the Department of clinical neurosciences - CHUV, we are now taking on the challenge of providing world-class research infrastructure and a collaborative environment to the scientific community in the Lemanic region and beyond. The remarkable success of LREN given its young age, is building on the full support by the Department for clinical neurosciences, the CHUV Directorate and the Faculty of biology and medicine, UNIL.

The unique setting within the Department for clinical neurosciences - CHUV, offers direct access to patients, facilitates interactions between neurologists, psychiatrists, neurosurgeons, psychologists and basic scientists to provide an unprecedented opportunity for research with direct impact on clinical decision making and patient's outcome. The LREN neuroimaging platform is centred on state-of-the-art facilities – research-only 3 Tesla MRI Siemens Prisma scanner at the edge of MR technology, well-established infrastructure for neurophysiological testing, computer pool for hands-on student teaching and 200m2 of laboratory space.

Building on the unique expertise of our team, spanning the full-range of competences from data acquisition, through automated processing and sophisticated analysis, LREN provides support to major Swiss National Science Foundation funded initiatives – National Centre of Competence in Research "Synapsy", SPUM "Imaging large scale networks in epilepsy", Synergia in 16p11 mutation carriers and the CoLaus initiative.

Our active participation in the Medical Informatics pillar of the Human Brain Project ensures the translational character of the research strategy and the scalability of the developed infrastructure.

Looking to the future, I am truly convinced that our collaborators' and LRENs own achievements will contribute to major domains of neuroscience for the benefit of Swiss research and patients' outcome.

Bogdan Draganski
Director of LREN
Department of Clinical Neurosciences - CHUV, UNIL

02 Mission

LREN is a neuroimaging laboratory where clinical and basic neuroscientists study human brain structure and function relevant to neurological disorders and normal cognition. We develop and apply non-invasive neuroimaging methods - magnetic resonance imaging (MRI) and electro-encephalography (EEG) to investigate topics such as use-dependent brain plasticity, rehabilitation of lost function and neurodegeneration.

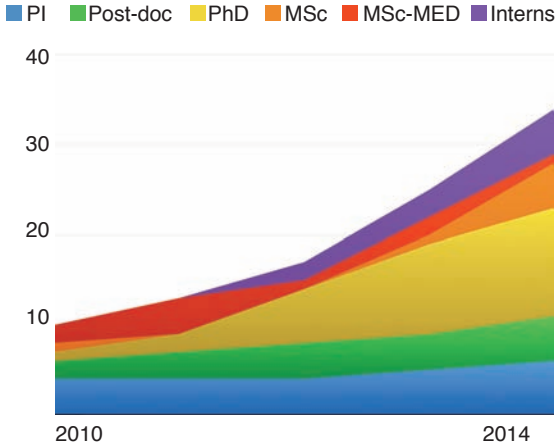
LREN hosts a state-of-the-art neuroimaging platform featuring high-end research-only Siemens Prisma 3T MRI scanner, sophisticated MRI compatible neurophysiological equipment and two high-density EEG machines.

LRENs Neuroimaging platform is a methodological platform open to all basic and clinical neuroscience researchers.
The mission of the LREN platform is to provide an innovative framework to allow the integration of the existing neuroimaging expertise of the world-class research community in the Lemanic area (CHUV, UNIL, HuG et EPFL).

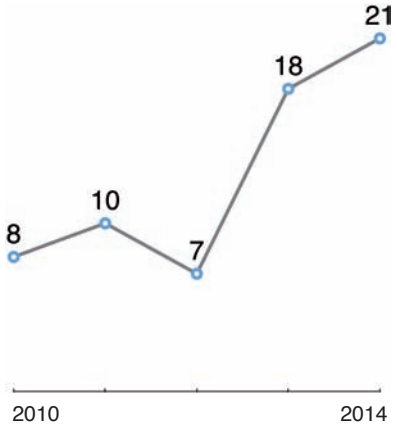
LRENs platform provides cutting-edge equipments and expertise covering all methodological aspects of neuroimaging ranging from study design to statistical analysis through the acquisition of high quality behavioural and MRI data and state-of-the-art automated processing up.

03 Facts & Figures

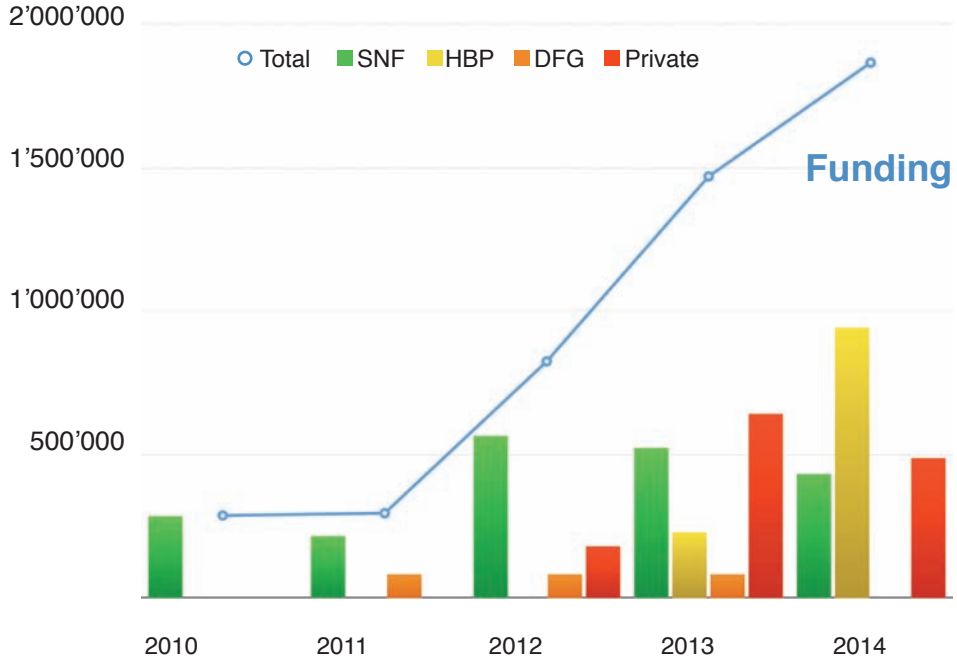
LREN Growth



Publications



Funding



2010

- LREN is created as part of CHUVs strategic decision to develop clinical neurosciences.
- Founding members Richard Frackowiak, Melissa Saenz, Ferath Kherif and Bogdan Draganski join LREN.

2011

- Researcher Maria Knyazeva joins LREN as Principal Investigator.
- First Lausanne SPM course with more than 50 participants from all over Europe.

2012

- LREN obtains funding for research-only MRI scanner through the charitable Spoelberch and Partridge Foundations.
- LREN moves in dedcated lab spaces at Mont Paisible 16 on the CHUV campus

2013

- 3T Siemens Prisma MRI scanner delivered and installed successfully.
- LRENs first retreat in Rolle, VD
- Researcher Antoine Lutti joins LREN as Head of Physics.

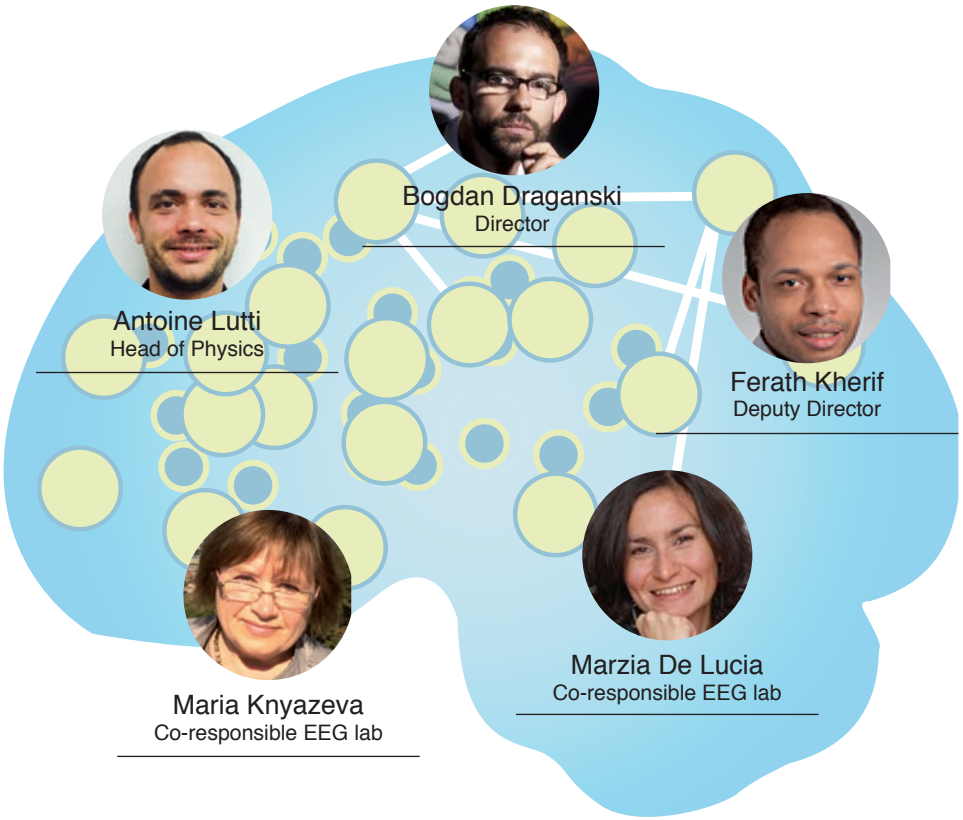
2014

- LRENs Neuroimaging platform reports more than 400 study participants scanned.
- Researcher Marzia De Lucia joins LREN as Principal Investigator.

2015

- Launch of CoLaus neuroimaging project
- Installation of prospective motion correction for brain imgaging planned
- Human Brain Project education workshop at CHUV scheduled

04 Organisation of LREN



LRENs Team

Bogdan Draganski
Ferath Kherif
Antoine Lutti
Marzia De Lucia
Maria Knyazeva
Lester Melie-Garcia
Elisabeth Roggenhofer
Anne Ruef
Renaud Marquis
Sara Lorio
Borja Fernandez
Fabrizio Pizzagalli
Valerie Zufferey
Sandrine Muller
Sandra Martin
Elsa Juan
Ludovic Sautel
Jing Cui
David Slater
Elham Barzegaram
Valerie Beaud
Natacha Vida Martins
Remi Castella
Claudia Modenato
Yanick Derighetti
Tea Danelutti
Mihaela Damian

05 Research projects

In vivo histology

The main aim of this project is to provide evidence for the anatomical plausibility of cyto- and myeloarchitectonic inferences from quantitative MRI brain data both at macroscopic and microscopic level. We conduct direct comparison between in vivo and ex vivo MRI and histology data in brain surgery specimens from well-characterised brain disorders – focal cortical dysplasia and temporal lobe epilepsy.

The specific aims are:

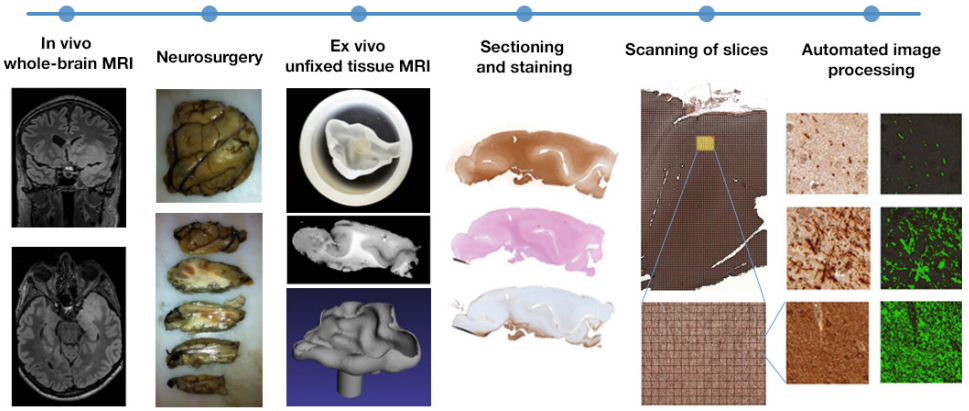
1) Harmonisation and optimisation of ex vivo data acquisition and data processing protocols

- MRI – implementation of hard- and software solutions for optimal spatial resolution and signal-to-noise ratio
- Histology – concatenation of 2D information to 3D volumes avoiding interpolation artefacts

2) Validation of in vivo estimates of cyto- and myeloarchitecture at macro- and microscopic level with ex vivo high-resolution MRI and histology measurements

- Comparison of grey-white matter boundary delineation between in vivo and ex vivo MRI and histology data
- Parcellation of hippocampus subfields based on differential cortex layer MR signal and cytoarchitectonic properties

3) Extrapolation of local findings on MRI-histology correlation to the whole brain



This interdisciplinary project will establish the leading role of UNIL and CHUV in the area of translational research based on cutting edge imaging neuroscience to address most relevant questions in the domain of brain imaging data interpretation in brain health and disease. The intention to establish and validate in a proof-of-concept study the correlation of qMRI signal properties with state-of-the-art histology assessment is both innovative and extremely challenging.

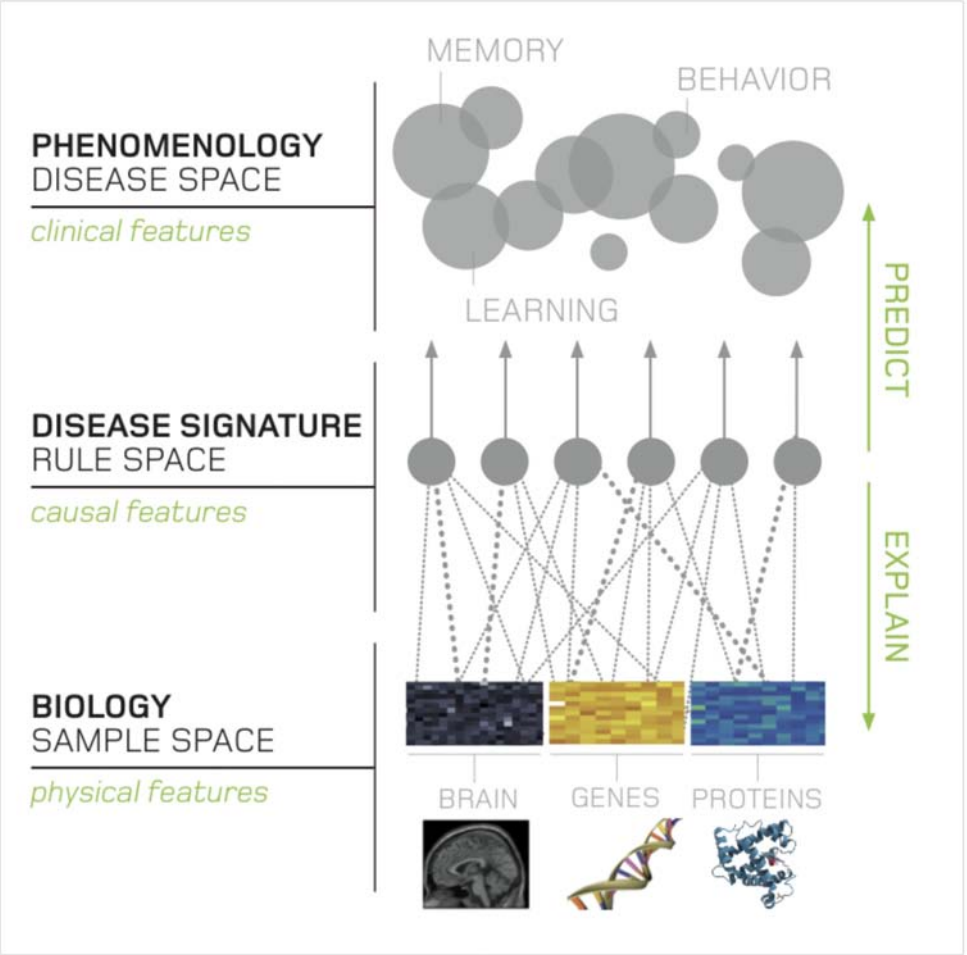
Lorio S, Lutti A, Kherif F, Ruef A, Dukart J, Chowdhury R, Frackowiak RS, Ashburner J, Helms G,
Weiskopf N, Draganski B. Disentangling in vivo the effects of iron content and atrophy on the ageing human brain. Neuroimage. 2014 Sep 25. pii: S1053-8119(14)00786-1. doi: 10.1016/j.neuroimage.2014.09.044.

Imaging genomics in the CoLaus cohort

With this project we provide a comprehensive framework for imaging genomics in a true interdisciplinary way - from identification and monitoring of cognitive and behavioural phenotypes, over analysis of brain imaging data informed by biophysical models to “meta-variate” analysis of multi-scale data.
The framework relies on integration of temporal and spatial scales of human and animal imaging data to facilitate biological interpretation. The combination of in vivo / ex vivo human and rodent imaging will increase the granularity of inferences by correlating brain imaging at macroscopic scale with histological information at the microscopic level. In a complementary way the convergence of superior quality brain imaging and genetic data in a “meta-analysis” should ultimately allow the generation of reliable predictive models of brain development, ageing and related disorders.

For this study we will recruit healthy volunteers (n=900) and their offspring (n=100) from the PsyCoLaus cohort. They will undergo the quantitative MRI protocol and diffusion-weighted imaging. For data analysis we use the established framework of VBQ [16] and novel approaches for mapping genetic information on brain morphometry analysis. This will be the first study looking for characteristic patterns of brain anatomy changes to inform reliable and accurate models of the intertwined relationship between genotype, cardiovascular disease and depression accounting for the heterogeneity of clinical manifestation and interdependency of mediators.

Maillard AM*, Ruef A*, Pizzagalli F, Migliavacca E, Hippolyte L, Adaszewski S, Dukart J, Ferrari C, Conus P, Männik K, Zazhytska M, Siffredi V, Maeder P, Kutalik Z, Kherif F, Hadjikhani N, Beckmann JS, Reymond A**, Draganski B**, Jacquemont S The 16p11.2 locus modulates brain structures common to autism, schizophrenia and obesity. Molecular Psychiatry, 2014 in press * shared first authorship, ** shared senior authorship



Function recovery after stroke

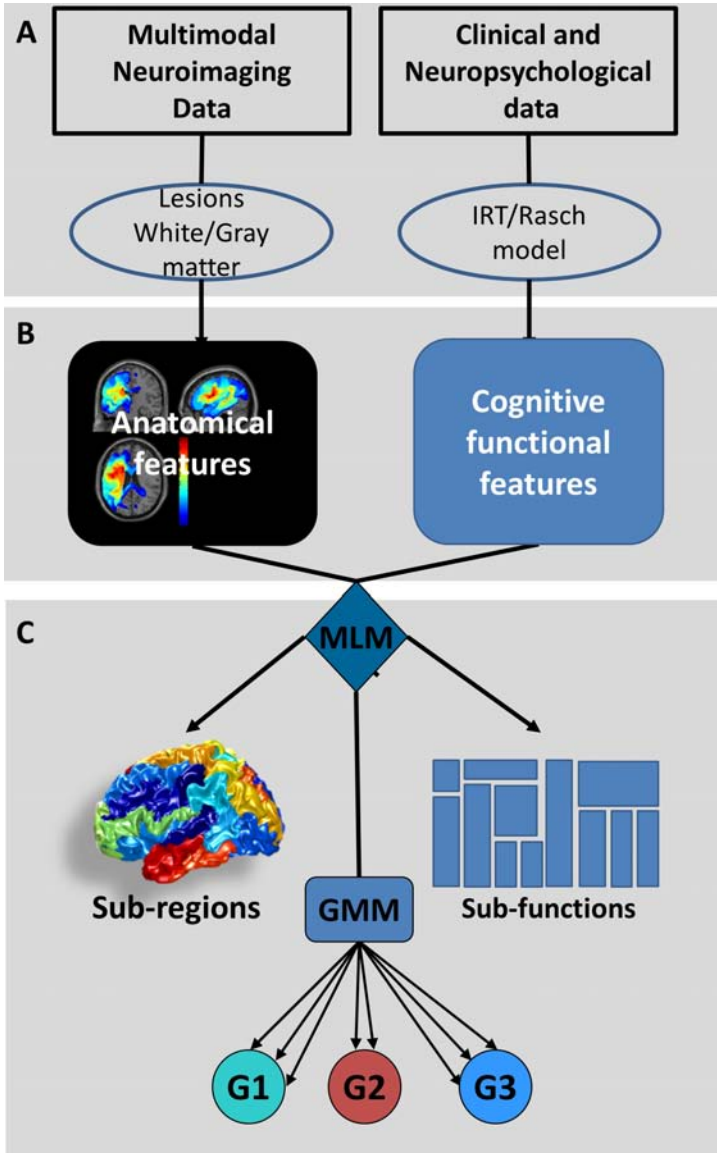
Here we aim to create a causal model of function recovery (e.g. language, motor function) after acute ischemia using a multivariate network analysis approach, which takes into account the variability of distributed networks and the interactions between complex neural systems. We build on our previous findings in post-stroke aphasia, based on the concept of degeneracy, suggesting that performance is preserved/recovered when the very same function can be supported by different sets of brain regions.

The specific aims are:

- **Describe** the temporal trajectory of structural changes in the subacute and chronic phase after stroke. Study the interaction between brain anatomy changes and the dynamic pattern of function recovery assessed using clinical and neuropsychological tests.
- **Provide** a functional mapping of language recovery by comparing patterns of neural activity in healthy controls and well-recovered patients at various stages of aphasia rehabilitation using functional MRI.
- **Establish** and **test** a predictive model of clinical outcome in aphasic stroke patients based on network analysis of brain anatomy and function characteristics related to language recovery.

During the past year we have setup the necessary logistic in order to ensure patients' data collection and to guarantee successful completion of this project. We invite participants from all consecutive patients who were admitted to the Comprehensive Stroke Centre – DNC, CHUV with a main diagnosis of acute ischemic stroke.

Preusser S, Thiel SD, Rook C, Roggenhofer E, Kosatschek A, Draganski B, Blankenburg F, Driver J, Villringer A, Pleger B. The perception of touch and the ventral somatosensory pathway. Brain 2014 accepted



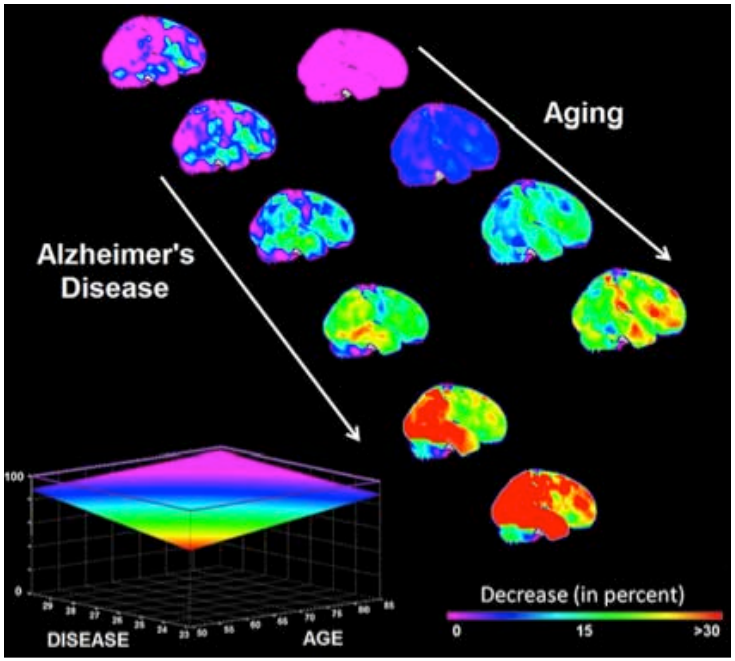
Biomarkers in Neurodegeneration

The use of multimodal data in combination with a multivariate model that captures and explains the extent of inter-subject variability is critical for characterization of Alzheimer's disease specific neurodegeneration pattern. Our approach to this question is providing relevant distances, or similarity measures, between different brain tissue parameter maps belonging to different subjects in order to determine the best predictive factors of disease. We suggest that characteristic distributions of brain anatomy changes will be of diagnostic value through identification of disease-related patterns. Further, we will inform the created predictive model by obtaining clinical, neuropsychological and genetic data.

The specific aims are:

- Describe in detail the pattern of progressive brain volume and tissue property changes in healthy ageing and different stages of MCI.
- Assess the differential pattern of motor function (gait behaviour) in patients and healthy ageing controls.
- Study the interaction between brain volume, tissue properties and gait behaviour/clinical/neuropsychological phenotypes.
- Establish a predictive model of motor and cognitive impairment in MCI as a biomarker for individual-based early detection and clinical outcome prognosis in patients at risk for AD.

We plan to recruit healthy subjects (n=300) and MCI/AD (n=300) patients who will be scanned twice within 3 years. We build on novel approaches taking advantage of our whole-brain VBQ analysis of multiparameter mapping data as well as unique expertise in the domain of clinical assessment of dementia.



Adaszewski S, Dukart J, Kherif F, Frackowiak R, Draganski B; Alzheimer's Disease Neuroimaging Initiative.How early can we predict Alzheimer's disease using computational anatomy? Neurobiol Aging. 2013 Dec;34(12):2815-26. doi: 10.1016/j.neurobiolaging.2013.06.015

Brain plasticity in mood disorders

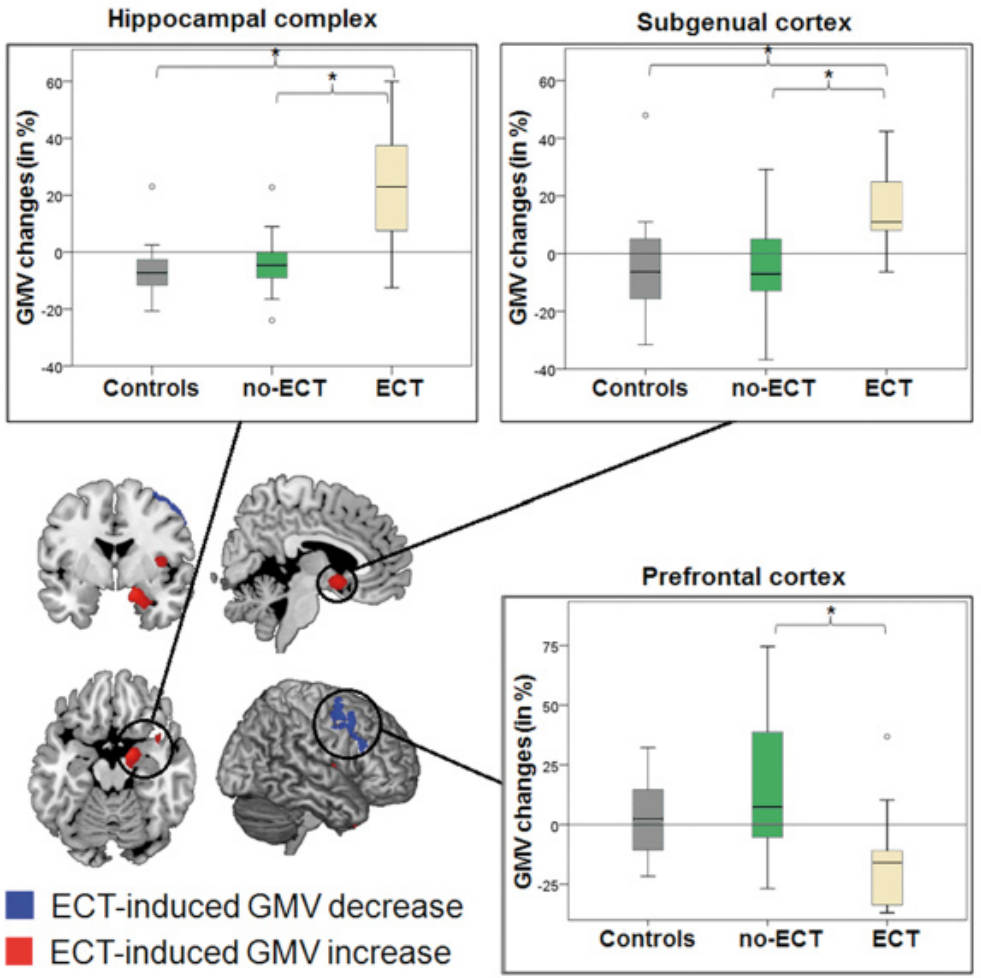
Opposed to previous research in the field using exogenous training paradigms, we use the opportunity to study endogenously induced neuroplasticity. We validate the methods by addressing a series of questions in histo-pathologically well-characterised conditions - temporal lobe epilepsy (TLE) and electroconvulsive therapy (ECT) in therapy refractory mood disorder patients. To this aim, we acquire at multiple time points before, during and after TLE- and ECT- induced seizures, anatomical and functional MRI data next to careful clinical/behavioural assessment.

The *main neuroscientific goals* of the project are to:

- **Describe** in detail the spatial and temporal dynamics of neuroplasticity induced by TLE- and ECT- related seizures.
- **Investigate** the differential effects of TLE- and ECT- induced neuroplasticity on recollection and familiarity as key aspects of recognition memory.
- **Infer causality** between TLE- and ECT- induced neuroplasticity and associated changes in behaviour, cognition, brain anatomy and function

The hypothesis for the proposed studies is that ECT will be associated with clinical improvement of depressive symptoms paralleled by brain anatomy changes in hippocampus and subgenual cortex next to specific transient modulation of hippocampus dependent recollection memory. The general aim of the project is to provide clinically relevant information allowing prediction of individual's clinical outcome, objective monitoring of ECT treatment- and TLE seizure activity- related brain changes over time.

1. Dukart J, Regen F, Kherif F, Colla M, Bajbouj M, Heuser I, Frackowiak RS, Draganski B. Electroconvulsive therapy-induced brain plasticity determines therapeutic outcome in mood disorders. Proc Natl Acad Sci U S A. 2014 Jan 21;111(3):1156-61.
2. Draganski B, Kherif F, Lutti A. Computational anatomy for studying use-dependent brain plasticity. Front Hum Neurosci. 2014 Jun 27;8:380.



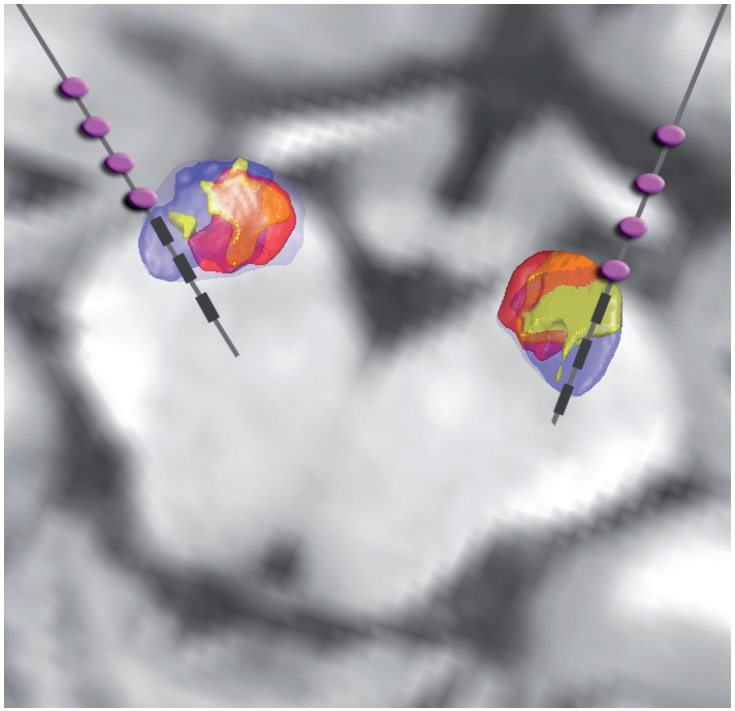
Optimization of target planning for DBS

The choice of DBS targets and their optimal localisation is hampered not only by substantial inter-individual anatomical variability but also by intra-operative “brain shift” mainly due to CSF loss. However, the clinical outcome after DBS is heavily dependant on optimal electrode positioning. Limited knowledge about individual topography of cortico-cortical and cortico-subcortical anatomical connectivity and the methodological problems of atlas-based target definition pose a pertinent limitation to optimal target planning and prediction of DBS clinical outcome.
We aim to implement established computational anatomy methods for pre- and intra-operative DBS target optimization and to validate a resultant “brain shift” index as a readily available predictive model of spatial transformation.

The specific aims are:

- **Quantification** of spatial deformation changes between pre- and post-surgery high-resolution anatomical MR data corresponding to “brain shift” due to the intervention.
- **Validation** of a predictive model for “brain shift” induced spatial transformation using an independent data set in a prospective manner.
- **Assessment** of DBS target topological features paralleled by correlation analysis with electrophysiological, clinical outcome characteristics and localisation of DBS electrode/ active contacts.

The **main goal** of the project is to study the spatial precision of connectivity topography estimation intra-individually and implement these methods in routine functional surgery planning in cases with Parkinson’s disease (PD), essential tremor (ET) and obsessive-compulsive disorder (OCD) undergoing DBS. We plan to evaluate intra- and inter-individually the tractography-based estimation precision of topographic organisation of basal ganglia cortical and subcortical projections based on pre-surgical DWI imaging data, routine intra-operative electrophysiological recordings and post-interventional modulation of DBS parameters in PD, ET and OCD patients. The objective is to evaluate the anatomical precision of the estimated location and spatial extent of functionally segregated basal ganglia sub-regions.



Accolla EA, Dukart J, Helms G, Weiskopf N, Kherif F, Lutti A, Chowdhury R, Hetzer S, Haynes JD, Kühn AA, Draganski B. Brain tissue properties differentiate between motor and limbic basal ganglia circuits. Hum Brain Mapp. 2014 Apr 28. doi: 10.1002/hbm.22533.

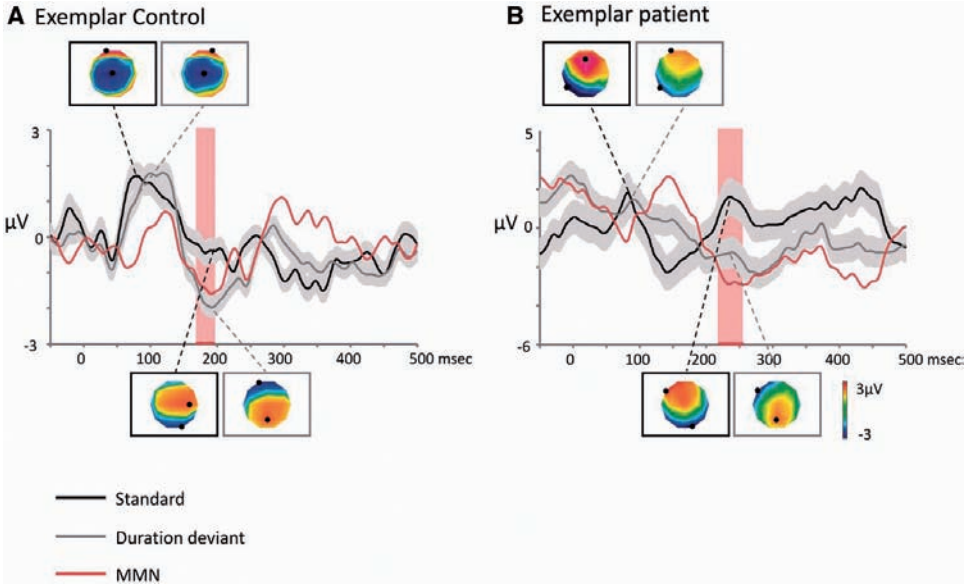
Brain function in coma

Coma is the leading etiology of permanent cognitive disability in adults. During the last decade, the advancement in early clinical care has drastically improved the number of patients with good outcome. These improvements have encouraged the neuroimaging community to better understand the neural functions underlying the recovery of these patients, improve prognostication and develop appropriate tools to detect consciousness recovery. The vast majority of the studies in the field have focused on patients in the late stages of coma, often in a vegetative state and with heterogeneous coma etiologies. The degree of preserved brain function in patients during the first days of coma is currently underexplored. In these project we focus on post-anoxic coma, the leading cause of admission in the critical care departements in advanced countries.

Specific aims of this project are :

- Developing quantitative markers for an early prediction of patients' outcome.
- Quantifying the degree of preserved functions in comatose patients as a function of their level of consciousness
- Establishing efficient experimental designs for detecting minimal level of consciousness in the acute stage of coma
- Developing 'command following' paradigms for early communication

These projects are based on the hypothesis that the degree of impairment of brain functions in comatose patients is particularly sensitive to the time passed after coma onset. In particular the degeneration over time of basic functions such as auditory responses to frequent vs deviant sounds can be intact during the first day of coma irrespective of patients' outcome. However the improvement over the first days of brain functions can provide critical information about patients' condition and can lead to a new assessment of prognostication tools and consciousness detection.



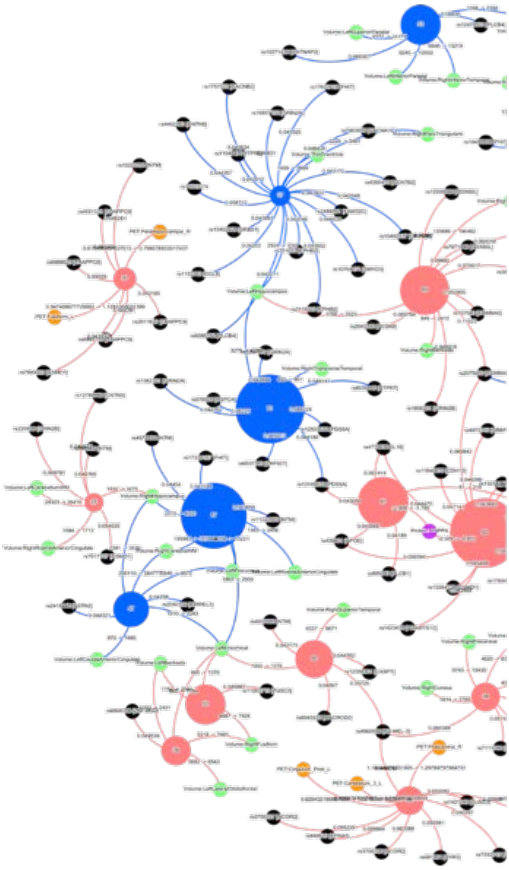
Tzovara A, Rossetti AO, Spierer L, Grivel J, Murray MM, Oddo M, **De Lucia M** (2013) Progression of auditory discrimination based on neural decoding predicts awakening from coma. Brain, 136(Pt 1):81-9.

06 Teaching

Project presentation
Weekly Human Brain seminar
Methods meeting
Annual SPM course
Clinical Neuroscience programme

07 Platforms

Human Brain Project



The CHUV Department of Clinical Neuroscience are responsible for the setting up of the Medical Informatics Platform of the Human Brain Project, under the leadership of Prof. Richard Frackowiak and Dr. Ferath Kherif. The platform will federate hospital and other clinical data on all brain diseases and across multiple levels of biology.

Medicine is experiencing a data explosion, driven by advances in genetics and imaging technology. We lack effective strategies to integrate the data and to identify the unique “biological signatures” of neurological and psychiatric diseases. However, new databasing and data mining technologies now makes it possible to federate and analyse the huge volumes of data accumulating in hospital archives, allowing researchers to identify the biological changes associated with disease and opening possibilities for early diagnosis and personalised medicine.

In the longer term, the data will allow for disease simulation by modifying models of healthy brains. Disease simulation will provide researchers with a powerful tool to prove the causal mechanisms responsible for disease, and to screen putative treatments. This will accelerate medical research and reduce suffering and costs associated with brain diseases.

Neuroimaging platform

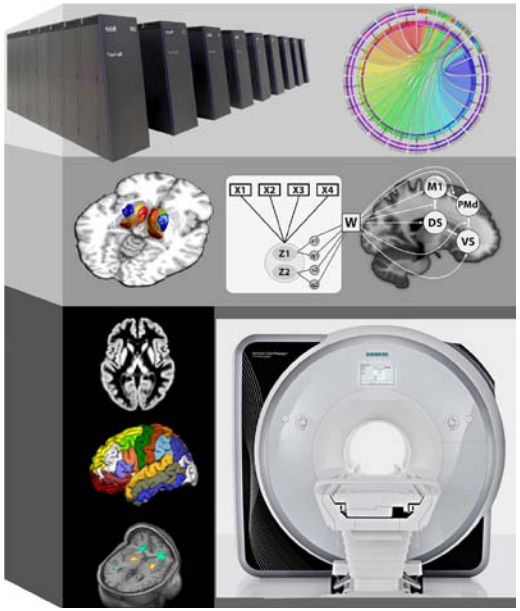
LRENs Neuroimaging platform provides a framework that benefits neuroscientists, epidemiologists and geneticists to investigate the healthy and diseased brain, to develop biomarkers for therapeutic monitoring, early diagnosis and prediction of clinical outcome, particularly in neurodegenerative disorders like Alzheimer´s disease.
Based on non-profit principles LRENs Neuroimaging platform provides an academic network for translational research in all major clinical and non-clinical domains of neuroscience.

High performance imaging data acquisition

Scientific instrumentation
- High-end 3T MR system offering high signal-to-noise ratio (SNR), high speed and high stability.
- A complete panel of equipment for real-time assessment of study participants' behaviour during data acquisition.
- Pioneering real-time motion correction system allowing optimal data quality.

Expertise
- In-house developed brain imaging acquisition sequences for optimal sensitivity in cross-sectional and longitudinal studies.
- Full-range of customized protocols for assessment of brain anatomy and function

Support team
- MRI engineers for customized solutions to the most challenging demands of neuroimaging research.
- MRI physicists for tailored acquisition protocols and optimal scientific output in all neuroscience studies.
- Close monitoring of scanner performance for sustained optimal data quality.



Advanced data processing and analysis

Scientific instrumentation
Advanced software solutions & High Performance Computing
- Lab management
- Data provenance
- Traceability of computing workflow process
- Partnership with CHUV IT

Expertise
End-to-end computing workflow
- Data capture of auxiliary data (behavioral, online cognitive testing, ..)
- Large volume data storage (DICOM, CSV, ..)
- Comprehensive data base
- Data analysis and statistical tools
- Data reporting, real-time dashboard

08 Principal Investigators

Bogdan Draganski

Bogdan Draganski qualified in Clinical Neurology in Germany followed by work on computational anatomy research at the Institute of Neurology, UCL London, UK, and at the Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig Germany. He is Academic Editor for the journals PLOS One, Movement Disorders, Frontiers in Human Neuroscience, Journal of Clinical Movement Disorders and is a member of the Dystonia Medical Research Foundation Scientific Advisory Council, USA.

Expertise
Areas of research: modulation of brain anatomy and function after electro-convulsive therapy; identification of surrogate imaging biomarkers in the presymptomatic phase of neurodegenerative diseases; deep brain stimulation; neuropsychiatry - Gilles de la Tourette's syndrome, obsessive-compulsive disorder.

Experimental techniques structural and functional Magnetic Resonance Imaging; neurological assessment.
Methods: univariate and multivariate analyses of behavioural and MRI data.

Ongoing projects
- Anatomical and functional segregation within cortico-subcortical circuits - Swiss National Science Foundation / Parkinsons disease - Parkinson Switzerland
- Development of an imaging biomarker for idiopathic Parkinson's disease Novartis Stiftung für Biologisch-Medizinische Forschung (Switzerland) - Imaging large scale network in epilepsy Swiss National Science Foundation - SPUM (Prof. Margitta Seeck - HUG)
- The 16p11.2 rearrangements: genetic paradigms for obesity and neurodevelopmental disorders Prof. Alexandre Reymond - CIG - UNIL
- Development of a composite imaging/gait behaviour biomarker for early detection of cognitive impairment in ageing Synapsis Foundation
- Human Brain Project as work package leader "Data collection"

Ferath Kherif

Ferath Kherif obtained his PhD in neuroscience at the University Pierre et Marie Curie in Paris. Before joining CHUV in 2010, he worked as Research Fellow at the MRC-CBU in Cambridge, UK and at the Wellcome Trust Center for Neuroimaging in London UCL, UK. He currently coordinates and directs the Human Brain Project platforms of Medical Informatics and Future Medicine.

Expertise
Areas of research: models of individual differences in cognitive neuroscience in health and disease; mechanisms of recovery of lost function after stroke.
Experimental techniques: structural and functional Magnetic Resonance Imaging; neuropsychology assessment.

Methods: mathematical modelling; machine learning; univariate and multivariate analyses of behavioural and MRI data.

Ongoing projects
- Velux Grant on recovery of aphasia as principal investigator: "Comprehensive Outcome Models of Aphasia "
- Brain networks of cognition and personality in Alzheimer's disease – co-investigator, principal investigator Armin von Gunten
- Models of memory
- Human Brain Project as work package leader "Medical Informatics" – "Big data and biological signature of Alzheimer's disease"

Antoine Lutti

Dr. Antoine Lutti is Head of Physics at the LREN-DNC-CHUV. Dr. Lutti obtained his PhD in MRI physics at Victoria University, Wellington, New Zealand in 2007 and then joined the Wellcome Trust Center for Neuroimaging, UCL, London – UK as a post-doctoral research fellow. He was deputy Head of Physics there from 2012. He joined the LREN in 2013 and is in charge of the development of MRI acquisition techniques, the supervision of the MRI platform and the physics support for neuroscientists.

Research
Development of quantitative relaxometry, functional and diffusion MRI acquisition techniques. Development and optimization of MRI biomarkers for the in-vivo characterization of brain tissue.

Applications: assessment of brain microstructure with MRI, complementarity of relaxometry- and diffusion-based MRI biomarkers, relationship between brain structure and function.

LREN MRI Platform
- Design and supervision of the construction for optimal neuroimaging research.
- Monitoring of MRI scanner performance to ensure high-end data quality for neuroscientists.
- Platform manager: access, safety, user training, supervision of staff.
- Support - Project–specific customization of MRI protocols for high-quality neuroimaging data.
- Teaching - Lausanne & London SPM course, Lemanic Neuroscience PhD course module Modern Neuroimaging Methods.

Maria Knyazeva

Dr. Maria G. Knyazeva obtained her PhD in neuroscience from the Institute of Developmental Physiology of Russian Academy of Sciences, Moscow, Russia. Before joining LREN in 2010, she worked as a senior researcher, then, as a Head of Research group in the Department of Cognitive Neurophysiology at the same institute. She combined her research activities with a position of a scientific editor of “Human Physiology” (Russian) journal.

Research
Her current research is centered on the formation, localization, behavior, evolution, and the structural substrate of distributed cooperative neural assemblies in normal human brain and in neurological conditions. The projects listed below focus on linking these issues to spatio-temporal dynamics of high-density EEG.

Expertise
Neurophysiology of child development, Brain lateralization, Interhemispheric mechanisms, Visual perception, Neurophysiology of aging, Age-related neurodegeneration, Biomarkers of Alzheimer’s disease.

Experimental techniques: Electroencephalography (EEG)

Methods: EEG technology, Ongoing EEG, Oscillations, Event-related potentials, Clinical EEG applications, Behavioral paradigms, EEG synchronization analysis, Network analysis, Dynamic Causal Modeling.

Ongoing projects
- Wearable ICT for Zero Power medical Application.
- EEG-based functional connectivity in patients with PNES
- Multimodal exploration of functional and anatomical connectivity of the brain in Alzheimer’s disease.
- Connect’in age - nested CoLaus project

Marzia De Lucia

Marzia De Lucia received her PhD in Physics in 2004 from the University La Sapienza of Rome, Italy. She then joined as post-doc the Bioengineering and Medical Physics Department, University College London and in 2006 the Center for Biomedical Imaging Lausanne University Hospital. Since 2014 she is principal investigator at LREN and the Faculty of Biology and Medicine, University of Lausanne.

Expertise
Areas of research: neural basis of human auditory perception and cognition in healthy and clinical populations, brain functions in coma, brain functions in the absence of consciousness, decision-making.Experimental techniques: Electroencephalography (EEG); Intracranial EEG recordings (iEEG); functional Magnetic Resonance Imaging.

Methods: Algorithms for supervised and unsupervised learning; multivariate analyses for single-trial EEG/iEEG decoding and prediction; Event-related potential analyses

Ongoing projects
- Grant of the Service Projets et Organisation Stratégiques of the University Hospital of Lausanne as principal investigator: “Validation d’un test pour prédire les chances de réveil de patients dans le coma basé sur le EEG”
- Swiss National Foundation grant (CR32I3_143780) as co-applicant “Early electrophysiological correlates of brain injury and outcome in comatose patients after cardiac arrest”

Results
Patent: Application number: PCT/EP2013/055036; September 2014 Europe and USA protection

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Book chapter:

1. Dukart J and Draganski B. Imaging in Neurodegenerative Disorders edited by Luca Saba, Oxford University Press 2014
2. De Lucia M, Tzovara A. "Prognostic Use of Cognitive Event-Related Potentials in Acute Consciousness Impairment" In Clinical Neurophysiology in Disorders of Consciousness, Springer, In Press

10 Collaborations & Sponsors

Martin Preisig & Peter Vollenweider, CHUV - CoLaus project
Alexandre Reymond, CIG - UNIL - 16p11.2 CNV carriers project
Armin von Gunten & Jean Frédéric Mall, CHUV - Brain Plasticity in mood disorders
Jocelyne Bloch, CHUV - Optimisation of DBS targeting
Jean-Pierre Hornung, DFN-UNIL & Roy Daniel, CHUV - In vivo histology
Zoltan Kutalik, CHUV & SIB - Imaging Genomics
John Ashburner & Nikolaus Weiskopf, UCL UK - Computational anatomy
Margitta Seeck, HuG & Roland Wiest, Bern - Large networks in epilepsy

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