HBP SCIENCE MARKET

HUMAN BRAIN ORGANISATION

SP2

What we do

Our brain consists of around 86 billion nerve cells, the neurons. Each neuron is connected to between 1 and 200,000 other neurons, resulting in 100 trillion nerve fibres running through the brain. This high complexity is further increased by the inter-individual variability of the brain - each of us is different, has different talents, feelings and their own personality. How the brain is organised, which brain regions are interconnected and which areas work together to execute a certain function is by far not fully answered.
SP2 researchers from 14 research institutions throughout Europe are working on these questions by using many different methods. For example, researchers of the Forschungszentrum Jülich in Germany are working on a map of the human brain (JuBrain atlas) based on differences in the distribution and size of the neurons in brains of body donors. Connections between the neurons, i.e. nerve fibres and bundles can be detected by powerful methods such as polarized light imaging (PLI) and diffusion tensor imaging (DTI), where experts in Jülich and at the CEA in Paris collaborate. Functional magnetic resonance imaging (fMRI) is used by groups in the Netherlands, France, Belgium, UK and Germany to identify regions and networks involved in brain functions like visual and auditory processing or cognition, and reveals more and more details of the functional brain organisation.
One of the greatest goals of SP2 is to develop the HBP Human Brain Atlas, which can be used by neuroscientists all over the world, in neurosurgery and as a basis to understand the differences between the healthy and diseased brain.

How we are organised

WP2.1 HUMAN NEUROGENOMICS. This WP aims to understand brain function by correlating genetic variability with brain phenotypic variability in humans. Another aim is to deliver fundamental sets of biological information (DNA, DNA methylation, RNA) for all HBP brain samples by generating "-omics" data (e.g. whole genome sequence, whole genome DNA methylation, transcriptome derived from brain regions and single cells).
WP2.2 MORPHOLOGY AND ARCHITECTURE OF THE HUMAN BRAIN. A MULTI-LEVEL AND MULTI-MODAL APPROACH. Here, we study the organisation of the visual, motor and limbic systems and areas of the allo- and neocortex. In addition, participants exploit the advantages of state-of-the-art genetic, cell biological, histochemical, and imaging methodologies in cell typing, fibre orientation ("connectivity") and protein distribution across brain regions.
WP2.3 FUNCTION AND VARIABILITY. This WP aims to build a holistic view of the brain macroscopic organisation that includes anatomical and functional information gained through *in vivo* imaging.
WP2.4 COMPARATIVE COMPUTATIONAL ARCHITECTURE OF MULTI-MODAL PROCESSING STREAMS (SYSTEMS PHYSIOLOGY). We investigate representations and mechanisms at the different organisational levels in the human and monkey brain, e.g. to advance our understanding on how the brain processes stimuli and how information is integrated within and between visual and auditory processing streams during cognitive tasks.
WP2.5 INTEGRATIVE MAPS AND MODELS. This WP aims to build the multimodal connectome of the human brain to be embedded in a multi-level human brain atlas.
WP2.6 CO-DESIGN/METHODS AND BIG DATA ANALYTICS. We aim to provide scientists with the tools to project atlas information on to their own datasets, and offer retrieval of quantitative data based on 3D coordinates, macroanatomical landmarks or structural areas.
WP2.7 COORDINATION AND MANAGEMENT. This WP aims to coordinate the scientific activities within SP2 and its interactions with other SPs, the entire HBP, and the larger community.

SP LEADER Katrin AMUNTS
DEPUTY SP LEADERS Jean-Francois MANGIN
Francesco PAVONE
WORK PACKAGE LEADERS

- WP2.1 Human Neurogenomics: Thomas BOURGERON
- WP2.2 Morphology and architecture of the Human Brain: A multi-level and multi-modal approach: Francesco PAVONE
- WP2.3 Function and Variability: Simon EICKHOFF
- WP2.4 Comparative computational architecture of multi-modal processing streams (Systems Physiology): Rainer GOEBEL
- WP2.5 Integrative maps and models: Jean-Francois MANGIN
- WP2.6 Co-design/Methods and Big Data Analytics: John ASHBURNER
- WP2.7 Coordination and Management: Katrin AMUNTS

SP MANAGER Sabine BRADLER

Publication highlights

Eickhoff SB, Constable RT; Yeo BT. *Topographic organization of the cerebral cortex and brain cartography.* Neuroimage (in press). DOI: 10.1016/j.neuroimage.2017.02.018

Kemper VG, De Martino F, Emmerling TC, Yacoub E, Goebel R. 2017. *High resolution data analysis strategies for mesoscale human functional MRI at 7 and 9.4 T. Neuroimage 2017; DOI: 10.1016/j.neuroimage.2017.03.058 (in press).*

Klink PC, Dagnino B, Gariel-Mathis MA, Roelfsema PR. *Distinct feedforward and feedback effects of microstimulation in visual cortex reveal neural mechanisms of texture-segregation. Neuron 2017;95:209–220.e3 DOI: 10.1016/j.neuron.2017.05.033*

Nichols TE, Das S, Eickhoff SB, Evans AC, Glatard T, Hanke M, *et al. Best practices in data analysis and sharing in neuroimaging using MRI. Nature Neurosci 2017;20:299–303. DOI: 10.1038/nn.4500*

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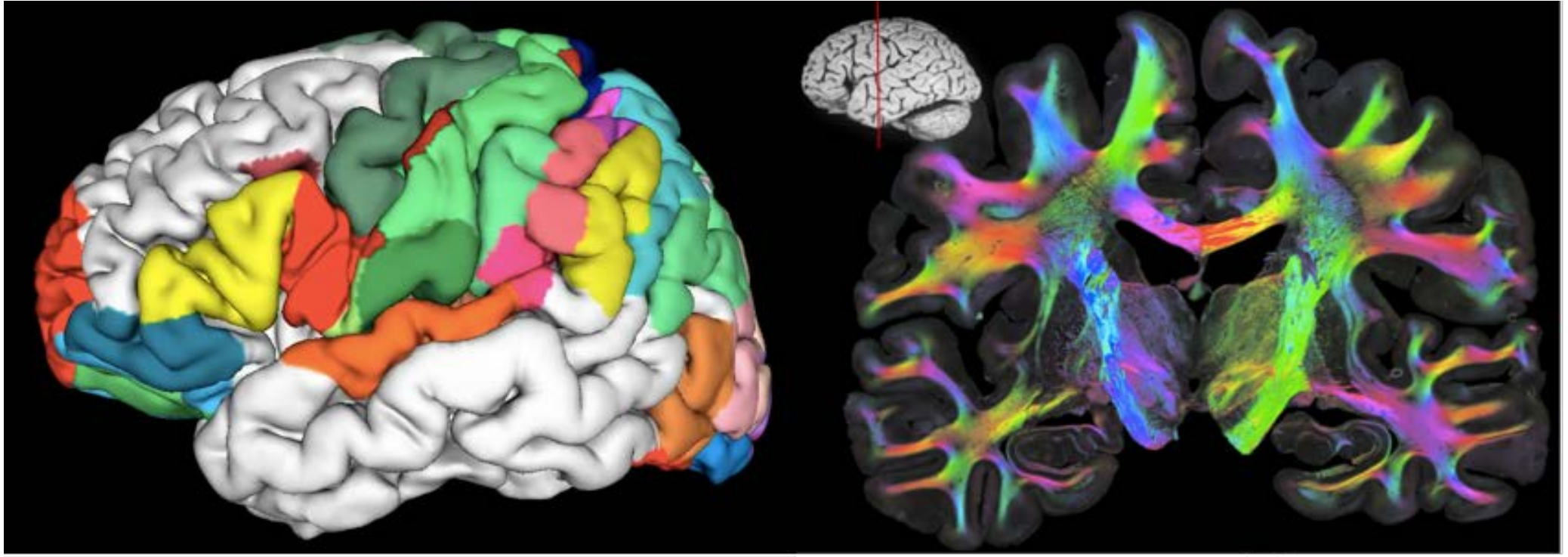
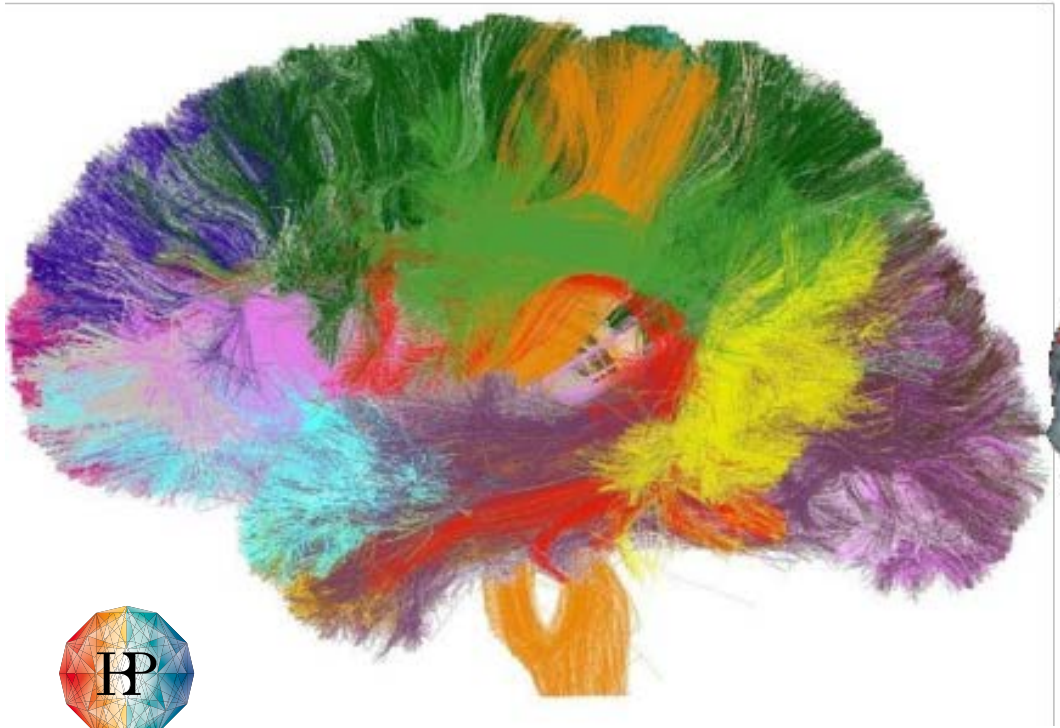
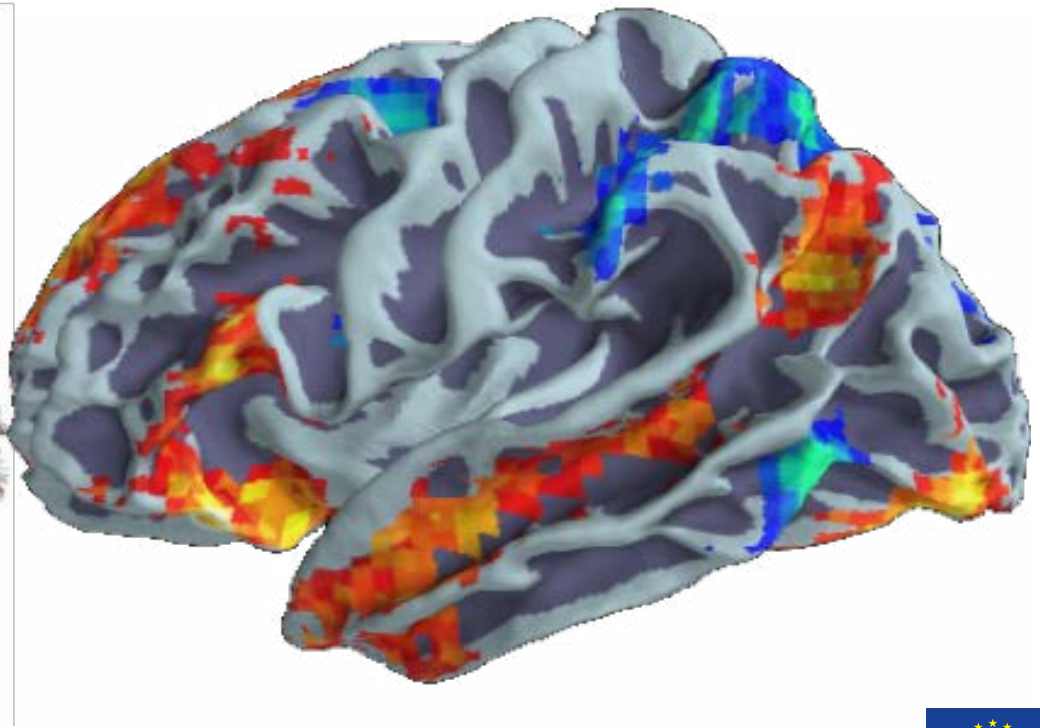
https://www.humanbrainproject.eu/en/about/project-structure/subprojects/







Human Brain Project

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