Introductory Remarks to Symposium 25

Multilevel human brain mapping and atlas as a tool connecting micro- and macro-structures

Nataliia Fedorchenko and Alexey Chervonnyy, Duesseldorf

To understand how cognitive networks are related to the organization of the brain, and which areas and nuclei are part of a network, atlases are essential. Over the past decades, different types of brain atlases have been developed. However, many of them only provide information about the brain surface based on sulci and gyri patterns, while subcortical structures, which are important hubs of large-scale networks, are not adequately represented. In addition, sulci and gyri do mostly not reflect borders of cortical areas, which are only visible at microscopical resolution. Inter-individual differences, which are massive in humans compared to standard model species, provide another challenge for human brain mapping.

The Julich Brain Atlas addresses such questions. It contains cytoarchitectonic probabilistic maps of 227 areas and nuclei and is freely accessible via the EBRAINS research platform. EBRAINS allows the linking of different brain maps covering a broad range of modalities and spatial scales and provides data and tools according to the FAIR principles. Atlas data is available in three different template spaces (MNI Colin 27, ICBM 2009c, and the BigBrain). While the first two are frequently used in neuroimaging research and clinical applications, the BigBrain is an important tool when high spatial resolution is required.

In our symposium, speakers will present (1) the concept of multi-modal and multi-scale brain mapping and the role of the Julich Brain Atlas to study cognitive functions and brain diseases, (2) how the siibra toolsuite can be used to connect atlas data with the results from other imaging experiments, to retrieve data for own experiments or to use them for modelling and simulation, and (3) how ultra-high resolution data from the cellular and subcellular level of brain organization can be integrated in order to add spatial context. These keynotes will be complemented by short communications from two young researchers presenting the mapping process of the hypothalamus and subdivisions of Broca's region.

It is hoped that the symposium will demonstrate how high-resolution, multi-level brain mapping, coupled with advanced methods, can improve our understanding of structure-function relationships and advance studies of brain connectivity, function, and pathology.

Symposium 25

Friday, March 28, 2025
14:30 - 16:30, Lecture Hall 102

Chairs: Nataliia Fedorchenko and Alexey Chervonnyy, Duesseldorf

14:30   **Opening Remarks**

14:35   Katrin Amunts, Duesseldorf
BRAIN ARCHITECTURE – FROM CELLS TO ORGAN (S25-1)

15:05   Timo Dickscheid, Juelich
BRIDGING DIFFERENT LEVELS OF BRAIN ORGANIZATION USING THE SIIBRA TOOLSUITE (S25-2)

15:35   Tim Salditt, Goettingen
MULTI-SCALE NEUROIMAGING WITH SYNCHROTRON RADIATION: VOLUME DATA FOR THE BRAIN ATLAS, AND ALSO FOR FUTURE CONNECTOMICS? (S25-3)

16:05   Alexey Chervonnyy, Duesseldorf
HIGH-RESOLUTION 3D MAPPING OF THE HUMAN HYPOTHALAMUS AND ITS SUBDIVISIONS (S25-4)

16:15   Nataliia Fedorchenko, Duesseldorf
HIGH-RESOLUTION 3D MAPPING WITHIN AREAS 44 AND 45 – NEW CYTOARCHITECTONIC SUBDIVISIONS IN BROCA'S REGION (S25-5)

16:25   **Concluding Remarks**

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