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Human brain segregation and networks

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Brain segregation has been in the focus of research for more than 120 years. It has early been understood that the microstructural organization is closely linked to brain function and behavior, as formulated in early cy-toarchitectonic (Brodmann, 1909), or myeloarchitectonic studies (Vogt and Vogt, 1919). Although Brodmann and the Vogts were working together in one lab, their cyto- and myeloarchitectonic maps follow different nomenclatures and ontologies. Even today, there are very different concepts for brain segregation as well as brain maps. We propose a multi-level human brain atlas that is based on coherent cyto-, fiber- and receptor architectonic mapping. Key elements are the three-dimensional cytoarchitectonic probabilistic maps of cortical areas and nuclei of the Julich Brain Atlas and the high-resolution BigBrain model, available at EBRAINS. The siibra software tool suite enables a programmatic access to the different maps and data that are anchored to the brain areas. Considering the large amount of data and resulting requirements of their processing and analysis, methods of High-Performance Computing are mandatory. The "Big Three", cyto-, fiber-, and receptor architecture of the Julich Brain Atlas, represent a spatially and semantically organized reference to link structure and function across the scales.

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