HIBALL

HELMHOLTZ International BigBrain
Analytics & Learning Laboratory

WP4 Vision, Plans & Status
Prof. Dr. – Ing. Morris Riedel

22 April 2020 | Steering Board Meeting

UNIVERSITY OF ICELAND
SCHOOL OF ENGINEERING AND NATURAL SCIENCES
FACULTY OF INDUSTRIAL ENGINEERING,
MECHANICAL ENGINEERING AND COMPUTER SCIENCE

Mitglied der Helmholtz-Gemeinschaft

HELMHOLTZ AI   **CIFAR**   **Mila**   **McGill**   **JÜLICH** Forschungszentrum

Work packages and tasks

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WP1: Brain parcellation using AI-based segmentation

Timo Dickscheid | Alan Evans

T1.1: Cortical layer maps (Evans, Wagstyl)

T1.2: Propagating 3D maps of cytoarchitectonic areas from 2D histology (Dickscheid, Amunts)

T1.3: Automated hippocampal topological analysis (Khan)

WP4: Modular computing architecture for cellular BigBrain

Morris Riedel | Tristan Glatard

T4.1: Develop Parallel & Scalable Workflows for Deep Learning (Riedel, Eicker)

T4.2: Exploit Maximum Data Accessibility for Neuroscience Datasets (Riedel, Pleiter)

WP2: Multimodal data integration into BigBrain

Boris Bernhardt | Markus Axer

T2.1: Mapping 3D Chemoarchitectonic maps to BigBrain (Funck, Palomero-Gallagher)

T2.2: Mapping Transcriptomics maps to BigBrain (Iturria-Medina)

T2.3: 3D-PLI based connectivity and cellular architecture (Axer, Dickscheid, Iturria-Medina)

T2.4: Cross-modal, cross-subject mapping of histological data to in vivo MRI (Collins)

T2.5: BigBrain as a prior with 7T in vivo MRI (Bernhardt)

T2.6: BigBrain as a prior for connectivity-based parcellation (Eickhoff)

WP6: Brain-Inspired Artificial Intelligence

Blake Richards

Brain-inspired AI (Richards, Precup)

WP3: Cellular BigBrain

Katrin Amunts | Timo Dickscheid

T3.1: 20 μm reconstruction of a new brain sample (Mohlberg)

T3.2: 3D reconstruction at the level of individual cells (Huysegoms, Dickscheid)

WP5: The Virtual BigBrain

Alan Evans | Timo Dickscheid

T5.1 Increase spatial resolution of the models (Wang)

T5.2 Update forward models to simulate functional rhythms across multiscale networks (McIntosh)

T5.3 Functional validation of multiscale brain models against empirical data (McIntosh)

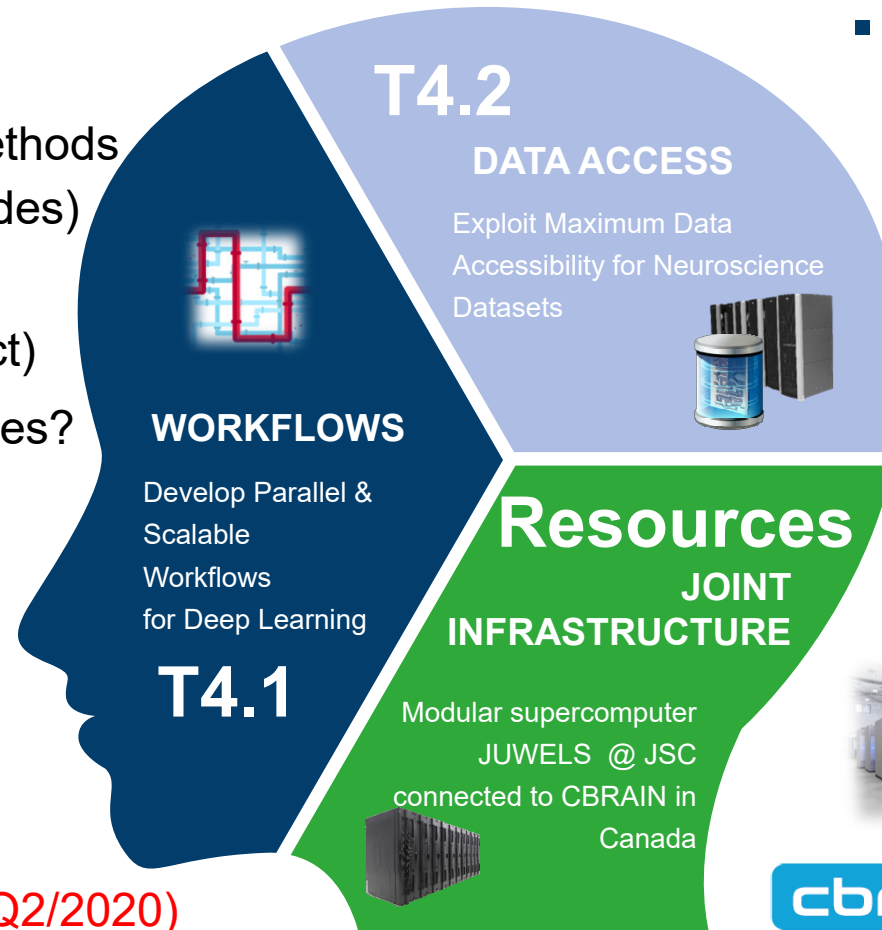T5.3 Functional validation of multiscale brain models against empirical data (McIntosh)

WP4: Modular computing architecture for cellular BigBrain

- T4.1 'Workflows'
  - Scale Deep Learning Methods (e.g. Horovod across nodes)
  - Use innovative GPU interconnects (GPUDirect)
  - How to exchange pipelines? (e.g. explore 'Boutiques' system to exchange containerized pipelines)

- Practical Next Steps
  - Draft architecture of joint infrastructure between JSC & CBRAIN (end of Q2/2020)

- T4.2 'Data Access'
  - Exploit hierarchical memory architecture for datasets
  - How to exchange/sync data between infrastructures? (e.g. I/O optimization methods)

T4.2 DATA ACCESS
Exploit Maximum Data Accessibility for Neuroscience Datasets

WORKFLOWS
Develop Parallel & Scalable Workflows for Deep Learning
T4.1

Resources JOINT INFRASTRUCTURE
Modular supercomputer JUWELS @ JSC connected to CBRAIN in Canada