

Parallel session descriptions

Parallel session 1

- **Neuromorphic computing: BrainScaleS and SpiNNaker+NRP - hands on (part I):** The session will provide an introduction to the new features (multicompartment neurons, structured dendrites, programmable local plasticity rules) of BrainScaleS-2 for spiking neural network emulations and a brief hands-on for running a simple network on the BrainScaleS-1 system.
- The session will provide a hands-on session on using SpiNNaker with the NRP (neuro robotics platform).
- **WP2 objectives, planning and interactions and Planning of Live papers in SP3-WP2:** From SGA2 to SGA3. In this session, we will introduce WP2, how it follows from SGA2, its objectives, tasks, and interactions with WP1 and WP3 and EBRAINS. WP2 partners are expected and all HBP partners also welcome.
- SP3 and SGA3 WP2 will discuss main topics that can be structured as SGA3 live papers. Individuals or groups will propose main topics / collaborative projects that can articulate live papers in WP2 SGA3 period.
- **WP9: Responsible Research and Innovation in the HBP, and WP4: Data Governance and Data Protection in SGA3 and Beyond:** The annual Ethics Rapporteur Programme's physical meeting is an open session which gives an overview of the ongoing ethical issues relevant to the science and technology work in the HBP presented and discussed by representatives of each subproject with the participation of the Ethics Advisory Board and other ethics governance structures of the HBP.
- An exploration of the key challenges facing the HBP with regards to the data it stores, shares and collects, and how the project will seek to tackle those challenges in the forthcoming phase of the project. In particular, this session will look towards the challenges faced by the EBRAINS infrastructure, and the groundwork being laid now to tackle them.
- **Fenix User Forum meeting:** The Fenix User Forum is a new organisation that has the goal of facilitating interaction between users and Fenix as well as among the users. It will allow Fenix users to discuss and share their experiences, to express their future needs as well as to provide feedback on the current services and resources of the ICEI infrastructure. This will allow users to benefit from sharing experiences and may impact the future operation and further evolution of the ICEI infrastructure. The Fenix User Forum meeting will include presentations providing an overview on the currently available e-infrastructure services as well as an introduction on how HBP members can apply for HPC, Cloud and storage resources.
- **HBP Collaborations (Partnering Projects):** Activities of Partnering Projects will be presented and their synergies with HBP highlighted. It will also be explained how to formalize your existing collaborations into HBP Partnering Projects.

Parallel session 2

- **Neuromorphic computing: BrainScaleS and SpiNNaker+NRP - hands on (part II):** see part I
- **SGA3 WP3 science:** In this session, we will introduce WP3 and the scientific aspects that are foreseen for SGA3 (objectives, tasks, and interactions with other WPs and EBRAINS), and discuss the transition from SGA2 to SGA3.
- **International collaboration in neuroscience: What are the neuroethical issues?** "When I'm approached to collaborate with Chinese neuroscientists, I ask myself what to do", "I worry AI and brain-like computing are already exploited on a world-wide scale for unethical purposes". "What to do with patient data gather in studies from around the globe?". In this interactive session, we introduce some of the hot topics (from research with non-human primates to modelling human attributes) that are

discussed by the International Brain Initiative neuroethics working group, and by the different brain initiatives around the world. We invite you to take part in an open discussion and collaborative development of the key neuroethical questions that should be asked globally – to advance global collaboration and ultimately neuroscience. International collaboration and public engagement on neuroethical issues is an important component of WP9 in SGA3. We expect to use your input to inspire our future work.

- **The Human Brain Atlas - workflows and plans on functional and connectivity data:** The session will give an update on tools and workflows available to work with the human brain atlas, and provide a forum to discuss stronger integration of functional and connectivity data towards SGA3, with simulation as a key user of such data.
- **HBP Collaborations (Partnering Projects):** See above
- **SIAB-EAB-SIB-SGA3 WP leader meeting (09:45-10:45, internal meeting)**

Parallel session 3

- **HLST internal meeting (SGA2-T5.9/SGA3-T4.13):** The people active in HLST in SGA2 and those to be active in SGA3-T4.13 will review experiences from work in SGA2 to document achievements in SGA2 and to prepare efforts in SGA3.
- **SGA3 WP1 science:** In this session, we will introduce WP1 and the scientific aspects that are foreseen for SGA3 (objectives, tasks, and interactions with other WPs and EBRAINS. This session should be open to WP1-3.
- **Interactive Modeling and Visualization for Neuroscience:** This session will present various visualization tools developed and supported by HBP. We will present visualization tools for data emerging from neural simulator like NEST as well as visual analysis libraries for statistical data. Beside visual data analysis, we will present an interactive and web-based user interface for NEST, called NEST Desktop, which not only gives interactive access to running NEST simulations but also enables novices and unexperienced user to simulated neural networks previously modeled using a visual representation of the network. NEST Desktop's primary application area is education but also offers very fast prototyping of neural network models for scientific applications.
- **Transforming microcircuit models for closed loop controllers and virtual brains:** This parallel session illustrates a core issue of the HBP crucial for the transition into SGA3. The strategy to transform detailed microcircuit models in order to make them usable in closed loop controllers and virtual brains will be described and exemplified through the experience of CDP2. The detailed microcircuit models incorporate biophysical and biochemical properties of neurons and synapses, providing a faithful explanation of biological properties. The drawback is that these models are computationally intensive and do not scale well to the requirements of large-scale simulations in integrated brain systems. Therefore, transformation strategies need to be designed in order to generate models that are both computationally efficient and, at the same time, able to preserve the fundamental properties of neurons and microcircuits relevant for function. CDP2 has elaborated these strategies by (1) designing neuron simplification procedures maintaining the salient computational features of neurons, (2) designing a "scaffold" for neuronal placement and network connectivity that can be used with different simulators, and (3) performing a multiscale validation across simulators and against experimental data. This workflow has been technically implemented by transforming pyNEURON into pyNEST and PYNN codes (preliminary results with ARBOR are also available). These codes have then be used be used to run simulations on HPC using CPU parallel computers, GPUs and neuromorphic hardware (SpiNNaker). This workflow will be exemplified for the case of the cerebellar network, that has been fully developed and transformed through the different steps and run on the different simulators and HPC machines. Finally, we will show how the models have been

specifically adapted to work into neurobotic controllers and The Virtual Brain. Examples of parts of the workflow implemented on the BSP and NRP will be shown.

- **Ethics Advisory Board (EAB) and Ethics Rapporteur (ER) Meeting (internal meeting):** To discuss 2020 trilateral ethics meetings, EC physical final review (ethics part for each SP) and open a dialogue about future EAB & ERs collaboration during the SGA3 period.
- **First Contact - Internal WP8 Meeting:** An internal meeting for WP8 Participants and collaborators from within the consortium to discuss plans for SGA3 work. A key objective is to ensure everybody is introduced in person to their colleagues for the next three years.

Parallel session 4

- **Neuro/Tech Ecosystem:** Overview of the Neuro/Tech Ecosystem (e.g. European Brain Research Area (EBRA) and its activities, including the calls for clusters: <https://www.ebra.eu/call4clusters/>; as well as EU support landscape)
- **The Virtual Brain:** We will present TheVirtualBrain (TVB) related tools and workflows deployed at the Neuroinformatics and Brain Simulation Platform accessible via HBP Collab. This includes: (1) Use of Image processing Pipelines via Collab with FENIX services, (2) Use of TVB co-simulation via jupyter notebooks in Collab, (3) Use of fast and parallel TVB code via Collab on CSCS, (4) Demo of digital atlas connected to TVB, and (5) Demo of our didactic EduCase in INCF training space. We also will demo TVB developments for clinical application and introduce our Partnering Project TVB-Cloud. The session provides a forum for discussion of upcoming TVB/TVB-Cloud related work during SGA3 that aims to advance existing solutions.
- **Protection, exploitation and ownership of HBP results:** This session will provide HBP members with practical insights on exploitation, protection and ownership of results.
- **mouse - Slow Wave Activity (m-SWA): analysis and simulation of slow rhythms in the mouse cerebral cortex (multi-scale, multi-model, multi-method):**
- The study of the mouse cerebral cortex is an important testbench for understanding the cortical connectivity and the mechanisms that determine cognitive systems in mammals. The focus on slow rhythms is motivated by observing SWA as a universal, default pattern for the cortex [1]; in addition, several studies recognize the crucial role that sleep plays in biology and its link with cognitive functions [2]. The opportunities given by the large variety of available experimental protocols (and the number of protocols under development) allow to evaluate different analysis strategy and to open new scientific quests [3]. Such a richness of experimental data demands for a robust analysis approach [4], able to identify common benchmark observables, overcome the specificities of the different recording techniques, produce solid comparisons, highlight complementarities between datasets, enrich the statistical significance of the results. This approach could provide reliable experimental constraints for theoretical models [5], aimed at understanding - and reproducing via dedicated simulations [5] - the phenomenology of the cortical activity.
- The goal of this Session is to illustrate experimental protocols and to discuss analysis strategies, in particular aimed at comparing data and results at different scales, enabling complementarities of experimental techniques.
- Agenda: (1) Slow rhythms and Slow Wave Activity in mammals: deep sleep, anesthesia and links with cognitive functions, (2) Experimental techniques and protocols for the study of the mouse cortical activity, (3) Unified approach for data analysis: compare and combine methods for a robust description of the phenomenology of the SWA (experimental data and simulations), (4) Automatic methods to set up large scale mean field and spiking simulations strongly constrained by experimental data

- References: 1. [SWA] Sanchez-Vives, et al (2017), Neuron., 2. [sleep and learning] Capone C., et al (2019), Sci. Rep. 9, 8990, 3. [experimental techniques and experimental protocols] Mohajerani (2013), Nature Neuroscience; Mitra (2018), Neuron; Steriade (1993), Journal of Neuroscience, 4. [data analysis] De Bonis G, et al (2019), Front. Syst. Neurosci. doi:10.3389/fnsys.2019.00070 (in press); Celotto M, et al (2018), arXiv:1811.11687, 5. [inference, models, simulations] Capone C. et al., Scientific reports (2018) 8.1: 17056; Capone C et al., Cerebral cortex (2019): 29, 1; Pastorelli, E. et al. (2019) Front. Syst. Neurosci 13, 33
- **Integration of the Knowledge Graph into the Neurorobotics Platform, a use case with SP6 Cerebellum**
- **In-person CSCS/Curation team meeting (internal meeting)**

Parallel session 5

- **Multi-scale co-simulation in the HBP:** This session provides an overview of the multi-scale efforts in SGA2 and a forward-looking introduction to the work to be done in SGA3. The session will consist of a number of presentations and an open discussion for current and potential users of the co-simulation efforts.
- **Use-case driven analysis of activity data and model validation in experiments and simulations:** Today, neuroscientists have a diversified and constantly growing repertoire of methods to analyze neuronal activity data. Moreover, the availability of open data sets containing neuronal activity data puts modelers in a position to perform a more in-depth validation of their models (e.g., [1]) based on the statistical descriptions of the activity observed in experiments. However, the increased possibilities also come at the cost of higher complexity of such analysis and validation processes. In this session, we practically showcase the state of HBP-enabled, tool-based workflow solutions that implement rigorous and well-defined data handling and analysis, as well as model validation schemes. We demonstrate a hands-on, in-depth example that covers searching for data (using [2]), representing of data and metadata, and its analysis using multiple emerging open-source software tools (e.g., [3-5]). Analysis is performed using the Electrophysiology Analysis Toolkit (Elephant, <http://neuralensemble.org/elephant/>) as a community-centered analysis framework for parallel, multi-scale activity data developed within the HBP, while validation is carried out using the HBP validation framework, and in particular the NetworkUnit library [6-8]. Following the introduction, three HBP use cases will demonstrate how these principles can be implemented in performing scientific research.
- Agenda: (1) Tutorial on activity data analysis using the HBP Infrastructure (ca 30 Minutes), (2) Reports from use cases, (3) SP3 UC3 -- Analysis of neural activity data (analysis of spike data in a visuo-tactile discrimination task in rat), (4) SP3 UC2 - Pipeline for analysis and simulation across multiple scales and multiple measurement modalities of spontaneous and perturbed SWA, transition to AW and cortical response complexity [9, 10], (5) SP5 UC3 - Paper reproduction of [11] on the Collaboratory, (6) Discussion
References: 1. van Albada, S.J. et al. (2018). Front Neuroinf 12, 291, 2. Brochier et al (2018). Scientific Data 5, 180055, 3. Garcia, S. et al. (2014). Front Neuroinf 8, 10, 4. Zehl, L. et al. (2016). Front Neuroinf 10, 26, 5. Grewe, J. et al. (2011). Front Neuroinf 5, 16, 6. Gutzen, R. et al. (2018) Front Neuroinf 12, 90, 7. Omar, C. et al. (2014). ICSE Companion 2014, 524–527, 8. Sarma, G. P. et al. (2016). F1000 Research, 5:1946., 9. Pastorelli, E. et al. (2019) Front. Syst. Neurosci 13, 33, 10. De Bonis, G. et al. (2019) Front. Syst. Neurosci. doi: 10.3389/fnsys.2019.00070 (in press), 11. Denker, M. et al. (2018) Scientific Reports 8, 5200.
- **WE ARE HBP - work for and engage in activities and research for equality:** This section will provide an overview on the SGA2 measures and guiding materials for diversity and equal opportunities in the HBP. In an open dialogue with the Gender

Advisory Committee achievements will be critically reflected. Conclusions will be drawn for SGA3.

- **EBRAINS Community Building:** This session will introduce the community building efforts for EBRAINS, the initial work, what will happen during SGA3 and the visions for EBRAINS community beyond HBP. The session will also follow up on learnings from initial community building workshops.
- **Responsible Dual Use of Neuroscience and Neurotechnology:** This session will take stock of work done by the HBP Dual Use Working Group by identifying potential dual use and misuse issues in the HBP and possible ways to address them. It will set a forward-looking agenda for activities to ensure responsible use of neuroscience and neurotechnology infrastructure in SGA3 and EBRAINS. It will also discuss plans for sharing HBP experiences with policy-makers and neuroscience community beyond the HBP.

Parallel session 6

- **Bringing molecular knowledge to the human brain connectome and Integration of cellular level data and modeling in studies of cognitive phenomena/brain function in health and disease:** 3 scientific presentations followed by a roundtable (2-5 mins presentations by all participants so that faces and names and science can be connected) followed by a free discussion of directions in SGA3.
- **Changes in NEST 3.0:** This session provides an overview of the changes coming in NEST with NEST 3.0. We will showcase new features, and try to give a guide on how to migrate from NEST 2.x to NEST 3.0.
- **A deep dive into EBRAINS services for finding, sharing and analyzing neuroscience data:** **Title: A deep dive into EBRAINS services for finding, sharing and analyzing neuroscience data:** EBRAINS is a new shared European infrastructure platform providing tools and services developed in the Human Brain Project to assist scientists to collect, analyse, share, and integrate brain data, and to perform modeling and simulation of brain function. In this parallel session, we will present some of the key EBRAINS services that allow researchers to 1) browse multimodal neuroscience data and computational models in the EBRAINS Knowledge Graph, 2) submit their data and receive data management support, long term storage, and 3) access new generation 3-D reference brain atlases as well as tools and workflows for exploring, analyzing and integrating research data. Join the session and learn what EBRAINS can offer and how you can get started. Outline for the session: (1) Introduction to EBRAINS by Jan Bjaalie, (2) Multimodal exploration of brain atlases, (3) Using Knowledge Graph metadata for automated data analysis pipelines, (4) QUINT workflow for 2D rodent brain image analyses, (5) Q&A / Discussions
- **Portable Simulation:** One of the main deliverables of WP5 in SGA3 will be individual simulation engines, model building tools, and workflows built on top of them, provided to users via the EBRAINS platform. This session will focus on the portable model descriptions and application programming interfaces (API) required to interact with individual tools, and couple them together in workflows. It will be a forum for users of the platform to describe their requirements, and for WP5 participants to show planned approaches such as the portable SONATA model description.
- **Selling EBRAINS - Engagement and Outreach in SGA3:** A presentation and Q&A about the engagement, outreach and recruitment strategy in SGA3 for EBRAINS (A joint presentation between Communication, Outreach and Education, Partnering and Innovation). For everyone, but particularly useful for anyone involved in dissemination, communication, and coordination, or who would be keen to become more involved in these activities.