Multi-scale, multi-species, multi-methodology experiments, analysis tools and simulation models of **Brain States** and **Complexity** in **SP3-UseCase002**

Human Brain Project

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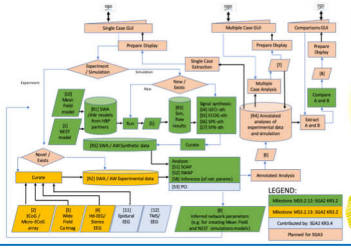
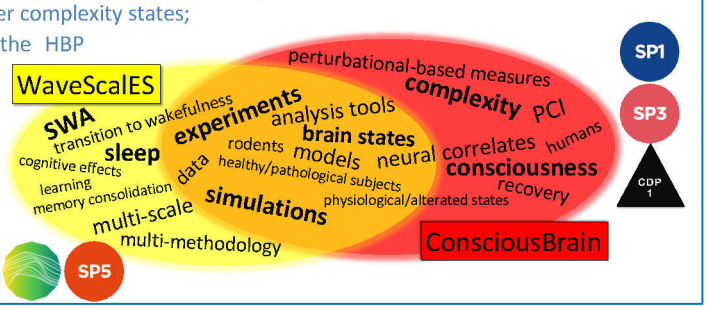
Goals of SP3-UseCase002

→Join **WaveScalES** & **ConsciuosBrain,** Scientific Mission: multi-scale, multi-methodology, multi-species investigation of brain states, their transitions, their complexity and their specific cognitive functions, starting from deep sleep to higher complexity states;

→Offer experimental data, simulation models, results and analysis tools to the HBP Community (and beyond) through **EBRAINS**;

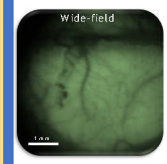
→Define a solid workflow for addressing specific scientific quests, create a reproducible and cooperative scientific framework providing **FAIR** access to experimental data, analysis tools and simulation models and supporting their comparison.



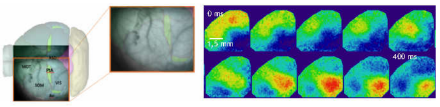


Experimental Data

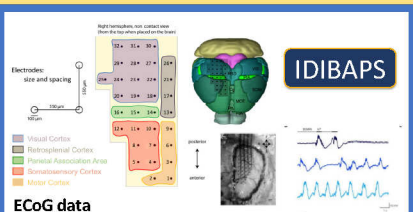
LENS



Ca-imaging data
Wide-field fluorescence microscopy on transgenic mouse model (GCaMP6f) expressing a calcium indicator (GECI). Ketamine-anesthetised subjects exhibit spontaneous SWA. Data curation in the KnowledgeGraph is in progress.



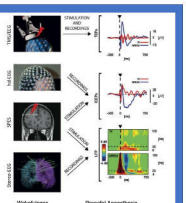
IDIBAPS



ECoG data
Spontaneous LFP activity recorded with a superficial 32-channel multielectrode array placed on the cortical surface at different levels of anaesthesia in mouse subjects. Data curated in the KG.

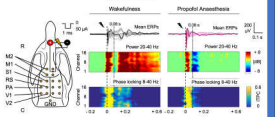
UniMI

Human data
EEG acquisitions in physiological and pathological human brains; **TMS** for a perturbational-based measurement of complexity (**PCI**). Data curated in the KG:
DOI: 10.25493/NXN2-05W
DOI: 10.25493/5TNA-R5P
DOI: 10.25493/30W7-0WK

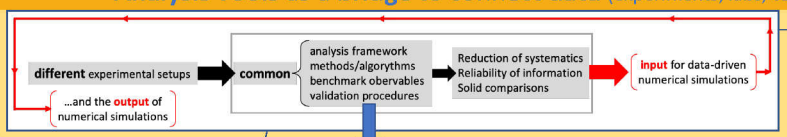


UiO

Rodent data
Epidural **EEG** and stimulations in rat brains for perturbational-based measurement of complexity (PCI). Data curated in the KG:
DOI: 10.25493/2FS0DM-BK5
DOI: 10.25493/4SPM-V00



Analysis Tools as a **bridge** to connect **data** (experiments, labs, techniques) and **models** (theory, simulations)



CNRS

Julich

expand/integrate general tools

neo

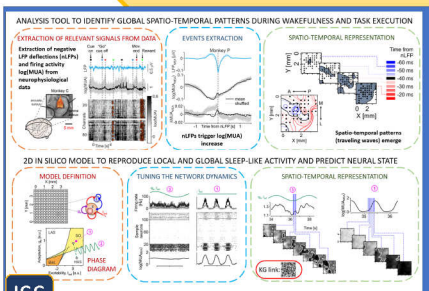
fairgraph

NetworkUnit

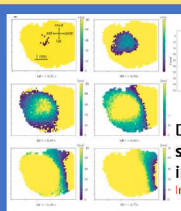
elephant

snakemake

- Reliable pipelines
- Data-driven simulations
  calibration of models
  → understanding complexity
  → simulate biological plausibility



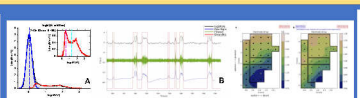
ISS



Data-driven **mean-field simulation** of slow rythms, **inference** of parameters.
In preparation

Identification and features of **propagating waves** in fluorescence recordings from anesthetised mice.
Celotto et al, in press, [q-bio.NC]1811.11687

LENS INFN

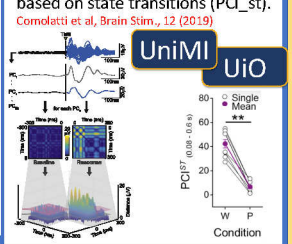


MUA estimation from ECoG recordings of LFP activity expressing **bimodality** (Up and Down states) during SWA in anesthetised mice; features of the **Slow Oscillations** extracted at each channel and cortical area, evaluating the statistical significance of the observed differences. De Bonis et al, Front. Syst. Neurosci., 22 (2019)

INFN ISS IDIBAPS

Perturbational complexity index based on state transitions (PCI_st).
Comolatti et al, Brain Stim., 12 (2019)

UniMI UiO



Models/Methods/Results

EBRAINS

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