Data-driven cellular models of brain regions: the Hippocampus and the Olfactory Bulb use cases

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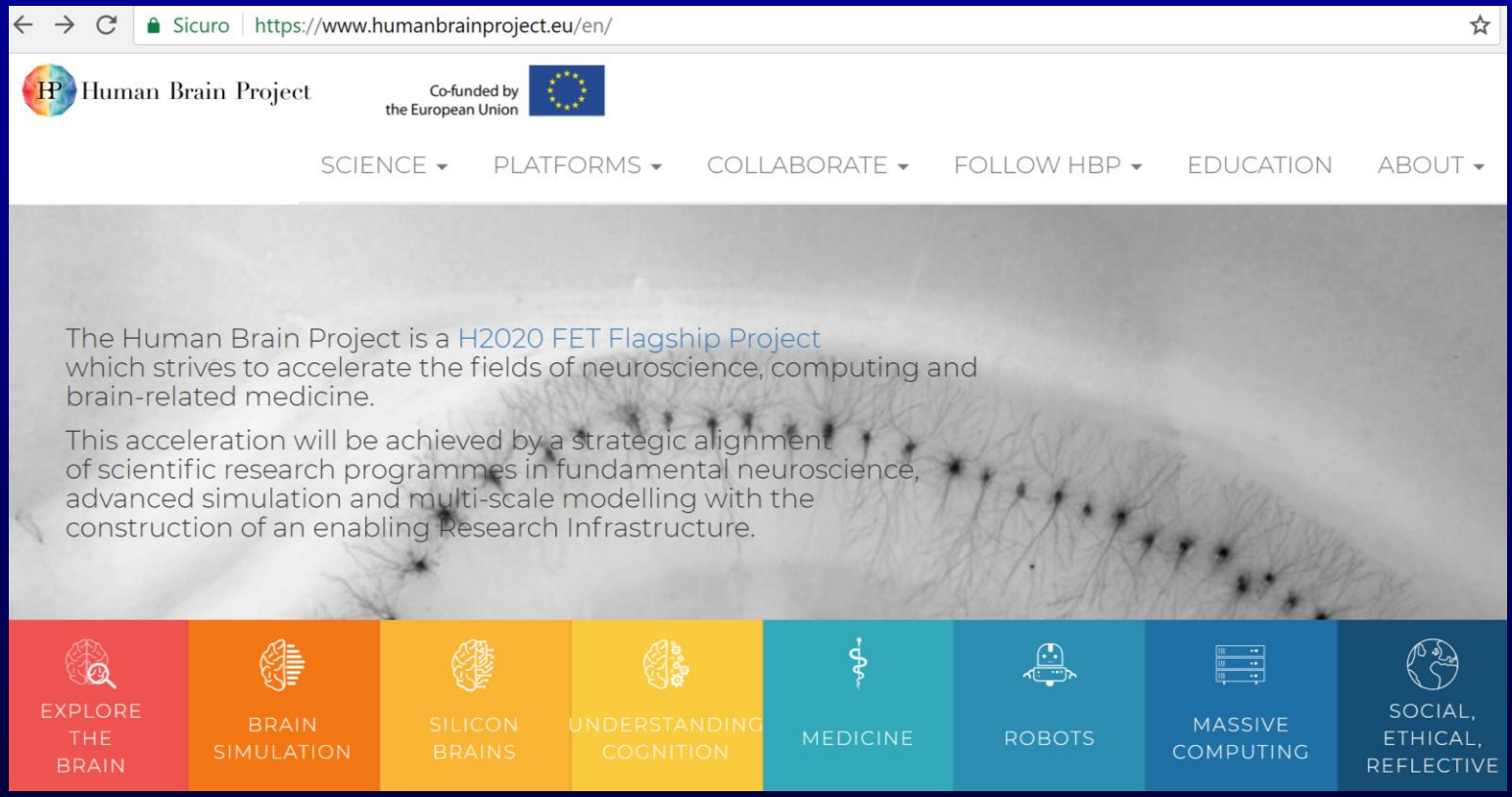
Models are available for public download on ModelDB


Sicuro | https://www.humanbrainproject.eu/en/
Human Brain Project
Co-funded by the European Union
SCIENCE
PLATFORMS
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EDUCATION
ABOUT
The Human Brain Project is a H2020 FET Flagship Project which strives to accelerate the fields of neuroscience, computing and brain-related medicine.
This acceleration will be achieved by a strategic alignment of scientific research programmes in fundamental neuroscience, advanced simulation and multi-scale modelling with the construction of an enabling Research Infrastructure.
EXPLORE THE BRAIN
BRAIN SIMULATION
SILICON BRAINS
UNDERSTANDING COGNITION
MEDICINE
ROBOTS
MASSIVE COMPUTING
SOCIAL, ETHICAL, REFLECTIVE

THE HUMAN BRAIN PROJECT

Leader of the Brain Simulation Platform WP

Member of the Infrastructure Development and Joint Platform Coordination Committees.

Simulation engine apps for the platform

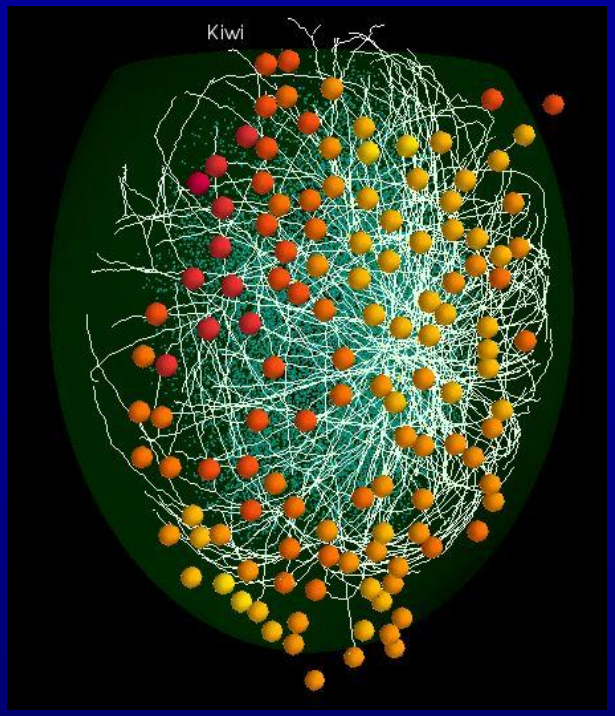
Platform administration and operations

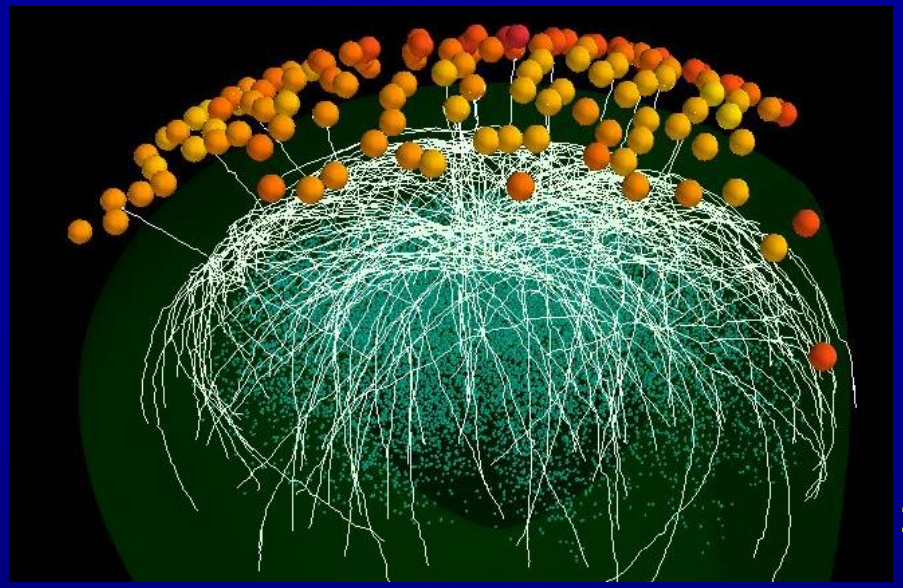
Tech. Leader of Co-Design Project 2, Mouse-Based Cellular Cortical and Subcortical Microcircuit Models

Integrating plasticity into microcircuit models (hippocampus)

Education (tutorials for platform use, tools, teaching material)

Synaptic transmission and hippocampus modeling





movie

635 mitral cells
100K granule cells
$7 \cdot 10^5$ synapses
(1/20 of the real system area
32,000,000 nonlinear ODEs)

Table 2 | Model parameters and execution times for a typical simulation.

	Seg (min-max)	States (min-max) (v, channels, and syn. gates)	Syn (min-max)
MC ($n = 635$)	380,748 (189–1433)	5,259,735 (2536–20,028)	707,216 (308–2799)
GC ($n = 69013$)	4,344,724 (33–257)	26,892,317 (261–869)	707,216 (1–62)
Total	4,725,472	32,152,052	

	Computation time	Comm. time (spike exchange)	Comm. time (multisplit)	Total run time (2048 procs)
Average (sec)	27,149.35	68.53	555.94	32,552.86
Max (sec)	27,756.25	813.44	1453.96	

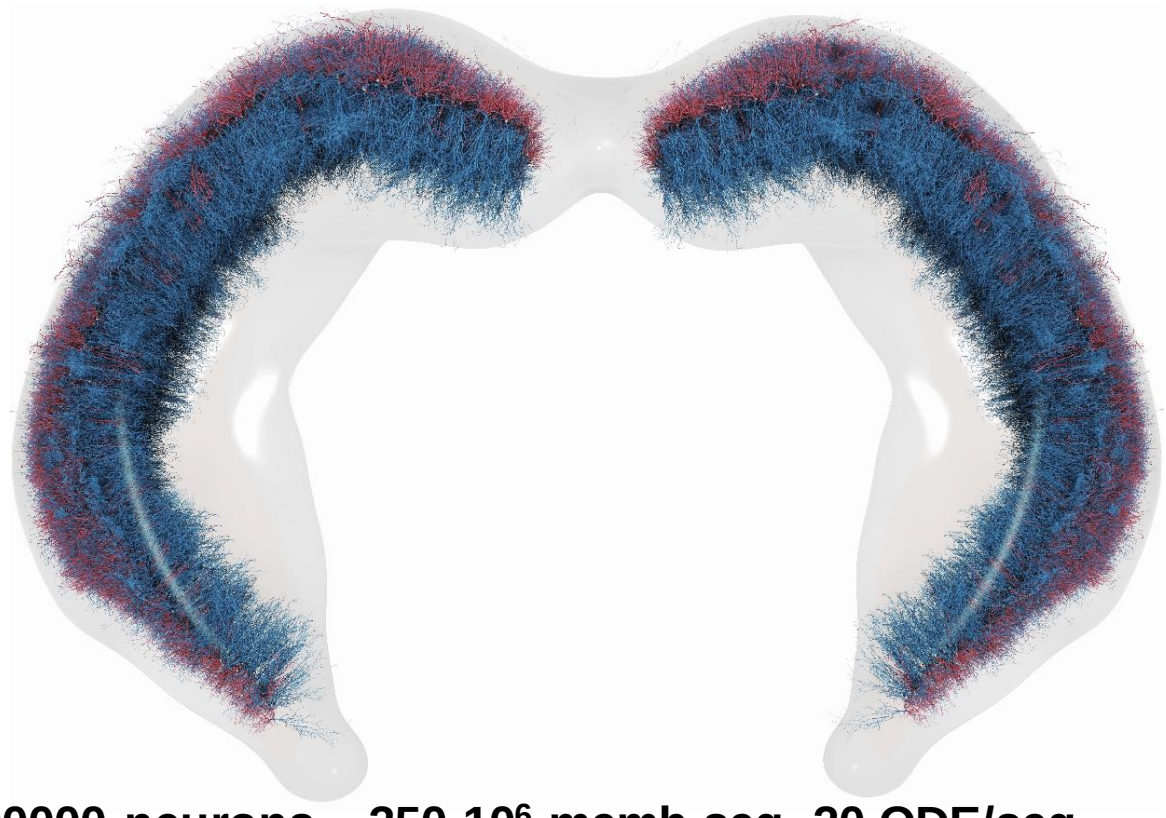
Currently installed on

CINECA Marconi

JSC JURECA, JUQUEEN

Typical 40 sec of sim. on 2048 processors, fully integrated NEURON+python implementation, $750 \cdot 10^6$ spikes: 9 hours, 10 Gb output, 99% eff.

biophysically accurate network



700000 neurons, ~350·10^6 memb seg, 20 ODE/seg

7·10^9 ODEs + synapses

1” of sim time: 5hr on BG/Q using 32000 procs

~8Tb of input, up to ~3Tb of output

- Quali sistemi di supercalcolo utilizzate e in base a quali criteri di accesso? Grant, accordo di ricerca, risorse istituzionali, acquisizioni? **NSG (pubblico), CINECA (accordo, PRACE), JULICH (accordo, PRACE)**

- Quali sono gli applicativi e i modelli di simulazione numerica che utilizzate ? **NEURON**

- Quale tipologia di servizio innovativo ritenete più utile **CLOUD HPC, scientific visualization from web browser**

- Quale modello di utilizzo è più adatto al tipo di ricerca del prossimo futuro: interattivo o batch? **ENTRAMBI**

- Pensate in futuro di affiancare all'HPC classico uno o più dei suddetti servizi innovativi? **SI**

- In relazione all'innovazione dei servizi/paradigmi/sistemi di quali competenze specialistiche ritenete avere maggiore necessità (es: esperti in: **visualizzazione scientifica, UNICORE, HPC systems integration**)

- Oltre l'attuale modello di distribuzione di risorse basato su call pubbliche e convenzioni, nell'ipotesi di un incremento significativo delle risorse quali strumenti vorreste vengano affiancati alle suddette modalità? (es: **modelli a sportello, cloud like: accesso pianificato per esigenze di progetti con target di eccellenza)**