CAJAL BLUE BRAIN PROJECT

Volume 4, issue 8. December 2012

2012 Cajal Blue Brain Project

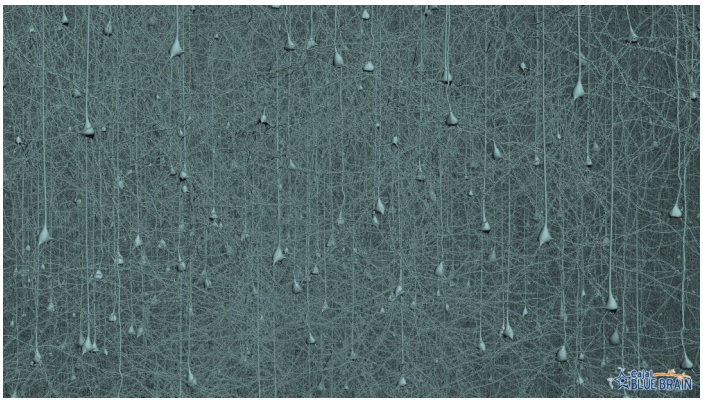
INSIDE THIS ISSUE:

Cajal Blue Brain Project: Most relevant contributions	1,2, 3
Alzheimer 3π Project updated	3

Special points of interest:

- ☐ 2012 CBBP
- ☐ 2013 Alzheimer 3π Project

2012 Cajal Blue Brain Project



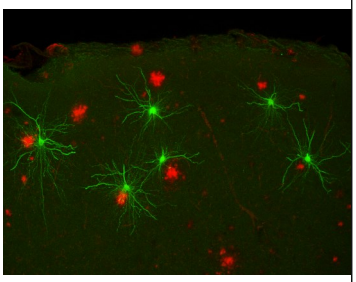
One of the main goals of neuroscience is to understand the biological mechanisms responsible for human mental activity. In particular, the study of the cerebral cortex is and without any doubt will be the greatest challenge for science in the next centuries, since it represents the foundation of our humanity. In other words, the cerebral cortex is the structure whose activity is related to the capabilities that distinguish humans from other mammals. Thanks to the development and evolution of the cerebral cortex we are able to perform highly complex and specifically human tasks, such as writing a book, composing a symphony or developing technologies. For these reasons the **Blue Brain project** emerged in 2005, when the *L'Ecole Polytechnique Fédérale de Lausanne* (Switzerland) and IBM jointly launched an ambitious project to create a functional brain model by means of reverse engineering of the mammalian brain, using the *Blue Gene* supercomputer from IBM. The aim was to understand the functioning and dys-function of the brain through detailed simulations. By late 2006, the *Blue Brain* project had created a model of the basic functional unit of the cerebral cortex, the neocortical column. However, the goals set by the project, which covered a period of 10 years, imposed its conversion into an international initiative (The Blue Brain Project, Nat Rev Neurosci. 7, 153 -160, 2006). In this context, the ***Cajal Blue Brain* project** (CajalBBP), the Spanish contribution to this international project, started in January 2009.
The CajalBBP is hosted by the Universidad Politécnica de Madrid (UPM) in the Campus of Montegancedo, supported by two of its research centers, the Centro de Tecnología Biomédica (CTB) and the Centro de Supercomputación y Visualización de Madrid (CeSViMa).

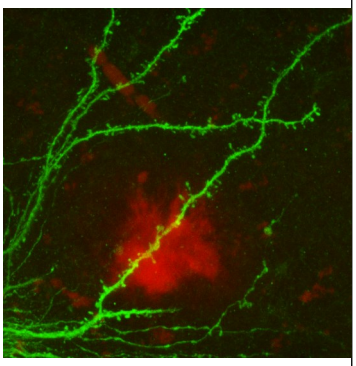
Research Modules and teams involved during the fourth year of the project are as follow:

- Neuroscience:
  - Neuroscience Module: Cajal Cortical Cicuits Laboratory, CCCL (UPM-CSIC): hosted at the CTB (Campus of Montegancedo).
- Neuroinformatics:
  - Informatics Tools (UPM) hosted at CeSViMa
  - Data Analysis Module (UPM) at the Computer Science School.
  - Visualization Module (UPM) at the Computer Science School.
  - Image Processing Module at the Computer Science School.
- External collaborators:
  - Cell Physiology Cajal's Laboratory (FCAN): From Instituto Cajal (CSIC).
  - Modeling and Virtual Reality Group (GMRV)
  - University of Oxford (this collaborator was previously located at the IMDEA Materials but has recently moved to the University of Oxford).
  - ETSII-UPM

2012 Cajal Blue Brain Project

Most Relevant Contributions





Benavides-Piccione R, Fernaud-Espinosa I, Robles V, Yuste R, DeFelipe J. Age-Based Comparison of Human Dendritic Spine Structure Using Complete Three-Dimensional Reconstructions. Cereb Cortex. 2012 Jun 17

Knafo S, Venero C, Sánchez-Puelles C, Pereda-Peréz I, Franco A, Sandi C, Suárez LM, Solís JM, Alonso-Nanclares L, Martín ED, Merino-Serrais P, Borcel E, Li S, Chen Y, Gonzalez-Soriano J, Berezin V, Bock E, DeFelipe J, Esteban JA. Facilitation of AMPA receptor synaptic delivery as a molecular mechanism for cognitive enhancement. PLoS Biol. 2012 Feb; 10 (2):e1001262. Epub 2012 Feb 21

León-Espinosa G, DeFelipe J, Muñoz A. Effects of amyloid-β plaque proximity on the axon initial segment of pyramidal cells. J Alzheimers Dis. 2012; 29 (4):841-52

DeFelipe J, Markram H, Rockland KS. The neocortical column. Front Neuroanat. 2012. 6: 22. Epub 2012 Jun 26

Avila J, León-Espinosa G, García E, García-Escudero V, Hernández F, DeFelipe J. Tau Phosphorylation by GSK3 in Different Conditions. Int J Alzheimers Dis. 2012; 2012:578373. Epub 2012 May 17.

Sánchez-Ponce D, DeFelipe J, Garrido JJ, Muñoz A (2012) Developmental expression of Kv potassium channels at the axon initial segment of cultured hippocampal neurons. Plos One 7 (10):e48557. doi: 10.1371/journal.pone.0048557.

Blazquez-Llorca L, Merchán-Pérez A, Rodríguez R, Gascón J, Defelipe J FIB/SEM Technology and Alzheimer's Disease: Three-Dimensional Analysis of Human Cortical Synapses. Journal of Alzheimer's Disease, in press

Javier DeFelipe, Pedro L. López-Cruz, Ruth Benavides-Piccione, Concha Bielza, Pedro Larrañaga, et al. Classification and nomenclature of neocortical GABAergic interneurons. Nature Reviews Neuroscience: accepted.

Angel Merchán-Pérez, José-Rodrigo Rodríguez, Santiago González, Víctor Robles, Javier DeFelipe, Pedro Larrañaga, Concha Bielza. Three-Dimensional Spatial Distribution of Synapses in the Neocortex: a Dual-Beam Electron Microscopy Study. Cerebral Cortex: accepted

Angel Merchán-Pérez, José-Rodrigo Rodríguez, Santiago González, Víctor Robles, Javier DeFelipe, Pedro Larrañaga, Concha Bielza. Three-Dimensional Spatial Distribution of Synapses in the Neocortex: a Dual-Beam Electron Microscopy Study. Cerebral Cortex: accepted.

Juan Morales, Ruth Benavides-Piccione, Angel Rodríguez, Luis Pastor, Rafael Yuste, Javier DeFelipe. "Three-dimensional analysis of spiny dendrites using straightening and unrolling transforms" Neuroinformatics Springer Verlag. Vol. 10 No. 4 ISSN 1539-2791 DOI: 10.1007/s12021-012-9153-2 pp. 391-407. 2012 Indexed: JCR

J.A. García, J.M. Peña, S. McHugh and A. Jérusalem. A model of the spatially dependent mechanical properties of the axon during its growth. Computational Modeling in Engineering & Science (CMES), in press.

Navarrete M, Perea G, Maglio L, Pastor J, de Sola RG, Araque A (2012) Astrocyte calcium signal and gliotransmission in human brain tissue. Cerebral Cortex (in press)

Navarrete M, Perea G, Fernandez de Sevilla D, Gómez-Gonzalo M, Núñez A, Martín ED, Araque A (2012) Astrocytes mediate in vivo cholinergic-induced synaptic plasticity. Plos Biology 10: e1001259

2012 Cajal Blue Brain Project

External Funding Plan

2012 Participation in other projects and actions

The following tables summarize all the RTD Actions, directly linked witn the project, that were applied for or were ongoing during 2012 and in which CajalBBP participants were involved:

RTD COLLABORATIVE PROJECTS & ACTIONS			
ACTION	**Funding Organization**	**Requested Budget (In Euros)**	**Result**
Fundamental Non-oriented RTD Projects (SAF2010)	MICINN	127.080 €	Awarded
Fundamental Non-oriented RTD Projects (AMCA-BFU2012-34963)	MICINN	199,650	Awarded
Scientific Culture and Innovation Programme 2012 (FECYT-MICINN)	MICINN	46.421,53 €	Rejected
Complemetary Actions (AACC 2012 MICINN)	MICINN	12.000 €	Awarded
Tu mascorta y la enfermedad del Alzheimer	NA	NA	Ongoing
ERANET NEURON	EC	279.752 €	Rejected
7FP_COOPERATION: FET flags-hips (HBP)	EC	1.190 M € (54 M € in Ramp Up Phase)	Awarded
7FP_ERC_ Synergy Grant	EC	6,6 M €	Submitted

2013 Alzheimer 3π

2013 Alzheimer 3π

This determined project, very big in size and resources, is one of the most relevant initiatives that the Cajal Blue Brain Project is currently being carried out, under an integrating and multi-disciplinary approach with international dimension. During 2012 the project was submitted to an open call of the BBVA Foundation but it was no succeed. We're currently seeking funds to implement the core of the project; meanwhile several tasks have been started.

Project Fiche:

Project Title: 'Alzheimer 3π'
Funding Organism: Private Funding
Participant Entities: UPM, CSIC, FRS, AFALcontigo Foundation, Cien Foundation, CSIC-UAM, along with other partners.
Principal Investigator: Prof. Javier DeFelipe
Duration: 5 years (to be extended)
Total Budget Requested: Euros 11M
Status: Ongoing

CTB

The Cajal Blue Brain Project is hosted by the Universidad Politécnica de Madrid (UPM) in the Scientific and Technological Park of Montegancedo Campus. Computational needs and support infrastructure required by CajalBBP are provided by two of the Research Centers of the Park, the Centro de Tecnología Biomédica (CTB) and the Centro de Supercomputación y Visualización de Madrid, CeSViMa, which is focused on the massive storage of information, high-performance computing and advanced interactive visualization.

More information: www.ctb.upm.es

Sponsorship