Part A. PERSONAL INFORMATION

CV date	13/11/2026

First name	Santiago		
Family name	Canals Gamoneda		
Gender (*)	Male	Birth date	16/02/1974
ID number	50853305Y		
e-mail	scanals@umh.es	www.canalslab.com	
Open Researcher and Contributor ID (ORCID) (*)		0000-0003-2175-8139	

A.1. Current position

Position	Profesor de Investigación. Instituto de Neurociencias (CSIC)		
Initial date	08/04/2022		
Institution	Agencia Estatal Consejo Superior de Investigaciones Científicas		
Department/Center	Cellular and Systems Neurobiology	Instituto de Neurociencias	
Country	Spain	Teleph.	965919202
Key words	Systems Neuroscience, memory, addiction, brain networks		

A.2. Previous positions (research activity interruptions, art. 14.2.b)

Period	Position/Institution/Country/Interruption cause
2019-2022	Investigador Científico. Instituto de Neurociencias (CSIC)
2010-2018	Científico Titular. Instituto de Neurociencias (CSIC).
2009	Independent Young Investigator. Instituto de Investigaciones Biomédicas (CSIC), Madrid, Spain.
2005-2008	Postdoc. Max Planck Institute for Biological Cybernetics (Prof. Nikos Logothetis), Tübingen, Germany.
2003-2004	Postdoc. Hospital Ramón y Cajal (Dr. Óscar Herreras), Madrid.

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Licenciado en Biología	Universidad Complutense de Madrid	1997
Grado en Neurobiología	Universidad Complutense de Madrid	1998
Doctor en Biología	Hospital Ramón y Cajal de Madrid	2003

Part B. CV SUMMARY *(max. 5000 characters, including spaces)*

Research:

The primary goal of my research is to elucidate the mechanisms governing **communication in brain networks**. Two major strengths of the lab are its pioneering technological innovations and its genuinely multidisciplinary approach. These strengths stem from my extensive research across a broad spectrum of neurobiology fields, spanning molecular and cellular neuroscience to systems neuroscience and behavioral studies (e.g., *Curr. Biol.*, *Nat. Commun.*, *Nat. Physics*, *Neuron*).

A landmark discovery by our lab demonstrated that activity in global brain networks is routed by local, transient changes in synaptic strength (*Curr. Biol.*, 2009). This finding garnered significant attention as it was the first demonstration of enhanced hippocampal–neocortical interactions controlled by a synaptic mechanism. Subsequent studies (*Philos. Trans. R. Soc. Lond. B*; *Cereb. Cortex*; *Nat. Commun.*; *eLife*; *Cell Systems*; *PLoS Comput. Biol.*; *iScience*; *PLoS Biol.*) further substantiated a framework in which synaptic plasticity modulates information routing across distributed networks. Building on these insights, we began to explore how such mechanisms could be harnessed to **reorganize functional circuits under pathological conditions**, initiating research programs aimed at developing innovative neuromodulation strategies (*Transl. Psychiatry*, *Addict. Biol.*, *Psychiatry Clin. Neurosci.*, *Neuropsychopharmacology*). This translational direction eventually converged with our work in neuropathology, where we sought to understand how disruptions in network communication manifest in disease states**.**

A second landmark discovery, in the context of our neuropathological studies, revealed that the brain alterations caused by alcohol addiction not only persist but worsen during early abstinence (*JAMA Psychiatry, Sci. Adv., J. Neurosci., Psychiatry Clin. Neurosci.*). Rather than exhibiting early recovery, the brain shows progressive deterioration, prompting us to investigate the underlying

biological drivers. Our ongoing work focuses on white-matter integrity, neuroinflammation, and the causal relationships within the gut–liver–brain axis, with the goal of identifying mechanistic entry points for restoring healthy network dynamics.

Finally, we leverage our expertise in brain imaging—particularly in rodent models (rats and mice)—to develop novel methods for basic research, with potential for clinical translation. These methods are grounded in the unique microstructural configuration of brain parenchyma and the capabilities of advanced diffusion-weighted (dw) MRI. We have developed techniques to identify specific cellular responses in tissue, such as neuroinflammation (*De Santis et al. Science Adv. 2022*), and apply machine learning-based texture analysis to distinguish disease stages, cross-species similarities and differences, and even individual subject identity (*Varga et al. Cell Sys 2024; Ruiz-España et al. 2023*).

Commission of trust:

I am currently the co-vice director of the Instituto de Neurociencias. In the last 10 years, I have been Director of the Department of Cellular and Systems Neurobiology of the IN (2015-2020), Director of the Magnetic Resonance Imaging Unit at IN (2010-2024), Member of the Executive Committee of the Severo Ochoa Excellence Grant (2014-present) and Director of the Innovation and Transfer Unit (2020-present). In addition, in the same period, I have been a member of the evaluation board in CSIC competitions for "Científico Titular" and "Investigador Científico" positions on 9 occasions, as well as in evaluation panels of the Spanish Research Agency (AEI) for research projects and Ramon y Cajal contracts, the Spanish "Instituto de Salud Carlos III" (regularly since 2022) and the evaluation panel on the Swedish Research Council from 2024 to 2026. I also review grant applications and personnel recruitment calls for the ERC, the French National Research Agency (ANR), the Swiss National Science Foundation (SNSF), the Belgian Fonds Wetenschappelijk Onderzoek (FWO), Research Council UK, and the Basque Foundation for Science (Ikerbasque). I regularly review for prestigious scientific journals (Neuron, Nat Neurosci, PNAS, PLoS Biology, Cerebral Cortex, Journal of Neuroscience, Neuroimage).

Part C. RELEVANT MERITS

C.1. Publications (10 selected)

1. Pérez-Montoyo E, Caramés JM, Garcia-Hernandez R, Peralta-Cañadas M, **Canals S***, Marcos E*. Inhibitory tone in the dentate gyrus dynamically prioritizes memory flexibility or stability by tuning a sensitivity-consistency continuum. **PLoS Biology**. 2026;24(8):e3003956.
2. Estarellas C, Álvarez-Salvado E, Pérez-Cervera L, Caramés JM, Pérez-Montoyo E, López-Madrona VJ, Garcia-Hernandez R, Mirasso CR*, **Canals S***. Synaptic plasticity in the perforant pathway drives inhibitory reorganization enhancing dentate gyrus functionality. **iScience**. 2026;29(3):114878.
3. Chalkiadakis D, Sánchez-Claros J, López-Madrona VJ, **Canals S***, Mirasso CR*. The role of feedforward and feedback inhibition in modulating theta-gamma cross-frequency interactions in neural circuits. **PLoS Computational Biology**. 2025;21(8):e1013363.
4. Pérez-Segura A, Medina J, Cerdán Cerdá A, Sánchez-Ferri C, Torres D, Mirasso CR, Strange B, Eguíluz VM, Lacasa L, **Canals S***. NAc-DBS selectively enhances memory updating without effect on retrieval. **Neuropsychopharmacology**. 2025;50(9):1420-1429.
5. Varga L, Moca VV, Pérez-Cervera L, Selim MK, Díaz-Parra A, Moratal D, Sommer WH, Muresan R, **Canals S***, Ercsey-Ravasz M. Brain dynamics supported by a hierarchy of complex correlation patterns defining a robust functional architecture. **Cell Systems** (2024) 15(8):770-786.e5.
6. Selim MK, Harel M, De Santis S, Perini I, Heilig M, Zangen A, **Canals S***. Repetitive deep TMS in alcohol dependent patients halts progression of white matter changes in early abstinence. **Psychiatry and Clinical Neurosciences** (2023) 78(3):176-185.
7. Garcia-Hernandez R, Cerdán Cerdá A, Trouve Carpena A, Drakesmith M, Koller K, Jones DK, **Canals S***, De Santis S*. Mapping microglia and astrocyte activation in vivo using diffusion MRI. **Science Adv**. (2022) 8(21):eabq2923.
8. López-Madrona VJ, Pérez-Montoyo E, Álvarez-Salvado E, Moratal D, Herreras O, Pereda E, Mirasso CR, **Canals S***. Different theta frameworks coexist in the rat hippocampus and are coordinated during memory-guided and novelty tasks. **eLife**. (2020) 9: e57313.

9. De Santis S, Bach P, Pérez-Cervera L, Cosa-Linan A, Weil G, Vollstädt-Klein S, Hermann D, Kiefer F, Kirsch P, Ciccocioppo R, Sommer WH, **Canals S***. Microstructural White Matter Alterations in Men with Alcohol Use Disorder and Rats with Excessive Alcohol Consumption During Early Abstinence. **JAMA Psychiatry**. (2019) 76(7):749-758. *(IF= 25.8)*
10. Del Ferraro G, Moreno A, Min B, Morone F, Pérez-Ramírez Ú, Pérez-Cervera L, Parra LC, Holodny A, **Canals S***, Makse H*. Finding influential nodes for integration in brain networks using optimal percolation theory. **Nat Commun**. (2018) 9(1):2274. *(IF=14.9)*

C.2. Most relevant invited talks:

1. Central Institute of Mental Health, Mannheim (April 2011); **2.** European Winter Conference on Brain Research, Switzerland (2012); **3.** Medical Research Council, London (Feb 2012); **4.** Centre for Cognitive and Neural Systems, Edinburgh University (September 2013); **5.** The Royal Society, London (December 2013); **6.** University of Hamburg-Eppendorf, SFB 936 meeting (2015); **7.** University of Sussex, Brighton (Feb 2017); **8.** Bernstein Conference, Göttingen (Sept 2017). **9.** Transylvanian Experimental Neuroscience, Romania (Jun 2018); **10.** Patrick Wild Centre, University of Edinburgh (Feb 2018); **11.** Gordon Research Conference (Galveston, US, March 2020); **12.** ECNP Conference, Virtual (2020); **13**. Real Academia de Medicina y Cirugía de la región de Murcia, Virtual (Nov, 2021). **14**. The Royal Society, London, UK (25 August, 2022). **15**. ISBRA/ESBRA Meeting. Cracow, Poland (Sept 2022). **16**. ESBRA 2023. Graz, Austria. (Sept 2023). **17**. Reial Acadèmia de Medicina de les Illes Balears, (April 2024). **18**. **Plenary Lecture** at the ISMRM Iberian Chapter (Porto, July 2024). **19**. Instituto de Investigaciones Biomédicas Sols-Morreale (Madrid, Sep 2024). **20**. ESBRA Meeting, Brussels (Sep 2025), **Key Note Lecture**. **21**. Cajal Symposium, Babeș-Bolyai University, Romania (2025), **Key Note Lecture.**

Organized scientific conferences/symposiums

(**2025**) International Symposium: "Brain Inflammation in alcohol use disorders" ESBRA, Brussels (Belgium). (**2024**) International Symposium: "The inflamed brain in alcohol addiction" Nordmann Award Meeting 2024, ESBRA, Lisbon (Portugal). (**2021**) International Symposium: "Binding cell assemblies into memory engrams". SENC Meeting, Lleida, (Spain); (**2021**) International Symposium: "Translational Neuroimaging in Alcoholism I: Novel approaches to neuro-immune and functional networks". ESBRA Meeting, Timisoara, (Romania); (**2020**) International summer school: "Memory School"). Toledo (Spain). (**2016**) International Symposium: "Modelling disease state networks in human and animal brains". 18th International Neuroscience Winter Conference, Sölden, (Austria). (**2015**) International Symposium: "Functional Connectomics: non-invasive windows into brain complexity". SENC Meeting, Granada, (Spain).

Education and dissemination activities:

Since 2020, we have been actively working to establish Neurotech-EU, an initiative focused on neurosciences and associated technologies. This initiative involves Miguel Hernández University, along with Bonn, Karolinska, Radboud, Cluj-Napoca, Debrecen, and others. Together with Prof. Juana Gallar, we lead the UMH node. Neurotech-EU's mission is to identify key neurotechnological challenges and provide the necessary training to address them. It also aims to strengthen collaboration among European research groups and foster partnerships between academia and industry.

I have participated in multiple outreach activities: interviews on television (TV3, "Tot es mou"), national radio (RNE "FuturoAbierto") and international radio (W Radio with Martha Debayle, Mexico), as well as articles in national (El País) and regional (La Voz de Galicia) newspapers. Additionally, we have contributed popular science articles (The Science Breaker), participated in public talks at open-air cinemas (e.g., "Drunk" with Eloísa del Pino), open house events (Brain Awareness Week, International Day of Women and Girls in Science), and others.

C.3. Research projects (in the last 5 years; only selected those as PI or co-PI)

1. ***Temporal Interference and Digital Twin–Enhanced Neuromodulation to Improve Memory Formation.*** Agencia Estatal de Investigación. Excelencia.
   Santiago Canals as PI. From 01-09-2025 To 31-08-2028 Funding: 281.250 €

2. ***Digital twins of the brain: a personalized AI tool for localizing epileptic foci.***
   Programa: Ministry for Digital transformation and the civil service.
   Santiago Canals as PI. From 1-6-2024 To 28-2-2026 Funding: 672.000 €
3. ***AppZheimer – A tool for large-scale monitoring of cognitive decline and its application for the early diagnosis of Alzheimer's disease.***
   Programa: Ministry for Digital transformation and the civil service.
   Santiago Canals as co-PI with Dr. Encarni Marcos. From 1-6-2024 To 28-2-2026 Funding: 952.500 €
4. ***Inflamed Brain Response in Alcohol Addiction: Understanding the role of neuroinflammation, immunotypes and gut-brain reactivity for heterogeneity in disease course and therapy response***
   Programa ERA-NET NEURON (Unión Europea).
   Santiago Canals coordinator. From 1-06-2024 To 31-12-2027 Funding: 300.000 € (1.2M € total)
5. ***White matter in alcohol use disorders: a new target of the gut-brain axis.***
   Programa PROMETEO Generalitat Valenciana.
   Santiago Canals and Yolanda Sanz as PIs. From 1-1-2023 To 31-12-2026 Funding: 600.000 €
6. ***Ciencia de datos para desarrollar biomarcadores con aplicación terapéutica.***
   Programa INVESTIGO Generalitat Valenciana.
   Santiago Canals as PI. From 15-10-2022 To 15-10-2024 Funding: 199.000 €
7. ***Updating the brain's memory base.*** Agencia Estatal de Investigación. Excelencia.
   Santiago Canals as PI. From 01-09-2022 To 01-09-2025 Funding: 260.500 €
8. ***Healthy Aging.*** Plataforma Temática Interdisciplinar (PTI) del CSIC.
   Santiago Canals as PI. From 01-01-2021 To 31-12-2022 Funding: 100.000 €
9. ***Imagen cerebral del eje microbiota-intestino-cerebro y su aplicación clínica***
   Generalitat Valenciana Programa de Excelencia Prometeo (PROMETEO/2019/015).
   Yolanda Sanz (IATA), Santiago Canals (IN), David Moratal (UPV)
   From 01-01-2019 To 31-12-2022 Funding: 195.000 €
10. ***Role of the nucleus accumbens in the regulation of hippocampal long-range functional connectivity.*** Ministerio de Economía y Competitividad. Plan Estatal de Investigación Científica y Técnica y de Innovación. Excelencia.
    Santiago Canals as PI. From 01-01-2019 To 31-12-2021 Funding: 193.600 €

Institutional grants: in addition to the above specific project grants, I've been guarantor (1 out of 10 PIs) in the two **Severo Ochoa Excellence** grants obtained by the IN (2014-2018, 2018-2022 and 2022-2026; overall 12M €).

C.4. Contracts, technological or transfer merits

Director of the Innovation Axis of the IN (Sep-2020 – present) supporting innovation activities in the IN with several actions and guidance on KTT. Budget renewed from the Valencian Innovation Agency for the period 2024-2026 (450K € for personnel and running costs).

Contracts: for advisory and development activities between the Miguel Hernández University of Elche and Open Ephys Incorporated (*Massachusetts Institute of Technology, MIT*). Santiago Canals as PI From 01-06-2014 To 25-04-2019. Funding: 130.037 €