Contents

Foreword ........................................................................................................................................................ 1
1. Strategy and Management ........................................................................................................................ 2
2. Partnerships and Collaborations ........................................................................................................... 6
3. People ....................................................................................................................................................... 10
4. Research ................................................................................................................................................. 13
5. Knowledge Transfer ............................................................................................................................... 25
6. Infrastructure and Equipment ................................................................................................................. 33
7. Main performance indicators ............................................................................................................... 35
Foreword

Dear reader,

During 2023 we continued our increasing pace in terms of publication output (77 papers published with 87% of them in Q1), funding (4.8 M€), attracting young qualified researchers with new lines of research, and consolidating highly productive Principal Investigators through tenured positions.

Specific highlights include the success of our researchers in three very competitive calls: ERC Consolidator, La Caixa Health Research Program, and The Simons Foundation. A 50% expansion of our facilities that took place this year is also of great consequence. Indeed, it has allowed us to provide state-of-the-art facilities to our Human Biomodels Platform, organize more lab space and substantially reinforce core services. This additional space will also be key in supporting the incorporation of new research topics and experimental models, as planned.

In line with the current strategy, over a year ago we began the profound internal re-organization into three Research Programmes (Neuro-glial interactions in brain diseases, Glial modulation of brain structure and function, and Gliotheranostics) which has fostered stronger internal interactions, and has allowed us to apply to a variety of highly competitive calls with projects involving many of our Principal Investigators.

Even though we did not succeed in all of them, teamwork dynamics are slowly being incorporated into the centre’s culture. We continue to design new projects with the idea of furthering this momentum, with an eye also in facilitating societal outreach, as Neuroscience is a fast-paced discipline of great social impact.

No withstanding the continued effort and ambition of our faculty, the expansion and reinforcement of our core facilities has been made possible through the support of our reference institutions, Ikerbasque and the Basque Government. Both have shown a strong commitment in encouraging our goals and scientific endeavours.

All in all, during this past year we have achieved all the milestones planned at this stage in our ongoing Strategic Research Plan. We aim to consolidate them in the coming years, with a stable work force, sustained resources, and an unrelenting ambition to improve continuously.

Ignacio Torres Alemán
Scientific Director

Elena Alberdi Alfonso
Assistant Scientific Director
ACHUCARRO is one of the BERC (Basque Excellence Research Centres) research organisations fostered by the Department of Education of the Basque Government.

There are nine organisations recognised as BERC within the Basque Science, Technology, and Innovation network.

1. Strategy and Management

In 2022, we launched our third strategic plan for the 2022-2025 period. ACHUCARRO’s overall objective is to perform co-ordinated multidisciplinary research of the brain functions on all levels: from single molecules through individual cells, acutely isolated nervous tissues, to the brain networks operating in vivo; all to further advance the discoveries in physiology and pathophysiology of the nervous system.

The foundations that support our strategic view and future vision are:

- Recruit, Reintegrate and Retain talented research personnel, to perform excellent research and contribute to advanced post-graduate training.
- Develop modern infrastructures within the Science Park of the UPV/EHU, at the University campus in Leioa.
- Assess and incorporate the latest technologies and equipment to let the centre operate on the frontier of knowledge.
- To perform research projects centred in the study of glial cells to contribute to the discovery of new therapies for neurological diseases for the benefit and well-being of the Society.

By the end of 2023 we were halfway through the current strategic programme and underwent the BERC assessment. The assessment involved a written report and the site visit by the evaluation panel established by IKERBASQUE.

Scientific Plan 2022–2025

The key strategic direction of ACHUCARRO is the in-depth study of neuronal-glial biology in normal and pathological brains.

The new Scientific Plan has defined three programmes, with a bottom-up approach: to attain a strategy that fosters internal collaboration and maximizes its impact.

Research Programmes

- Neuro-Glial interactions in brain diseases
- Glial modulation of brain structure and function
- Gliotheranostics
Microglial phagocytosis is essential to maintain brain health but, unexpectedly, it is disrupted in diseases such as ischemic stroke.

Potential new development of therapeutic strategies focusing on the promotion of microglial protective responses during ischemic stroke

During an ischemic stroke a vascular plug forms in an artery of the brain, interrupting the blood flow to the brain areas irrigated by the artery, leading to oxygen and nutrient deprivation and, eventually, cell death. In this recent research article, we have shown that microglia lose their ability to remove or phagocytose dead neurons in mice and monkey models of ischemic stroke due to alterations in the microglial lysosomes, in charge of degrading all types of biological macromolecules, from carbohydrates to lipids or nucleic acids. Thus, they are not only critical to degrade the phagocytosed debris, but also to recycle intracellular organelles.

This latter process, known as autophagy (“eating oneself”) is stimulated to promote survival under metabolic stress conditions such as oxygen and nutrient deprivation.

Ischemic stroke intensified autophagy in microglia, probably to get rid of damaged proteins and organelles, adapt to the new metabolic scenario, and promote microglial survival. However, autophagy promotion during ischemic stroke did not come without cost for microglia. Indeed, the over-engagement of the autophagic degradation pathway in microglia led to a significant depletion of lysosomes, which were no longer available for the clearance of phagocytic material such as dead neurons, leading to accumulation of debris in the brain parenchyma and worsening the evolution of the disease. Furthermore, inhibition of autophagy was detrimental for microglial health and survival, suggesting its critical supportive role. The alternative treatment with an autophagy inducer, rapamycin, produced complex effects in microglia, including beneficial, neutral, and toxic effects, depending on the experimental model used for the assessment of microglial phagocytic activity and survival. Although autophagy modulation turned out to be ineffective or inconclusive for microglial phagocytosis modulation in this study, the data obtained was crucial for understanding the mechanistic complexities of lysosomal responses in microglia under ischemic stroke.

“Microglial phagocytosis dysfunction in stroke is driven by energy depletion and induction of autophagy”
Beccari S, Sierra-Torres V, Valero J, Pereira-Iglesias M, [...], Plaza, A. & Sierra, A. Autophagy DOI: 10.1080/15548627.2023.2165313
EQUALITY AND INCLUSION PLAN 2022-2025

ACHUCARRO initiated the development of its first Equality Plan in 2017, in collaboration with an external consultancy specialised in this domain. In 2021, we undertook a comprehensive evaluation of the preceding plan to inform the formulation and implementation of our second iteration.

The plan has yielded tangible improvements, fostering a culture of greater equity, equality, and diversity within our organization. We are gratified to observe a positive evolution in the balance and representation of individuals in leadership positions.

Our Equality Committee (EC) comprises representatives from across the organisation, spanning various roles and career stages, and maintains gender parity. Serving as both the driving force and assessor of all initiatives outlined in the plan, the EC plays a pivotal role in ensuring its efficacy and impact.

This new plan continues building on four improvement areas that were already identified in the first plan:

1. Promoting equal opportunities in positions of responsibility.
2. Generate working environments and conditions that facilitate the co-responsible conciliation of personal, family, and professional life.
3. Incorporate a gender perspective in the policies, products, and operating dynamics.
4. Promote inclusive leadership styles.

![Figure 1. Evolution of number of Principal by gender, from 2012 to 2023](https://www.achucarro.org/equality)
Equality, Science and Technology. For a Paradigm Shift

In the framework of the Basque Pact for Equality and living free of violence against women, the Emakunde – Basque Women’s Institute (Basque Government), together with other organisations in the Basque Country, and the international support of the European Union and United Nations, organised this congress to promote a paradigm shift in the field of science and technology to systematically and fully incorporate a gender perspective and respond to the challenges of achieving a fairer and more egalitarian society where no one is left behind.

The programme included keynote lectures by experts in the field like María Ángeles Sallé, Anne Pépin, Londa Schiebinger, Silvia Rueda, Hélène Molinier, Curt Rice, Alan Greig and Emma Short among others.

The selection of ACHUCARRO to be part of the Scientific Committee is a recognition to our commitment towards Equality, Equity and Diversity in Science.

https://www.berdintasunazientzian.eus
Cultivating partnerships is not just about sharing resources; it’s about multiplying possibilities. Together, we achieve more than we ever could alone, unlocking innovation, driving growth, and creating lasting impact.

2. Partnerships and Collaborations

Working together with other people and institutions is key to unravelling the challenges of this changing World. Weaving a solid network of collaborators takes time and effort, and selecting the best companion is strategic for any institution.

We thoroughly identify and assess the individual and collective partners in our environment and sector to properly manage the mutual relationships for a win-win outcome.

Institutional Alliances

We formalise institutional partnerships with specific, written, long-term agreements, which cover the terms of the collaboration. To some extent, such alliances are also strategic in nature, as indicated by the agreements signed with Ikerbasque and the UPV/EHU for the appointment of personnel.

These are the institutional agreements by strategic partner during the year:

BASQUE GOVERNMENT

- BERC agreement to support the strategic deployment in 2022–2025.

BASQUE SCIENCE, TECHNOLOGY, AND INNOVATION NETWORK

- Appointment at the BSTI network and recognition in the “BERC - Basque Excellence Research Centre” category

IKERBASQUE

- Framework Agreement for the appointment of research staff: Ikerbasque Research Professors, Associates and Fellows
- Agreement to support the development of the IKUR Strategy of the Basque Government
- Agreement to support the development of the Neuronano Strategy Action of the Basque Government

UNIVERSITY OF THE BASQUE COUNTRY (UPV/EHU)

- Framework Collaboration Agreement
- Specific agreement for the appointment of teaching and research and personnel
- Specific agreement of collaboration to appoint the Deputy Scientific Director
Our strategic alliances are with those organisations or individuals that allow us to extend our capabilities or complement our services.

**STRATEGIC ALLIANCES**

**European Commission – HRS4R Community**
Following our endorsement of the European Charter for Researchers fostered by the European Commission, we underwent the process of recognition of our internal policies for managing research personnel, according to HRS4R and OTM-R initiatives of the European Commission.

In 2023 we underwent a new assessment process with the aim of renewing our **HR Excellence in Research** recognition.

**CIBER**
The **Center for Biomedical Research in Network** is a research organization with its own legal entity, fostered by the Spanish Government (Instituto de Salud Carlos III) and constituted by research groups without physical contiguity, belonging to different state administrations and autonomous communities, from the public and private sectors, with research lines and objectives focused on a common specific area.

In our case, two groups collaborate in the field of neurodegenerative diseases, which are coordinated to achieve scientific objectives that could hardly be considered in a specific context.

**Bizkaia Talent**
Established in 2005 with the support of the Provincial Council of Bizkaia, Bizkaia Talent is a non-profit organization that fosters and facilitates the attraction, connection, and retention of highly qualified professionals to the Basque Historic Territory of Bizkaia. Bizkaia Talent is a strategic partner and an ally of ACHUCARRO, which takes our name and objectives to the many international scientific events they attend, supporting our talent attraction process.
INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE (ISAC)

Our International Scientific Advisory Committee comprises esteemed researchers from various domains of neuroscience. They offer invaluable perspectives and insights on strategic and operational matters to facilitate the continued advancement of ACHUCARRO.

The members of this committee performed the assessment of all Principal Investigators and research groups in 2023 in the framework of the BERC mid-term evaluation.

Figure 2. Members of the ISAC in 2023
Hyperglycemia has been linked to worsening outcomes after subarachnoid haemorrhage (SAH). Nevertheless, the mechanisms involved in the pathogenesis of SAH have been scarcely evaluated so far.

Hyperglycemia worsens the progression of subarachnoid haemorrhage

This article showed for the first time the detrimental role of acute hyperglycemia in an experimental model of SAH using a combination of non-invasive multimodal imaging such as Positron Emission Tomography (PET) and Magnetic Resonance Imaging (MRI).

This study provides valuable insight into the detrimental effect of hyperglycemia on early Blood Brain Barrier damage mediated by neutrophil infiltration and metalloprotease activation that could explain the worse prognosis in SAH and open new avenues for the identification of new therapeutic approaches for the clinical management of hyperglycemia.

“Multimodal imaging of the role of hyperglycemia following experimental subarachnoid hemorrhage”
J Cereb Blood Flow Metab. DOI: 10.1177/0271678X231197946
We gather professionals from 24 different nationalities and foster equality, equity, and diversity as one of the core values of our organisational culture.

3. People

In 2023 we continued our growth and finished the year with 158 people appointed.

![Evolution of personnel 2018-2023](image)

Throughout the year there has been rotation of some personnel, especially in the categories that imply greater mobility, such as pre and postdoctoral researchers. In addition, some people have advanced in their careers, either by consolidating their employment, or by becoming principal investigators on projects.

RETREAT

In June 19 we gathered all the Principal Investigators at Baserri Antzokia (Zamudio), with a representation of postdoctoral researchers, technical staff, and administration to reflect on strategic objectives for the future and approaches to tackle them. It was a very fruitful day to continue advancing in the development of our organization and our science.
APPOINTED STAFF (December 2023)

Oihane ABIEGA ETXABE · Laura AGUADO SANTOS · Elena ALBERDI ALFONSO · Óscar ALEIXOS GRAU · Francisco Javier ALFARO MOZAZ · María ALFONSO TRIGUERO · Mikel ÁLVAREZ TUEROS · María Isabel ARDAYA FRANCO · Xabier ARECHABALA RODRIGUEZ · Amaia ARRANZ MENDIGUREN · Mariana ASTIZ CADENAS · Uxue BALANTZATEGI FERNÁNDEZ DE ARROIABE · Jimena BALERIOLA GÓMEZ DE PABLO · Andres Mateo BARRAIBAR SIERRA · Laura BAYÓN CORDERO · Nora BENGOA VERGNIOY · Xabier BENOETXEA BAUSELA · Ana BERNAL CHICO · Eva BLANCO COSTALES · Itziar BONILLA DEL RÍO · Leire BOVEDA ALTUBE · Izaskun BUENDÍA ABAITUA · Stefano CALOVI · Estibaliz CAPETILLO GONZÁLEZ DE ZARATE · Alejandro CARRETERO GUILLEN · Fabio CAVALIERI · María CEPIRÍN COSTOSO · Jesús CESPÓN GONZÁLEZ · Juan Carlos CHARA VENTURA · Brenda Nadia CHINO VILCA · Dalila CICERI · Raffaella CIPRIANI · Teresa COLOMER MOLLA · Lorea CORTÉS MELER · Joan CRUZ SESÉ · Aida DE LA CRUZ GAMBRA · María DOMERCQ GARCÍA · Jonathan EVAN DRAFFIN · Jon EGAÑA HUGUET · Izaskun ELEZGARAI GABANTXO · Iratxe ELORDUY GARCÍA · Juan Manuel ENCINAS PÉREZ · Laura ESCOBAR CASTAÑONDO · Dmitry FEDOROV · Mario FERNÁNDEZ BALLESTER · Héctor FLORES ROMERO · Nuria GALBIS GRAMAGE · María Tatiana GALLEGO FLORES · María GAMARRA GARCÍA-BERMEJO · Adhara Mikaela GAMINDE BLASCO · Maider GABIRU ALBISU · Laura GARCÍA GASTAÑAGA · Mirta GARCÍA MARTÍNEZ · Fernando GARCÍA MORENO · Lorena GARCÍA RUIZ-CLAVIJO · Paula GIMÉNEZ MÍNGUEZ · Sonia GÓMEZ URQUIJO · Nerea GOROSTIOLA · Pedro Rolando GRANDES MORENO · María Inmaculada GUERRICAGOITIA MARINA · Mazahir Tahid HASAN · María Isabel HERNÁNDEZ CORTÉS · Tamás HORVÁTH · Izaskun IGERE I ARTETXE · Leire IGLESIAS IGLESIAS · Josune IMAN IRURETAGOYENA · Leire IZAGIRRE URIZAR · Sara JIMÉNEZ ÁLVAREZ · Isabel JIMÉNEZ RDurjEJO · Muhammad Zahid KHAN · Gorka KORTABARRIA PÉREZ · María KUKLEY · Begüm KURT · Rizky Sarakhski Ersaid LASABUDA · Nerea LLAMOSAS MUÑOZGUREN · Eneritz LÓPEZ MUGURUZA · Irene LUENGAS ESCUZA · Diana del Socorro LUNA · Joel MALDONADO TEIXIDÓ · Abraham MARTÍN MUÑOZ · Soraya MARTÍN SUAREZ · Endika MARTÍNEZ GUTIÉRREZ · Zara MARTÍNEZ PÁEZ · Maialen MARTÍNEZ PRECIADO · Gilda Paloma MATA SALGADO · Diego Martín MATEOS · Susan MATO SANTOS · Carlos José MATUTE ALMAU · Alejandro MELERO CARRILLO · Juan Luis MENDIZABAL ZUBIAGA · Amaia MIMENZA SAIZ · Fosca MIRATA · Marta MIRÓN ALCALÁ · Luna MORA HUERTA · Oscar MORENO MORENO · Teresa MURO GARCÍA · Irene NUÑEZ GARCÍA · Blanca Isabel OCHOA BUENO · Jon OLALDE JOMETON · Jon OLANO BRINGAS · Aitor PALOMINO FERNANDEZ DE LARREA · Carla PEIRÓ MORENO · Marta PEREIRA IGLESIAS · Nerea PÉREZ CERDÁ · Lucila Maite PÉREZ GIANMARCO · Erisé PÉREZ PASCUAL · Alberto PÉREZ SAMARTÍN · José Ramón PINEDA MARTÍ · Joaquín PIRIZ · Ainhoa PLAZA ZABALA · Nagore PUENTE BUSTINZA · Virginia PUENTE MUÑOZ · Aurora PUTZOLU · Paula RAMOS GONZÁLEZ · Almudena RAMOS URIARTE · Leire REGUERO ACEBAL · Pablo Alejandro REYES VELASQUEZ · Irantzu RICO BARRIO · Ane RODRÍGUEZ BODERO · Esther RUBIO LÓPEZ · Leire RUIZ BARREIRO · Asier RUIZ NUÑEZ · Jaime SAGARDUY BARRENA · Andrea SAINZ PRADO · Aitor SALAGRE PÉREZ · María Victoria SÁNCHEZ GÓMEZ · Dann SÁNCHEZ IRAOLA · Ester SANCHEZ MARTÍN · Lucía SANGRÓNIZ BELTRÁN · Ane SANTISTEBAN GARCÍA · Rafael SARRIÁ AROSTEGUI · Rodrigo SENOVILLA GANZO · Maitane SERRANO MURGIA · Amanda SIERRA SAAVEDRA · Vladislav SOLDATOV · Edgar Jesús SORIA GÓMEZ · Federico Nicolas SORIA LANNES · Vanja TEPAVCEVIC MANDIC · Irene TOMÉ VELASCO · Jan TØNNESEN · Ignacio TORRES ALEMÁN · Nerea URESTIZALARA ARENAZA · Carmen Lucía UTRILLA CARRIAZO · Luis VARELA FERNANDEZ · Alexei VERKHRYATSKY · María VILLAFRANCA FAUS · Patricia VILLEGAS ZAFRA · Jonathan Adrián ZEGARRA VALDIVIA · Jose Luis ZUGAZA GURRUCHAGA
In multiple sclerosis and the experimental autoimmune encephalomyelitis (EAE) model, both resident microglia and infiltrating macrophages contribute to demyelination as well as spontaneous remyelination, but...  

The specific roles of microglia versus macrophages were unknown.

To investigate microglia in EAE we used the colony stimulating factor 1 receptor (CSF-1R) inhibitor, PLX5622, which depletes the microglial population, and Ccr2RFP/+fmsEGFP/+ mice, which allow us to distinguish peripheral macrophages and microglia.

PLX5622 treatment depleted microglia and provoked a massive infiltration of CCR2+ macrophages into demyelinating lesions and spinal cord parenchyma. Albeit this massive infiltration of peripheral macrophages, the neurological symptoms were not altered during the EAE chronic phase. In contrast, microglia depletion induced an important delay in EAE onset. We demonstrated that microglia has a role in antigen presentation and T cell reactivation at initial stages of EAE.

Our results define the specific role of microglia in the early phases of the pathology and suggest that targeting these cells could help to ameliorate the immune reaction in the pathology.

“Microglia and meningeal macrophages depletion delays the onset of experimental autoimmune encephalomyelitis”
Montilla, A., Zabala, A., Er-Lukowiak, M. [...], Sierra A, Matute C, Domercq M. Cell Death & Disease DOI: 10.1038/s41419-023-05551-3
We authored 77 new scientific publications in 2023.
87% of them in the first quartiles of their research fields
85% of the publications are Open Access

4. Research

PROGRAMME 1: NEURO-GLIAL INTERACTIONS IN BRAIN DISEASES

Coordinator: José Luis Zugaza Gurruchaga
This programme integrates 9 Principal Investigators from 6 different laboratories.

Glial cells, including astrocytes, microglia, and oligodendrocytes, work in coordination with neurons to support the structural and functional integrity of the nervous system.

The members of this program are experts in different areas of cellular biology and neuroscience, and we set the goal of creating a project in which all members collaborate to understand neural-glial interactions both in health and disease.

Modulating these interactions could offer new avenues for treating or slowing the progression of various brain disorders, such as neurodegenerative diseases.

Elena Alberdi
Nora Bengoa-Verniory
Estibaliz Capetillo
Carlos Matute
Abraham Martín Muñoz
Vicky Sánchez Gómez
Vanja Tepavčević
Luis Varela
Jose Luis Zugaza
PROGRAMME 2: GLIAL MODULATION OF BRAIN STRUCTURE AND FUNCTION

Coordinator: Juan Manuel Encinas Pérez
This programme integrates 12 Principal Investigators from 11 different laboratories.

This programme was designed to bring together investigators studying brain function at different levels.

Under the premise that function follows structure, synapses and networks are investigated morphologically, anatomically, and functionally. With an integrative mindset, glial cells and neurons are considered together.

The study of the glio-neuronal dynamic interaction is of special interest in neurological and neurodegenerative disorders in which the role of glia, via neuroinflammation for instance, is an essential modulator of neuronal survival and activity. In the program’s regular meetings, the groups discuss several issues in common: 1) Scientific discussion of new projects and lines of research; 2) Fine-tuning of projects for funding application; 3) how to synergistically optimize and share the available techniques in the program (confocal microscopy-based quantitative image analysis, two-photon imaging and wearable miniscope in vivo imaging, patch-clamp electrophysiology; intracranial local field recordings and behaviour).

Finally, special care is placed on the mentoring of newly joined scientists.
PROGRAMME 3: GLIOOTHERANOSTICS

Coordinator: Amanda Sierra Saavedra
This programme integrates 10 Principal Investigators from 9 different laboratories.

Our programme is focused on understanding the properties and capabilities of glial cells in physiological conditions to then exploit them in brain pathologies.

Our research combines our expertise in astrocyte, oligodendrocyte and microglial development, their interaction with other elements of the brain parenchyma (matrix, neurons), and their phagocytic and regenerative potential to identify novel therapeutical targets using mouse models, iPSCs, and xenotransplants. In addition, our goal is to create a collaborative environment and for this purpose we foster monthly “chalk talk” meetings to discuss specific aspects of ongoing projects or papers.
Cannabinoid 1 receptors in reactive glial cells of a mouse model of Alzheimer's Disease

To help understand the role of the endocannabinoid system in the pathophysiology of AD, the localization of the cannabinoid CB1 receptor was investigated in the subiculum severely affected by a large accumulation of plaques in a mouse model of AD (5xFAD/CB2EGFP/f/f).

High resolution immuno-electron microscopy revealed an increase in the number and proportion of CB1-positive microglial processes, as well as in the number of CB1 receptors in microglia surrounding amyloid plaques and dystrophic neurites. Conversely, a reduction in CB1 receptor density associated with the enlargement of the microglial processes. Finally, the number of CB1 receptors increased in astroglial processes.

The detailed correlation between glial reactivity and the CB1 receptor expression in microglia and astrocytes during the progression of AD shown in this investigation, is crucial to understand the role of cannabinoids in preventing glial activation and beta-amyloid (Aβ)-induced neurotoxicity in AD.

“Altered glial expression of the cannabinoid 1 receptor in the subiculum of a mouse model of Alzheimer’s disease”
Terradillos I, Bonilla-del-Rio I, Puente N, Serrano M, [...], Elezgarai I, Grandes P
GLIA. DOI: 10.1002/glia.24312
1) Microglial phagocytosis dysfunction in stroke is driven by energy depletion and induction of autophagy
Beccari, Sol; Sierra-Torre, Virginia; Plaza-Zabala, Ainhoa; Sierra, Amanda
Autophagy (Jan, 2023) DOI: 10.1080/15548627.2023.2165313

2) Characterization of microglia behaviour in healthy and pathological conditions with image analysis tools
Martinez, Aleix; Hériché, Jean-Karim; Calvo, Maria; Tischer, Christian; Otxoa-de-Amezaga, Amaia; Pedragosa, Jordi; Bosch, Anna; Planas, Anna M.; Petegnief, Valérie
Open Biology (Jan, 2023) DOI: 10.1098/rsob.220200

3) Microglia and meningeal macrophages depletion delays the onset of experimental autoimmune encephalomyelitis
Montilla, Alejandro; Zabala, Alazne; Er-Lukowiak, Marco; Rissiek, Björn; Magnus, Tim; Rodriguez-Iglesias, Noelia; Sierra, Amanda; Matute, Carlos; Domercq, María
Cell Death & Disease (Jan, 2023) DOI: 10.1038/s41419-023-05551-3

4) Editorial: Tumor Microenvironment in Primary Brain Cancers
Niechi, Ignacio; Pineda, Jose
Frontiers in Oncology (Jan, 2023) DOI: 10.3389/fphar.2022.1039904

5) Astrocyte endfoot formation controls the termination of oligodendrocyte precursor cell perivascular migration during development
Su, Yixun; Wang, Xiaorui; Yi, Chenju; Niu, Jianqin
Neuron (Jan, 2023) DOI: 10.1016/j.neuron.2022.10.032

6) Pharmacokinetic Evaluation of New Drugs Using a Multi-Labelling Approach and PET Imaging: Application to a Drug Candidate with Potential Application in Neuromuscular Disorders
Passannante, Rossana; Gómez-Vallejo, Vanessa; Aizpurua, Jesus M.; Llop, Jordi
Biomedicines (Jan, 2023) DOI: 10.3390/biomedicines11020253

7) Editorial: Natural products and brain energy metabolism: Astrocytes in neurodegenerative diseases Volume II
Wang, Fushun; Xu, Shijun; Pan, Fang; Verkhratsky, Alex; Huang, Jason H.
Frontiers in Pharmacology (Jan, 2023) DOI: 10.3389/fphar.2022.1039904

8) Blockage of STAT3 during epileptogenesis prevents GABAergic loss and imprinting of the epileptic state
Martín-Suárez, Soraya; Cortes, Jesús María; Bonifazi, Paolo
Brain (Feb, 2023) DOI: 10.1093/brain/awad055

9) The influence of astrocytic leaflet motility on ionic signalling and homeostasis at active synapses
Toman, Marinus; Wade, John Joseph; Verkhratsky, Alex; Dallas, Mark; Bithell, Angela; Flanagan, Bronac; Harkin, Jim; McDaid, Liam
Scientific Reports (Feb, 2023) DOI: 10.1038/s41598-023-30189-8

10) Recent Insights into the Functional Role of AMPA Receptors in the Oligodendrocyte Lineage Cells In Vivo
Kukley, Maria
International Journal of Molecular Sciences (Feb, 2023) DOI: 10.3390/ijms24044138

11) Untangling IGF-I signaling in the aging brain
Zegarra-Valdivia, Jonathan; Nuñez, Angel; Aleman, Ignacio Torres
Aging (Feb, 2023) DOI: 10.18632/aging.204507

12) Local diffusion in the extracellular space of the brain
Tønnesen, Jan; Hrabětová, Sabina; Soria, Federico N.
Neurobiology of Disease (Feb, 2023) DOI: 10.1016/j.nbd.2022.105981
13) P-Rex1 is a novel substrate of the E3 ubiquitin ligase Malin associated with Lafora disease
Kumarasinghe, L.; Garcia-Gimeno, M. A.; Ramirez, J.; Mayor, U.; Zugaza, J. L.; Sanz, P.
Neurobiology of Disease (Feb, 2023) DOI: 10.1016/j.nbd.2023.105998

14) Pre-and Postfusion Tuning of Regulated Exocytosis by Cell Metabolites
Zorec, Robert; Verkhratsky, Alexei
Function (Feb, 2023) DOI: 10.1093/function/zqac062

15) A novel murine model of mania
Molecular Psychiatry (Mar, 2023) DOI: 10.1038/s41380-023-02037-8

16) Radial stem astrocytes (aka neural stem cells): Identity, development, physio-pathology, and therapeutic potential
Yeh, Chia-Yu; Wu, Kuan-Yu; Huang, Guo-Jen; Verkhratsky, Alexei
Acta Physiologica (Mar, 2023) DOI: 10.1111/apha.13967

17) hiPSC-based models to decipher the contribution of human astrocytes to Alzheimer's disease and potential therapeutics
TCW, Julia; Arranz, Amaia M.
Molecular Neurodegeneration (Mar, 2023) DOI: 10.1186/s13024-023-00612-9

18) Self-assembled three-dimensional hydrogels based on graphene derivatives and cerium oxide nanoparticles: scaffolds for co-culture of oligodendrocytes and neurons derived from neural stem cells
Polo, Yurena; Luzuriaga, Jon; Langarica, Sergio Gonzalez de; Pardo-Rodríguez, Beatriz; Martínez-Tong, Daniel E.; Tapeinos, Christos; Manero-Roig, Irene; Marin, Edurne; Muñoz-Ugartemenda, Jone; Ciofani, Gianni; Ibarretxe, Gaskon; Unda, Fernando; Sarasua, Jose-Ramon; Pineda, Jose Ramon; Larrañaga, Aitor
Nanoscale (Mar, 2023) DOI: 10.1039/D2NR06545B

19) Therapeutic effect of α7 nicotinic receptor activation after ischemic stroke in rats
Aguado, Laura; Joya, Ana; [...] Llop, Jordi; Martín, Abraham
Journal of Cerebral Blood Flow & Metabolism (Mar, 2023) DOI: 10.1177/0271678X231161207

20) CREB3L2-ATF4 heterodimerization defines a transcriptional hub of Alzheimer's disease gene expression linked to neuropathology
Gouveia Roque, Cláudio; Chung, Kyung Min; McCurdy, Ethan P.; Jagannathan, Radhika; Randolph, Lisa K.; Herline-Killian, Krystal; Baleriola, Jimena; Hengst, Ulrich
Science Advances (Mar, 2023) DOI: 10.1126/sciadv.add2671

21) Circadian glucocorticoids throughout development
Lehmann, Marianne; Haury, Katharina; Oster, Henrik; Astiz, Mariana

22) Altered glial expression of the cannabinoid 1 receptor in the subiculum of a mouse model of Alzheimer's disease
Terradillos, Itziar; Bonilla-Del Río, Itziar; Puente, Nagore; Serrano, Maitane; Memenza, Amaia; Lekunberri, Leire; Anaut-Lusar, Ilazki; Reguero, Leire; Gerrikagoitia, Inmaculada; Ruiz de Martín Esteban, Samuel; Hillard, Cecilia J.; Grande, Maria T.; Romero, Julián; Elezgarai, Izaskun; Grandes, Pedro
Glia (Apr, 2023) DOI: 10.1002/glia.24312

23) Aluminum alters excitability by inhibiting calcium, sodium, and potassium currents in bovine chromaffin cells
Baraibar, Andrés M.; de Pascual, Ricardo; Carretero, Victoria Jiménez; Liccardi, Ninfa; Juárez, Natalia Hernández; Hernández-Guijo, Jesús M.

24) Spatial organization of neuron–astrocyte interactions in the somatosensory cortex
Baraibar, Andrés M; Belisle, Lindsey; Marsicano, Giovanni; Matute, Carlos; Mato, Susana; Araque, Alfonso; Kofuji, Paulo
Cerebral Cortex (Apr, 2023) DOI: 10.1093/cercor/bhac357
Rasero, Javier; Jimenez-Marin, Antonio; Diez, Ibai; Toro, Roberto; Hasan, Mazahir T.; Cortes, Jesus M.
Biological Psychiatry (Apr, 2023) DOI: 10.1016/j.biopsych.2023.04.014

26) Advances toward precision therapeutics for developmental and epileptic encephalopathies
Bertocchi, Ilaria; Cambiaghi, Marco; Hasan, Mazahir T.

27) Target cell-specific plasticity rules of NMDA receptor-mediated synaptic transmission in the hippocampus
Lutzu, S.; Alviña, K.; Puente, N.; Grandes, P.; Castillo, P.E.

28) The effect of omega-3 fatty acids on alcohol-induced damage
Serrano, Maitane; Rico-Barrio, Irantzu; Grandes, Pedro
Frontiers in Nutrition (Apr, 2023)

29) Astrocytic chloride is brain state dependent and modulates inhibitory neurotransmission in mice
Untiet, Verena; Beinlich, Felix R. M.; Kusum, Peter; Kang, Ning; Ladrón-de-Guevara, Antonio; Song, Wei; Kjaerby, Celia; Andersen, Mie; Hauglund, Natalie; Bojarowska, Zuzanna; Sigurdsson, Bjorn; Deng, Saiyue; Hirase, Hajime; Petersen, Nicolas C.; Verkhratsky, Alexei; Nedergaard, Maiken
Nature Communications (Apr, 2023) DOI: 10.1038/s41467-023-37433-9

30) Astroglia support, regulate and reinforce brain barriers
Verkhratsky, Alexei; Pivoriūnas, Augustas
Neurobiology of Disease (Apr, 2023) DOI: 10.1016/j.nbd.2023.106054

31) Notch and Wnt Signaling Modulation to Enhance DPSC Stemness and Therapeutic Potential
Uribe-Extebarria, Verónica; Pineda, Jose Ramon; García-Gallastegi, Patricia; Agliano, Alice; Unda, Fernando; Ibarretxe, Gaskon
International Journal of Molecular Sciences (Apr, 2023) DOI: 10.3390/ijms24087389

32) Apoptotic cell death in disease—Current understanding of the NCCD 2023
Vitale, I.; Pietrocola, F.; [...] Kroemer, G.; Galluzzi, L.
Cell Death and Differentiation (Apr, 2023) DOI: 10.1038/s41418-023-01153-w

33) Technical approaches and challenges to study AMPA receptors in oligodendrocyte lineage cells: Past, present, and future
Perez-Gianmarco, Lucila; Kurt, Begüm; Maria Kukley
GLIA (Apr, 2023) DOI: 10.1002/glia.24305

34) Electroacupuncture prevents astrocyte atrophy to alleviate depression
Cell Death and Disease (May, 2023) DOI: 10.1038/s41419-023-05839-4

35) Cognitive Deficits in Aging Related to Changes in Basal Forebrain Neuronal Activity
Chaves-Coira, Irene; García-Magro, Nuria; Zegarra-Valdivia, Jonathan; Torres-Alemán, Ignacio; Núñez, Ángel
Cells (May, 2023) DOI: 10.3390/cells12111477

36) Xth Cajal Conference: New frontiers in neuron-glial plasticity in health and disease
Louail, Alice; Bengoetxea de Tena, Iker; Rojas, Rocio; Casals, Núria
European Journal of Neuroscience (May, 2023) DOI: 10.1111/ejn.15960

37) Pathological potential of oligodendrocyte precursor cells: terra incognita
Yi, Chenju; Verkhratsky, Alexei; Niu, Jianqin
Trends in Neurosciences (May, 2023) DOI: 10.1016/j.tins.2023.04.003

38) Dissociation Between Neuronal and Astrocytic Calcium Activity in Response to Locomotion in Mice
Fedotova, Anna; Brazhe, Alexey; Doronin, Maxim; Toptunov, Dmytro; Pryazhnikov, Evgeny; Khiroug, Leonard; Verkhratsky, Alexei; Semyanov, Alexey
Function (May, 2023) DOI: 10.1093/function/zqad019
39) High performance photonics-based biosensing platform for COVID detection  
Castaño, Alain; Zugaza, Jose Luis; Zubia, Joseba; Arrizabalaga, Oskar  
Proceedings of SPIE - The International Society for Optical Engineering (May, 2023) DOI: 10.1117/12.2665589

40) Histological Examination of Mitochondrial Morphology in a Parkinson’s Disease Model  
Bengoa-Vergniory, N.  
Journal of visualized experiments : JoVE (Jun, 2023) DOI: 10.3791/65453

41) The neurobiology of insulin-like growth factor I: From neuroprotection to modulation of brain states  | Molecular Psychiatry  
Nuñez, Ángel, Angel; Zegarra-Valdivia, ; Fernández de Sevilla, ; Pignatelli, jaime; Torres Alemán, Ignacio  
Molecular Psychiatry (Jun, 2023) DOI: 10.1038/s41380-023-02136-6

42) Electroactive Materials Surface Charge Impacts Neuron Viability and Maturation in 2D Cultures  
Marques-Almeida, Teresa; Ribeiro, Clarisse; Irastorza, Igor; Miranda-Azpiazu, Patricía; Torres-Alemán, Ignacio; Silvan, Unai; Lancers-Méndez, Senentxu  
ACS Applied Materials & Interfaces (Jun, 2023) DOI: 10.1021/acsami.3c04055

43) 27-hydroxycholesterol promotes oligodendrocyte maturation: implications for hypercholesterolemia-associated brain white matter changes  
Alanko, Vilma; Gaminde-Blasco, Adhara; Quintela-López, Tania; Loera-Valencia, Raúl; Solomon, Alina; Björkhem, Ingemar; Cedazo-Minguez, Angel; Maioli, Silvia; Tabacaru, Graziella; Latorre-Leal, María; Matute, Carlos; Kivipelto, Mia; Alberdi, Elena; Sandebring-Matton, Anna  
Glia (Jun, 2023) DOI: 10.1002/glia.24348

44) The endoplasmic reticulum stress and unfolded protein response in Alzheimer’s disease: A calcium dyshomeostasis perspective  
Lim, D.; Tapella, L.; Dematteis, G.; Genazzani, A.A.; Corazzari, M.; Verkhratsky, A.  
Ageing Research Reviews (Jun, 2023) DOI: 10.1016/j.arr.2023.101914

45) Effects of spaceflight on the EEG alpha power and functional connectivity  
Pusil, Sandra; Zegarra-Valdivia, Jonathan; Cuesta, Pablo; Laothathai, Christopher; Cebolla, Ana Maria; Haueisen, Jens; Fiedler, Patrice; Funke, Michael; Maestú, Fernando; Cheron, Guy  
Scientific Reports (Jun, 2023) DOI: 10.1038/s41598-023-34744-1

46) Calcium dysregulation combined with mitochondrial failure and electrophysiological maturity converge in Parkinson’s iPSC-dopamine neurons  
Beccano-Kelly, Dayne A.; Cherubini, Marta; Mousba, Yassine; Cramb, Kaitlyn M. L.; Giussani, Stefania; Cailazzo, Maria Claudia; Rai, Pavandeep; Vingill, Siv; Bengoa-Verginy, Nora; Ng, Bryan; Corda, Gabriele; Banerjee, Abhirup; Vowles, Jane; Cowley, Sally; Wade-Martins, Richard  
iScience (Jun, 2023) DOI: 10.1016/j.isci.2023.107044

47) Hepatic levels of S-adenosylmethionine regulate the adaptive response to fasting  
Capelo-Diz, Alba; Lachiendo-Ortega, Sofia; […] Martínez-Chantar, Marta Luz; Varela-Rey, Marta  
Cell Metabolism (Jul, 2023) DOI: 10.1016/j.cmet.2023.07.002

48) Amyloid β1–42 Oligomers Induce Galectin–1S8 O–GlcNAcylation Leading to Microglia Migration  
Arrazola Sastre, Alazne; Luque Montoro, Miriam; Llaverio, Francisco; Zugaza, José L.  
Cells (Jul, 2023) DOI: 10.3390/cells12141876

49) The differential response to neuronal hyperexcitation and neuroinflammation of the hippocampal neurogenic niche  
Ruiz-Clavijo, Lorena; Martín-Suárez, Soraya  
Frontiers in Neuroscience (Jul, 2023) DOI: 10.3389/fnins.2023.1186256

50) Understanding the Role of the Glial Scar through the Depletion of Glial Cells after Spinal Cord Injury  
Perez-Gianmarco, Lucila; Kukley, Maria  
Cells (Jul, 2023) DOI: 10.3390/cells12141842

51) Decline of astrocyte Ca2+ signalling in Alzheimer’s disease: STIM1 to the rescue!  
Verkhratsky, Alexei; Semyanov, Alexey  
Cell Calcium (Jul, 2023) DOI: 10.1016/j.cce.2023.102756
Astrocytes adjust the dynamic range of cortical network activity to control modality-specific sensory information processing


Cell Reports (Aug, 2023) DOI: 10.1016/j.celrep.2023.112950

Alterations of Oligodendrocyte and Myelin Energy Metabolism in Multiple Sclerosis

López-Muguruza, Eneritz; Matute, Carlos

International Journal of Molecular Sciences (Aug, 2023) DOI: 10.3390/ijms241612912

A neuron-specific interaction between Alzheimer’s disease risk factors SORL1, APOE, andCLU

Preman, Pranav; Arranz, Amaia M.

Cell Reports (Sep, 2023) DOI: 10.1016/j.celrep.2023.113129

How can cry acoustics associate newborns’ distress levels with neurophysiological and behavioral signals?

Laguna, Ana; Pusil, Sandra; Acero-Pousa, Irene; Zegarra-Valdivia, Jonathan Adrián; Paltrinieri, Anna Lucia; Bazán, Ægel; Piras, Paolo; Palomares i Perera, Clàudia; García-Algar, Oscar; Orlandi, Silvia

Frontiers in Neuroscience (Sep, 2023) DOI: 10.3389/fnins.2023.1266873

Non-uniform temporal scaling of developmental processes in the mammalian cortex

Paolino, Annalisa; Haines, Elizabeth H.; Bailey, Evan J.; Black, Dylan A.; Moey, Ching; García-Moreno, Fernando; Richards, Linda J.; Suárez, Rodrigo; Fenlon, Laura R.

Nature Communications (Sep, 2023) DOI: 10.1038/s41467-023-01652-5

Multimodal imaging of the role of hyperglycemia following experimental subarachnoid hemorrhage

Joya, Ana; Plaza-García, Sandra; Padro, Daniel; Aguado, Laura; Iglesias, Leyre; Garbizu, Maider; Gómez-Vallejo, Vanessa; Laredo, Carlos; Cossio, Unai; Torné, Ramon; Amaro, Sergio; Planas, Anna M.; Llop, Jordi; Ramos-Cabrer, Pedro; Justicia, Carles; Martin, Abraham

Journal of Cerebral Blood Flow & Metabolism (Sep, 2023) DOI: 10.1177/0271678X231197946

MEG3 activates necroptosis in human neuron xenografts modeling Alzheimer’s disease

Balusu, Sriram; Horré, Katrien; [...] Fiers, Mark; De Strooper, Bart

Science (Sep, 2023) DOI: 10.1126/science.abp9556

Functional evolutionary convergence of long noncoding RNAs involved in embryonic development

Olazagoitia-Garmendia, Ane; Senovilla-Ganzo, Rodrigo; García-Moreno, Fernando; Castellanos-Rubio, Ainara

Communications Biology (Sep, 2023) DOI: 10.1038/s42003-023-05278-z

Prenatal androgenization triggered neuroimmune alterations in the fetal ovary and programmed its persisting dysfunction

Bazzano, Maria Victoria; Hardardottir, Lilja; Shi, Wenqin; Cattan, Joanne; Arck, Petra C.; Bosurgi, Lidia; Königser, Angel; Astiz, Mariana; Solano, Maria Emilia

Journal of Reproductive Immunology (Sep, 2023) DOI: 10.1016/j.jri.2023.104066

Astrocytes in human central nervous system diseases: a frontier for new therapies

Verkhratsky, Alexei; Butt, Arthur; Li, Baoman; Illes, Peter; Zorec, Robert; Semyanov, Alexey; Tang, Yong; Sofroniew, Michael V.

Signal Transduction and Targeted Therapy (Oct, 2023) DOI: 10.1038/s41392-023-01628-9

Astrocytes in human central nervous system diseases: a frontier for new therapies

Verkhratsky, Alexei; Butt, Arthur; Li, Baoman; Illes, Peter; Zorec, Robert; Semyanov, Alexey; Tang, Yong; Sofroniew, Michael V.

Signal Transduction and Targeted Therapy (Oct, 2023) DOI: 10.1038/s41392-023-01628-9

Insulin-degrading enzyme (IDE) as a modulator of microglial phenotypes in the context of Alzheimer's disease and brain aging

Corraliza-Gomez, Miriam; Bermejo, Teresa; Lilue, Jingtao; Rodriguez-Iglesias, Noelia; Valero, Jorge; Cozar-Castellano, Irene; Arranz, Eduardo; Sanchez, Diego; Ganfornina, Maria Dolores

Journal of Neuroinflammation (Oct, 2023) DOI: 10.1186/s12974-023-02914-7
64) Non-Excitatory Amino Acids, Melatonin, and Free Radicals: Examining the Role in Stroke and Aging
Carretero, Victoria Jiménez; Ramos, Eva; Segura-Chama, Pedro; Hernández, Adan; Baraibar, Andrés M.; Álvarez-Merz, Iris; Muñoz, Francisco López; Egea, Javier; Solís, José M.; Romero, Alejandro; Hernández-Guijo, Jesús M.
Antioxidants (Oct, 2023) DOI: 10.3390/antiox12101844

65) Brain IGF-I regulates LTP, spatial memory, and sexual dimorphic behavior
Herrero-Labrador, Raquel; Fernández-Irigoyen, Joaquín; Vecino, Rebeca; González-Arias, Candela; Ausín, Karina; Crespo, Inmaculada; Acosta, Francisco J. Fernández; Nieto-Estévez, Vanesa; Román, M. José; Perea, Gertrudis; Torres-Alemán, Ignacio; Santamaría, Enrique; Vicario, Carlos
Life Science Alliance (Oct, 2023) DOI: 10.26508/lsa.202201691

66) CerS6-dependent ceramide synthesis in hypothalamic neurons promotes ER/mitochondrial stress and impairs glucose homeostasis in obese mice
Hammerschmidt, Philipp; Steculorum, Sophie M.; [...] Brodesser, Susanne; Brüning, Jens C.
Nature Communications (Nov, 2023) DOI: 10.1038/s41467-023-42595-7

67) A role for astrocytic insulin-like growth factor I receptors in the response to ischemic insult
Suda, Kentaro; Pignatelli, Jaime; Genis, Laura; Fernandez, Ana M; de Sevilla, Estrella Fernandez; de la Cruz, Ines Fernandez; Pozo-Rodrigalvarez, Andrea; de Ceballos, Maria L; Diaz-Pacheco, Sonia; Herrero-Labrador, Raquel; Aleman, Ignacio Torres
Journal of Cerebral Blood Flow & Metabolism (Nov, 2023) DOI: 10.1177/0271678X231217669

68) Changes in osteogenesis by human dental pulp stem cells on porcine decellularised adipose tissue solid foams of different porosity
Luzuriaga, J.; García-Urkia, N.; Salvador-Moya, J.; Pardo-Rodríguez, B.; Etxebarria, I.;Fernandez-San-Argimiro, F.-J.; Olalde, B.; Unda, F.; Pineda, J.R.; Madarieta, I.; Ibarretxe, G.
European Cells and Materials (Nov, 2023) DOI: 10.22203/ecm.v046a06

69) Pre- and postsynaptic NMDA receptors are required for sequential printing of fear memory engrams
Bertocchi, Ilaria; Rocha-Almeida, Florbela; Romero-Barragán, María Teresa; Cambiaghi, Marco; Carretero-Guillén, Alejandro; Botta, Paolo; Dogbevia, Godwin K.; Treviño, Mario; Mele, Paolo; Oberto, Alessandra; Larkum, Matthew E.; Gruart, Agnes; Sprengel, Rolf; Delgado-García, José Maria; Hasen, Mazahir T.
iScience (Nov, 2023) DOI: 10.1016/j.isci.2023.108050

70) The Role of Insulin-like Growth Factor I in Mechanisms of Resilience and Vulnerability to Sporadic Alzheimer’s Disease
Zegarra-Valdivia, Jonathan A.; Pignatelli, Jaime; Nuñez, Angel; Torres Aleman, Ignacio
International Journal of Molecular Sciences (Nov, 2023) DOI: 10.3390/ijms242216440

71) P2X7R influences tau aggregate burden in human tauopathies and shows distinct signalling in microglia and astrocytes
Beltran-Lobo, Paula; Hughes, Martina M.; Troakes, Claire; Croft, Cara L.; Rupawala, Huzefa; Jutzi, Daniel; Ruepp, Marc-David; Jimenez-Sanchez, Maria; Perkinton, Michael S.; Kassiou, Michael; Golde, Todd E.; Hanger, Diane P.; Verkhratsky, Alexei; Perez-Nieves, Beatriz G.; Noble, Wendy

72) Omega-3 Recovers Cannabinoid 1 Receptor Expression in the Adult Mouse Brain after Adolescent Binge Drinking
Martín-Llorente, Ane; Serrano, Maitane; Bonilla-Del Río, Itziar; Lekunberri, Leire; Ocerin, Garazi; Puente, Nagore; Ramos, Almudena; Rico-Barrio, Irantzu; Gerrikagoitia, Inmaculada; Grandes, Pedro
International Journal of Molecular Sciences (Dec, 2023) DOI: 10.3390/ijms242417316

73) Multi-modal analysis of infant cry types characterization: Acoustics, body language and brain signals
74) Astrocite chloride, excitatory-inhibitory balance and epilepsy
    Untiet, Verena; Nedergaard, Maiken; Verkhratsky, Alexei
    Neural Regeneration Research (Dec, 2023) DOI: 10.4103/1673-5374.390981

75) Analysis of the mechanism of Sophorae Flavescentis Radix in the treatment of intractable itching
    based on network pharmacology and molecular docking
    European Review for Medical and Pharmacological Sciences (Dec, 2023) DOI:
    10.26355/eurrev_202312_34766

76) Mitochondrial malfunction and atrophy of astrocytes in the aged human cerebral cortex
    Popov, Alexander; Brazhe, Nadezda; Morozova, Kseniia; Yashin, Konstantin; Bychkov, Maxim;
    Nosova, Olga; Sutyagina, Oksana; Brazhe, Alexey; Parshina, Evgenia; Li, Li; Medyanik, Igor;
    Korzhevskii, Dmitry E.; Sherekar, Zakhar; Lyukmanova, Ekaterina; Verkhratsky, Alexei;
    Semyanov, Alexey
    Nature Communications (Dec, 2023) DOI: 10.1038/s41467-023-44192-0

77) Bruton's tyrosine kinase-bearing B cells and microglia in neuromyelitis optica spectrum disorder
    Liu, Ye; Huang, Zhenning; Zhang, Tian-Xiang; Han, Bin; Yang, Guili; Jia, Dongmei; Yang, Li; Liu,
    Qiang; Lau, Alexander Y. L.; Paul, Friedemann; Verkhratsky, Alexei; Shi, Fu-Dong; Zhang, Chao
Mariana Astiz was awarded with an ERC Consolidator Grant 2022. The project StarTicking is funded with 2 million euros and will be developed during 5 years.

New project to understand when and how the circadian clock starts to work

The 24-h (circadian) timing system develops during the perinatal period and rules our physiology later in life. It has the essential task of anticipating daily recurring changes in the environment (day/night) to find the best time for each molecular and cellular process. It is organised hierarchically, with a master pacemaker in the hypothalamic suprachiasmatic nucleus (SCN), which is able to perceive environmental light and tell the body what time it is.

StarTicking proposes to answer a long-standing question in the field: When and how the circadian clock starts ticking with a multidisciplinary and integrated approach focused on the development of the central pacemaker in mice and humans.

StarTicking. The early ticking of the central circadian pacemaker: when and how
ERC Consolidator Grants 2022
2024-2028
https://www.achucarro.org/laboratory/circadian-physiology-of-neurons-and-glia/
Knowledge sharing is an important support for the continuous innovation and sustainable development of scientific research, and essential for positively impacting Society and global challenges.

5. Knowledge Transfer

POSTGRADUATE EDUCATION

The staff of ACHUCARRO collaborates with three Masters’ programmes coordinated by the University of the Basque Country (UPV/EHU):

- Neuroscience
- Molecular Biology and Biomedicine
- Pharmacology, Development, Assessment, and Rational Use of Medicines

We also collaborate with the UPV/EHU’s Doctoral Programme in Neuroscience.
Congratulations

**Zorionak Adhara, Aitor, Ana, Irene, Koldo and Paula**

**PhD theses completed in 2023**

- **Dr. Koldo Berganzo**
  Laboratory of Ultrastructural and Functional Neuroanatomy of the Synapse
  *Dysautonomic disorders in Parkinson’s disease*

- **Dr. Irene Durá Esteve**
  Laboratory of Neurogenesis and Neural Stem Cells
  *Traumatic Brain Injury-induced alterations in Adult Hippocampal Neurogenesis*

- **Dr. Adhara M. Gaminde Blasco**
  Laboratory of Glia and Matrix Biology
  *Identifying alterations in RNA metabolism and translation dynamics of oligodendrocytes in Alzheimer’s disease*

- **Dr. Paula Giménez Mínguez**
  Laboratory of Neuronal Excitability
  *The role of the brain extracellular space in diffusion and cell signalling*

- **Dr. Aitor Medrano Peras**
  Laboratory of Ultrastructural and Functional Neuroanatomy of the Synapse
  *Topographic relationship between the subcellular localization of group II metabotropic glutamate receptors (mGlu2/3) and the cannabinoid CB1 receptor in the hilus region of the mouse dentate gyrus*

- **Dr. Ana Joya Villanúa**
  Laboratory of Neuroimaging and Biomarkers of Inflammation
  *Blood brain barrier disruption after subarachnoid hemorrhage: Role of hyperglycemia and effect of potentiating endogenous antioxidant mechanisms using molecular imaging.*

Another **62** theses (13% more than in 2022) are in different stages of this process.
ACHUCARRO SEMINARS

JANUARY
20 • Is there any therapy for Alzheimer’s disease?
   Jesús Ávila de Grado
   Centro de Biología Molecular “Severo Ochoa” CSIC/UAM (Madrid, Spain)
27 • Deciphering synaptic autophagy to empower brain health
   Sandra Soukup
   Université de Bordeaux (France)

FEBRUARY
01 • Brain Organoids as Avatars to understand Human brain Development and Disease
   Paola Arlotta
   Harvard Stem Cell Institute [HSCI] (USA)
03 • Virus delivered, brain circuit targetable, tightly-controlled inducible gene expression system
   Gorka Kortabarria Pérez
   Laboratory of Brain Circuits Therapeutics, ACHUCARRO
   • Aβ oligomers cause dysregulation of RNA dynamics and translational activity in oligodendrocytes
   Adhara Gaminde Blasco
   Laboratory of Neurobiology, ACHUCARRO
06 • Plasma biomarkers for the diagnosis of Alzheimer’s disease (AD). A game changer.
   Pascual Sánchez Juan
   Fundación Centro de Investigación de Enfermedades Neurológicas (CIEN, Madrid)
17 • Learning as a functional state of the brain
   José María Delgado García
   Universidad Pablo de Olavide (Seville)
24 • Targeting Microglia via Engineered Adeno-associated Virus
   Rui Lin
   National Institute of Biological Sciences (China)

MARCH
03 • Astrocytes in neurodegenerative diseases
   Laura Civiero
   Università di Padova (Italy)
10 • The matrix and the vision: new perspectives for imaging neuroinflammation
   Carmen Infante Duarte
   Charité - Universitätsmedizin Berlin (Germany)
17 • Hypothalamic circuits regulating energy balance: the role of astrocytes
   Luis Varela Fernández
   Laboratory of Glia-Neuron Interactions in the Control of Hunger, ACHUCARRO
MARCH
24 • The PIWI Pathway in Lifelong neurogenesis and neuroinflammation
   Davide De Pietri Tonelli
   Istituto Italiano di Tecnologia (Italy)

31 • What makes us human: a neuro-physiologist perspective
   Albert Gidon
   NeuroCure, Charite - Universatmedizin Berlin (Germany)

APRIL
14 • Voltage mapping of dendritic spikes in Purkinje neurons of awake mice
   Christopher Roome
   Okinawa Institute of Science and Technology (Japan)

21 • Microglial brainization: intrinsic and environmental cues controlling
devolutional microglial maturation
   Marta Pereira Iglesias
   Laboratory of Glial Cell Biology, ACHUCARRO

28 • New Horizons: Gonadotropin-releasing hormone and cognition
   Vincent Prévot
   Université de Lille (France)

MAY
05 • Angelman Syndrome causing UBE3A ligase displays predominantly synaptic
   ubiquitination activity in the mouse brain
   Ugo Mayor
   Ikerbasque - UPV/EHU (Leioa)

12 • Traveling Through Uncharted Territory: Spatial Lipidomics of the Brain
   José A. Fernández
   UPV/EHU (Leioa)

15 • Circulating myeloid suppressor cells as a translational tool for biomarker
   discovery in multiple sclerosis
   Diego Clemente
   National Hospital of Paraplegics & CIBERNED (Toledo, Spain)

19 • Circulating insulin peptides and interoception
   Ignacio Torres Aleman
   Laboratory of Neurobiology of Insulin Peptides, ACHUCARRO

26 • Cell Therapy for Parkinson’s disease using Carotid Body as a source of GDNF:
   pros and cons of the coronavirus pandemic
   Juan José Toledo Aral
   Universidad de Sevilla (Spain)
JUNE
02 • Whole brain perineuronal net and parvalbumin expression analysis in Fragile X mice
   Ilaria Bertocchi
   University of Torino (Italy)
09 • Non-invasive brain stimulation: an old tool into the hands of modern translational research
   Marco Cambiaghi
   University of Verona (Italy)
16 • Exercise on cognition
   Jose Luis Trejo
   Instituto Cajal - CSIC (Madrid, Spain)
23 • Junior symposium organized by the Laboratory of Neurobiology
   Naroa Ibarra Aizpurua, Chao Zheng, Isabel Chato Astrain & Veronica Giusti
   Oxford, Karolinska, Nice - Sofia Antipolis & Padova
30 • Disruption in the light/dark cycle alters the circadian regulation of female fertility
   Valérie Simonneaux
   Institut des Neurosciences Cellulaires et Intégratives [INCI] (Strasbourg, France)

JULY
14 • Modulation of synaptic translation by astrocytic extracellular vesicles in 5xFAD mice
   Aída de la Cruz Gambra
   Laboratory of Local Translation in Neurons and Glia, ACHUCARRO

SEPTEMBER
15 • Subcellular architecture studied by correlative light and electron microscopy
   Alejandro Melero Carrillo
   Laboratory of GTPases and Neurosignalling, ACHUCARRO
22 • Mechanisms of neuronal diversification and evolution
   Nuria Flames Bonilla
   Instituto de Biomedicina de Valencia [CSIC] (Spain)
29 • Genetic features controlling the specific expression of developmental genes
   Álvaro Rada-Iglesias
   IBBTEC [CSIC/University of Cantabria] (Santander)
ANNUAL REPORT 2023

OCTOBER
06 • Exploring Neurogenesis through the Olfactory System
   María Figueres Oñate
   Instituto Cajal - CSIC (Spain)

11 • In Vivo Multimodal Imaging of Adenosine A2A Receptors in Neuroinflammation after Experimental Stroke
   Maider Garbizu Albisu
   Laboratory of Neuroimaging and Biomarkers of Inflammation, ACHUCARRO

18 • The future of EEG and non-invasive neuromodulation in neuroscience and mental health applications
   Frank Zanow
   Neuromotion BV (The Netherlands)

20 • Gender specific differences in endocannabinoid regulation of obesogenic diet-induced memory deficits
   Guillaume Ferreira
   University of Bordeaux (France)

27 • Extracellular fluid circulation in the brain parenchyma and its role in Alzheimer's disease
   Juan A. Varela
   University of St Andrews (UK)

NOVEMBER
03 • Astrocytes as key elements in the efficiency of sensory information processing by cortical networks
   Juliana M Rosa
   Hospital Nacional de Parapléjicos, IDISCAM (Toledo, Spain)

11 • From synchronous to asynchronous: multiscale exploration of cortical state transitions
   María Victoria Sánchez-Vives
   Clinic Barcelona - IDIBAPS (Barcelona)

13 • Calcium regulation of neuronal energy metabolism. Mitochondrial calcium uniporter and Aralar/malate-aspartate shuttle
   Jorgina Satrústegui
   CBMSO [UAM-CSIC] (Madrid, Spain)

24 • Cortical interneurons in health and disease
   Oscar Marín
   King’s College London (UK)

DECEMBER
05 • Neuroglia basis of behavior
   Edgar Soria-Gomez
   Laboratory of Cellular Basis of Behavior and Disease, ACHUCARRO
Among our objectives we list the promotion of scientific knowledge and the dissemination a culture based on facts and critical thinking. This is also a personal and collective commitment of contributing to a well-informed Society.

Dissemination and advocacy

We deploy our commitment to Outreach; Equality, Equity and Diversity; Talent Development; and fostering a culture of scientific literacy through various activities during the year.

February 11th and the commitment with Equality is present in many of our activities. In 2023 we joined forces with the ongoing initiative “Emakumeak Zientzian”, currently the reference movement towards equality in the field of science and technology in the Basque Country.
Many times, these activities require not only the commitment but the personal effort of our staff and volunteers.

Many thanks to all of you.
Eskerrik asko.

You can check all the information on our website: https://www.achucarro.org
The Science Park of the UPV/EHU in Leioa, hosts the headquarters of ACHUCARRO. In 2023 we increased our premises by 50% with the support of IKERBASQUE.

6. Infrastructure and Equipment

In the one hand, the proximity with Bilbao, and communications hub, and in the other hand, our location in the campus of the University provide us a perfect environment to develop our mission.

The settlement within the campus, close to the general research facilities to support research provided by the UPV/EHU (i.e., optical and electronic microscopy, genomics, proteomics, etc.); also the potential to partnering with other neighbouring R&D agents in the area allow us to jointly develop investment strategies to complement the existing and to complement those specific scientific resources of each sector and research field.

ACHUCARRO currently occupies the third floor of the Sede building, a space of 3000 m² in a privileged location within the campus of the UPV/EHU.

Some of the research groups also have laboratories and offices in the School of Medicine and Nursing, only 400 metres from the main location.

https://www.achucarro.org/facilities
New challenges deriving from the scientific progress in biomedicine and the new European strategy directed to develop more relevant biomodels to study the human physiology, pushed us to find new human biomodels to study the human brain physiology.

The Basque Biomodels Platform for Human Research

The Basque Biomodels Platform for Human Research (BBioH) is a collaborative initiative of Achucarro Basque Center for Neuroscience and the Instituto Biofisika (UPV/EHU-CSIC) in partnership with the Fundación Biofisica Bizkaia. BBioH is funded in part by the Department of Education of the Basque Government under the IKUR Strategy, with additional support from the Spanish Ministry of Science and Innovation with funding from European Union NextGenerationEU.

Main objectives
BBioH is the first public-based human biomodels platform in Basque Country and the second in Spain, specialized in human brain organoids. We foster the use of human 2D and organoid models in basic and applied research. The main scientific objective is to reproduce the human brain development in normal and pathological conditions, whereas the three strategic objectives are: 1. to promote collaborations between BERCS; 2. to create links between basic, clinic and applied research; 3. to elevate Euskadi as a referent in the field of personalized medicine.

A multidisciplinary approach to the clinics, industry, and academic research.
BBioH proposes a multidisciplinary approach with the support of other associated units in Achucarro like the platform of biomarkers, molecular biology, imaging, and the collaboration of the Basque Resource for Electron Microscopy (BREM). Moreover, we collaborate with the Basque Institutes of Health Research (Biobizkaia and Biogipuzkoa) for the use and recruitment of human samples, the Research Institutes in biomaterials like BCMaterials and Tecnalia and the University of Basque Center.

In 2023 we already offered our services abroad to the University of Piemonte Orientale (Italy), University of Padova (Italy) and University of Bologna (Italy).

More information: https://www.achucarro.org/facilities/human-biomodels/
7. Main performance indicators

The following indicators reflect the evolution on the performance of ACHUCARRO, with this panel agreed by the Basque Government and ACHUCARRO for the current strategic period.

The following indicators strive to show the development of our organization, according to some external (partners and funders) and internally defined parameters.

Our overall assessment is very positive. Some indicators have reflected the effects of the global pandemic (in the years 2022 and 2021), and others clearly reflect the degree of maturity and consolidation of ACHUCARRO.

<table>
<thead>
<tr>
<th>Total number of indexed publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources: Scopus &amp; Web of Science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of publications in quartile 1 of their research areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source: Scimago Journal Ranking</td>
</tr>
</tbody>
</table>

![Graph showing total number of indexed publications from 2022 to 2025](chart1)

![Graph showing % of publications in quartile 1 from 2022 to 2025](chart2)
Total citations
Source: Scopus & Web of Science

This total amount produce a mean of 9 citations per document

h-index of ACHUCARRO
Source: Scopus

Scopus and Web of Science produce similar numbers for the h-index indicator, while Google Scholar reflects 104 for the same indicator.

https://scholar.google.es/user=hO1jBxYAAAAJ
In terms of talent attraction and collaboration with the strategic objectives of IKERBASQUE, we keep hosting a good number of their researchers, and contributing to their career development and retention.

**Total number of Ikerbasque Researchers (Professors, Associated and Fellows)**

Source: Internal

**Total number of Ramón y Cajal Fellows**

Source: Internal
The improvement of conditions after the restrictions of the pandemic (2020 and 2021) had a clear and positive effect on the number of PhD thesis successfully defended in 2022. During the pandemic we were below the forecast, but once recovered, we overcame the expected numbers.

**Completed PhD Thesis**

<table>
<thead>
<tr>
<th>Year</th>
<th>Objective</th>
<th>PhD thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>2023</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2024</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>2025</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

In addition, our commitment with postgraduate education and contribution to the supervision of Masters’ dissertation continues to increase, as the number of students taking these degrees is also increasing in our environment.

**Completed Masters’ Dissertations**

<table>
<thead>
<tr>
<th>Year</th>
<th>Objective</th>
<th>Masters dissertations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>2023</td>
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<td>2024</td>
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<td>11</td>
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<tr>
<td>2025</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>
The financial stability and sustainability of ACHUCARRO keeps consolidating, derived from the increase in the attraction of funding, both nationally and internationally, public and private.

% of funding different from BERC

Source: Internal

Private funding (EUR)

Source: Internal

International funding (EUR)

Source: Internal