

PIEZ 
4SPINE
NEWSLETTER

Nº3

OUR RADICAL VISION
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THIRD PIEZO4SPINE NEWSLETTER

Welcome to the third edition of the Piezo4Spine Newsletter. As we step into 2026, the final and most defining year of our HORIZON EUROPE EIC Pathfinder Project, we look back on a dynamic and successful 2025. The coming months will be crucial, and our consortium is fully committed to bringing this innovative approach to spinal cord injury therapy closer to reality.

Over the past year, our teams have been exceptionally active – presenting new scientific findings at conferences, publishing research results, and engaging with spinal cord injury patients, healthcare specialists, and the wider public. One memorable highlight was our appearance in a Spanish national TV documentary series, which brought the vision of Piezo4Spine to an even broader audience.

A key moment of 2025 was our 4th Annual Partner Meeting in Brussels, kindly hosted by UC Louvain. The two days provided a productive space for open discussion, strategic alignment, and preparation for this decisive final phase. Alongside the scientific sessions, we enjoyed a creative urban puzzle adventure through the city centre and a wonderful evening of food and conversation – moments that strengthened team spirit and collaboration.

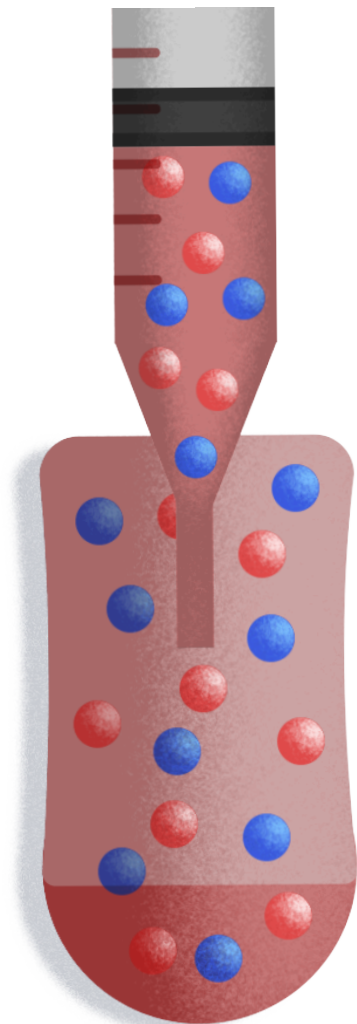
In this edition, we are pleased to share the milestones, activities, and insights that shaped our past year – and to offer a glimpse of how we are preparing for the exciting final stretch ahead.

YOURS SINCERELY,
THE PIEZO4SPINE TEAM





OUR RADICAL VISION



THERAMESH

THE GLOBAL CHALLENGE OF SPINAL CORD INJURIES

Annually, between 250,000 and 500,000 people worldwide suffer from spinal cord injuries (SCIs), predominantly due to preventable causes like road accidents, falls, and violence. These injuries severely disrupt neural circuits, impairing connectivity between the brain and the rest of the body. The complex nature of these injuries, influenced by factors such as injury severity and location, has so far limited treatment options to merely symptomatic relief ¹.

OUR AIM: REVOLUTIONIZING SCI RESEARCH

Piezo4Spine is dedicated to developing a novel multifactorial therapy for SCI, focusing on two pivotal aspects of neural repair: mechanotransduction and inhibitory scarring. Our approach is designed to more effectively tackle the complexities of SCIs, offering new possibilities for therapies and functional recovery.

OUR CUTTING-EDGE-TECHNOLOGY

Leveraging advancements in Nanotechnology, Molecular Biology, Tissue Engineering and Neuroelectronics, Piezo4Spine is developing a bioprinted 3D mesh, the '3D-theramesh', infused with nanocarriers. These carriers are engineered to deliver gene therapeutic agents to injury sites via wireless powering.

OUR IMPACT

Our interdisciplinary consortium aims to transcend the limitations of current technologies by addressing multiple cellular targets involved in neural regeneration. This includes a balanced combination of therapeutic interventions focusing on mechanotransduction and inhibitory scarring, which has the potential to significantly enhance functional recovery after SCI and pave the way for novel treatments in various other neural and non-neural pathologies.

Discover more about our project's aims and groundbreaking approach by watching our informative video on [YouTube](#) and on www.piezo4spine.eu.

¹<https://www.who.int/news-room/fact-sheets/detail/spinal-cord-injury>

SCIENTIFIC ACHIEVEMENTS



A SINGLE ELECTRODE ORGANIC NEUROMORPHIC DEVICE FOR DOPAMINE SENSING *IN VIVO*

In the November 2024 issue of *Advanced Electronic Materials*, our team at IIT introduced a single-electrode organic neuromorphic device capable of detecting dopamine directly *in vivo*. The sensor integrates signal processing into the material itself, delivering high sensitivity and stable performance under physiological conditions. By enabling real-time monitoring of dopamine dynamics, this work showcases how neuromorphic electronics can interface seamlessly with living tissue and provides valuable insights for future neuroregenerative strategies.

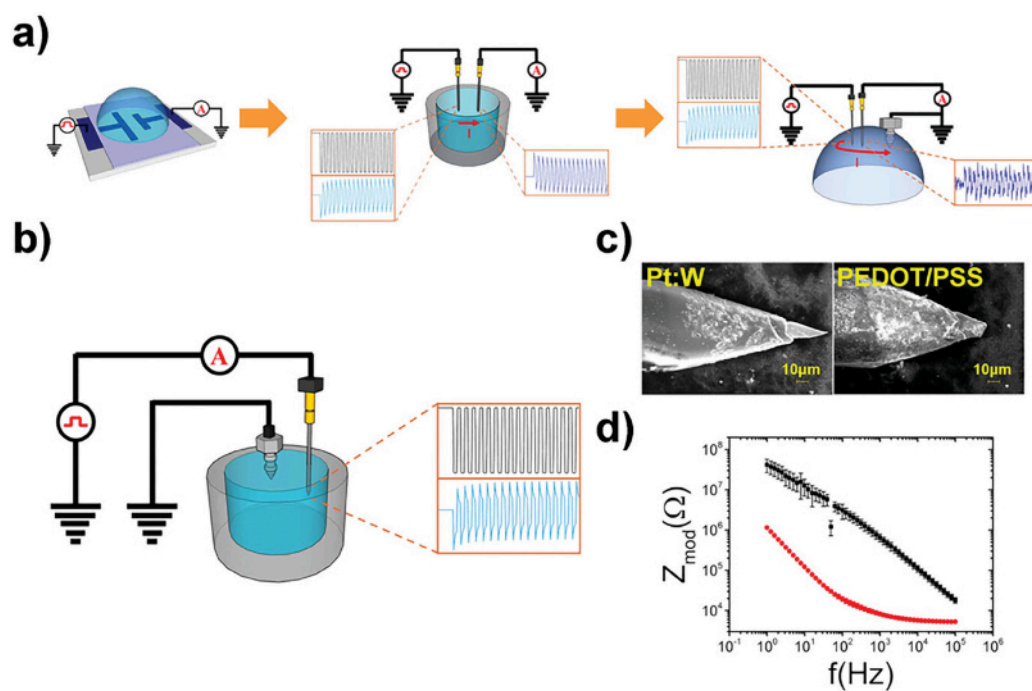


Fig. 1: Overview of the SEND Device.

a) It shows how the design evolved from a simple bench-top synapse to the final implantable version, including its input (black) and output (blue) signals.

b) A schematic of the implantable device highlights how voltage inputs translate into output currents.

c) Electron microscopy images compare the device tip before and after electrodeposition.

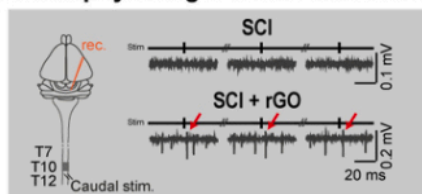
d) Bode plots show how the impedance changes

READ THE FULL PUBLICATION HERE
<https://doi.org/10.1002/aelm.202400467>

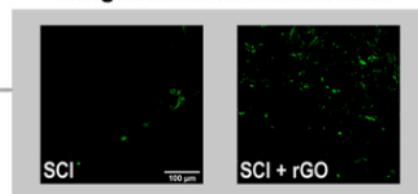
SCIENTIFIC ACHIEVEMENTS

GRAPHENE OXIDE SCAFFOLDS PROMOTE FUNCTIONAL IMPROVEMENTS MEDIATED BY SCAFFOLD-INVADING AXONS IN THORACIC TRANSECTED RATS

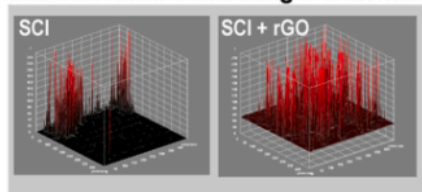
Electrophysiological detection of active axons



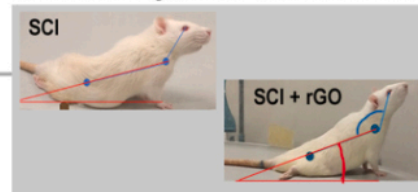
Regrowth of blood vessels



More abundant and longer neurites



Higher trunk stability and functional recovery



Published in May 2025 in *Bioactive Materials* by our partners SESCAM and ICMM-CSIC (MaMBIO Group), this study introduces a graphene oxide-based 3D scaffold that promotes cell adhesion, vascular growth, neurite extension, and reconnection of the spinal cord with the brain. Thanks to its high biocompatibility, mechanical softness, residual electrical conductivity, and stable 3D porous architecture, graphene oxide provides a promising microenvironment for forming organised neural networks, marking an important step forward in developing advanced materials for spinal cord repair.

READ THE FULL PUBLICATION HERE:

<https://doi.org/10.1016/j.bioactmat.2024.12.031>

HIGH-THROUGHPUT NANORHEOLOGY OF LIVING CELLS POWERED BY SUPERVISED MACHINE LEARNING

The Force Tool Group at ICMM-CSIC has been very active, contributing three high-impact publications that strengthen the biophysical and nanomechanical foundations of Piezo4Spine.

Their earliest publication, released in *Advanced Intelligent Systems* (April 2025), demonstrates how automated nanomechanical measurements combined with supervised machine-learning analysis can characterize the behaviour of living cells at high throughput. This approach enables rich mechanical profiling at scale - a valuable asset for modelling how neural tissues respond to mechanical and electrical cues.

READ THE FULL PUBLICATION HERE:

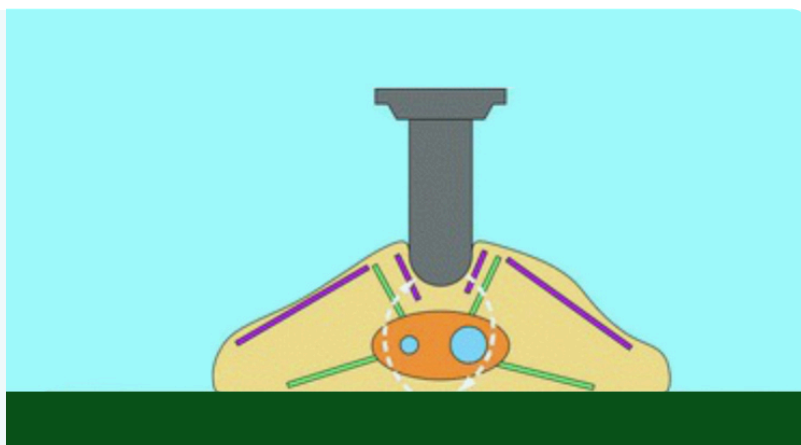
<https://doi.org/10.1002/aisy.202400867>

SCIENTIFIC ACHIEVEMENTS

EVIDENCE OF THE BOTTOM STIFFNESS EFFECT ON ATOMIC FORCE MICROSCOPY-BASED CELL MECHANOBIOLOGY

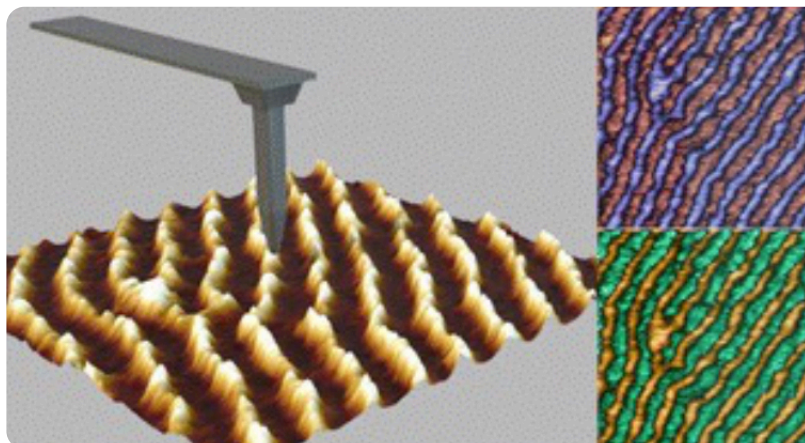
A few months later, in *Nanoscale* (June 2025), the group introduced a novel piezoresistive framework enabling ultrasensitive deformation measurements in neuronal cells. This method established a robust platform for probing mechanotransduction pathways and offers powerful tools for understanding the biophysical processes underlying neuronal regeneration.

READ THE FULL PUBLICATION HERE:
<https://doi.org/10.1039/d5nr01236h>



ADVANCES IN NANOMECHANICAL PROPERTY MAPPING BY ATOMIC FORCE MICROSCOPY

A further contribution of the Force Tool Group (ICMM-CSIC) followed in October 2025, published in *Nanoscale*, offering a wide-angle overview of nanoscale force sensing. This review consolidates recent advances in the field and outlines emerging directions in neuromechanics, positioning the team as a reference point for nano-enabled sensing strategies relevant to biomedical applications.



READ FULL PUBLICATION HERE:
<https://doi.org/10.1039/D5NA00702J>

PIEZO4SPINE AT CONFERENCES

NANOMEDICINE COOPERATION MEETING

SPAIN – THAILAND

The first major event took place in January at the Spain–Thailand Nanomedicine Cooperation Meeting in Madrid. Here, **María del Puerto Morales** (MaMBIO team at ICMM-CSIC) introduced the Nanomedicine Hub and its role in developing new health-related nanotechnologies. Our project coordinator **María Concepción Serrano** (MaMBIO team at ICMM-CSIC) presented current approaches using nanomaterials for neural repair, while **Ricardo García** (Force Tool at ICMM-CSIC) provided an update on advanced force-microscopy methods relevant to mechanobiology. The meeting offered a productive setting for strengthening ties with colleagues from Thailand and exchanging perspectives on nanomedicine.

In 2025, Piezo4Spine was represented at a wide range of scientific meetings across Europe, Asia, and the United States. Our partners contributed talks, posters, symposium organisation, and expert discussions that helped strengthen collaborations and share the project’s latest research developments. Below is an overview of only some of our key moments from a very active conference year.



Fig 2. María del Puerto Morales introducing the Nanomedicine Hub.

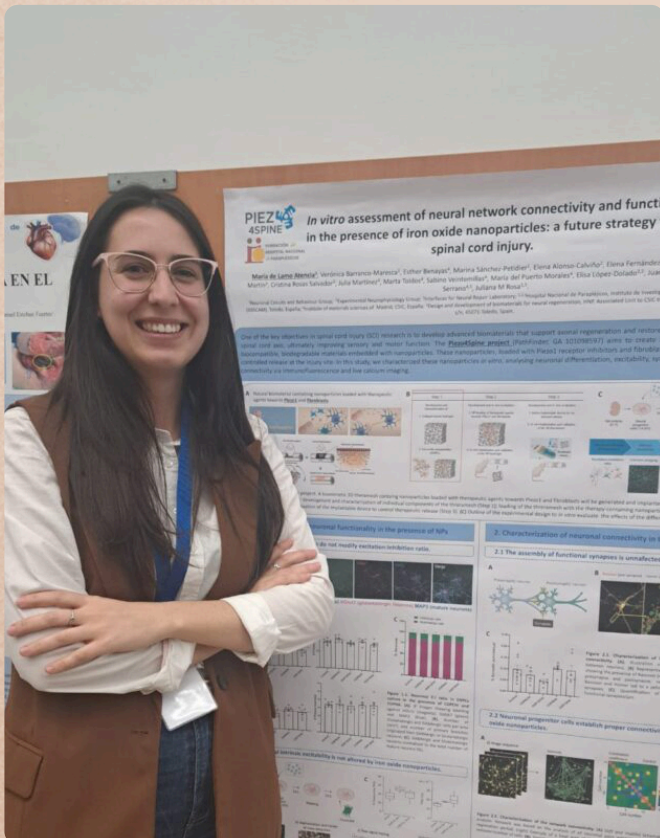
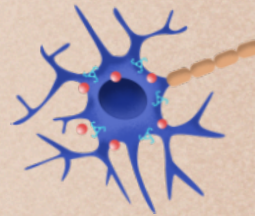


Fig 3. Poster presentation by María de Lamo

NATIONAL HOSPITAL FOR PARAPLEGICS TOLEDO



In March, the National Hospital for Paraplegics in Toledo hosted its third scientific conference, focusing on research, rehabilitation and clinical practice in spinal cord injury. Our partner SESCAM presented two contributions: **Verónica Barranco** shared new findings on combining a biomimetic 3D matrix with motor training, and **María de Lamo** discussed neural connectivity in the presence of iron oxide nanoparticles. Their work sparked conversations with clinicians and researchers exploring complementary treatment and diagnostic approaches.



Fig 4. Oral presentation by Verónica Barranco

PIEZO4SPINE AT CONFERENCES

SOCIETY FOR BIOMATERIALS 2025 CONFERENCE

CHICAGO

April took the project to Chicago for the Society for Biomaterials 2025 Conference. **Conchi Serrano** co-organized a symposium on regenerative medicine of complex tissues and presented recent progress from Piezo4Spine. The symposium, developed together with **Professors Guillermo Ameer, Jian Yang and Gulden Camci-Unal**, attracted specialists from regenerative medicine, biomaterials and tissue engineering. Discussions created new links with international groups working on strategies closely aligned with ours.

Fig 6. Conchi Serrano with Professors Guillermo Ameer, Jian Yang and Gulden Camci-Unal



Fig 5. Conchi Serrano at the Society for Biomaterials 2025 Conference in Chicago



ASPAYM MADRID'S XXIX SCIENTIFIC WORKSHOP (SBAN 2024) MADRID

In late spring, Piezo4Spine contributed to ASPAYM Madrid's XXIX Scientific Workshop at the Fundación del Lesionado Medular. Together with **Elisa López-Dolado** (SESCAM), **Conchi Serrano** presented ongoing project activities in front of a mixed audience of scientists, clinicians and more than fifty paraplegic patients. The workshop emphasized the value of direct dialogue between research teams and the people ultimately affected by advances in spinal cord injury research.



Fig 7. Conchi Serrano and Elisa López-Dolado at the ASPAYM Scientific Workshop

PIEZO4SPINE AT CONFERENCES

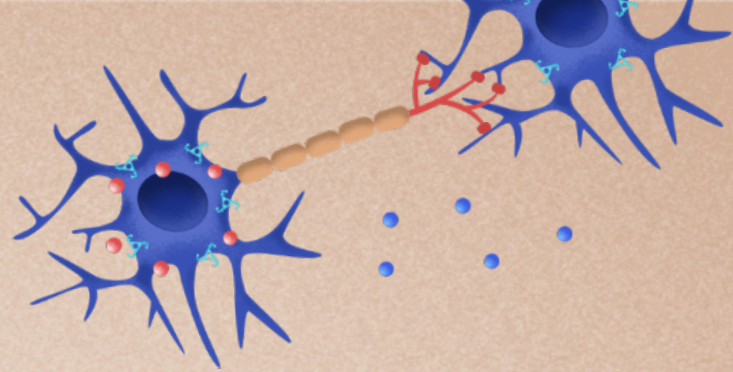


Fig 8. Conchi Serrano at the SENC 2025 conference introducing the Piezo4Spine consortium members

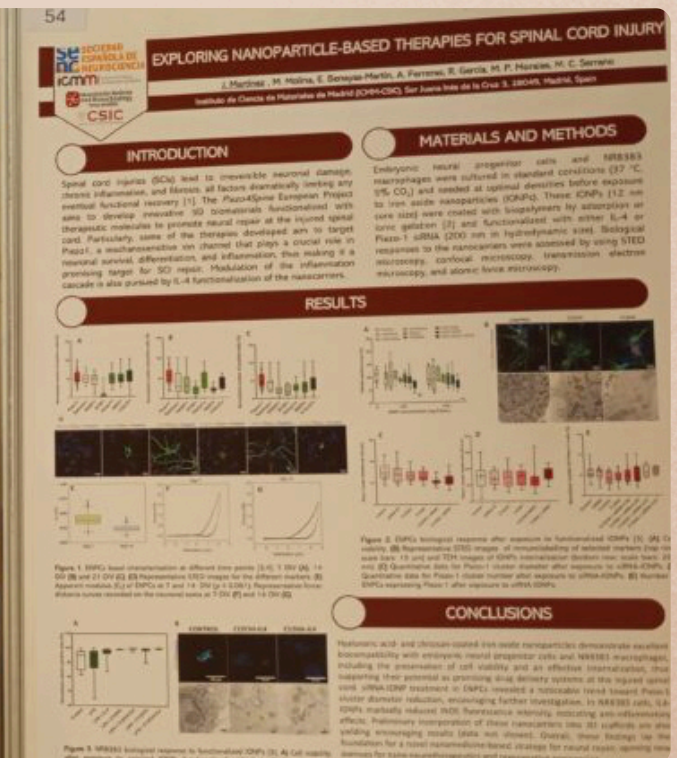
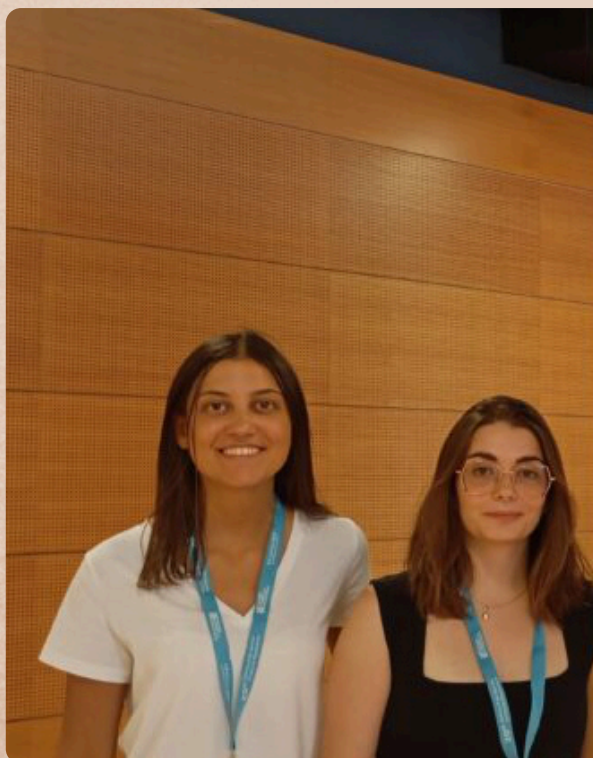


Fig 9. Julia and Marta from ICMM-CSIC presenting their poster on Nanoparticle-Therapies for Spinal Cord Injury

PIEZO4SPINE AT CONFERENCES

20TH MEETING OF THE SPANISH SOCIETY FOR NEUROSCIENCE (SENC 2025)

LAS PALMAS DE GRAN CANARIA

The busy year continued in September at the 20th Meeting of the Spanish Society for Neuroscience (SENC 2025) in Las Palmas de Gran Canaria, Spain. Juan Aguilar and Conchi Serrano (SESCAM & CSIC) co-organized a symposium on spinal cord injury and presented two different talks on project results. Young researchers Julia Martínez, Marta Molina and Verónica Barranco contributed respective posters presenting their ongoing work, giving early-career scientists the opportunity to engage with the broader neuroscience community.

IV ANNUAL ASSEMBLY OF THE NANOMED-CSIC HUB

MADRID

Back in Madrid, Piezo4Spine was also represented at the IV Annual Assembly of the Nanomed-CSIC Hub, where Conchi Serrano gave an overview of our research on biomaterials and mechanobiology for neural repair. The meeting brought together national experts working on nanomedicine and provided an opportunity to align project efforts with related initiatives across the CSIC network.

BELGIAN SYMPOSIUM OF TISSUE ENGINEERING

KORTRIJK

Further afield, our team from Belgium joined the Belgian Symposium of Tissue Engineering in Kortrijk. Paloma Lozano (UC Louvain) presented new results on modulating neuroinflammation through therapeutic iron oxide nanoparticles. Her contribution generated discussions with researchers working on 3D bioprinting, advanced in vitro models and biomaterial-based therapies, broadening the project's international connections in regenerative medicine.

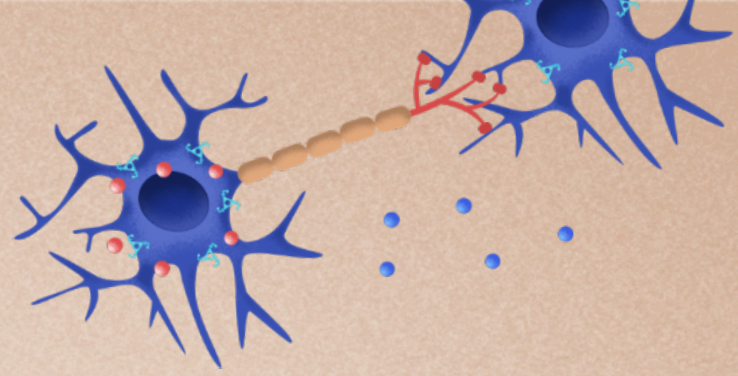


Fig 10. Conchi Serrano at the IV Annual Assembly of the Nanomed-CSIC Hub

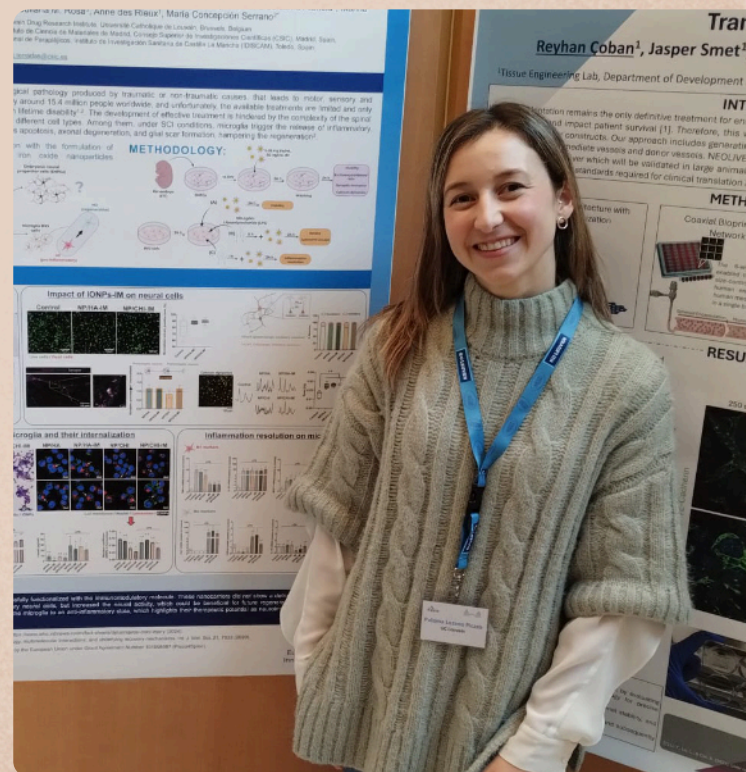


Fig 11. Paloma Lozano at the Belgian Symposium of Tissue Engineering

PIEZO4SPINE GOES PUBLIC

Alongside an active conference year, Piezo4Spine partners also dedicated substantial time to outreach and public engagement. Across different cities and audiences – from school classrooms to large public science events – our team members helped bring the project’s research to wider communities, showing once again how committed they are to sharing knowledge beyond academic settings.

A good example of this was Julia Martínez’s participation in **Pint of Science Madrid on 20 May**. At the Mercado de San Leopoldo, Julia introduced to the audience her PhD work on iron-based nanomaterials and their relevance for spinal cord regeneration. She also contributed to the new “Pinta a bulo” format, taking time to explain scientific facts and address common misconceptions. Her participation highlighted how approachable and relevant complex research becomes when explained clearly and openly.

Only ten days later, Piezo4Spine contributed to **VentuCiencia 2025 in Venturada, Madrid** – a lively science fair visited by more than 2,500 people. Our coordinator, Conchi Serrano, met a group of primary school students to talk about women in science. Her session offered an encouraging and relatable introduction to scientific careers and showed the importance of representation in inspiring young minds. The event as a whole created a strong connection between local communities and ongoing scientific work, and Piezo4Spine was pleased to be part of it.



Fig 12. Julia Martínez at the Pint of Science Madrid



Fig 13. Paloma Lozano and Anne des Rieux hosting a school workshop in Brussels

Education and curiosity also guided an outreach session organised by UC Louvain. Anne des Rieux and Paloma Lozano visited a **high school class** to explain the basics of spinal cord injury, the structure and function of the nervous system, and the principles behind Piezo4Spine’s theramesh. By showing real experimental images and videos – including cell tests with iron oxide nanoparticles – they opened up an authentic window into research practice. The conversation with the students quickly became interactive, with questions ranging from the causes of injury to the realities of scientific careers. Their enthusiasm underscored how valuable initiatives like these can be in encouraging interest in STEM fields.

PIEZO4SPINE GOES *PUBLIC*

And as every year, we also joined the European Researchers' Night 2025, with activities taking place both in Madrid and Graz. In Madrid, members of the MaMBIO (ICMM-CSIC) team, including Esther, Julia, Conchi, Puerto and Victor, and Laura Carvalho from the UC team developed interactive activities such as a scientific game board, a short escape-style experience on Women Nobel Prize Laureates, and hands-on demonstrations. In Graz, Piezo4Spine was represented by Katharina Schwaiger from acib, who engaged visitors with a poster and discussions about the project's goals.



Fig 15. Katharina Schwaiger (acib) at the European Researchers' Night in Graz, Austria



Fig 14. The MaMBIO (ICMM-CSIC) and UC Teams at the European Researchers' Night in Madrid, Spain

PIEZO4SPINE IN THE *MEDIA*

2025 was also a strong year for Piezo4Spine in the media, especially in Spain, where our **MaMBIO (ICMM-CSIC)** and **SESCAM** teams received

SIGNIFICANT ATTENTION FOLLOWING THE PUBLICATION OF THEIR STUDY IN BIOACTIVE MATERIALS (2025),

[Graphene oxide scaffolds promote functional improvements mediated by scaffold-invading axons in thoracic transected rats.](#)

One of the highlights was a radio interview on the **Spanish National Radio (RNE)** in the programme ***A hombros de gigantes***, where our coordinator Conchi Serrano discussed the research behind graphene-based scaffolds and their potential to reconnect severed spinal cords in preclinical models. She explained the scientific progress made so far, the remaining challenges, and the broader outlook for regenerative strategies in spinal cord injury.

rne

LISTEN HERE:

[Reconectan médulas seccionadas en ratones de laboratorio](#)

Piezo4Spine was also featured on **RTVE, the Spanish national television broadcaster**, in an episode of ***De seda y hierro – Mirar hacia adelante***. The programme followed the story of former professional cyclist Sergio Martín, offering insights into life after spinal cord injury. During the episode, Sergio visited Conchi Serrano at ICMM-CSIC, where she introduced the project's biomaterials research, including graphene oxide scaffolds.

The visit also included conversations with Elisa López-Dolado and Juan Aguilar from SESCAM, who explained their work on preclinical evaluation and neurophysiology. Through these exchanges, the programme highlighted the importance of connecting laboratory research with real patient experiences.

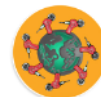
rtve

WATCH THE EPISODE HERE:

<https://www.rtve.es/play/videos/de-seda-y-hierro/mirar-hacia-delante/16816921>

AROUND 40 MEDIA PIECES INCLUDING TV, RADIO & PRESS WERE PUBLISHED, REFLECTING THE PUBLIC INTEREST IN ADVANCES TOWARD SPINAL CORD REPAIR.

Moreover, Paloma Lozano (UC Louvain) was interviewed for the **science radio programme Investigadores por el Mundo, presented by Antonio Armas**. In this episode, broadcast on 11 March 2025 on Radio Libertad, Paloma spoke about her career path – from her studies in biotechnology and regenerative biomedicine to her PhD in biomaterials – and her current postdoctoral work at UCLouvain within the frame of the Piezo4Spine project. She discussed her motivation for developing new approaches in tissue regeneration and introduced the project's research focus on spinal cord repair. The interview also highlighted the importance of international collaboration, with support from the Association of Spanish Researchers in Belgium.



LISTEN HERE:

<https://www.investigadoresporelmundo.com/podcast/piezo4spine-una-terapia-medular-polifacetica-ref100099752.html>



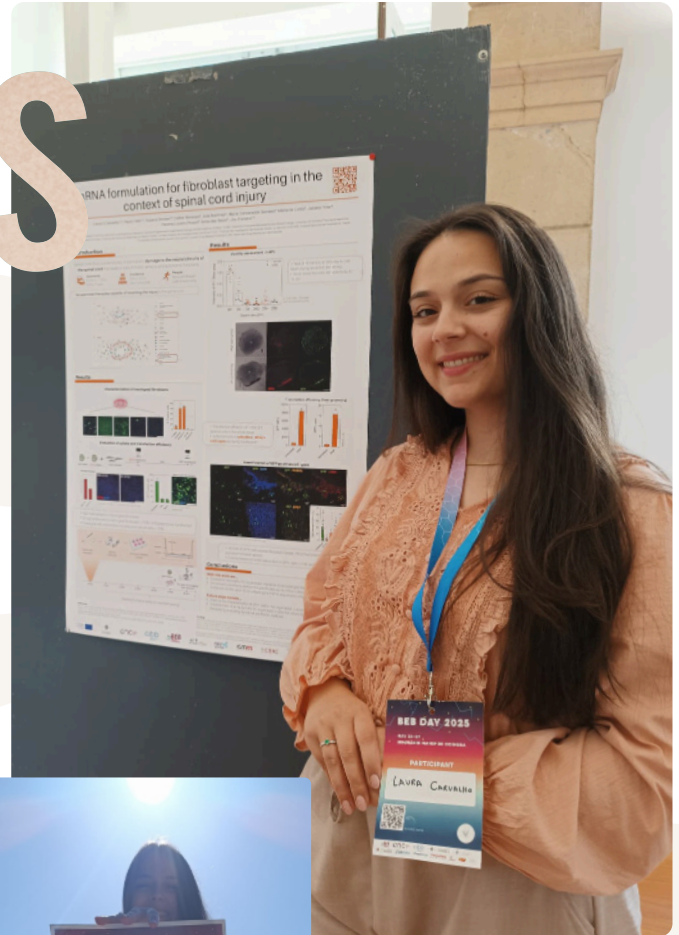
AWARDS

WE ARE DELIGHTED TO HIGHLIGHT ANOTHER
OUTSTANDING SUCCESS WITHIN OUR
PIEZO4SPINE TEAM!

Congratulations to **Laura Carvalho** from the University of Coimbra, who presented her research at BEBday 2025 in May – From Microscales to Macroworlds: Transcending the Limits of Science. Her poster showcased her work on developing organotypic cultures of the spinal cord, an important contribution to advancing our experimental models within Piezo4Spine.

We are thrilled to share that Laura was awarded the Best Poster Presentation Award for her excellent scientific communication and the quality of her research.

In September, Laura was also awarded with the Best Young Researcher Oral Presentation Award at the 2025 edition of the Spanish Conference of Biomedical Applications of Nanomaterials organized at the ICMM-CSIC. She shared with Spanish young and senior scientists in nanomedicine some of her most recent progress on the exploration of polymeric nanoparticles in the frame of the Piezo4Spine project.



WARMEST
CONGRATULATIONS
ON THESE
WELL-DESERVED
RECOGNITIONS!

PIEZO4SPINE NEWSLETTER
EDITORIAL TEAM

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